Exploring The Critical Path

A report from the Critical Illness Trends Research Group

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The views expressed in this paper are those of some or all of the authors and do not necessarily represent the views of our employers. Any errors or omissions are our sole responsibility too.

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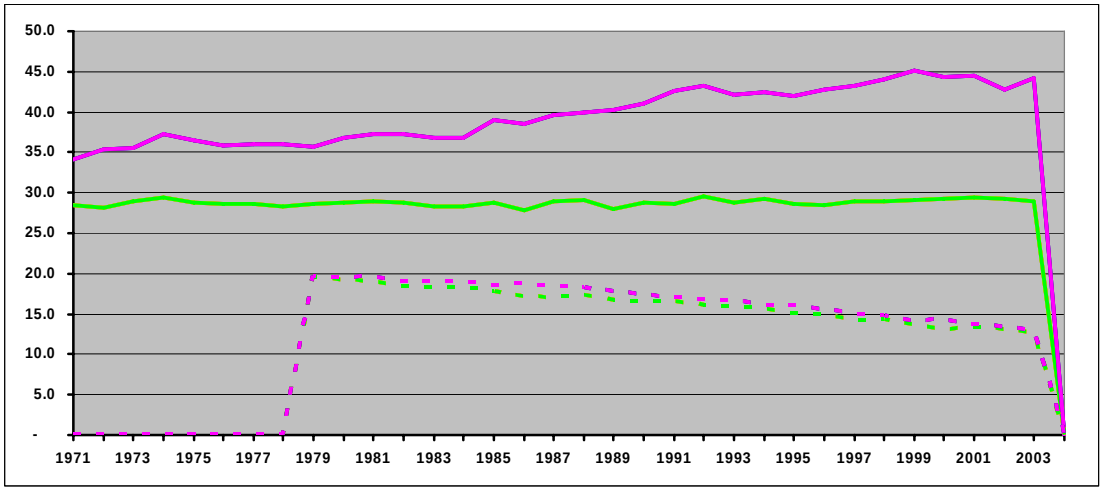
2.1 Cancer

The first step in observing cancer trends and estimating future trends is the understanding that we are not dealing with one illness. To really understand the drivers behind the overall past trend, we need to consider the trend for each of the major cancer sites.

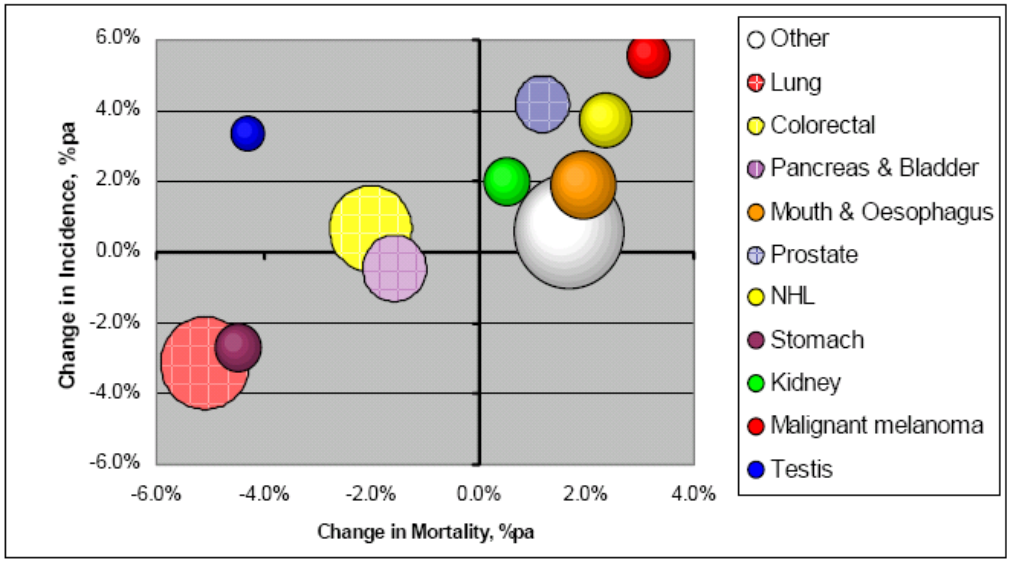
Figure 1 shows the incidence and mortality trend in England & Wales over the last 30 years. These gradually sloping lines could be easily extrapolated to project a trend, but as we will see they mask some significant variations by site, which will be highlighted below.

Figure 1: Cancer incidence and mortality rates (standardised ages 40-59)



In figures 2a & 2b we show the annualised rate of change in incidence and mortality for some of the major cancer sites, with the size of the ball reflecting the significance of that site to the overall cancer rate.

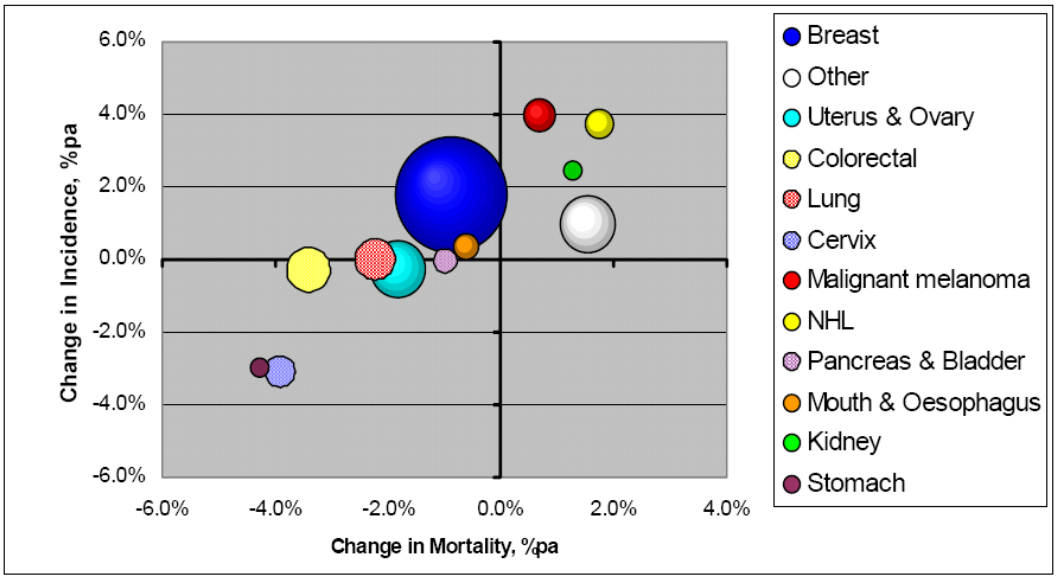
Figure 2a: Trends in incidence and mortality (average change %pa) for men aged 40-59 over 1971-1997



Size of balls indicates relative importance of cancer site measure by incidence rates in 1997.

We see for males, that the seemingly level trend observed in Figure 1 is being driven by an increase in incidence for the majority of sites, being balanced by a reduction in lung cancer incidence. This is particularly important to appreciate for critical illness pricing, as the lung cancer reduction will be driven by the reduction in smoker prevalence, and smoking is already a rating factor.

Figure 2b: Trends in incidence and mortality (average change %pa) for women aged 40-59 over 1971-1997



Size of balls indicates relative importance of cancer site measure by incidence rates in 1997.

For females we see that the increasing overall trend is composed of increasing incidence for the majority of sites, and total incidence is dominated by breast cancer. Smoker prevalence is higher for females and has not fallen as quickly and so we are not seeing the same reductions for lung cancer.

What are the drivers behind changing incidence?

Figure 3: Summary of drivers behind cancer incidence

Driving Factor	Examples	Sites
Accelerated diagnosis	Screening – formal	Breast, cervical, colo-rectal
	Screening – informal	Prostate, thyroid
	Awareness	Testicular, Breast
Environmental	Sun	Malignant melanoma
Societal / behaviour changes	Number of children, age of first child, contraceptive pill	Breast
	Diet	Breast

	Smoking	Lung, bladder, pancreas
Prior treatment	Treatment of other conditions	Stomach
	Vaccination	Cervical

As we see there are some key influences on changes in cancer incidence, and referring back to these drivers can be a useful way of thinking of other possible incidence changes.

Accelerated diagnosis

Screening - formal

The impact of formal screening depends very much on the way the cancer develops. With the national breast cancer screening programme, we saw an increase in incidence through acceleration of detection of a malignancy. Detection will be at an earlier age, but hopefully at an earlier cancer stage. Current mammogram technology is unlikely to detect a cancer at a pre-malignant stage.

For other sites we know there is a defined step through of pre-cancerous stages, examples including cervical cancer and colo-rectal cancer, and although screening will still identify some malignancies it will identify far more pre-malignant cell changes that can then be treated.

Fig 4 shows the observed incidence trend for breast cancer, illustrating the effect of the breast cancer screening campaign introduced between 1988 and 1991. This is an interesting example of the impact of a screening campaign, illustrating the jump in incidence for all age groups being screened for the first time. Screening is for ages 50 to 70 (recently extended from age 64), and at the first screening we see the increase in incidence for all screened ages. This new, elevated rate is maintained for the 50-54 age group as they are always going through screening for the first time. For the older ages though, we see the rate fall back as these groups have been screened previously. The rates for these age groups though fall to a higher trend line than pre-screening, equivalent to a permanent acceleration in detection of approximately 5 years.

Figure 4: Breast Cancer incidence 1971-2003

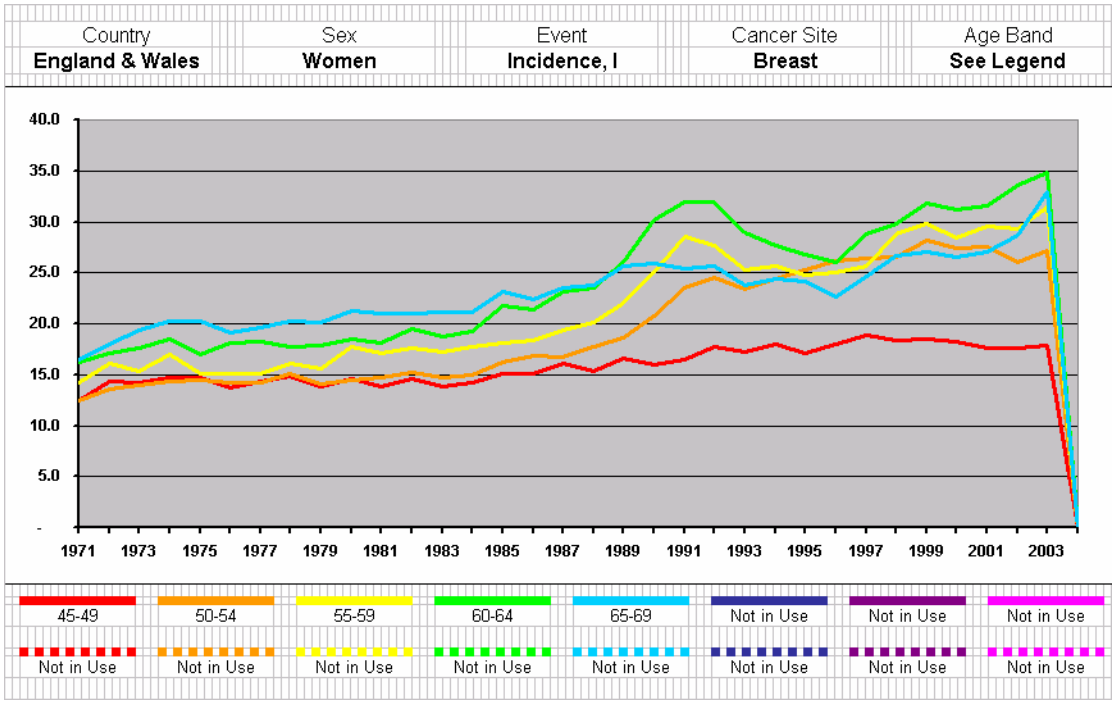
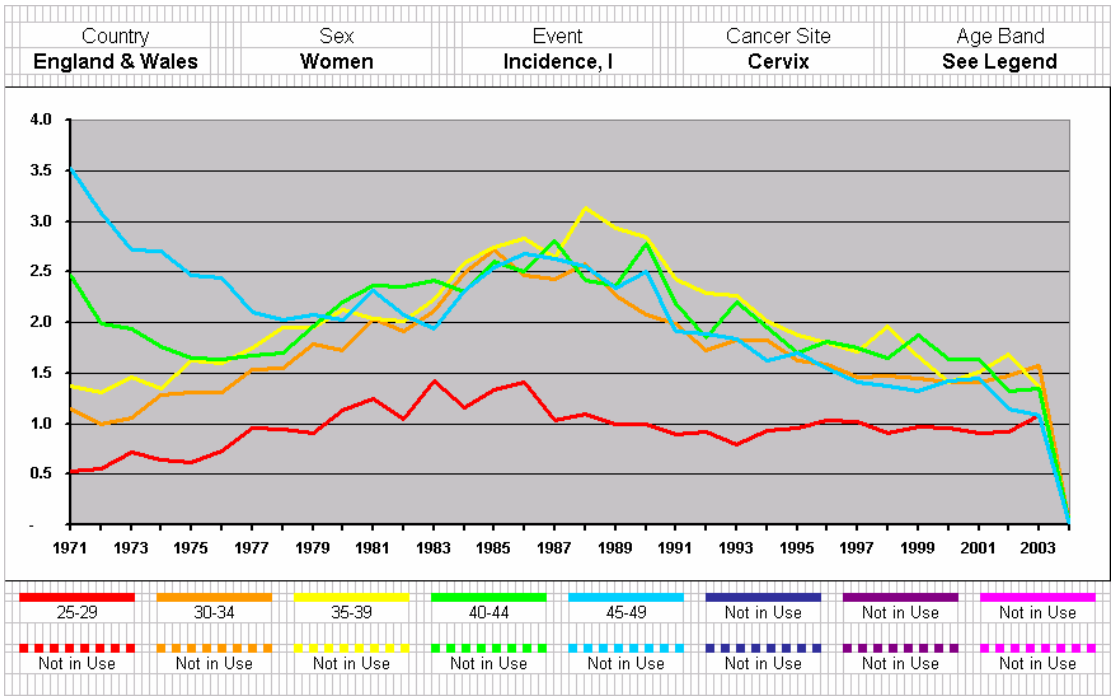


Figure 5 shows the incidence of cervical cancer, and we can see the impact of the screening programme introduced formally from 1988. This has had a huge impact on incidence, as there is approximately 10 years from pre-invasive conditions to invasive malignancy.

Figure 5: Cervical Cancer incidence 1971-2003

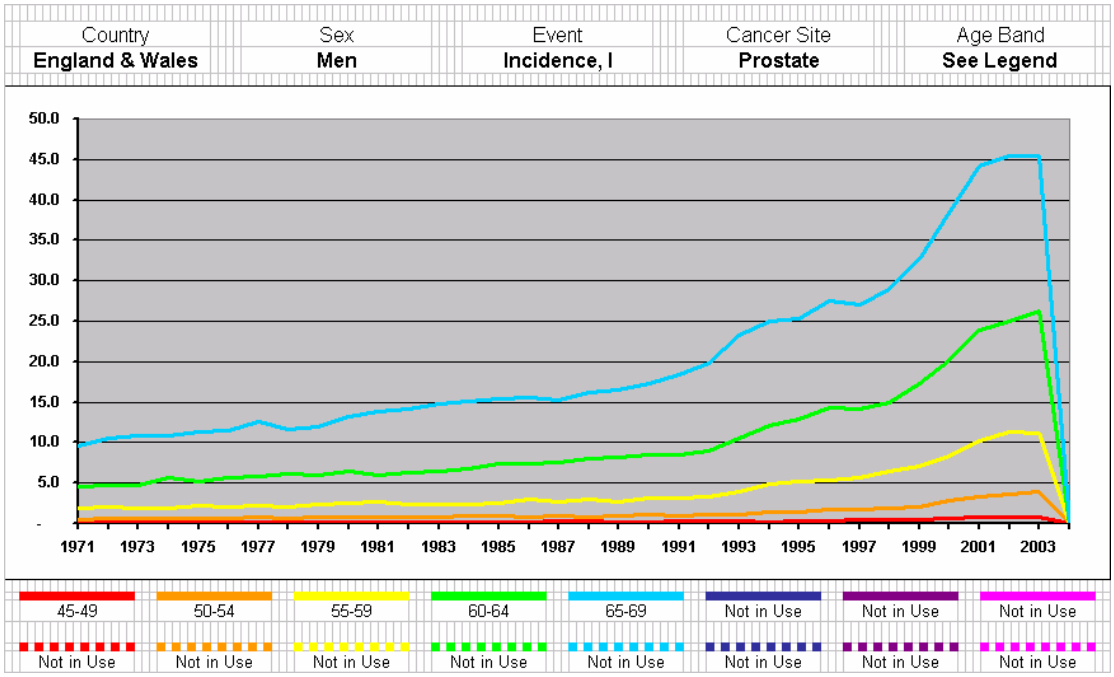


Colo-rectal cancer has a well-defined progression to invasive cancer and screening would identify pre-cancerous polyps as well as malignancies. The NHS is rolling-out a nationwide screening programme over the next 3 years. This will offer screening using faecal occult blood tests (FOBT) every 2 years to men and women aged 60 to 69. FOBT is less specific than techniques such as colonoscopy, but high demand for colonoscopy would be an issue as the procedure is expensive, and requires an anaesthetist and highly trained surgeon.

Screening – Informal

One of the most significant increases in cancer incidence since the mid 1980's has been for prostate cancer (Figure 6). When interpreting these graphs it is important to note the low base point, and the variation in increase by age. Much of this increase is believed to be due to the increased awareness of prostate cancer and the availability of Prostate Specific Antigen (PSA) testing. This is a blood test that detects the level of prostate specific antigen, a substance made by the prostate gland. A positive result is not specific to cancer and can be an indicator of other conditions such as benign enlargement or prostatitis. It is therefore not considered appropriate to a population-wide screening programme. There is also considerable debate as to whether an early diagnosis is beneficial to patients, particularly the elderly, as the disease often progresses very slowly and prostate surgery is extremely difficult. Informal screening is though becoming a common part of private medical examinations.

Figure 6: Prostate Cancer incidence 1971-2003

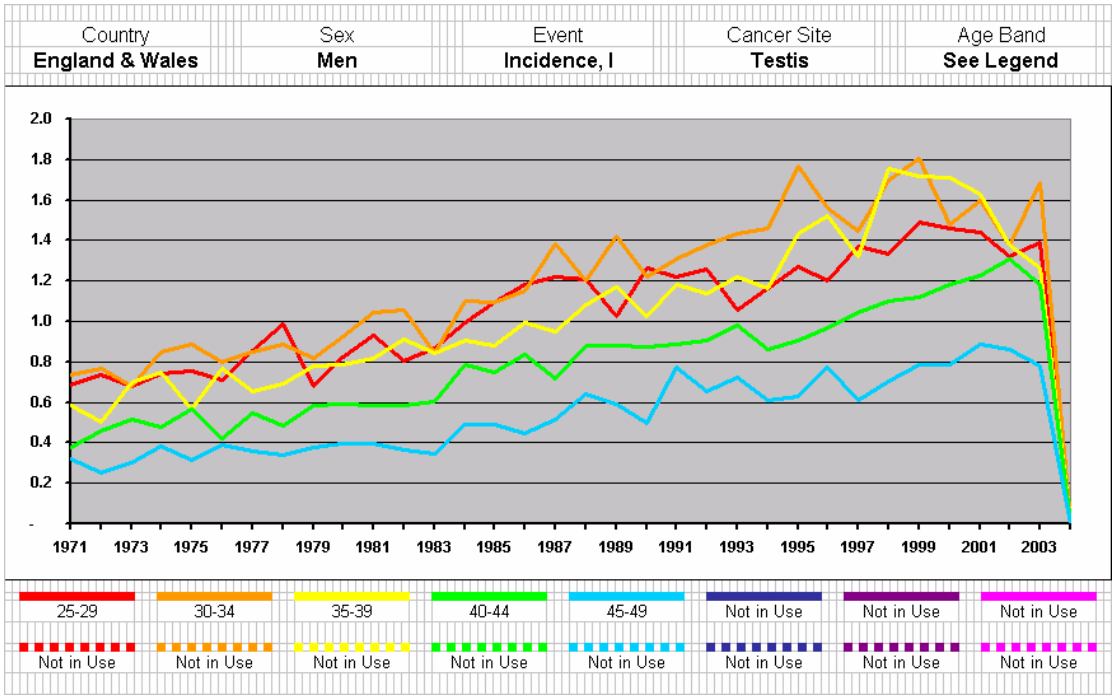


In South Korea, thyroid cancer makes up a significant proportion of critical illness claims. Mortality from papillary thyroid cancer is very low, but prevalence is approximately 10% (based on post-mortem studies). People are having ultrasounds after buying a critical illness policy and then claiming. The high prevalence is not necessarily specific to this population, and diagnostic techniques for other sites could also emerge posing a similar threat. Exclusions can be introduced, but consultation over these takes time, and changes cannot be made retrospectively.

Awareness

For those cancers where a tumour may be physically detectable at an early stage, then increased health awareness of the benefits of early identification may have led to an acceleration of detection. Examples include breast cancer at ages below the national screening programme, particularly where there may be a genetic risk, and testicular cancer (Fig 7).

Figure 7: Testicular Cancer incidence 1971-2003



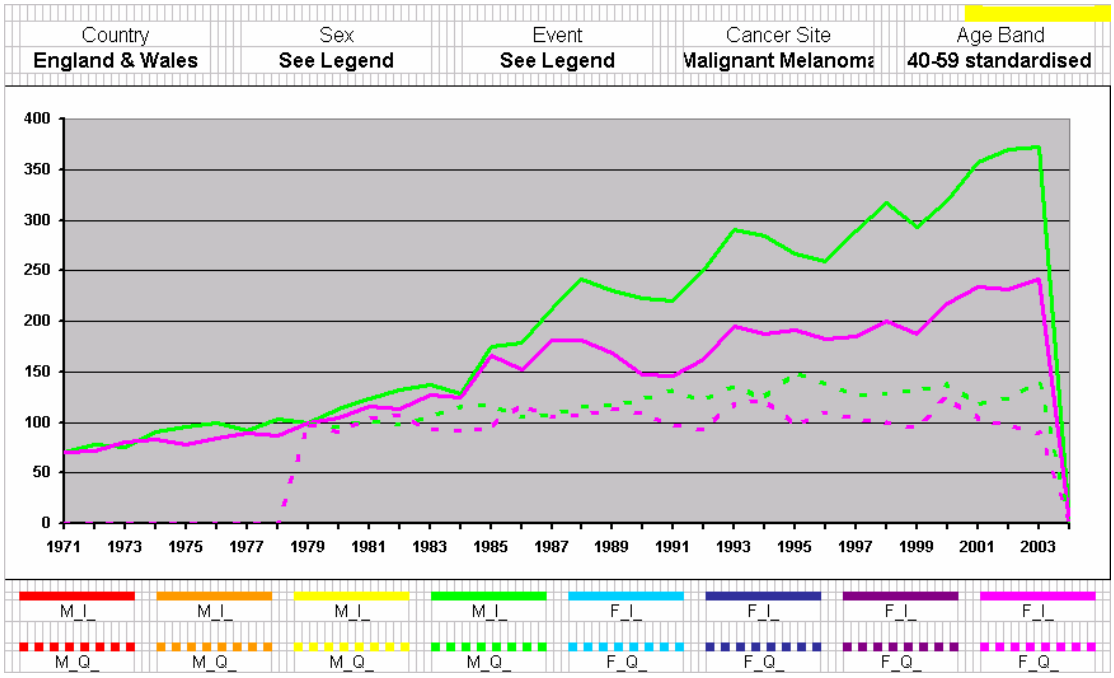
There is also much more awareness of symptoms for some other cancer sites, and a greater willingness to seek early medical help, for example, colo-rectal cancer (early bleeding), and prostate cancer (reduced urine flow).

Environmental

Sun

Malignant melanoma incidence has increase by over 300% since 1970 (Fig 8), and we believe a large part of this is due to exposure to the sun or artificial ultra-violet light. This is supported by the even higher incidence in warmer climates such as parts of the US and Australia.

Figure 8: Malignant melanoma incidence 1971-2003



Societal / behaviour changes

Number of children, age of first child, contraceptive pill

In Figure 4 we saw the impact of the screening programme for breast cancer. Looking at the pre-screening age group 45-49, we see an underlying increase in incidence of approx 1% per annum. There are believed to be many risk factors for breast cancer and the significance of each is unclear. There is though evidence of a hormonal influence, which could be affected by factors such as age at giving birth to first child, number of children, and number of years taking the contraceptive pill. Assessing the impact of any of these is very difficult. For example, contraceptive pills are continually being refined, and so we cannot simply extrapolate observed studies.

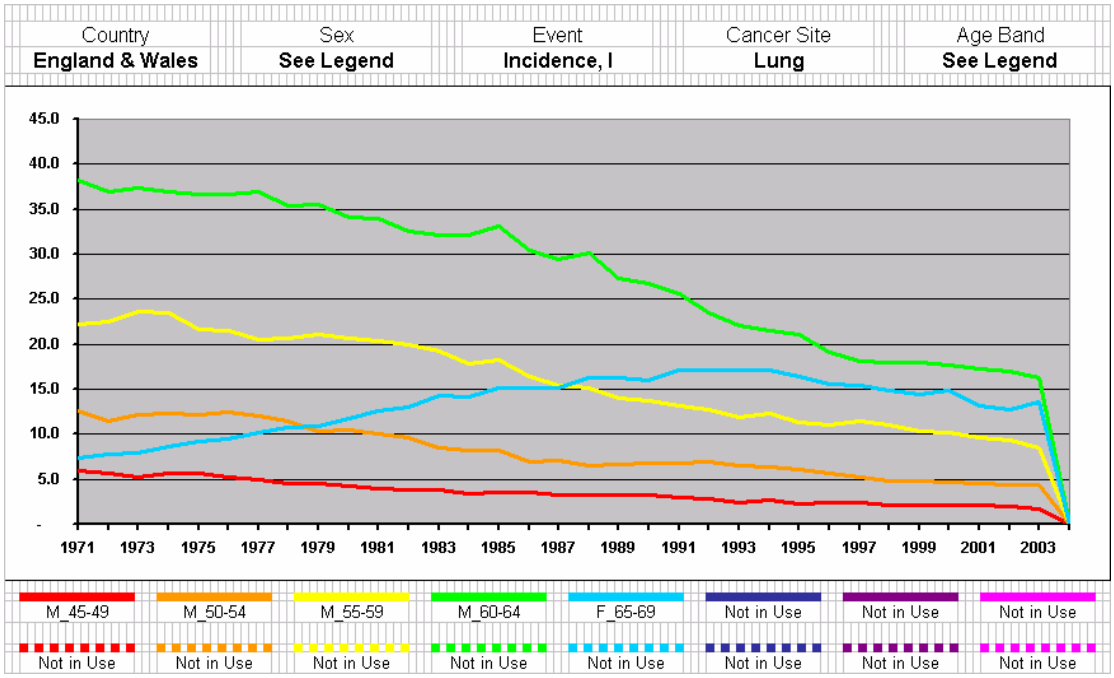
Diet

A study of Japanese women migrating to the US, showed an increase in breast cancer incidence from typically lower Japanese incidence to the much higher US incidence. Diet therefore could be a plausible factor.

Smoking

Approximately 95% of lung cancer cases are believed to relate to smoking, and we can therefore review the change in lung cancer incidence (Fig 9) against the change in smoker prevalence, available through the General Households Survey. Sections 3.2 and 3.3 look in more detail at the impact of smoking on critical illness. In particular, for lung cancer, Doll and Peto modelled the relationship between smoking level and lung cancer incidence. We have been able to update the formula to the latest data and the results are shown in Section 3.3.3. The significant lag and clear link to cigarette exposure can be developed to project lung cancer incidence. This has limited application though for insurers pricing critical illness, as rates are smoker differentiated.

Figure 9: Lung Cancer incidence 1971-2003

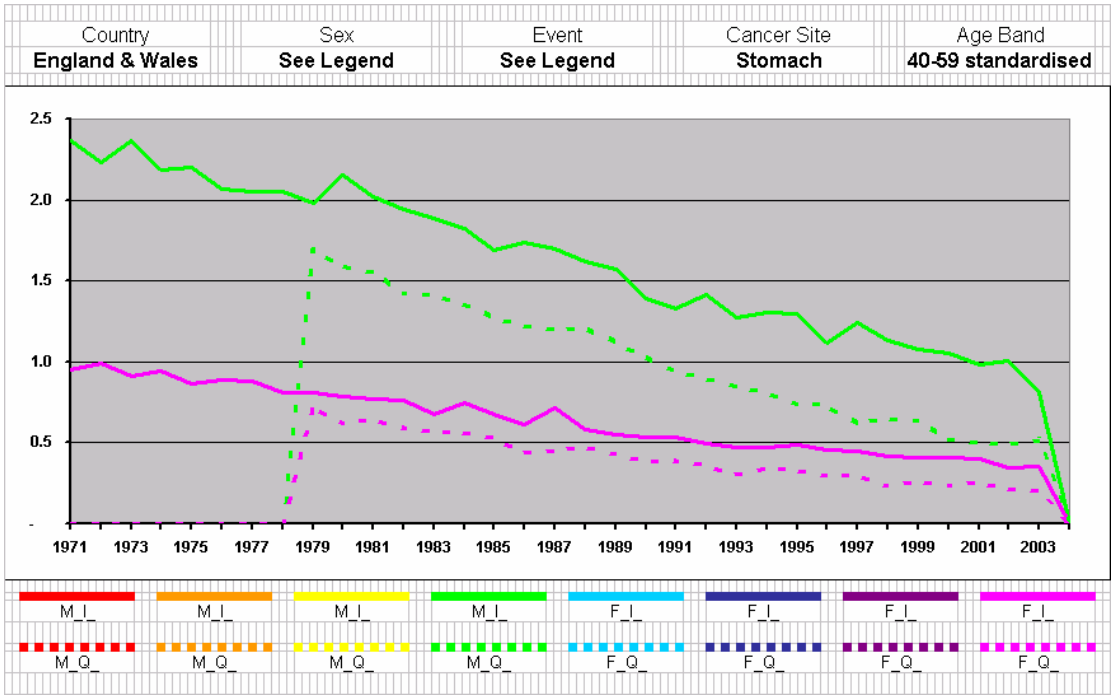


Prior treatment

Treatment of other conditions

There are a few sites where we have observed a significant reduction in incidence, and the trend in incidence and mortality for stomach cancer is an excellent example (Fig 10) of the impact of treatment for other conditions. There has been limited development in the treatment of stomach cancer and little development in detection. There has though been a big breakthrough with the understanding of the bacterial impact of helicobacter pylori on stomach ulcers and other digestive conditions. These conditions were often the starting point for malignancy, and antibiotic treatment has led to a corresponding fall in stomach cancer incidence.

Figure 10: Stomach Cancer incidence 1971-2003



Vaccination

Stomach cancer is one of the few cancers that can be linked to an infective agent. Another example is cervical cancer, and the link in many cases to the Human Papilloma Virus (HPV). There are now plans to vaccinate women against HPV and we would expect further falls in cervical cancer incidence as a result.

What are the drivers behind changing mortality?

Figure 11: Summary of drivers behind cancer mortality

Driving Factor	Examples	Sites
Accelerated diagnosis	Screening – formal	Cervical, colo-rectal
	Awareness	Testicular
Societal	Smoking	Lung, bladder, pancreas
	Number of children, age of first child, contraceptive pill	Breast

Treatment	Prior condition	Stomach
	Surgery	Many sites
	Chemotherapy	Many sites
	Radiotherapy	Many sites
	Hormonal therapy	Breast, prostate
	Monoclonal antibodies	Breast, bowel, leukaemia
	Biological treatments	Kidney
	Cancer growth inhibitors	Lung

There is obviously a clear link between change in incidence and mortality for many sites, particularly those sites with low survival rates. Many of the examples of factors affecting mortality are therefore the same as for incidence. However this is not always the case, for example, there has been only a limited increase in malignant melanoma mortality despite the 4-fold increase in incidence.

A summary of the incidence to mortality ratios is shown below and this can be helpful in the discussion of which cancers are critical. Comparing against other countries can also give an indication of the sites where we can expect further short to medium term advancement in diagnosis and treatment, for example comparing England & Wales and Scotland, against the USA for prostate cancer and breast cancer, we see much lower ratios for the USA.

Figure 12: Ratio of mortality to incidence rates (%), ages 40-59, 1998

	Males			Females		
	E & W	Scotland	USA	E & W	Scotland	USA
All CI cancers	51	49	35	34	34	26
Stomach	58	59	52	57	64	58
Colo-rectal	41	43	31	38	37	30
Lung	86	79	86	80	70	70
Malignant melanoma	26	26	15	16	19	9
Prostate	17	17	3	-	-	-
Testis	6	5	6	-	-	-
Breast	-	-	-	22	24	16
Cervix	-	-	-	42	26	32
Ovary	-	-	-	52	41	35

Accelerated Diagnosis

Screening – formal

Early diagnosis has had a greater impact on incidence than mortality, and there is still debate for some cancer sites, over whether screening has any impact on mortality. PSA screening, for example, has a limited effect on mortality, as most tumours are so slow-growing they have no impact on life expectancy. Some doctors also believe breast cancer screening has minimal impact on mortality as it

can only detect tumours of a size likely to have metastasised. More advanced diagnostic procedures such as MRI are being considered for high-risk groups.

We see the biggest impact of screening on mortality where pre-cancerous conditions can be detected. The cervical cancer screening programme has significantly reduced mortality. Proteomics, the study of protein function and shape, is developing to identify bio-markers for early tumour detection, but will take time to be widespread with accurate specificity. There is the question, as with PSA, over what you then do if a cancer is detected. Finally, positive emission tomography could be a tool of the future but it is currently very expensive and not suitable for screening.

Treatment

Some of the key treatments for cancer are summarised below. Several of these have been in use for many years but there are many more recently developed that seek to target cancer cells more specifically. It is interesting to note the time it can take for new developments to be widely used. Trials of some of the therapies becoming more commonly used were taking place in the 1970's, but treatment was only well established in the 1990's.

Figure 13: Summary of treatments for cancer

Treatment	Overview	Sites
Surgery	Removal of the primary tumour has always been a key treatment. There are also advances being made in types of surgery e.g. laser surgery and cryo surgery.	Many sites
Chemotherapy	Interferes in the cellular process for replication. As cancer cells are growing faster, it has most impact on the fastest replicating cells e.g.. tumour, but also bone marrow, gastro-intestinal. The latter two though recover more quickly.	Many sites, and particularly effective for leukaemias, lymphomas and testicular cancers.
Radiotherapy	The use of high energy waves applied either internally or externally to destroy cancer cells.	Many sites
Hormonal therapy	Used if hormones are thought to be a factor in the cancer. Can involve drugs to reduce the hormonal level (e.g. for breast cancer, Tamoxifen is an anti-oestrogen), or surgery to remove the hormone creating organ (e.g. ovarian ablation for breast cancer, and orchiectomy for prostate cancer)	Breast (tamoxifen, aromatase inhibitors, Zoladex) Prostate
Monoclonal antibodies	One of the big areas of development, with Herceptin the best known example. These involve producing antibodies outside the body that when introduced identify tumour cells, marking them for destruction by the immune system, blocking receptors to prevent growth, or targeting a chemotherapy drug to cancer cells.	Breast (Herceptin) Colo-rectal (Avastin) Mylotarg (Leukaemia)
Biological treatments	Work by encouraging the body's immune system to attack the tumour	Kidney (Interferon alpha, and interleukin-2).
Cancer growth inhibitors	Many cancer cells have epidermal growth factor receptors, to which the epidermal growth factor protein can attach causing cells to grow and divide more quickly. EGFR antagonists can be introduced	Lung (Erlotinib)

	which attach to EGF receptors and so prevents them being activated.	

In summary although it is difficult to conclude that cancer incidence will fall, much research is focused on early detection of cancer cells, and on improved targeting of these cells for treatment. This supports the conclusion of many oncology experts, that in the medium term we are not anticipating the eradication of ccancer, but the conversion from an often fatal illness, to a chronic, manageable illness such as diabetes.

2.2 Heart Attack

2.2.1 Fallacies of Using HES to Identify and Interpret Trends in Heart Attacks

HES are not an ideal data source for identifying and interpreting trends in the incidence of first ever heart attack. Section 8.5.9 summarises the limitations of HES data in general. These limitations are also discussed under stroke and coronary artery bypass graft but their significance for different conditions varies.

Only people who survive long enough to reach hospital following their heart attack or, who have a heart attack in hospital, will be included in HES. So, for heart attack, one of the most important factors that could lead to HES misrepresenting trends are changes to the sudden death rate from heart attack. No up-to-date information on deaths due to heart attack prior to admission to hospital is available. Government targets to reduce deaths from coronary heart disease and the consequent increased focus on improving survival from heart attack have led us to believe that more people who suffer a heart attack will survive to be diagnosed and treated in hospital. This change may be acting to increase the incidence in heart attacks as recorded in HES even if no real increase in incidence has occurred.

A general deficiency of HES is that people treated and diagnosed outside of an NHS hospital are not included in the statistics. For heart attack, however, the proportion of people treated privately, or by a GP, is thought to be very small. Changes in the proportion of people treated outside an NHS hospital are not expected to materially impact trends in heart attack.

In 1995 the disease classifications used in HES changed from ICD9 to ICD10. Trends in heart attack do not appear to have been materially impacted by this change in coding series. ICD10 has the advantage of enabling first heart attacks to be counted separately from second and subsequent heart attacks. This is helpful in the context of critical illness where usually a claim can only be made for the first heart attack. Since 1995 first ever heart attacks have represented the vast majority of all heart attacks. Changes prior to 1995 in the proportion of first to second and subsequent heart attack would need to have been extremely large for the trends for all heart attacks not to be representative of trends in first ever heart attack. We have not found any indication that such an extreme change has occurred. Therefore using trends in the all heart attack rate, over the longer time period in the past for which it is available, should not materially misrepresent historic trends.

The definition of heart attack used by the ABI does not correspond exactly to that used by the medical profession. It is our view, over the time period for which we have data, that this is not a major consideration when interpreting trends. The same is not necessarily true when considering future trends (see section 3.4).

HES are episode based and if someone who has suffered a heart attack is transferred to a new consultant during a hospital stay this would result in another count of a heart attack in the statistics. Overall 94% of hospital stays are under the care of a single consultant but we have no information to show if this proportion has varied over time or if it varies significantly by condition. If this proportion has changed over time for heart attack then trends may be distorted.

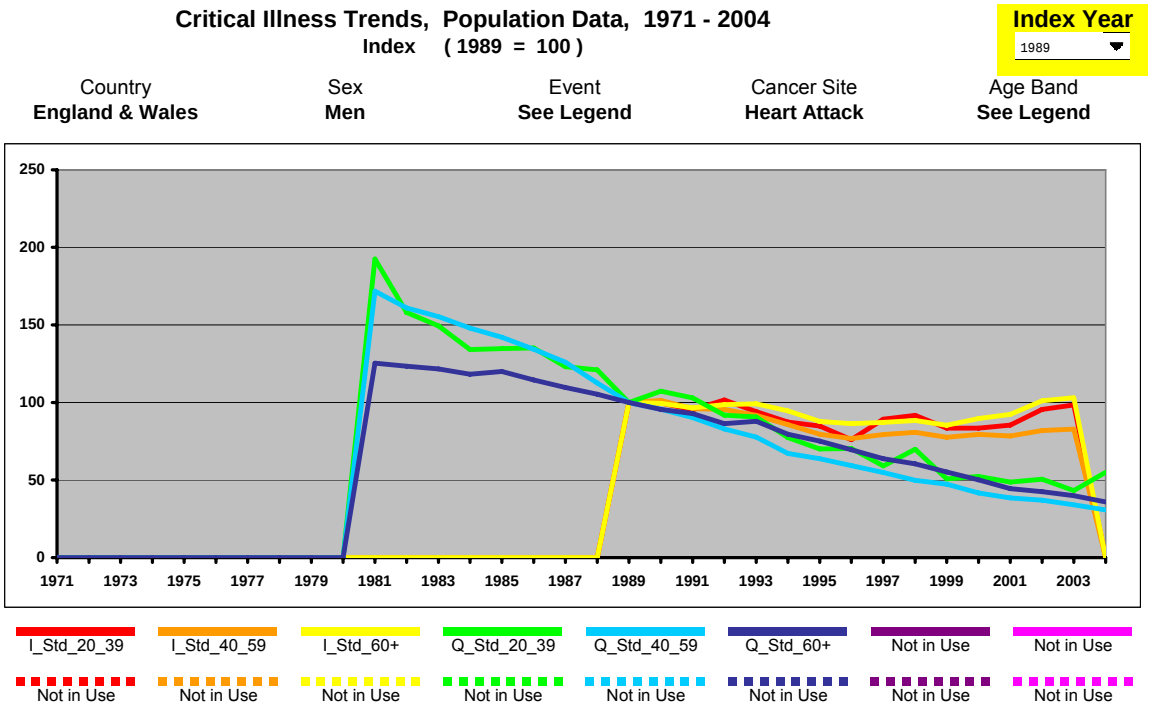
When analysing trends the crude ratio of counts of heart attack from HES divided by the population of England are used without any adjustment for prevalence. For trends in the first ever incidence of heart attack people who have previously suffered a heart attack should be removed from the exposure. Our data shows that, whilst mortality rates from heart attack continue to fall generally, incidence rates appear to be stabilising. The implication is that survival rates from heart attack are improving although direct data on this is scant. If survival is improving then we would expect the prevalence of heart attack in the population to increase. As prevalence is thought to be increasing the absence of a prevalence adjustment may mean that the incidence of first ever heart attack is increasingly being understated and the trend distorted.

HES only covers England and is not therefore reflective of the whole of the UK population. We briefly describe geographical differences in incidence rates in section 6.2.3. However, as HES is based on about 90% of the UK population it is the most credible and relevant source to use.

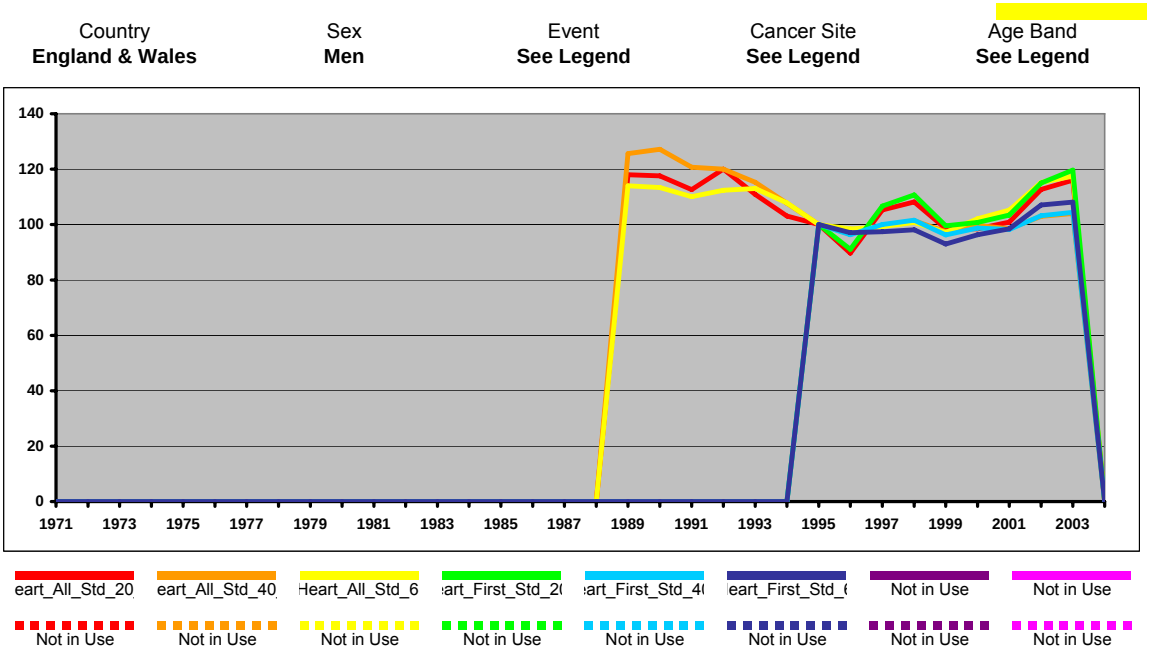
2.2.2 Trends in English Male and Female Mortality and Incidence Rates

Males

Mortality rates for males have been falling for some time. The falls in the 1980s were especially significant for the under 60s, with rates for all age groups continuing to fall in the 1990s and into the 2000s. The incidence rate from all heart attacks fell for all age groups throughout the early 1990s, however, since the mid 1990s incidence rates appear to have levelled off and may even be increasing for the under 40s and over 60s into the 2000s.

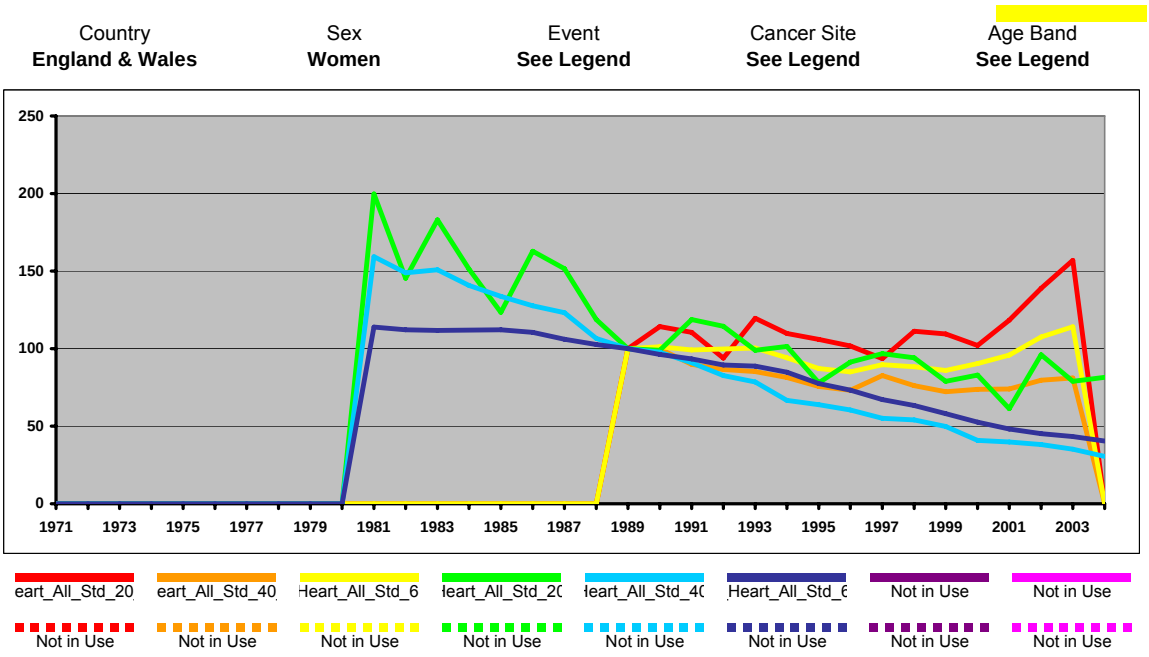


Since 1995 the trends in the incidence of first ever heart attack and all heart attacks have been very similar. It is only in the over 60s age group since 2000 where the all heart attack rate appears to be increasing more rapidly than the rate of first heart attack. The last year of HES data 2003/04 is however still ungrossed and is subject to revision.

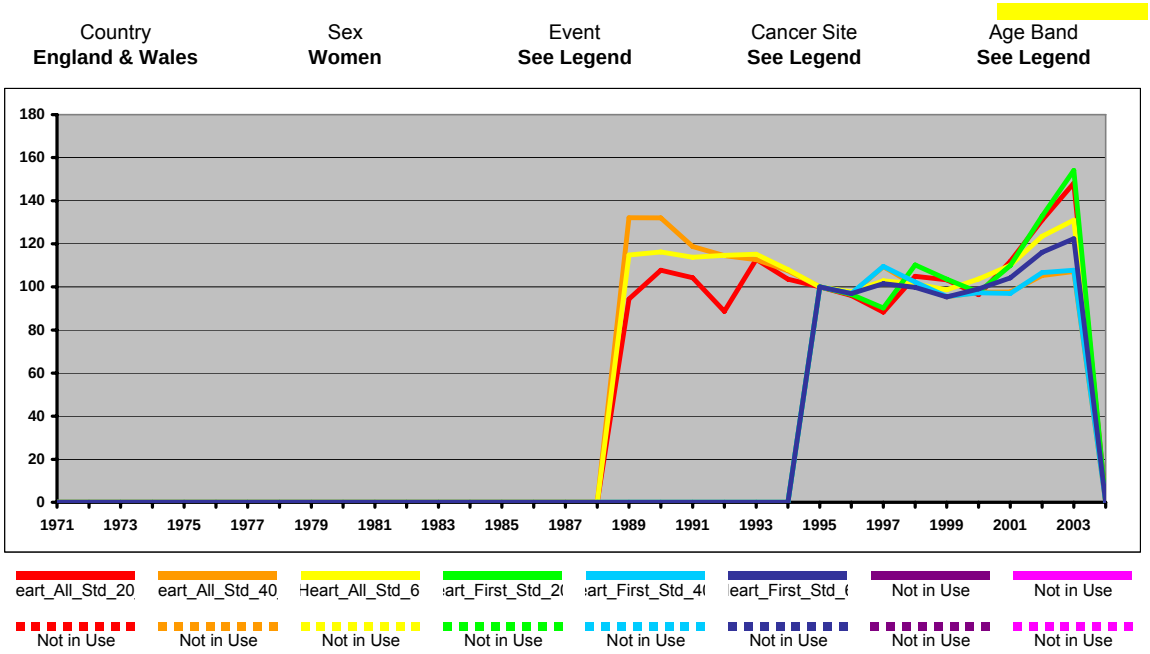


Females

For females the trends for mortality and incidence of all heart attacks have shown very similar patterns to those for males. The exception is for women less than 40 where the reduction in mortality rates since 1990 is not as marked as for males.



As for males, the trends in the incidence of first ever heart attack to all heart attacks have been very similar since 1995. Again, it is only in the over 60s age group since 2000 where the all heart attack rate appears to be increasing more rapidly than the rate of first heart attack.



The table below summarises the trends for mortality and incidence for broad age bands over the period from 1989 to 2003. Note that different results would be obtained if a more recent time period was used. The percentage per year change is stated to nearest decimal place and an indication of the 95% confidence interval is shown in brackets. These numbers are dependent on the time period chosen, the method of fitting the trend and the quality of the data.

Table 1: Log linear Trends (% per annum) in Incidence and Mortality of All Heart Attack in England (1989 to 2003)

	Male		Female	
Age Range	Mortality	Incidence	Mortality	Incidence
20-39	-6.4% (-7.2%, -5.6%)	-0.7% (-1.6%, 0.3%)	-2.5% (-4.0%, -1.0%)	1.7% (0.3%, 3.1%)
40-59	-7.7% (-8.0%, -7.5%)	-1.8% (-2.4%, -1.1%)	-7.5% (-7.9%, -7.1%)	-1.8% (-2.6%, -0.9%)
60+	-6.6% (-7.2%, -6.1%)	-0.7% (-1.4%, 0.0%)	-6.2% (-6.7%, -5.6%)	-0.5% (-1.4%, 0.4%)

Summary figures for first ever heart attack, and for all heart attack, for the time period 1995 to 2003 are stated in table 2 for comparison.

Table 2: Log linear Trends (% per annum) in Incidence of First Ever Heart Attack and All Heart Attack in England (1995 to 2003)

	Male		Female	
Age Range	Incidence First Heart Attack	Incidence All Heart Attack	Incidence First Heart Attack	Incidence All Heart Attack
20-39	2.1% (0.5%, 3.8%)	1.8% (0.2%, 3.5%)	5.1% (2.2%, 8.0%)	4.9% (2.2%, 7.7%)
40-59	0.5% (-0.1%, 1.2%)	0.5% (0.0%, 1.1%)	0.5% (-0.9%, 1.8%)	0.5% (-0.8%, 1.8%)
60+	0.6% (-0.4%, 1.6%)	1.6% (0.7%, 2.5%)	1.5% (0.2%, 2.7%)	2.3% (1.1%, 3.6%)

2.2.3 Drivers of Change

The substantial falls in mortality due to heart attack since the early 1980s and in the incidence until the mid 1990s are due to a combination of generally improving population risk factors and increased

or improved medical intervention. Improvements in diagnostic techniques have also had an important impact. These have led to more minor heart attacks being diagnosed and incidence rates have increased as a result.

2.2.3.1 Changes to Risk Factors

The major risk factors for heart attack are listed in the table below.

Risk Factor	Description of Change to Population Risk Factor	Description of Impact on Mortality from Heart Attack and Incidence of Heart Attack
Smoking	Generally falling prevalence of smoking for both males and females across most age bands since the 1980s.	Falling prevalence has led to a major reduction.
Cholesterol	Historical information on population cholesterol levels is sparse and often not on a consistent basis but cholesterol levels are thought to be falling.	Reduced cholesterol levels beneficial and are thought to have led to a small reduction.
Obesity	Obesity levels have risen since the 1980s for both males and females.	A detrimental effect.
Blood pressure	Generally falling since the early 1990s. Thought to be a result of medical treatments.	Reduced levels beneficial and are thought to have led to a small reduction.
Diabetes	The prevalence of diabetes is increasing since the early 1990s at most ages and for males and females. No consistent information of the prevalence of diabetes in the early 1980s. Diabetes is more prevalent in the obese so some correlation with this risk factor.	An adverse effect on trends.
Physical activity	Data on activity levels is difficult to obtain but indirect sources indicate that physical activity is in decline.	An adverse effect on trends.
Deprivation	Many of the other risk factors in this table are known to vary by deprivation score. Deprivation data is available for Scotland and is covered in section 6.2.2.	

The fall in the prevalence of smoking is the risk factor in which there is known to have been the most significant change since the 1980s. This single change explains a large proportion of the fall in mortality and incidence of heart attack in the population.

2.2.3.2 Changes to Medical Interventions

Treatments relevant to heart attack are grouped below in relation to the level or type of condition for which they may be given. As well as treatments for primary prevention, those given to people with heart failure and chronic or unstable angina are relevant to the incidence of heart attack, as people being so treated are at greater risk of a heart attack. Treatments given after a heart attack are aimed at preventing a second heart attack and improving survival following a heart attack.

Need for Treatment	Treatment	Reduces risk of incidence and mortality or mortality only
Primary Prevention	Statins, Hypertension Treatment	Incidence and mortality
Heart Failure	ACE inhibitors, Beta blockers, Statins	Incidence and mortality
Unstable Angina	Aspirin, Heparin	Incidence and mortality
Chronic Angina	CABG surgery, Angioplasty, Aspirin, Statins	Incidence and mortality
Acute Myocardial Infarction	Cardio-pulmonary resuscitation (CPR), Thrombolysis, Aspirin, Primary angioplasty, Intravenous beta blockers, ACE inhibitors	Mortality
Secondary Prevention	Aspirin, Beta blockers, ACE inhibitors, Statins, Warfarin, Rehabilitation	Mortality

A brief description of the treatments currently used in the prevention of heart attack or reduction of mortality from heart attack is given in the following table. The change in the prevalence or the uptake of each treatment is also indicated.

Treatment	Description	Changes in Treatment Availability or Uptake from 1980 to 2003
ACE (angiotensin converting enzyme) inhibitors	Assist in the long term pathological remodelling of the heart muscle and also help reduce blood pressure, and primary treatment for heart failure.	Used since the early 1980s but there has been significantly greater uptake in the last 5 years.
Angioplasty (and stenting) PCI (percutaneous coronary intervention)	Interventional (surgical) treatment to reopen a blocked or markedly narrowed (stenosed) coronary artery using a fine catheter with a small inflatable balloon at its tip. Now often combined with a stent (bare metal or drug coated) to reduce re stenosis.	Since the early 1990s, when the numbers of angioplasties performed where quite low, the number of angioplasties have increased exponentially across all age bands for both males and females.
Aspirin	An anti-platelet drug used to help prevent blood clots forming	Only routinely used since the early/mid 1980s.
Beta blockers	Used to block the action of the hormone adrenaline that makes the heart beat faster and more vigorously.	Initially used to reduce mortality after myocardial infarction (MI) in the 1980s. Fairly recently, around 2000, it was proved that low doses of the right type of beta blocker could be beneficial as additional agent in heart failure.
CABG surgery (coronary artery bypass grafting)	Surgical treatment to correct a narrowing or blockage of coronary arteries with by-pass grafts using internal mammary arteries or veins. Bypassing the narrowed segment there by improving / restoring blood flow (perfusion) to	For males and females the incidence of CABG increased during the early 90s and then for the under 60s has been falling since the mid 1990s. For the over 60s the incidence of CABG continues to rise significantly. This is particularly true for the oldest age

	the affected portion of heart muscle.	groups albeit the increases are starting from relatively low incidence rates at these very old ages.
Cardio-pulmonary resuscitation (CPR)	A series of procedures to partially restore circulation and respiration until the heart is restarted usually by a defibrillating shock.	This technique had been around for many years but is only effective in a minority of cases.
Heparin (anti thrombotic)	Used to disperse blood clots (thromboses) and pulmonary embolisms.	Used since 1950s together with other anti clotting agents.
Hypertension treatment (mainly ACE inhibitors and beta blockers)	Used to reduce high blood pressure.	First drugs used in the 1950s, now combinations usually used.
Platelet glycoprotein IIB/IIIA inhibitors	Anti platelet agents	Used in acute coronary syndromes and as an adjunct angioplasty
Primary angioplasty	Angioplasty as an emergency treatment of an acute myocardial infarction which is usually due to a fresh obstructing blood clot in a narrowed coronary artery	Introduced in 2001 but relatively uncommon as it requires a high level of expert resources available on 24 hour call. Likely to be rapid growth in the future.
Spironolactone	A long term treatment, a potassium sparing diuretic	Recently reintroduced as an additional agent in heart failure.
Statins	A long term treatment used to reduce cholesterol levels in the blood.	In use for the 1980s, with exponential growth in recent years.
Thrombolysis - fibrinolytics	Treatment with clot dissolving drugs for acute conditions.	Introduced in 1980s effective only if given within 12 hours of heart attack.
Warfarin (anti coagulant)	Reduces risk of blood clotting.	In use since the late 1950s.

A substantial proportion of the fall in mortality due to heart attack can be attributed to the combination of improved treatment of heart failure and secondary prevention, including faster access to thrombolytic treatment following a heart attack.

The interaction of medical and surgical treatments on incidence is complex. Some of the improvements in treatment that have improved mortality take place after the diagnosis of a heart attack. They therefore have no impact on the incidence of a first heart attack but may reduce the likelihood of subsequent heart attacks. It is not clear to what extent any reduction in incidence rates might be due to better treatment.

2.2.3.3 Changes to Diagnostic Techniques

In 2000 the medical definition of heart attack used in the UK came under review following a joint paper by the European Society of Cardiology and the American College of Cardiology This paper reviewed the definition of heart attack and the ability to measure troponin levels was an important new feature of their definition.

Troponin is a cardiac protein and is produced when heart muscle is damaged. Detecting troponin therefore indicates that heart muscle has been damaged which is what happens during a heart attack. Small previously undetected heart attacks that may have been classified as severe or unstable angina could now be classified as heart attack.

In 2000 only 50% of hospitals in England, (A baseline survey of the facilities of management of acute myocardial infarction in England, The Royal College of Physicians 2001) and in 2002 only 60% of

hospitals in Scotland (Pell BMJ 324), had access to troponin tests when patients presented with possible acute myocardial infarction. Tests for troponin are now routinely used in the UK as it helps inform decisions about suitable treatment. But between 2000 and 2003/04, the last year for which we have HES data, it is not thought that the majority of hospitals would have routinely tested for troponin.

As the HES is only available up to 2003/04, it is not thought that that testing for troponin and the possible subsequent increase in diagnosis in heart attack, will have had a major impact on the incidence of heart attack as seen in this data. But it may have had some impact. Incidence rates in the late 1990s and early 2000s are stabilising or increasing and increased diagnoses due to testing for troponin could be a contributory factor.

2.3 Stroke

2.3.1 Fallacies of using HES to identify and interpret Trends in Stroke

HES are not an ideal data source for identifying and interpreting trends in the incidence of first ever stroke. Section 8.5.9 summarised the limitations of HES data in general. These limitations have also been discussed under heart attack and coronary artery bypass graft but their significance for different conditions varies. In particular, identifying trends in stroke is not straightforward as re-admissions to hospital for stroke are not identified separately which leads to double counting. For stroke this is a significant issue as patients who suffer stroke tend to have multiple admissions to hospital. Changes in the methodology used to count stroke incidence by HES may lead to distortions in the trend over time.

Another general deficiency in HES is that people treated and diagnosed outside of hospital are not included in the statistics. The proportion of people treated privately or by their GP for stroke can be significant (Stroke 2005;36;1837-1843 Community-Based Stroke Incidence in a Scottish Population). However, if the proportion of patients treated outside the NHS changes this may lead to a distortion in the trend. This is a particular issue for older patients where many of them are treated by their GP without admission to hospital.

In 1995 HES changed from using ICD9 to ICD10. The overall trend in stroke does not appear to have been materially impacted by this change. However, we have noticed an impact on the trend when we considered individual ICD codes mappings from ICD9 to ICD10 for certain stroke sub codes (section XXX). Unfortunately, the ICD coding for stroke, unlike heart attack, is not split into first and subsequent stroke. This could lead to different trends for first ever stroke and total strokes if the proportion of first to subsequent stroke has changed over the period 1989 to 2003. We have not investigated this further as we have limited information.

The definition of stroke used by the ABI (SoBP 2006 and previously) does not correspond to the medical definition. In our view, this is not a major consideration when interpreting trends. The same is not necessarily true when considering future trends (section 3.4).

Our data shows that whilst stroke mortality rates continue to fall, incidence rates appear to have deteriorated over the 1990s. The implication is that survival rates from stroke are improving although direct data on this is scant. If survival is improving then we would expect the prevalence in the population of people who have suffered a stroke to increase. When analysing trends the crude ratio of counts of stroke from HES divided by the population of England are used without any adjustment for prevalence. For trends in the first ever incidence of stroke people who have previously suffered a stroke should be removed from the population used in the denominator of this ratio. As this proportion is thought to increase, the absence of such an adjustment may mean that the incidence (of first ever stroke) is increasingly understated and therefore the trend distorted.

HES data only covers England and is not therefore reflective of the whole of the UK population (insight section 3). Despite its limitations, HES is still the most credible and relevant source as it is based on about 90% of the UK population.

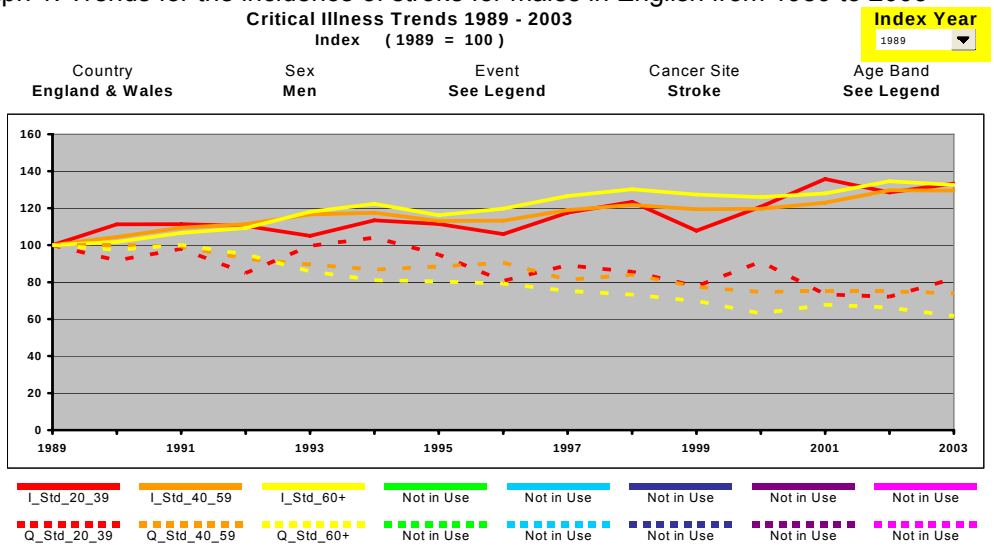
2.3.2 Trends in English Male and Female Mortality and Incidence rates

For males, mortality rates for stroke have been falling for all age groups over the same period. The log linear improvement trend for males over 1989 to 2003 are 1.8%, 2.4% and 3.6% for the age groups 20 to 39, 40 to 59 and 60+ respectively. The 60+ age group has experienced much higher levels of improvement compared to the other age groups.

Stroke incidence rates have shown a deterioration trend over the 1990's for all age groups (Graph 1). The log linear deterioration trends for males over this period is 1.6%, 1.5% and 2.0% for age groups 20 to 39, 40 to 59 and 60+ respectively. The trend over the 1990's is higher for the 60+ age group compared the younger age groups, however, all have converged to the same level at 2003. The trend appears to increase more rapidly at the start of the 1990's and has a slower increasing trend for

the remaining period up to 2003. The 20-39 age group is more volatile as it would be expected due to the lower level of incidence but is at the same level in 2003 as two older age groups.

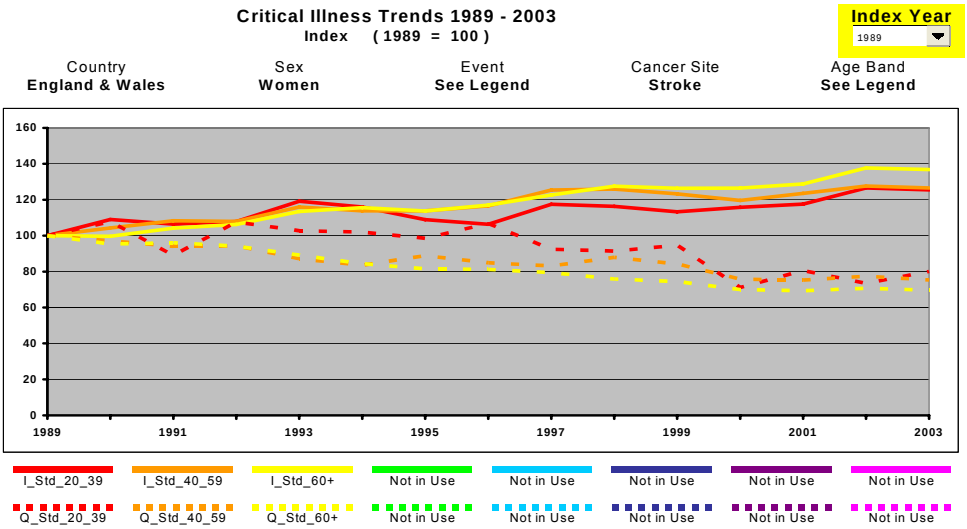
Graph 1: Trends for the incidence of stroke for males in English from 1989 to 2003



Similarly for females, mortality rates for stroke have been falling for all age groups over the same period. The log linear improvement trend for males over this period is 2.3%, 1.9% and 2.8% for the age groups 20 to 39, 40 to 59 and 60+ respectively. The older age group again has experienced higher levels of improvement in comparison to the other two age groups.

Stroke incidence rates show a deterioration trend over the 1990's for all age groups (Graph 2). The log linear deterioration trend for females over this period is 1.2%, 1.6% and 2.3% for age groups 20 to 39, 40 to 59 and 60+ respectively. The trend over the 1990s is similar in shape and level for the 40-59 and 60+ age groups up to 1997, but from that point on the older age group has experienced a higher level of deterioration and is significantly above the 40-59 age group at 2003. The 20-39 age group is again more volatile as it would be expected due to the lower level of incidence.

Graph 2: Trends for the incidence of stroke for females in English from 1989 to 2003



Summary

The table below summaries trends for mortality and incidence for broad age bands over the period from 1989 to 2003. Note that different results would be obtained if a more recent time period was used. The percentage per year change is stated to nearest decimal place and an indication of the 95% confidence interval is shown in brackets. However, these numbers are dependent on the time period, method of fitting trend and the quality of the data (2.3.1).

Table 1: Log linear Trends (% per annum) in Incidence and Mortality of Stroke in England (1989 to 2003)

	Male		Female	
Age Range	Mortality	Incidence	Mortality	Incidence
20-39	-1.8% (-2.8%, -0.9%)	1.6% (1.0%, 2.3%)	-2.3% (-3.4%, -1.3%)	1.2% (0.7%, 1.6%)
40-59	-2.4% (-2.7%, -2.0%)	1.5% (1.2%, 1.8%)	-1.9% (-2.3%, -1.5%)	1.6% (1.2%, 2.0%)
60+	-3.6% (-4.0%, -3.2%)	2.0% (1.6%, 2.4%)	-2.8% (-3.1%, -2.5%)	2.3% (2.1%, 2.6%)

2.3.3 Drivers of change

The stroke mortality trend has shown improvement since 1989 due to a combination of generally improving population risk factors and some improvement in medical intervention in the treatment of stroke. This improvement is lower for stroke compared to heart attack which can be explained by the lower levels of NHS services and public awareness for stroke compared to heart attack.

In contrast, incidence rates have deteriorated significantly over the 1990s due to a combination of factors including possible inconsistencies in data collection over time as well as improved detection techniques of minor stroke due to advances in scanning technologies. According to stroke specialists (Stroke: A practical guide to management; Warlow et al) the historical trend in stroke is difficult to interpret. The main reason for this is due to the inconsistencies in data collection. Stroke incidence in many countries, where they do have reliable data, seemed to have declined, stayed the same or increased. They are unclear about the direction of the underlying trend in incidence rates.

2.3.4 Changes to Risk Factors

The major risk factors for stroke are:

- High blood pressure;
- Previous stroke or TIA, or a family history of stroke;
- Atrial fibrillation (irregular heart rhythm);
- High blood cholesterol;
- Diabetes;

- Smoking;
- Advancing age;
- Unhealthy diet;
- Alcohol and drug abuse.

Many of these risk factors are the same as for heart attack (section 2.2.4.1). The most important risk factor for stroke is high blood pressure. The increase of cardiovascular risk factors such as high blood pressure could be a possible reason for the increase in incidence over time (Increasing Stroke Incidence and Decreasing Case Fatality, 1989-1998: A study From the Stroke Register in Malmo, Sweden; Stroke 2003; 34;913-918).

The department of health has run national campaigns which highlight the benefits of a healthy diet and lifestyle, and these may have assisted in partially offsetting the increases in incidence of stroke to some extend over the past decade.

2.3.5 Changes to medical interventions

Stroke has not achieved the same level of medical intervention compared to heart attacks. The Stroke Association carried out a survey in 1992/93 (J R Coll Physicians Lond. 1995 Nov-Dec; 29(6):479-84). The survey questioned consultants who routinely cared for patients with acute stroke. The conclusion of the survey was that aspirin and heparin alone are the only routine treatments for an immediate treatment of acute stroke where as other treatments were used sparingly if not at all.

In a more up-to-date report by The National Audit Office (NAO) (Department of Health: Reducing Brain Damage: Faster access to better stroke care; 16th November 2005), it was highlighted that the status awarded to stroke has not been commensurate with other leading diseases, such as heart disease, and more can be done to increase the level of mortality improvements and reduce the level of disability post a stroke event. In fact, looking at stroke mortality reduction since 1989 (graph 1 and 2) we see mortality has reduced for the 40-59 and 60+ age bands by between 70% to 80% for both males and females in contrast to heart attacks that have seen a reduction of below 50% over the same period.

There has been a significant level of medical and technological advances in scanning technology over the past two decades, making it possible to examine the brain and to diagnose the type of stroke that has occurred. These tests are believed to have increased the incidence of stroke by making it easier to pick up milder strokes which previously may not have been diagnosed. In particular, Magnetic Resonance Imaging (MRI) scanning became widely used in the UK late in the 1980s and before that Computerised Axial Tomographic (CT or CAT) scanning which became widely used in the early 1980s. However, the NAO has pointed out that scans in the NHS tend not to be carried out as quickly as they should be and there have been delays in treatment. The consequence of this are two fold: a lower level of mortality improvements and a greater level of disability for stroke patients.

In the late 1990s thrombolytic (clot busting) drugs were developed. They can reduce mortality and morbidity rates and were successfully introduced in Australia. In the UK this treatment is not yet a routine part of acute stroke care although it is regarded as an important step forward in the acute treatment of stroke.

A further development in management of stroke services was the introduction of specialist stroke units in all NHS hospitals. However, these units are still in their infancy and have not been fully utilised. The service of stroke units being underused is a key reason why government targets have been missed (The Stroke Association: www.stroke.org.uk).

Unlike stroke, heart disease services have assisted in significantly reducing mortality and incidence rates over the past decade but this may have led to a detrimental effect on stroke mortality and incidence. In fact, there is some evidence to suggest that the increase in CABG and angioplasty operations in the 1990's which reduced the risk of heart attack may have contributed to an increase the risk of stroke.

Furthermore, reductions in the incidence and mortality of heart attacks may lead to a higher incidence of stroke, particularly at older ages as there is a theoretically increasing population exposed to stroke. However, the Swedish study based on the population of Malmo (Stroke 2003;34;913-918) suggested that this is not the case.

2.3.6 Changes to Diagnostic Techniques

Better management of stroke services could utilise NHS resources more effectively and this could lead to further mortality and morbidity improvements. In fact, many of the components of clinical guidelines for optimal stroke care are already in place. The NAO has suggested how to deliver government targets by 2010.

Public awareness has also been poor over the past decade. A recent NAO survey showed that many people do not know how to recognise the symptoms of stroke and they do not always treat as an emergency. As a consequence the government may have further national campaigns to increase the public awareness.

According to an NAO recommendation, scanning technologies that are available have to be used more effectively. This means a more rapid response to a stroke event is necessary which will lead to a brain scan within a short period of time. This will enable the most effective and appropriate treatment to be delivered depending on the type of stroke. It is also expected that brain imaging technology will improve into the future as well. The combination of more effective use of existing scanning technology and new technologies should result in an increase in the incidence of stroke (i.e. diagnosing milder strokes) and continuing improvements in mortality.

Prevention of stroke is also seen as an important part of NHS strategy. For example, Transient Ischaemic Attacks (TIA) is a warning signal of a possible forthcoming stroke. It is important that delays are reduced to outpatient services and to ensure GPs refer suspected TIA patients to neurovascular clinics. A key part of the strategy is to have a more integrated stroke service within the NHS.

It is also possible that re-classification of stroke may lead to a higher incidence similar to how unstable angina has been re-classified as a heart attack through the change in diagnostic criteria. In particular, TIA classification may change in the future to be included in the stroke definition. But the new ABI definition (section 3.4) may remove some of the impact to the insured incidence rate.

2.4 Coronary Artery Bypass Graft (CABG)

2.4.1 Fallacies of Using HES to Identify and Interpret Trends in Coronary Artery Bypass Graft

The main drawback of using HES for identifying and interpreting trends in the incidence of first ever CABG is the overall quality of HES and our inability to reconcile HES to other data sources. Section 4.5.1.3 describes our attempts to reconcile HES to other data sources and section 8.5.9 summarises the limitations of HES data in general. These limitations are also discussed under heart attack and stroke but their significance for different conditions varies.

Changes in the sudden death rate prior to hospitalisation are not relevant for CABG. A proportion of people will be treated privately outside the NHS for CABG but as this is an expensive and serious operation we expect the proportion to be small and that changes over time in the proportion of people treated privately will not significantly impact trends.

There have not been any changes in the coding used for CABG so the coding classification cannot be impacting trends. Further, as all operations whether or not they were classified as primary are included in the data, changes in practice over time of whether or not an operation is classified as primary will not impact trends.

Historically the definition of CABG used by the ABI is consistent with that used by the medical profession. Trends seen in the HES apply to the same condition that we are interested in for critical illness. The ABI definition of CABG and the definition used by the medical profession may not remain so closely aligned in the future (see section 3.4).

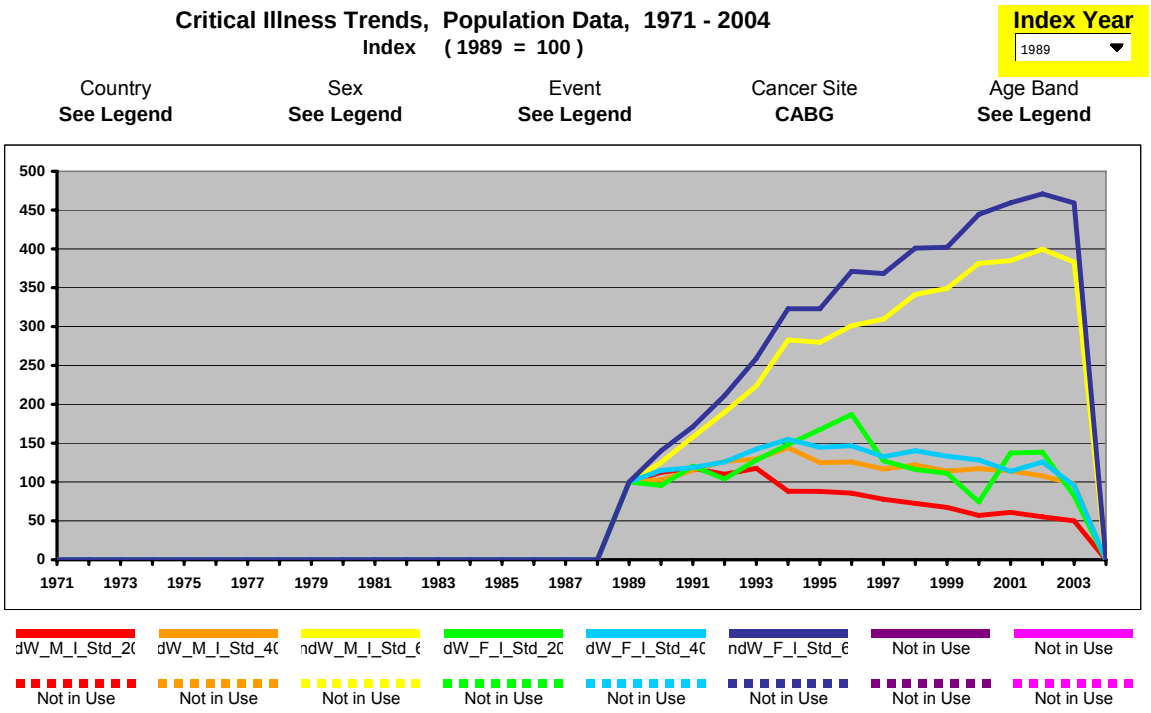
HES are episode based but this should not impact the number of operations recorded. About 5% of CABGs are repeat operations, (National Adult Cardiac Surgical Database Reports 1999-2000). If this proportion has varied over time then this could mean that the trends observed in the data are not fully representative of the trends in the first ever CABG. Historic figures of the proportion of repeat CABG are not available over a long time period but with repeat operations currently only at 5% this is unlikely to be a major influence on trends.

Only a very small proportion of the population will have had a CABG especially at the main insured ages. Therefore whilst theoretically the prevalence of CABS should be taken into account when calculating the incidence rates used to monitor trends in the first ever CABG, the percentage of the population who have had a CABG is not high enough to significantly impact trends except perhaps at the oldest ages.

HES data only covers England and is not therefore reflective of the whole of the UK population. We do briefly describe geographical differences in incidence rates in section 6.2.3. However, as HES is based on about 90% of the UK population it is the most credible and relevant source to use.

2.4.2 Trends in English Male and Female Incidence Rates

For males and females the incidence of CABG increased during the early 1990s. Since the mid 1990s incidence of CABG has been falling for the under 60s but continues to rise significantly for the over 60s. This continuing rise is especially notable for the oldest age groups albeit the increases are starting from relatively low incidence rates.



The table below summarises the trends in incidence for broad age bands over the period from 1989 to 2003 and from 1995 to 2003. The percentage per year change is stated to nearest decimal place and an indication of the 95% confidence interval is shown in brackets. These numbers are dependent on the time period chosen, the method of fitting the trend and the quality of the data.

Table 1: Log linear Trends (% per annum) in Incidence of Coronary Artery Bypass Graft in England

	Male		Female	
Age Range	Incidence (1989 to 2003)	Incidence (1995 to 2003)	Incidence (1989 to 2003)	Incidence (1995 to 2003)
20-39	-6.0% (-7.0%, -5.0%)	-7.0% (-7.9%, -6.0%)	-0.4% (-3.4%, 2.7%)	-6.5% (-12.4%, -0.3%)
40-59	-0.4% (-1.6%, 0.9%)	-2.6% (-3.5%, -1.6%)	-0.1% (-1.8%, 1.6%)	-4.1% (-5.9%, -2.3%)
60+	9.0% (6.8%, 11.1%)	4.0% (2.9%, 5.1%)	9.9% (7.5%, 12.4%)	4.1% (3.0%, 5.2%)

2.4.3 Drivers of Change

The incidence of CABG will be influenced by changes to risk factors determining the proportion of the population who might be in need of treatment with a CABG, together with changes to medical treatments such as drug therapies as well as other surgeries.

2.4.3.1 Changes to Risk Factors

The changes to risk factors relevant to CABG are the same as those described for heart attack in section 2.2.3.1.

2.4.3.2 Changes to Medical Interventions

The medical treatments described in section 2.2.3.2 for heart attack in relation to primary prevention of heart disease and chronic or unstable angina, are also pertinent to CABG. Chronic angina for

example can be treated by a CABG, so reducing the prevalence of chronic angina should also reduce the need for operations such as CABG. The increasing availability and efficiency of the various drug therapies should help reduce incidence rates and therefore cannot fully explain the change in the incidence rates observed. The increases in incidence rates in the early 1990s appear to be largely driven by the growing availability of expert resources to carry out CABG. A change in practice occurred in the late 1990s with an increasing number of angioplasty operations being performed, some of which were a substitute for a CABG.

In 2000 the guidance from the National Institute for Clinical Excellence (NICE) formalised this change in practice and the following quote appeared in the BMJ.

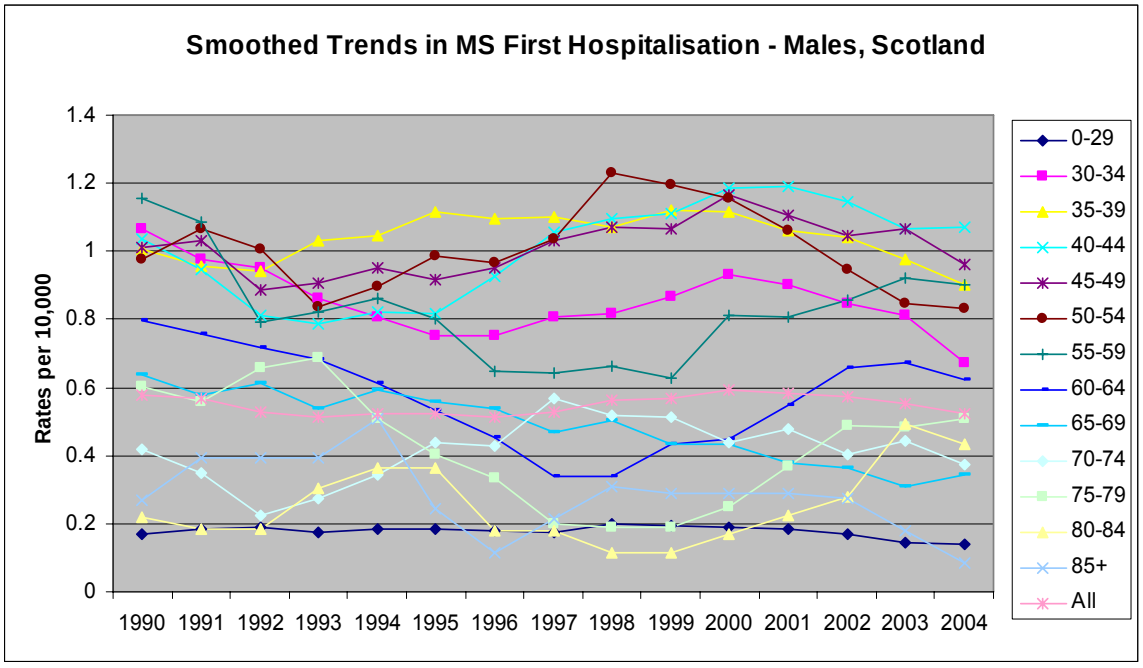
"..if a patient is suitable for both angioplasty and coronary artery bypass surgery (CABS) it may be preferable to undergo angioplasty with coronary artery stent instead of CABS."

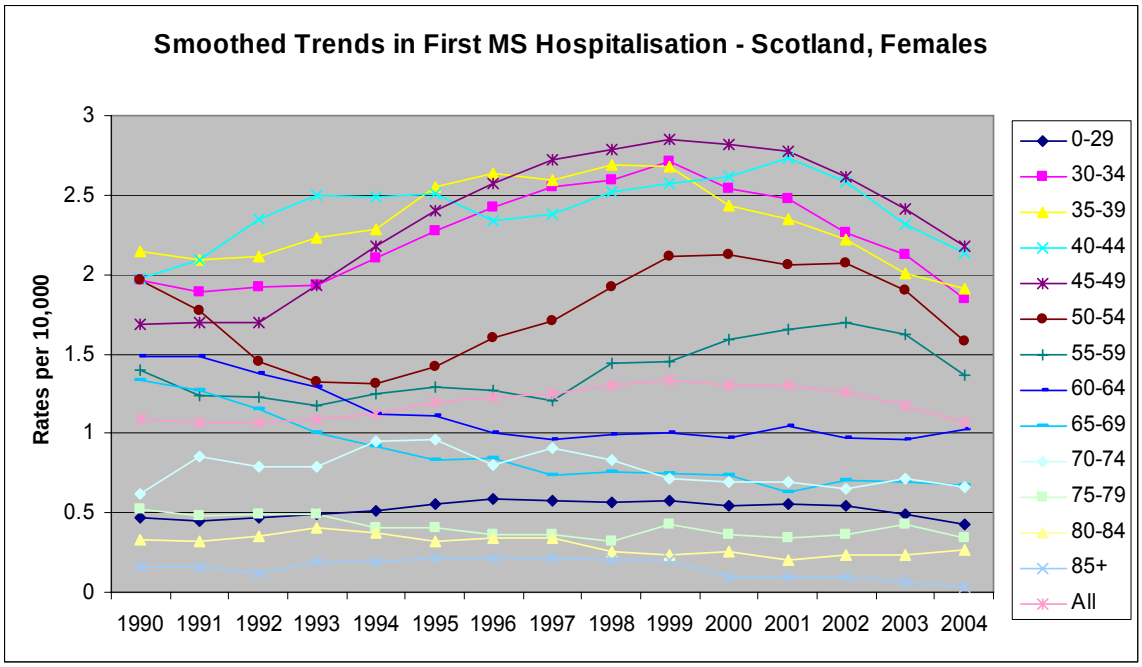
Since the mid 1990s the incidence of CABG have fallen except for the over 60s. Rates continue to increase significantly at the oldest ages especially at ages over 75. At the start of the 1990s the number of operations carried out at ages over 75 was very low. Over time a higher proportion of older people with heart conditions were considered eligible for surgery as techniques improved and the risks of surgery at these old ages fell. Rates are therefore increasing dramatically at these ages and an increasing proportion of CABGs are for people over 75.

2.5 Multiple Sclerosis (MS)

There are two sources giving trends in CI over time. The largest is HES data. HES data records hospitalisation episodes for MS. These are not necessarily related to new diagnoses. A sufferer may not need hospital treatment for many years, if ever, following diagnosis. Other suffers may have multiple hospital stays. The trends may therefore say more about prevalence of MS than they do about incidence and changes in practice regarding frequency on hospital in-patient treatment for MS will obscure any trends.

The Scottish ISD data records first hospitalisation of a patient for MS. Looking at trends over time will therefore give an idea of trends in MS reaching a certain severity level. However given the relapsing remitting nature of the disease in many individuals, first hospitalisation has only tangential relevance to whether the CI definition has been met and trends in this data as at best only indicative of the trends in MS is Scotland. There is evidence that MS incidence varies by latitude (even within the UK) and so we place further caveats around extrapolating these trends to the whole of the UK. Nevertheless smoothed trends (average of incidence in the previous 5 years to reduce the effect of stochastic variation) are shown below. There is evidence of first hospitalisations peaking around 1999/2000 and falling away in later years, but how much of this is due to medical practice and how much due to true incidence variations in population remains open to question.




Smoothed Trends in First MS Hospitalisation - Scotland, Females
Rates per 10,000
3
2.5
2
1.5
1
0.5
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
0-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85+
All

2.6 Kidney Failure (KF)

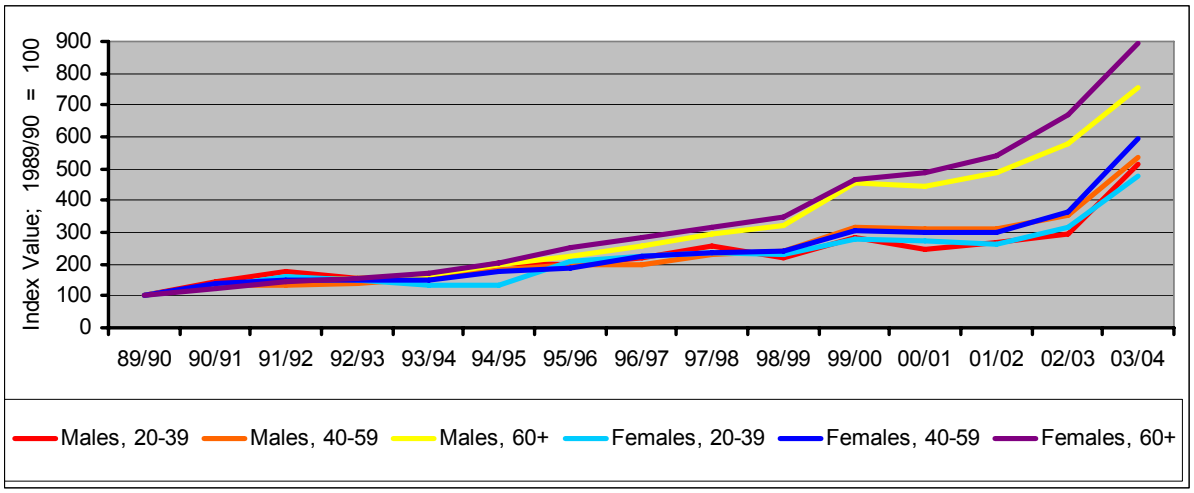
KF is a very minor contributor to overall CI rates and experience. The following comments on trends in KF incidence must therefore be read in context of a very low start point in overall CI cover terms.

The usual trigger for KF CI claims would be the need for renal replacement therapy (kidney dialysis and possible transplantation) (RRT). Feest et al reported on Trends in Adult RRT in the UK over 1982-2000[53] with the following key conclusions:

- The number of new RRT patients rose significantly between 1982 and 2000
  - from around 20 per million to around 30 per million for ages up to 44
  - from around 45 per million to around 125 per million for ages 45 to 64
  - from under 10 per million to around 280 per million for ages 65 and over
- Despite significant expansion in UK RRT services over the observation period, there is evidence of unmet need, and need is expected to rise further, particularly at older ages
- UK RRT acceptance and prevalence rates are lower than in many developed countries.

Data from HES, recording the frequency of hospital episodes for kidney failure, confirms the pattern of very significant increases over time particularly at older ages.

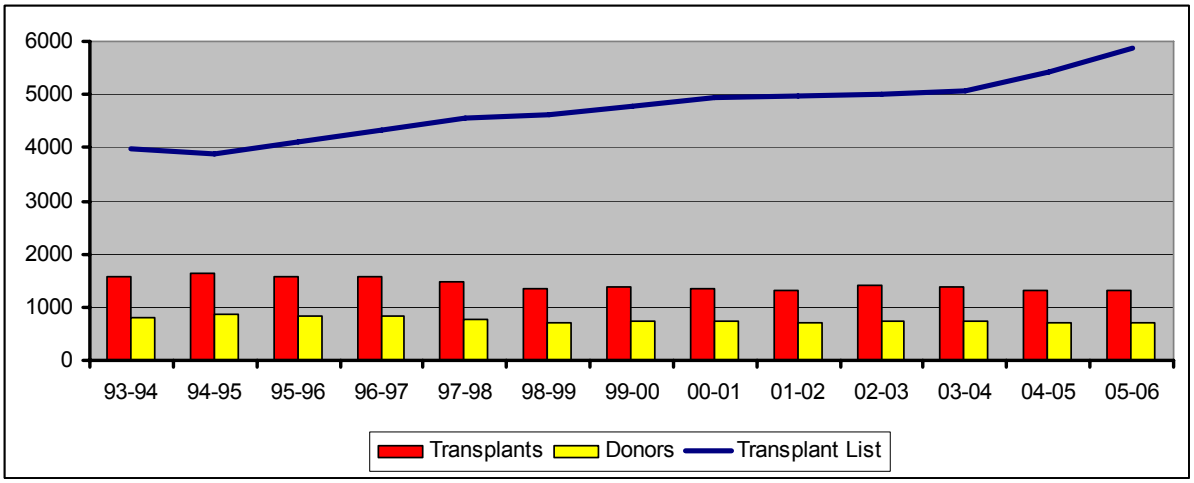
Trends in Hospital Episodes for Kidney Failure, 1989/90 to 2003/04



Source: HES Data Extract; ICD10 and OPCS4 codes: I120, I131, I139, N170-199, N990, O084, O904, P960, Z992, X401-9

The annual reports from UK Transplant[54] show a steady growth (averaging 3%pa) in the waiting list for kidney transplants but a small decline over the last 13 years in the actual number of transplants, with the limited availability of donor organs being a key factor.

Cadaveric Kidney Transplant Programme in the UK, 1 April 1993 - 31 March 2006
Number of donors, transplants and patients on the active transplant list at 31 March



Source: UK Transplant; Transplant Activity in the UK; Annual reports; 2002/3, 2003/4, 2004/5, 2005/6

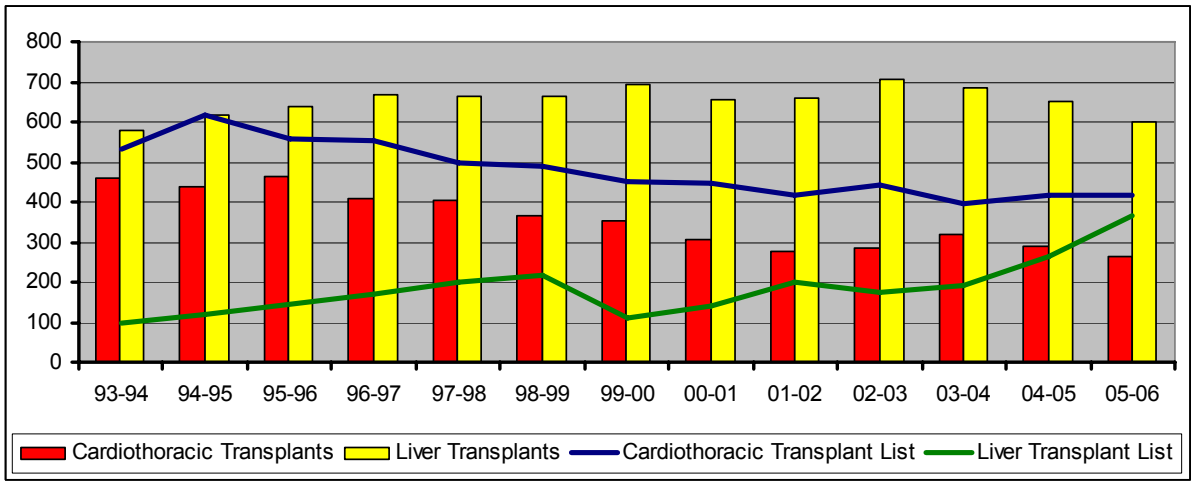
2.7 Major Organ Transplant (MOT)

MOT is a very minor contributor to overall CI rates and experience. The comments below on trends in MOT incidence must therefore be read in context of a very low start point in overall CI cover terms.

Although the CI MOT definitions generally include kidney, pancreas and bone marrow transplants we ignore these in our analysis as they overlap almost 100% with other CIs (KF and Cancer). The MOTs we need to consider are liver and cardiothoracic (heart, lung, or heart & lung) transplants. The usual trigger for MOT CI claims would be acceptance onto the waiting list for a transplant. We have been unable to obtain long time-series data on entrants to the waiting list, so look instead at the overall waiting lists and at the number of transplants carried out each year.

The annual reports from UK Transplant[54] show growth (averaging 7%pa) in the waiting list for liver transplants over the last 13 years, but a fall (averaging 3%pa) over the same period for the waiting list for the cardiothoracic transplant programme. The actual number of liver transplants each year has changed little over the period, whilst there has been a marked reduction in the number of transplants under the cardiothoracic programme. Much of course depends on the availability of suitable donor organs and the priority given within health budgets to such high-cost operations.

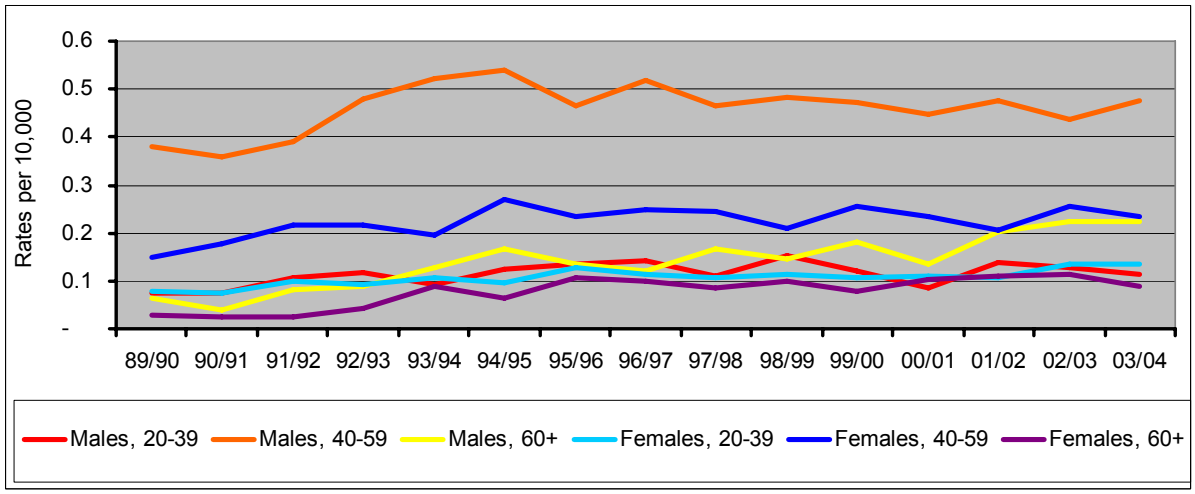
Cardiothoracic and Liver Transplant Programmes in the UK, 1 April 1993 - 31 March 2006
Number of transplants and patients on the active transplant list at 31 March



Source: UK Transplant; Transplant Activity in the UK; Annual reports; 2002/3, 2003/4, 2004/5, 2005/6

Data from HES, recording the number of MOTs in English NHS hospitals, confirms little change in incidence rates over the last 10 years in the 40-59 age group where transplants are currently most frequent, but also shows significant increases in incidence for the older 60+ age group.

Trends in Major Organ Transplants in English NHS Hospitals, 1989/90 to 2003/04



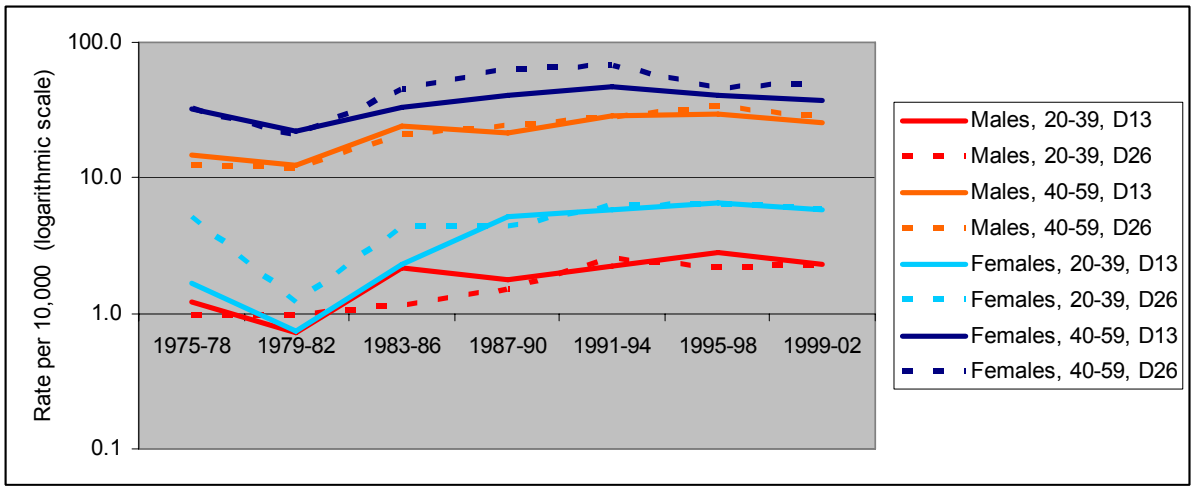
Source: HES Data Extract; Heart, Heart & Lung, Lung, Liver and Pancreas Transplants

2.8 Total & Permanent Disability (TPD)

There is no published data as such for TPD in the UK. The approach we have adopted to estimate TPD rates for CIBT02 is based on experience under Individual Income Protection (IP) policies sold in the UK (using CMI Individual IP experience for 1999-02) and is fully described in Section 4.9.

We can obtain an indication of trends in TPD rates by applying the same estimation approach to CMI Individual IP experience for earlier quadrennia. The chart below shows the estimated TPD rates based on experience for each quadrennia since 1975-78; these TPD rates are implicitly on an 'own occupation' definition and are shown without any allowance for overlaps with other CIs. The inferred TPD rates rise sharply from 1975-78, more than doubling by 1991-94, before the trend flattens out somewhat during the 1990s.

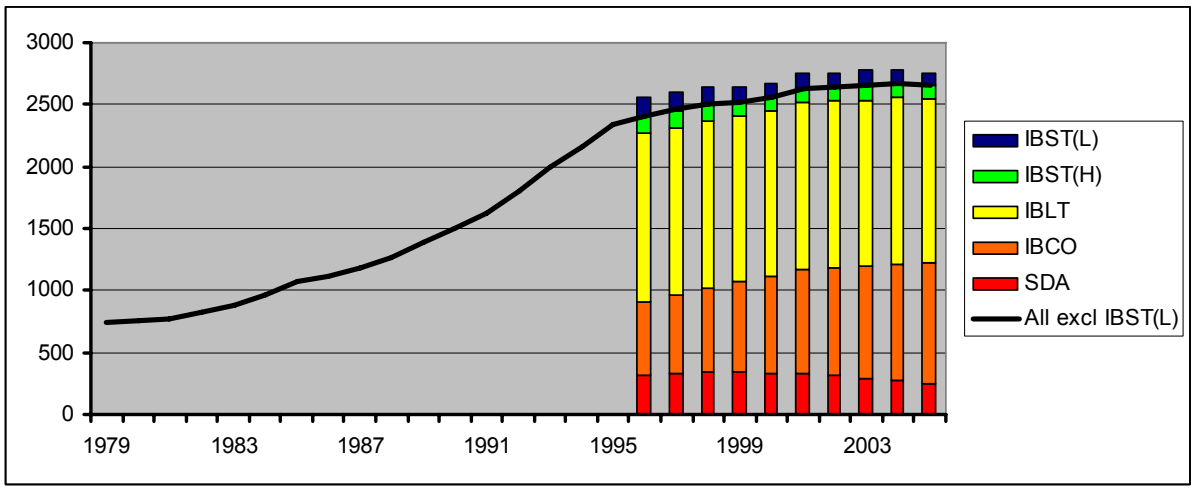
Trend in Estimated TPD Rates Inferred from CMI Individual IP Experience, 1975/78 to 1999/02



Source: Own calculations from CMI Individual IP Experience (CMIRs 15, 18, 20 & 22) using TPD model described in 4.9.3

For other guidance on trends we might also consider State Benefits. The chart below shows the number of claimants for Incapacity Benefit and Severe Disablement Allowance also rose steeply during the 1980s and through to the mid-1990s before levelling out more recently.

Number of Claimants for Incapacity Benefit / Severe Disablement Allowance, 1979 - 1995



Source: Department for Work & Pensions ; Figures relate to February in each year
IB = Incapacity Benefit ; IBST(L) = IB (Short Term Lower) ; IBST(H) = IB (Short Term Higher)
IBLT = IB (Long Term) ; IBCO = IB National Insurance Credits Only ; SDA = Severe Disablement Allowance
Figures for 1979-94 show forerunners of IB (Sickness Benefit and Invalidity Benefit), broadly equivalent to IB excluding IBST(L)

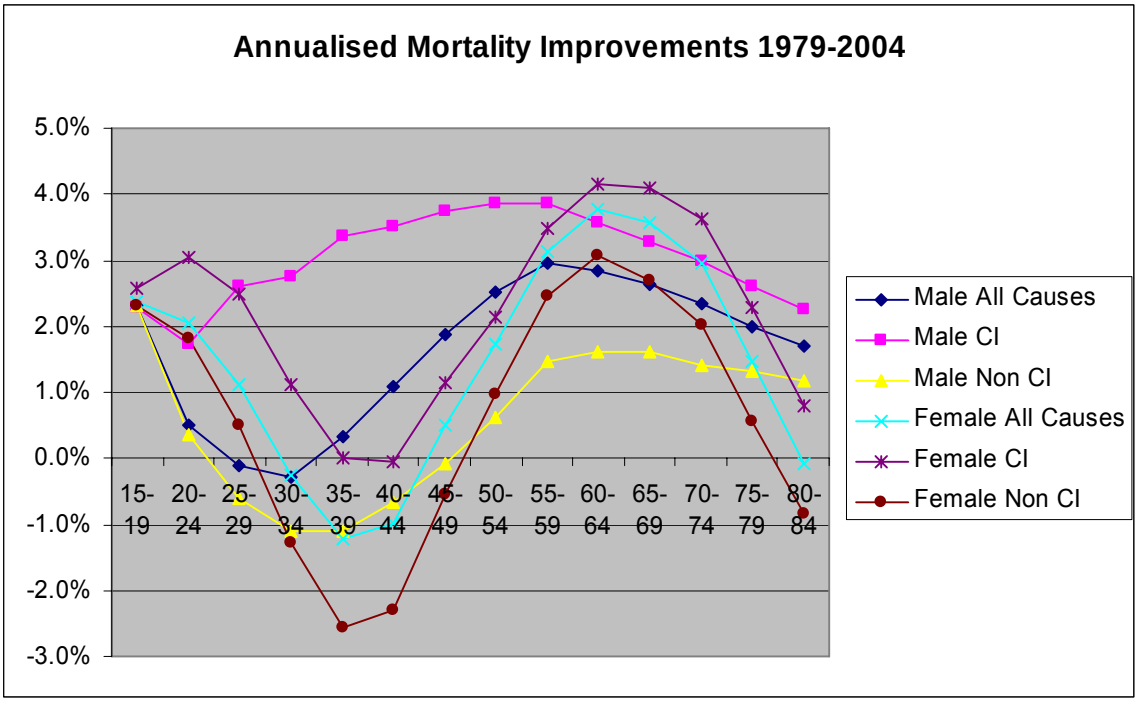
The interpretation of occupation-based TPD definitions is highly subjective and may therefore allow trends driven by social pressures and changes in expectations of quality of life. There is anecdotal evidence that the interpretation and cost of "any occupation" cover has moved closer to that of "own occupation" cover over the last 15 years.

2.9 Non-CI Deaths

The allowance for non critical illness related deaths in the CIBT93 and CIBT02 tables is implicitly made by use of kx factors. The total Accelerated Critical Illness decrement is calculated as $(\sum i_x) + (1-q_x.\sum k_x)$, where i_x is the incidence rate of each disease, qx is the mortality rate and k_x for each disease is the proportion of deaths due to that illness. The deaths left over are thus those from conditions other than critical illness.

This approach belies the fact that non CI deaths are one of the biggest causes of claim under Accelerated Critical Illness. They are the largest single cause for young males and the second largest cause of claim for females at most ages.

The graph below shows the trends in these non critical illness deaths, taken from ONS, over the 25 years up to 2004. The CI mortality is that from heart attack, cancer, stroke and kidney failure. Non CI deaths are those from all other causes.



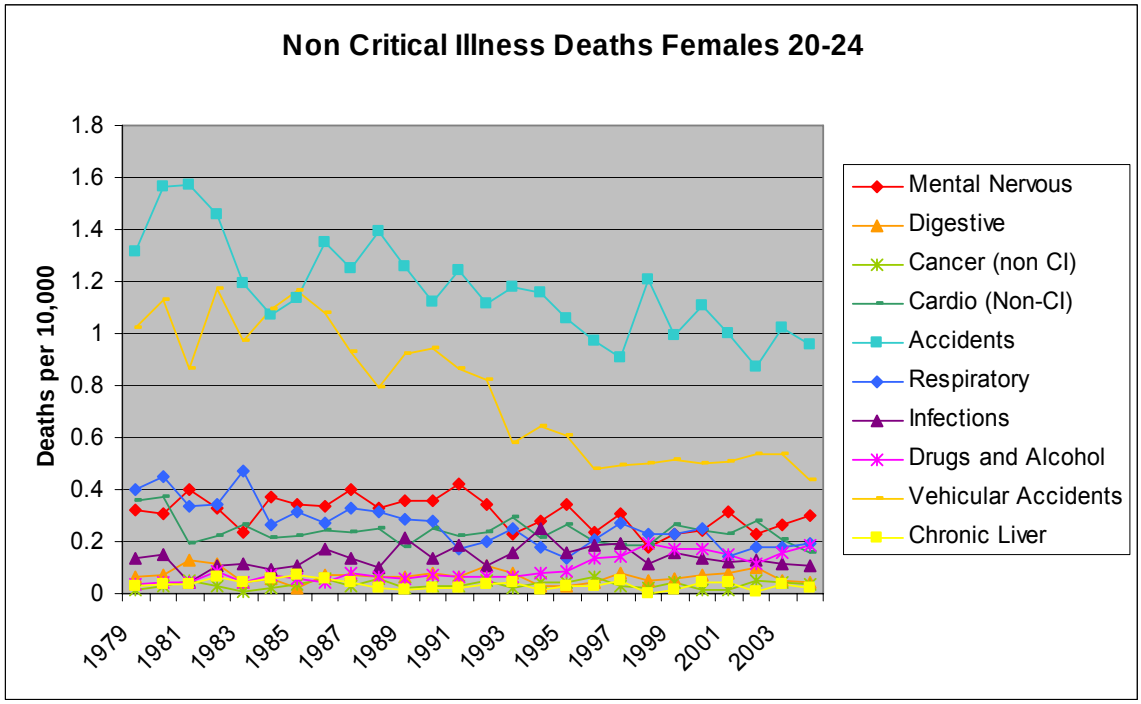
It can be seen that mortality improvements have been greater for the CI conditions than for non CI conditions everywhere. Critical Illness deaths are the minority of deaths at young ages (especially for males) and although CI deaths are a slight majority of deaths at old ages deaths due to respiratory conditions and cardiac conditions other the classic heart attack ensure non CI deaths are important throughout.

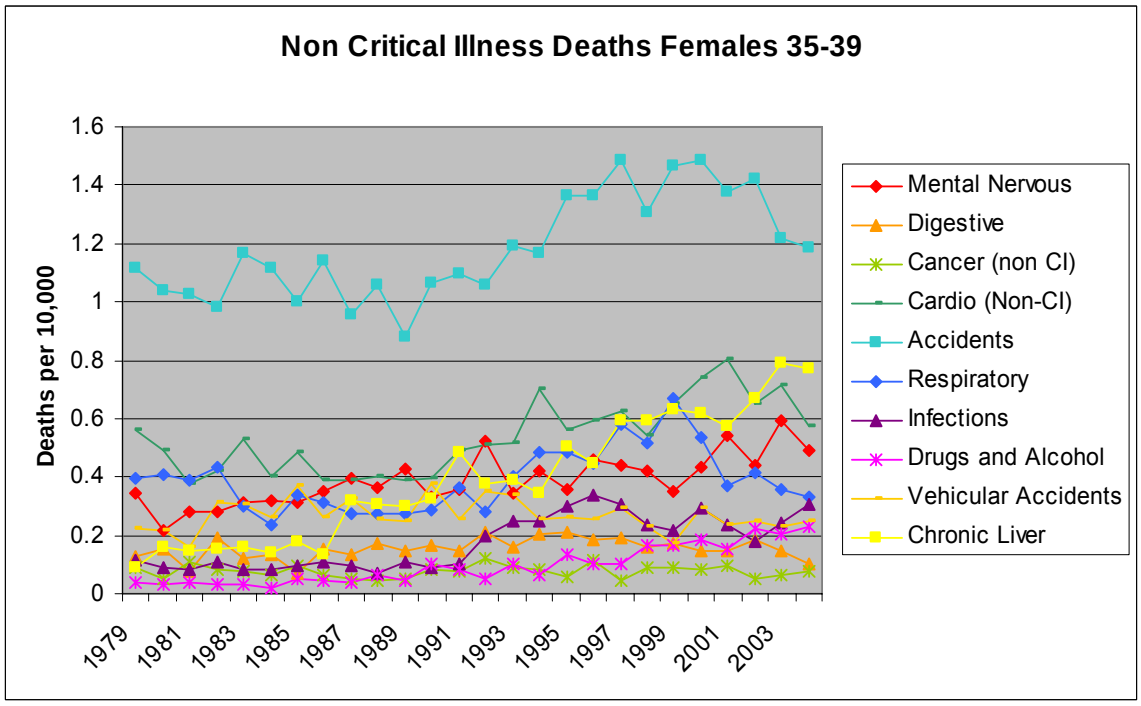
The individual components on non-CI death vary greatly by gender and age. Below we graph the trends in the major causes of non CI death at the key age bands on the graph above.

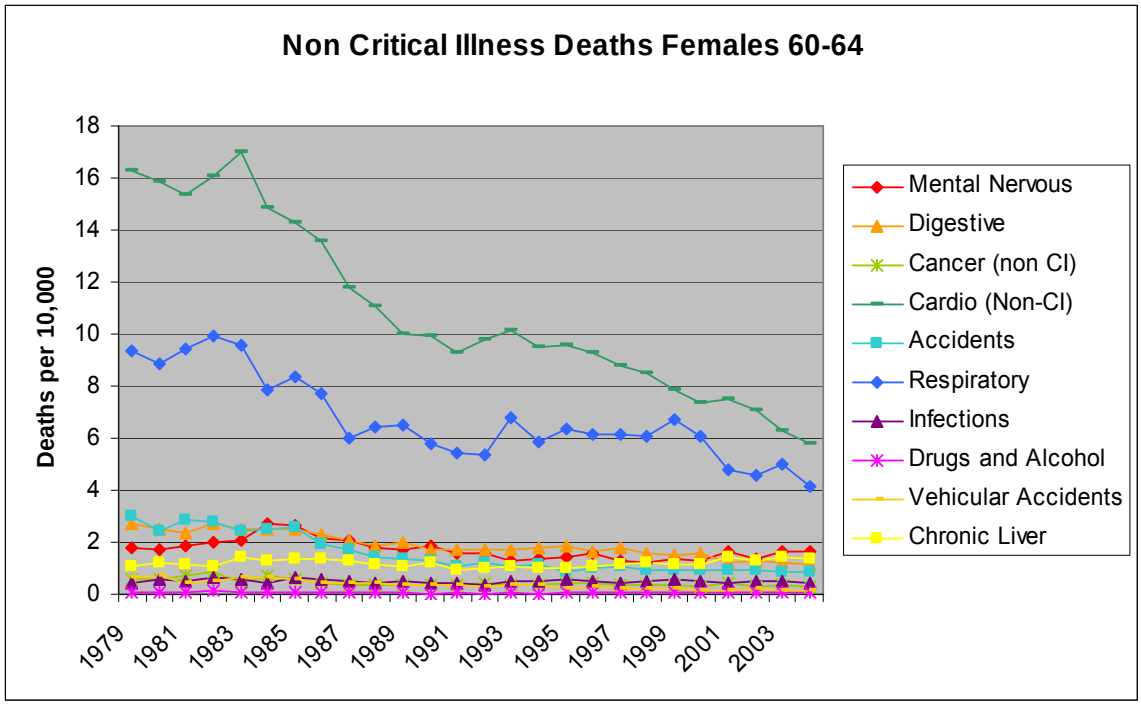
The improvements at young ages for non CI deaths are being driven by improvements in deaths from accidents and in particular, the separate class of vehicular accidents.

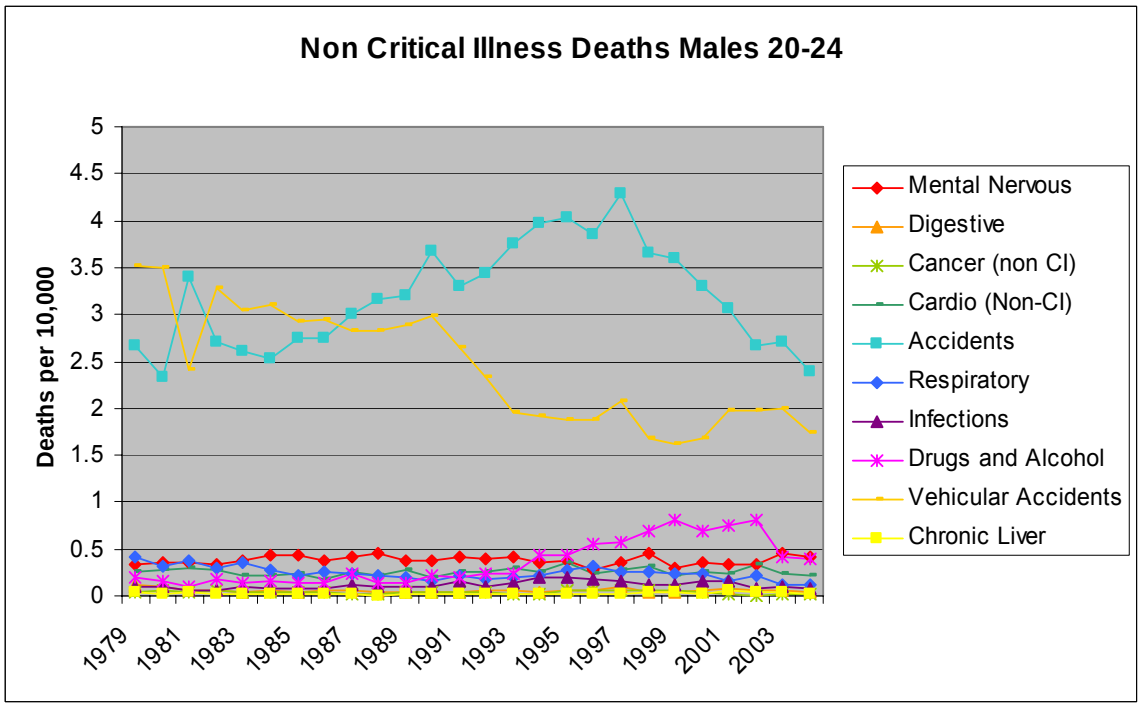
For middle aged females, there is still a very low level of non CI deaths, but this level has increased markedly during the period under consideration. Much of this rise is due to lifestyle factors – increases in accidents, liver disease and drug and alcohol deaths being markers of the ladette culture. For males all these features are present with a lower level of increase starting from a higher base.

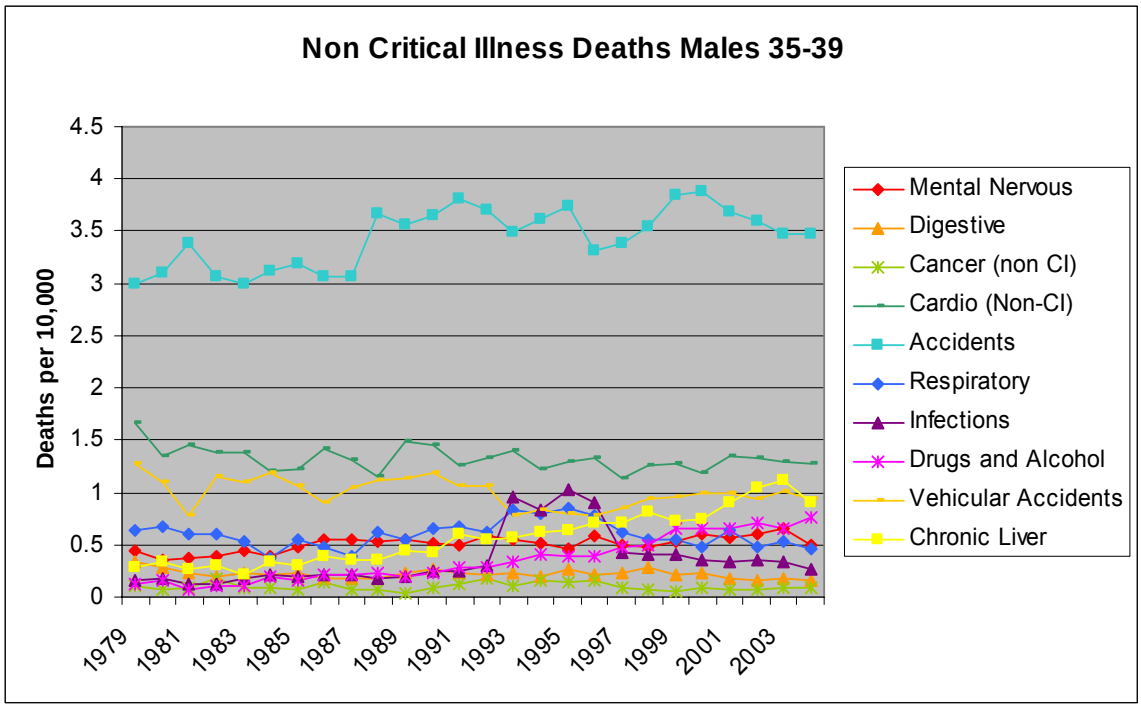
At older ages non-CI deaths are dominated by deaths from cardiac conditions other than classic heart attacks and from respiratory disease. The improved funding of the NHS over the period and the increasing willingness of the medical profession to actively intervene in the disease progression for this age group is helping enormously in diving mortality improvements forward.

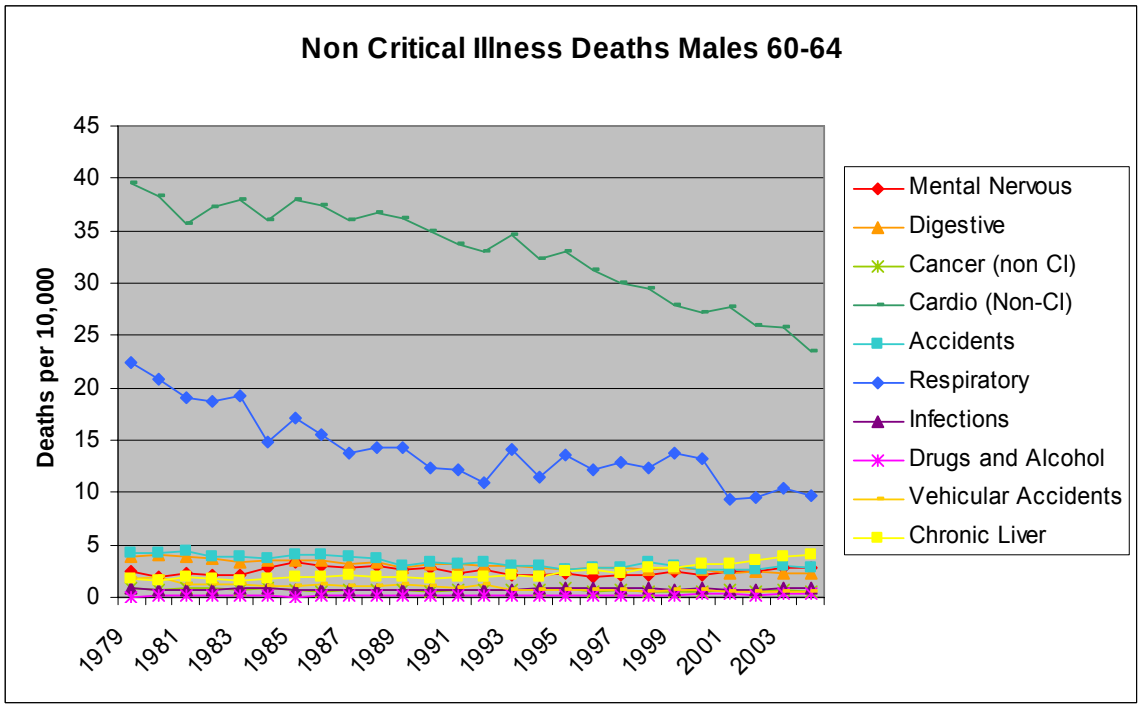

Non Critical Illness Deaths Females 20-24
Deaths per 10,000
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Mental Nervous
Digestive
Cancer (non CI)
Cardio (Non-CI)
Accidents
Respiratory
Infections
Drugs and Alcohol
Vehicular Accidents
Chronic Liver


Non Critical Illness Deaths Females 35-39
Deaths per 10,000
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Mental Nervous
Digestive
Cancer (non CI)
Cardio (Non-CI)
Accidents
Respiratory
Infections
Drugs and Alcohol
Vehicular Accidents
Chronic Liver


Non Critical Illness Deaths Females 60-64
Deaths per 10,000
18
16
14
12
10
8
6
4
2
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Mental Nervous
Digestive
Cancer (non CI)
Cardio (Non-CI)
Accidents
Respiratory
Infections
Drugs and Alcohol
Vehicular Accidents
Chronic Liver


Non Critical Illness Deaths Males 20-24
Deaths per 10,000
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Mental Nervous
Digestive
Cancer (non CI)
Cardio (Non-CI)
Accidents
Respiratory
Infections
Drugs and Alcohol
Vehicular Accidents
Chronic Liver


Non Critical Illness Deaths Males 35-39
Deaths per 10,000
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Mental Nervous
Digestive
Cancer (non CI)
Cardio (Non-CI)
Accidents
Respiratory
Infections
Drugs and Alcohol
Vehicular Accidents
Chronic Liver


Non Critical Illness Deaths Males 60-64
Deaths per 10,000
45
40
35
30
25
20
15
10
5
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
Mental Nervous
Digestive
Cancer (non CI)
Cardio (Non-CI)
Accidents
Respiratory
Infections
Drugs and Alcohol
Vehicular Accidents
Chronic Liver

2.10 Other (brief comments on other CIs outside of CIBT02)

Alzheimer's Disease

There is insufficient data on Alzheimer's disease incidence rates to study trends. Mortality data is available but it requires careful interpretation. The key risk factors driving incidence rates are advancing age and family history.

Mortality rates (ONS by cause data) appear to have seen a significant increase since 1989 for the age group 60+. For males, the mortality rate per 10,000 has increased from 0.96 in 1989 to 2.89 in 2003. Likewise for females, rate per 10,000 have increased from 1.35 in 1989 to 5.34 in 2003. Females appear to have a higher mortality rate which has increased to a greater extent from 1989 to 2003 compared to the males. However, these trends are distorted by coding changes from ICD9 to ICD10 and doctors having an increasing tendency to record Alzheimer's instead of dementia on death certificates (ONS: Trends in mortality for Alzheimer's disease, Parkinson's disease and dementia, England and Wales, 1979-2004). The underlying trend may be very different.

There is no readily available consistent data over time to give an indication on how incidence of Alzheimer's or dementia may be changing. The results on studies that are available will vary depending on diagnostic criteria used.

Parkinson's Disease

There is limited data on Parkinson's disease incidence rates. Mortality data is available but this data requires care interpretation of the trends. The key risk factors driving incidence rates are advancing age and family history, similar to Alzheimer's.

Mortality rates (ONS by cause data) have reduced since 1989 for the age group 60+. For males, the mortality rates per 10,000 have fallen from 5.41 in 1989 to 4.86 in 2003. Likewise for females, rates per 10,000 have fallen from 3.51 in 1989 to 2.99 in 2003. Males appear to have a higher mortality rate compared to females. Parkinson's disease does not have the same sorts of distortions in death certificate records compared to Alzheimer's disease. In fact, a study found that the cause of death for 76% of those with the disease was recorded as Parkinson's on the death certificate. (ONS: Trends in mortality for Alzheimer's disease, Parkinson's disease and dementia, England and Wales, 1979-2004).

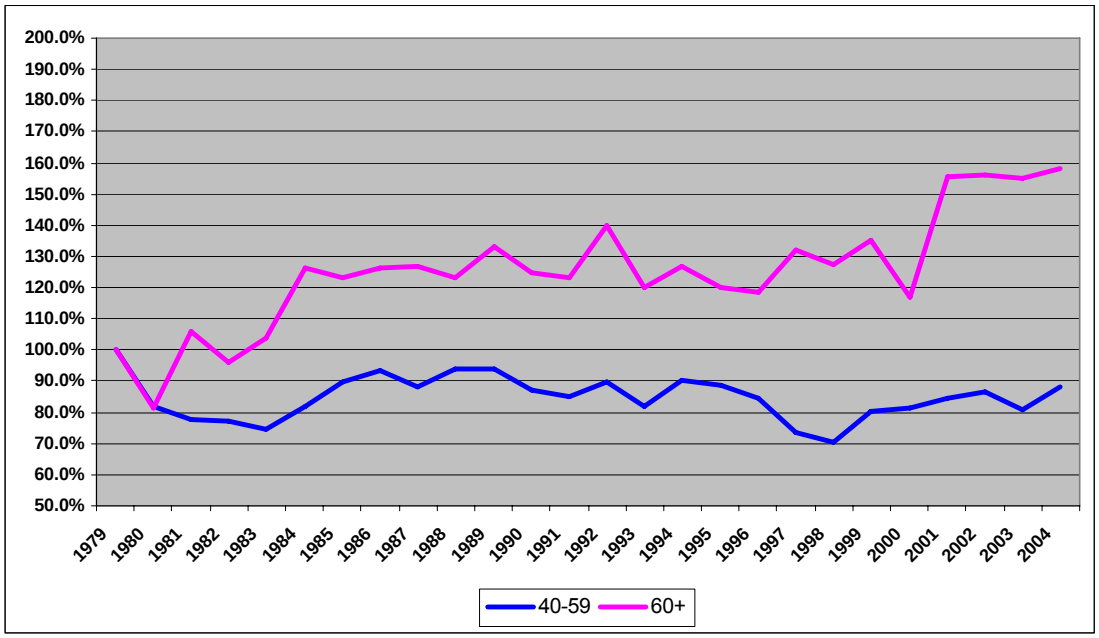
There is limited information on how the incidence of Parkinson's disease changes over time in the UK. There have been five studies over 40 years examining the prevalence of Parkinson's over time and this has suggested that prevalence has remained reasonably stable. This would imply a reducing trend in incidence over time given that mortality rates have declined.

Motor Neurone Disease

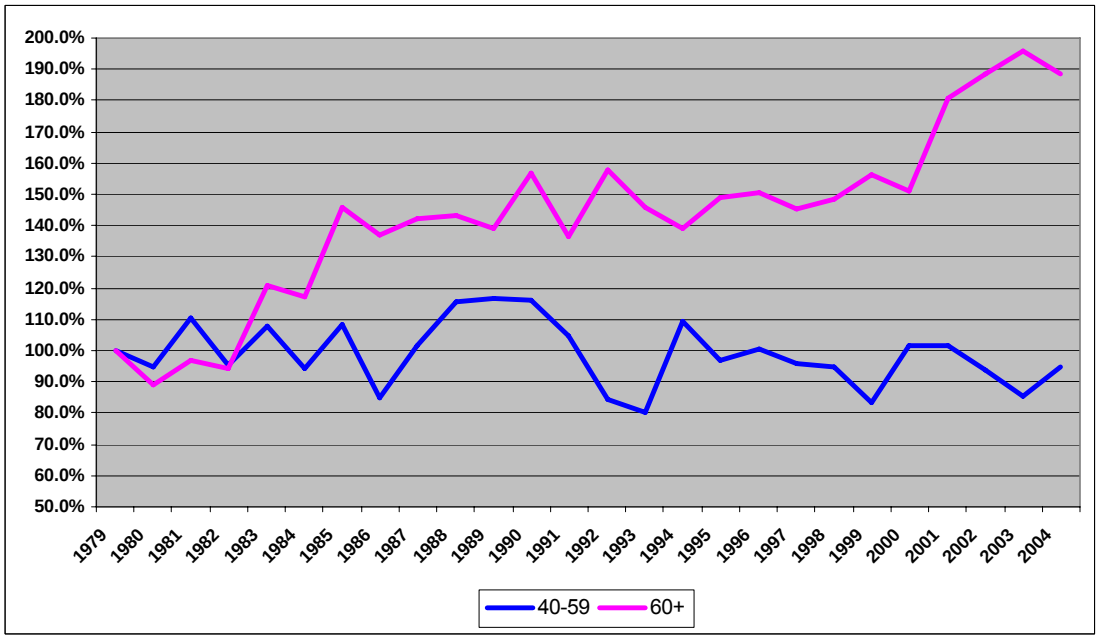
There is limited data for the incidence of Motor Neurone Disease. In deriving the incidence rates (section xxxx) given the poor prognosis for this disease, we used mortality instead of incidence rates. Examining trends in mortality should give an indication of the change in incidence over time.

For males, there appears to be an increase in the mortality trend over time for age group 60+ while 40-59 age group has remained reasonably stable over time (Graph 2.10a). However, the jumps at the start of the 1980's and later in 2001 are due to recording rules changing and code changes from ICD9 to ICD10 (ONS: Main changes in ICD-10 for mortality). Overall, if these distortions were removed the trend would appear to be reasonably stable over time. The same pattern applied to females (Graph 2.10b).

Graph 2.10a Motor Neurone Disease, Males, Mortality rates as a relative percentage of 1979 year, 1979 to 2004



Graph 2.10b Motor Neurone Disease, Females, Mortality rates as a relative percentage of 1979 year, 1979 to 2004



Angioplasty to Two or More Coronary Arteries

The increase in the rate of angioplasty operations since the 1990s has been rapid. For both males and females under 60 rates roughly doubled during the 1990s and this rate of increase has accelerated up until 2003/04 which is the last year that we have data for. The rates of increase since the 1990s has been particularly sharp for women under 30 with about a 7 fold increase in rates between the end of the 1990s and 2003/04. For the over 60s rates increased roughly 5 times during the 1990s and since then have increased by nearly 4 times up until 2003/04.

Table 1: Log linear Trends (% per annum) in Incidence of Angioplasty to Two or More Coronary Arteries

	Male	Female

Age Range	Incidence (1989 to 2003)	Incidence (1995 to 2003)	Incidence (1989 to 2003)	Incidence (1995 to 2003)
20-39	10.7% (6.7%, 14.8%)	14.1% (8.3%, 20.2%)	15.1% (6.7%, 24.2%)	23.0% (1.3%, 49.3%)
40-59	12.3% (8.9%, 15.9%)	18.6% (11.1%, 26.7%)	12.6% (9.8%, 15.4%)	18.7% (12.7%, 24.9%)
60+	21.4% (18.0%, 25.0%)	27.9% (20.8%, 35.5%)	22.9% (19.4%, 26.4%)	29.2% (22.7%, 36.0%)

At the start of the 1990s relatively few angioplasty operations were carried out. The number of angioplasty operations escalated as the operation became more widespread. There was also a change in usual medical practice in the late 1990s. Where patients were suitable for both a CABG and angioplasty with a stent the latter operation was preferred. The number of angioplasty operations grew whilst the number of CABG started to fall in many age groups. (See section 2.4.3.2)

Angina

This condition is not typically covered by a critical illness product but it is interesting to observe the changes in 'incidence' rates compared to those for other conditions also related to heart disease. HES will not give true incidence rates for angina as some occurrences recorded will not be in relation to the first visit to hospital.

Rates of angina have increased fairly consistently since the early 1990s, with increases for the over 60s being especially high.

For the over 60s the increase in CABG outstripped that of angina until the late 1990s when the increase in CABG stopped or slowed down but that of angina continued. For the under 60s the rates of CABG started to fall in the mid 1990s but until then the rates of increase in angina and CABG where similar.

The continuing increase in the rates of angina since the 1990s especially for females under 60 is consistent with the rapid escalation of the rate of angioplasty operations. Angioplasty is one of the possible treatments for severe angina.

Table 1: Log linear Trends (% per annum) in Incidence of Angina

	Male		Female	
Age Range	Incidence (1989 to 2003)	Incidence (1995 to 2003)	Incidence (1989 to 2003)	Incidence (1995 to 2003)
20-39	4.9% (4.2%, 5.6%)	3.2% (2.4%, 4.1%)	8.9% (8.3%, 9.6%)	8.3% (7.0%, 9.5%)
40-59	5.3% (4.3%, 6.4%)	2.3% (1.0%, 3.6%)	8.0% (6.7%, 9.3%)	4.2% (2.6%, 5.9%)
60+	11.2% (9.6%, 12.8%)	6.7% (4.9%, 8.4%)	12.7% (11.2%, 14.1%)	8.4% (6.6%, 10.3%)

Aorta graft surgery

Since 1989 rates of aorta graft surgery have increased the most for males and females under 30 (note that the absolute rates under 30 are relatively low) and over 60, with females showing slightly higher increases than for males. Since 1995 the rate of increase in aorta graft surgery has slowed for all but males under 30.

Table 1: Log linear Trends (% per annum) in Incidence of Aorta Graft Surgery

	Male		Female	
Age Range	Incidence (1989 to 2003)	Incidence (1995 to 2003)	Incidence (1989 to 2003)	Incidence (1995 to 2003)
20-39	4.2% (2.2%, 6.2%)	7.3% (3.4%, 11.4%)	4.8% (1%, 8.6%)	-0.8% (-6.6%, 5.2%)
40-59	0.7% (-0.6%, 2.0%)	-2.1% (-4.3%, 0.1%)	2.5% (0.6%, 4.4%)	0.5% (-2.8%, 3.8%)
60+	4.1% (2.7%, 5.5%)	0.0% (-1.1%, 1.2%)	5.4% (3.8%, 7.0%)	0.8% (-0.5%, 2.1%)

Heart valve replacement or repair

Rates of increase in heart valve operations have been greater for males than females although it is for the over 60s for both where increases are most marked. There has been a reduction in the rates for females between 30 and 60.

Table 1: Log linear Trends (% per annum) in Incidence of Heart Valve Replacement or Repair

	Male		Female	
Age Range	Incidence (1989 to 2003)	Incidence (1995 to 2003)	Incidence (1989 to 2003)	Incidence (1995 to 2003)
20-39	3.1% (1.7%, 4.5%)	6.5% (4.5%, 8.6%)	1.3% (-0.4%, 3.0%)	3.8% (0.0%, 7.8%)
40-59	0.7% (0.0%, 1.5%)	2.1% (0.7%, 3.5%)	-4.1% (-5.1%, -3.1%)	-3.2% (-4.7%, -1.7%)
60+	6.0% (5.1%, 6.8%)	6.6% (5.7%, 7.6%)	4.2% (3.1%, 5.4%)	3.9% (2.3%, 5.5%)

Loss of Hands or Feet

There has been a moderate increase in the number of amputations of hands or feet for the under 60s and a moderate decrease for the over 60s.

Table 1: Log linear Trends (% per annum) in Incidence of Loss of Hands or Feet

	Male		Female	
Age Range	Incidence (1989 to 2003)	Incidence (1995 to 2003)	Incidence (1989 to 2003)	Incidence (1995 to 2003)
20-39	2.2% (1.3%, 3.2%)	3.2% (1%, 5.4%)	3.3% (2.2%, 4.5%)	1.8% (-0.8%, 4.4%)
40-59	0.9% (0.3%, 1.5%)	1.2% (-0.1%, 2.4%)	1.0% (0.0%, 2.1%)	1.1% (-1.2%, 3.4%)
60+	-1.7% (-2%, -1.3%)	-1.7% (-2.4%, -1.0%)	-2.6% (-3.2%, -1.9%)	-4.2% (-5.1%, -3.2%)

Third degree burns

Data is only available since 1995 for third degree burns. Over this period where the absolute rates of burns are relatively high, (i.e. for the over 60s and males under 30), rates of burns are generally decreasing. Otherwise there are no very strong trends.

Table 1: Log linear Trends (% per annum) in Incidence of Third Degree Burns

Age Range	Male Incidence (1995 to 2003)	Female Incidence (1995 to 2003)
20-39	-1.6% (-3.5%, 0.4%)	-0.1% (-3.0%, 2.9%)
40-59	1.3% (-0.7%, 3.4%)	0.7% (-1.3%, 2.8%)
60+	-0.8% (-2.3%, 0.8%)	-1.5% (-3.3%, 0.3%)

2.11 Overview ("all CIs") - TO FOLLOW

3 Insight into Trends for Insured Lives

Trends in the UK population for the different critical illness conditions were discussed in section 2. In this section we will widen the discussion by considering the differences between critical illness incidence and mortality trends for insured lives compared to those in the population.

The CMI have collected insured critical illness data since 1998, however, this data is still too limited to enable a comprehensive study of trends by condition. In particular, the CMI portfolio of experience is immature being heavily weighted towards the younger ages and select durations. Furthermore the experience over time will be distorted by numerous factors including: changes in business mix; changes in underwriting standards; and changes in settlement delay pattern. The data will also have low credibility once it is split down according to year of claim, sex and smoker category as well as by condition.

In order to bridge the gap between insured lives and the general UK population we need to understand the key differences in trends by socio-economic group, as insured lives will have a different socio-economic mix than the general population, and the impact of having smoker-segregated rates. We also need to consider other factors that may influence the insured trend.

3.1 Variation in Trends by Region

3.1.1 Overview

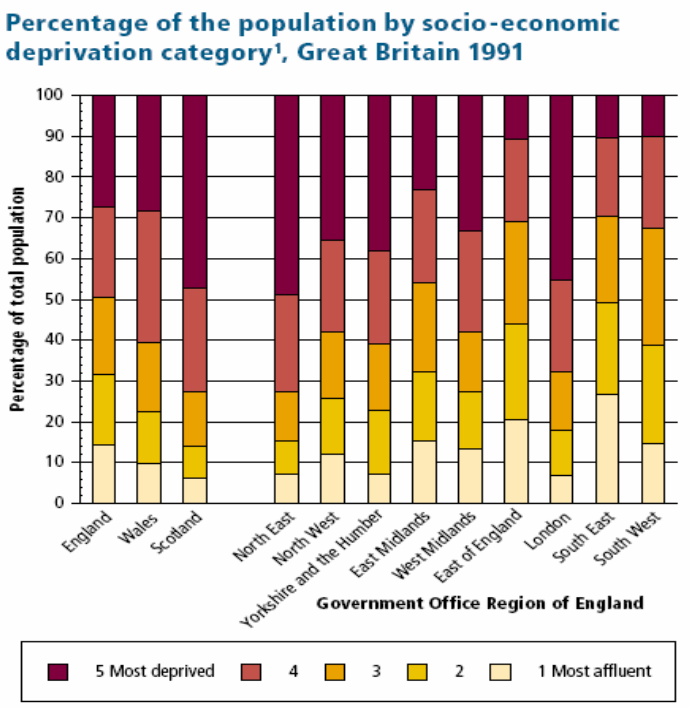
Firstly, we will compare trends between Scotland and England and then we will look in greater detail at the Scottish population split by deprivation category. This will give us an insight into possible trend differences by critical illness conditions between insured lives and the general population.

3.1.2 Comparing Trends between Scotland against England

The data used for investigation of trends by the different critical illness conditions (section 2) and CIBT02 (section 4) was mostly based on English data or English and Welsh data. It is worthwhile investigating Scottish data (ISD data – section 8.6) in more detail as Scotland makes up about one-tenth of the UK population. This will also help us understand the extent of any regional variations in trends. The Scottish data source is also of good quality and is split further by deprivation class across the whole of the Scottish population which will give further useful comparisons against the English trend.

Deprivation varies widely by region across the UK (Graph 3.1a).. The Scottish population has higher mortality and incidence of critical conditions than the English population due to a different socio-economic mix. Scotland has a higher proportion of deprived socio-economic groups than England. There are other regional factors such as differences in NHS services, diet, alcohol consumption and smoking prevalence. We will investigate if these regional differences influence the trends in incidence and mortality between the two countries.

Graph 3.1a



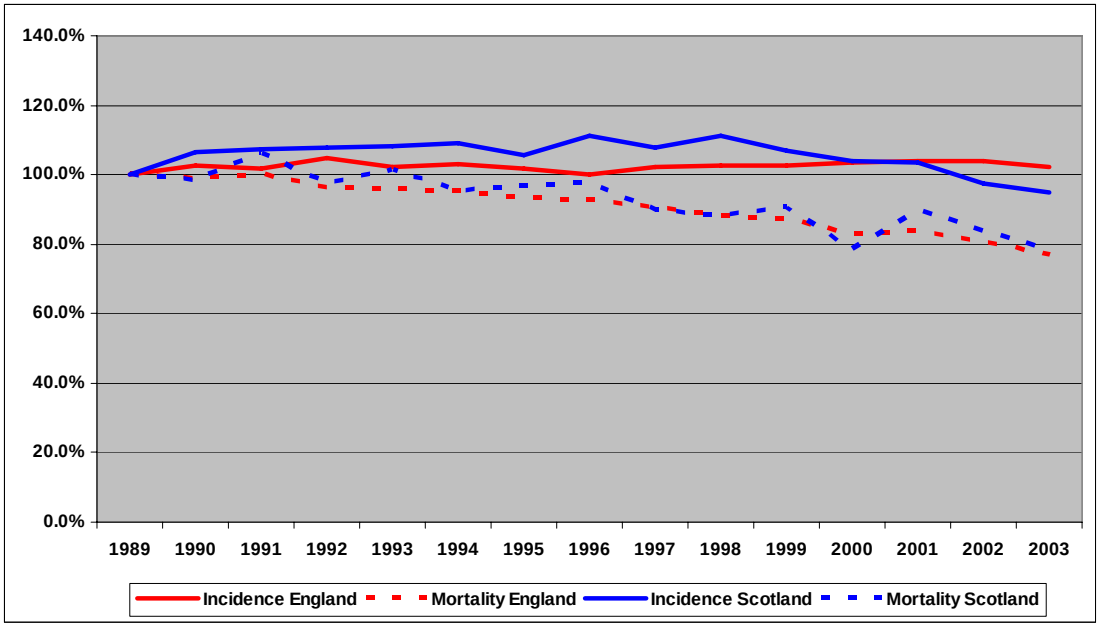
1 Based on the Carstairs index of deprivation[10] at the ward level

Cancer

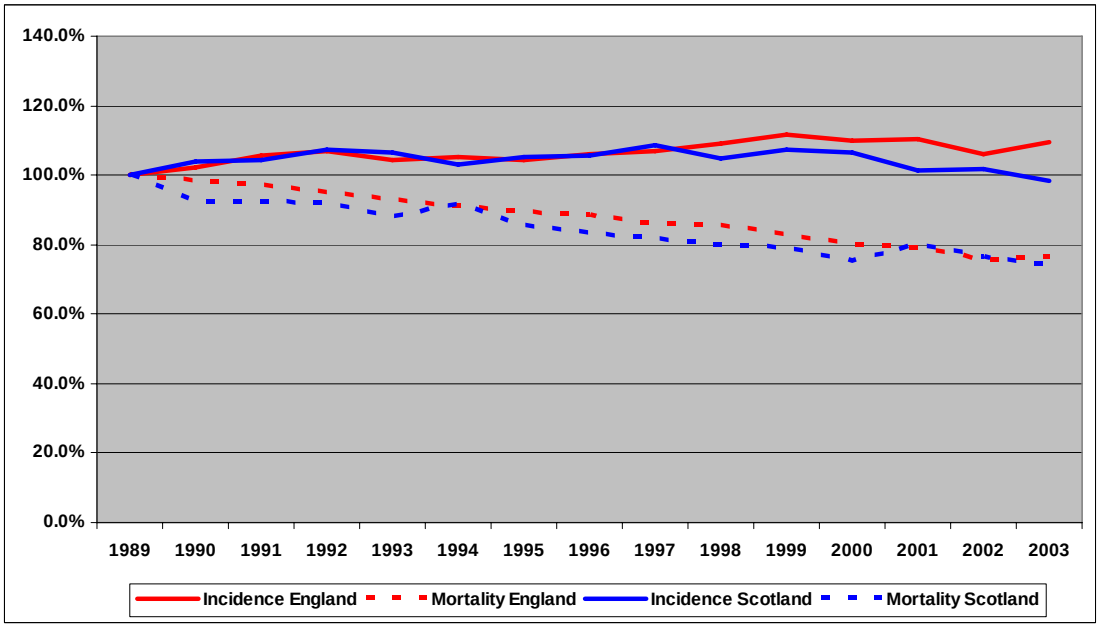
Cancer mortality trends for males and females are similar (Tables 3.1a and 3.1b) in both countries. However, trends in incidence rates between the two countries show a difference where incidence rates appear to be deteriorating in England and improving in Scotland.

For males, trends in Scottish incidence rate have a different shape compared to England (Graph 3.1b). They deteriorate more at the start of the 1990's and then improve more from 1998 onwards. Female trends in incidence rates are similar up to 1997 and then Scottish trends improve more compared to the English trends (Graph 3.1c).

Graph 3.1b – Scottish against English Incidence and Mortality from Cancer, 1989 to 2003, 40-59 age standardised, Males



Graph 3.1c – Scottish against English Incidence and Mortality from Cancer, 1989 to 2003, 40-59 age standardised, Females

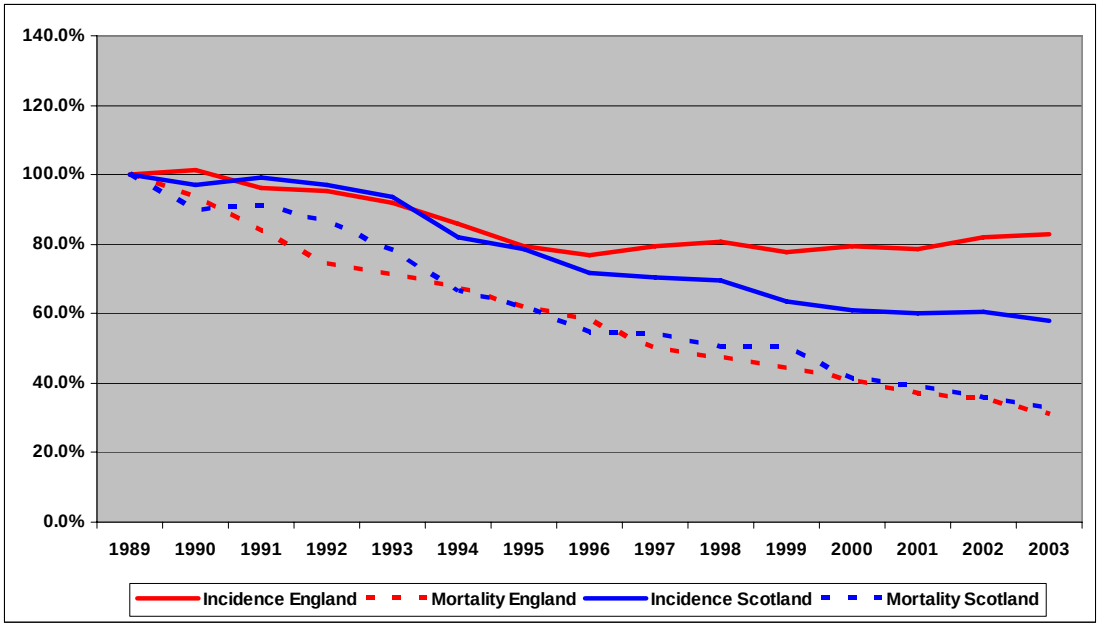


Heart Attack

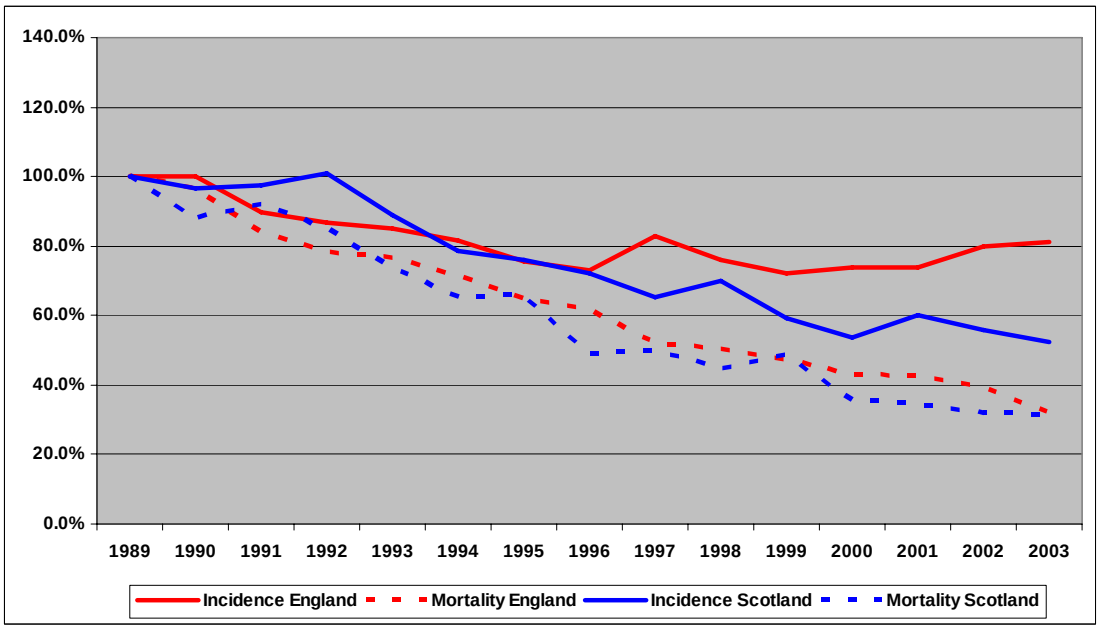
Heart attack mortality trends for males are similar (Tables 3.1d and 3.1e) in both countries. However female mortality has improved to a greater extent in Scotland compared to England (Graph 3.1e). Trends in incidence rates are significantly different between England and Scotland where Scotland has a much higher level of improvement.

For males and females, the trends in incidence rates appear to diverge from 1997, (Graph 3.1d and 3.1e), as English trends in incidence started to deteriorate and Scottish incidence continued to improve. We believe this is due to a new diagnostic test for heart attack, to identify the presence of troponin, being more widely used in England compared to Scotland (section 2.2.4.3 for medical sources) from 1997 onwards.

Graph 3.1d – Scottish against English Incidence and Mortality from Heart Attack, 1989 to 2003, 40-59 age standardised, Males



Graph 3.1e – Scottish against English Incidence and Mortality from Heart Attack, 1989 to 2003, 40-59 age standardised, Females

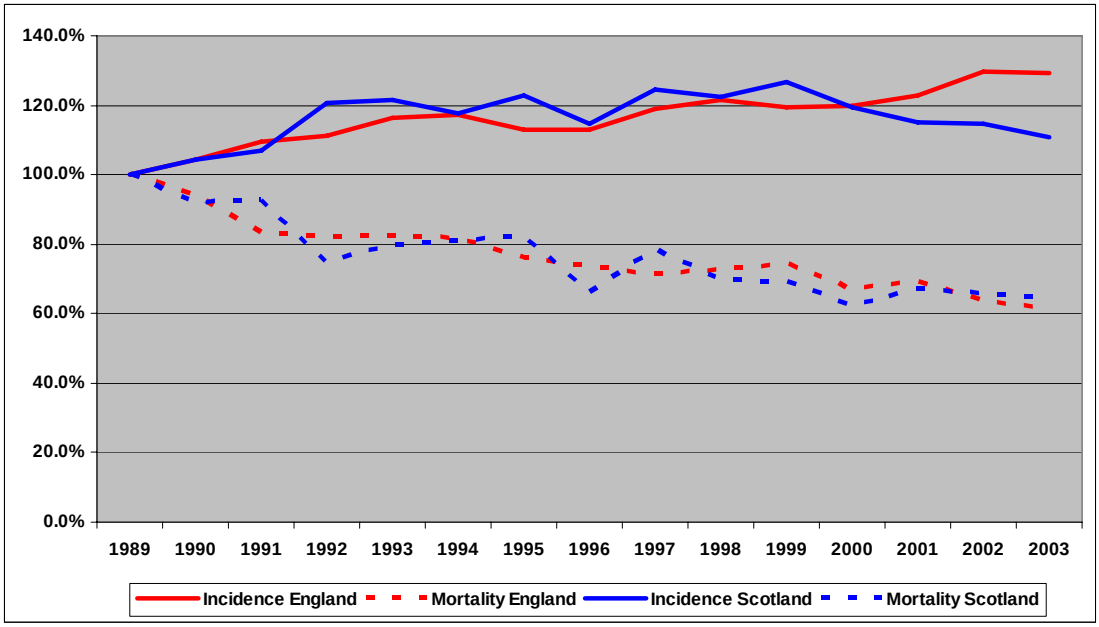


Stroke

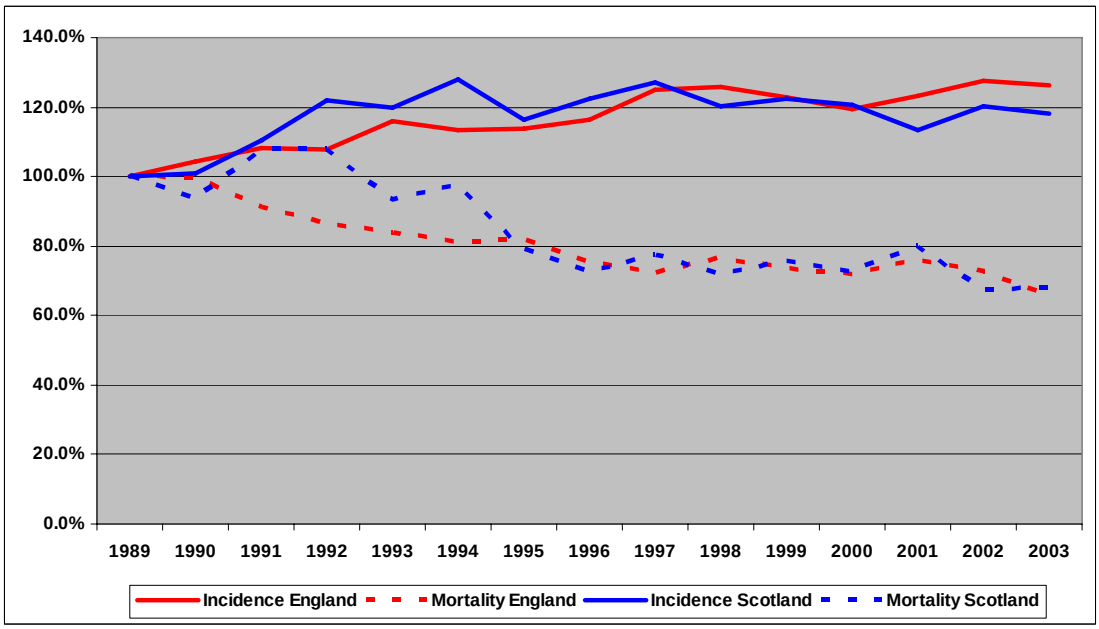
Mortality trends for males are similar (Tables 3.1a and 3.1b) in both countries. In Scotland female mortality deteriorated at the start of the 1990's (Graph 3.1g) but has since improved more rapidly than in England, so that over the whole time period the relative falls in mortality for females in Scotland and England are similar. Scottish incidence rates have a lower rate of deterioration compared to the English trend for both males and females.

The trend in incidence for males and females has a different shape between England and Scotland (Graph 3.1f and 3.1g). Scottish incidence appears to deteriorate over the first half of 1990's and improve more in the second half of the 1990's up to 2003 whereas English incidence continues to deteriorate.

Graph 3.1f – Scottish against English Morbidity, Stroke, 1989 to 2003, 40-59 age standardised, Males



Graph 3.1g – Scottish against English Morbidity, Stroke, 1989 to 2003, 40-59 age standardised, Females



Summary

England and Scotland have similar mortality trends for males. For females, cancer mortality is similar but Scottish females benefit from higher improvements in heart attack and stroke compared to English females.

Differences in the trends of incidence rates between Scotland and England are less clear. For cancer, heart attack and stroke there were significant differences in the shape of the trend. Regional factors such as NHS services may help to explain the gap.

The regional differences in cancer incidence trends are more complex to understand because of the large number of cancer sites, treatment and service variations across different regions. (England vs. Scotland: Does More Money mean Better Healthcare; Benedict Irvine, Ian Ginsberg; commentary Kevin Woods; civitas: Institute of the study of Civil Society London). Geographical patterns in cancer in the UK and Ireland by regions are described in section 3.1.3.

Table 3.1a: Scotland against England, Male Trends in Incidence and Mortality, aged 40-59, Cancer, Heart Attack and Stroke

	England	Scotland
Cancer		
Mortality	**-1.8% (-2%, -1.5%)**	**-1.7% (-2.3%, -1.2%)**
Incidence	**0.1% (0%, 0.2%)**	**-0.4% (-0.9%, 0.1%)**
Heart Attack		
Mortality	**-7.9% (-8.1%, -7.6%)**	**-7.7% (-8.2%, -7.2%)**
Incidence	**-1.8% (-2.4%, -1.1%)**	**-4.4% (-4.9%, -3.9%)**
Stroke		
Mortality	**-2.9% (-3.3%, -2.4%)**	**-2.9% (-3.7%, -2.1%)**
Incidence	**1.5% (1.2%, 1.8%)**	**0.7% (-0.1%, 1.4%)**

Table 3.1b: Scotland against England, Female Trends in Incidence and Mortality, aged 40-59, Cancer, Heart Attack and Stroke

	England	Scotland
Cancer		
Mortality	**-2% (-2.1%, -1.9%)**	**-1.9% (-2.2%, -1.6%)**
Incidence	**0.5% (0.3%, 0.8%)**	**-0.1% (-0.5%, 0.2%)**
Heart Attack		
Mortality	**-7.4% (-7.8%, -7%)**	**-8.5% (-9.3%, -7.7%)**
Incidence	**-1.8% (-2.6%, -0.9%)**	**-5% (-5.7%, -4.3%)**
Stroke		
Mortality	**-2.5% (-3.1%, -2%)**	**-3.2% (-4.1%, -2.2%)**
Incidence	**1.6% (1.2%, 1.9%)**	**0.8% (0.1%, 1.6%)**

3.1.3 Relative Trend of Incidence and Mortality by Deprivation Category

We considered the variation in trend by deprivation class by using Scottish ISD data (section 8.6). This data was broken down by 7 different deprivation categories ranging from group 1, the most affluent, to group 7, the most deprived.

The Carstairs & Morris Index is used to measure the level of deprivation using the 1991 census Deprivation Category Score (section 8.6). It is important to bear in mind that this is an area based index which will tend to dilute the real relationships at individual level. For example, those living in a deprived area will include some affluent people. The same is true for affluent areas where there will be some pockets of deprivation. This will mean that the variation in trend between the real deprivation categories at individual level will be even greater.

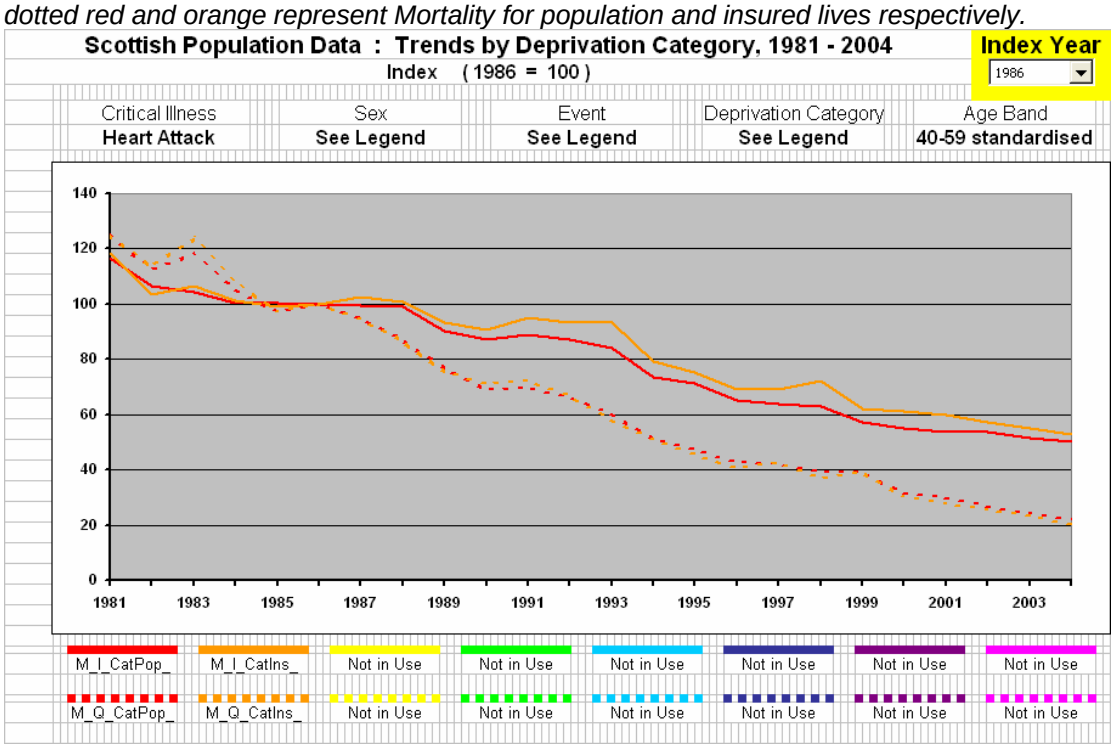
We grouped the deprivation categories, 1 to 7, by applying a different weight to each deprivation category to give a proxy to the insured lives. We used this proxy to compare insured trends against the general population.

The insured population is assumed to be made up of a proportion of each deprivation category being more weighted towards the affluent categories. After comparing a number of different groups, we assumed the following proportions by deprivation category as a reasonable proxy: 100% category 1 (most affluent), 75% category 2, 50% category 3, 25% category 4, and 0% for the remaining categories up to 7 being the most deprived.

Heart Attack

For males, the trends for mortality and incidence for the 40-59 age group, (the key ages for insured lives), show a different pattern for insured lives and the Scottish population as a whole (Graph 3.1i). Despite the widening mortality gap by social class, critical illness incidence rates improved faster for the general population than for the insured group (Table 3.1c). We believe this difference is caused by the insured group having better access to medical care. This is supported by the mortality trends, where the improvement has been greater in the insured population. Greater awareness of symptoms and improvements in medical intervention are increasing survival rates from a first heart attack.

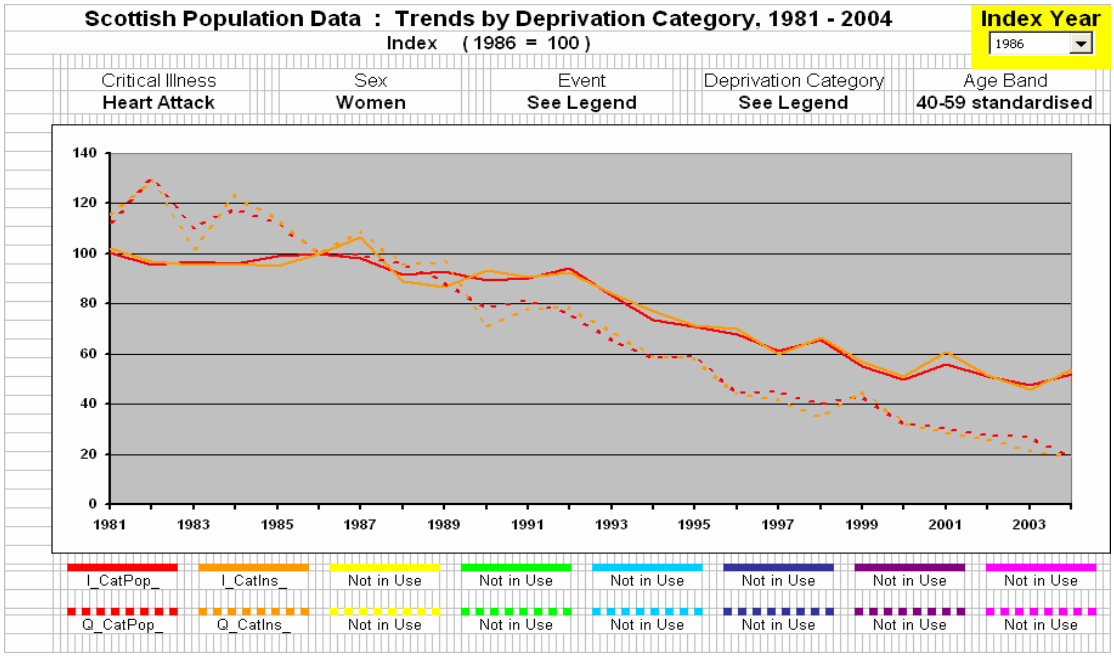
Graph 3.1i – Incidence and Mortality rates for Heart Attack relative to 1986, Males
Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.



(Section 8.6.5 – to explain early distortion in trend)

For females, the trends in incidence between general and insured populations are similar but the trend in mortality for the insured population is improving faster compared to the general population (Graph 3.1j). However, the level of incidence and mortality is at a much lower level for females in the 40-59 age range and consequently the confidence intervals in the gradient are wider (Table 3.1c). Statistically the incidence and mortality trends are not significantly different between insured and the general populations.

Graph 3.1j – Incidence and Mortality rates for Heart Attack relative to 1986, Females
Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.

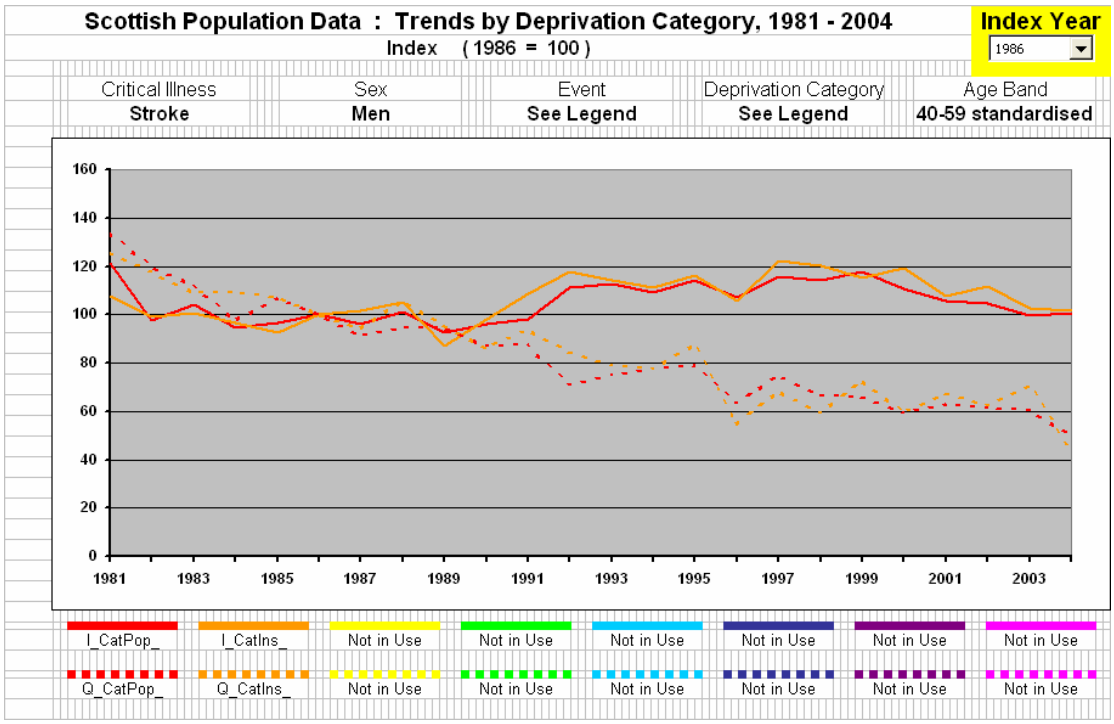


(Section 8.6.5 – to explain early distortion in trend)

Stroke

For males, the stroke incidence for the 40-59 age group was fairly flat over the 1980's, however, both the insured population and the general population have shown deterioration over the 1990's (Graph 3.1k). The trends for insured and general population are similar from 1986 to 2004 (Table 3.1c). On the other hand, mortality has show strong improvement throughout the period from 1981 to 2004. Mortality improvement is slightly greater for the insured group but statistically this difference is not significant.

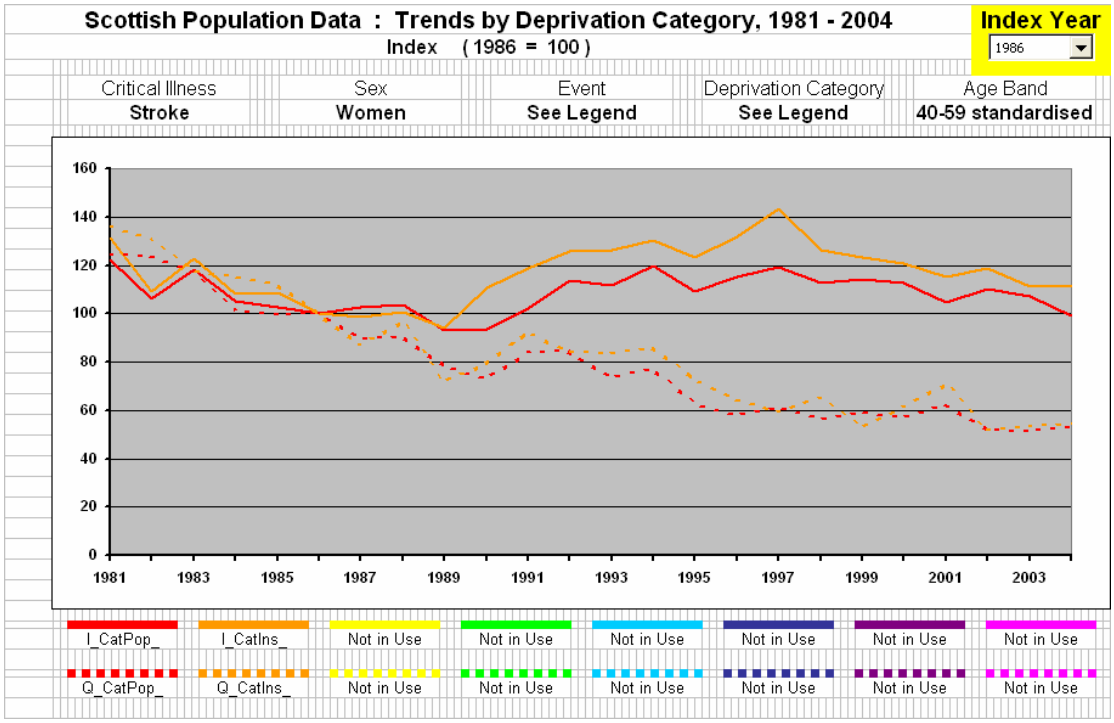
Graph 3.1k – Incidence and Mortality rates for Stroke relative to 1986, Males
Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.



(Section 8.6.5 – to explain early distortion in trend)

For females, the stroke incidence rate slightly improved over the 1980's, however, over the 1990's the incidence rate deteriorated, with a slightly greater deterioration for the insured population (Graph 3.1l). Mortality showed strong improvements throughout the period 1981 to 2004, similar to the males, but for females there was almost no difference between insured lives and the population.

Graph 3.1l – Incidence and Mortality rates for Stroke relative to 1986, Females
Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.

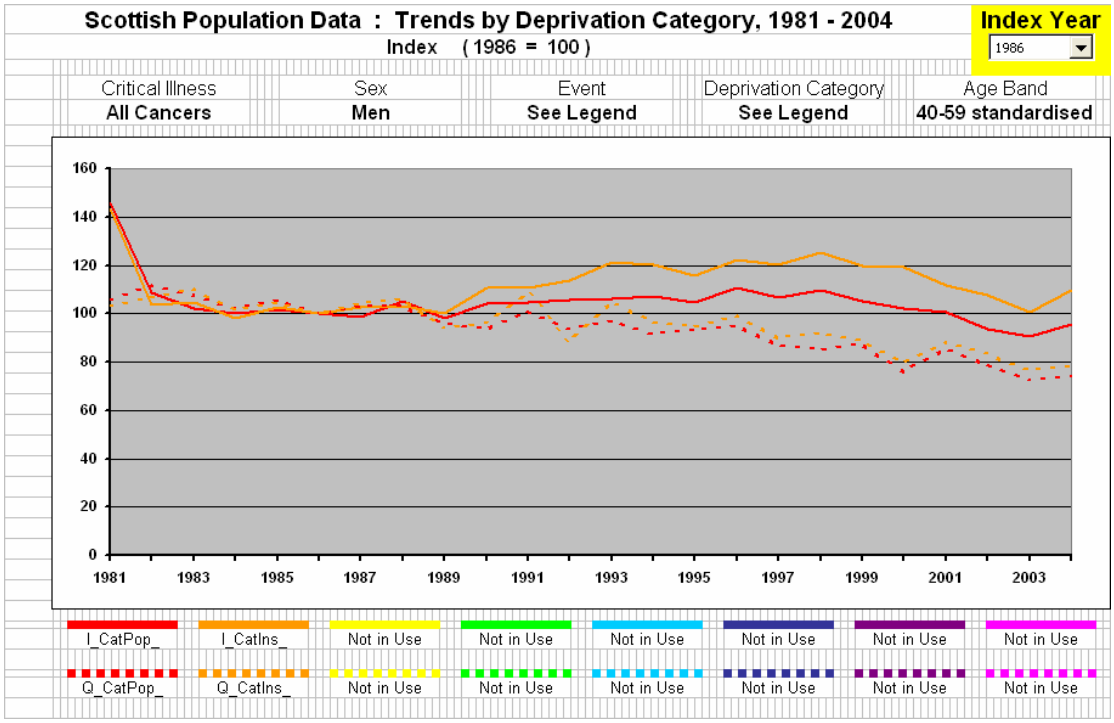


(Section 8.6.5 – to explain early distortion in trend)

All Cancer
For males, the incidence for the 40-59 age group was fairly flat over the 1980's except for the distortion in the early years when data collection started (Graph 3.1e, section 8.6.5). However, the insured trend deviated from the general population from 1989 onwards. It is difficult to interpret why this has occurred; male cancer is not dominated by any particular site, which is the case for females (breast cancer). The insured incidence trend appears to increase across many of the cancer sites for males. Interestingly the mortality rate trend is also not improving to the same extent as the general population. Perhaps a general change in underlying risk factors is driving this change which impacts the affluent males to greater extent.

Graph 3.1m – Incidence and Mortality rates for All Cancer relative to 1986, Males
Bold red and orange represent Incidence for population and insured lives respectively;

dotted red and orange represent Mortality for population and insured lives respectively.



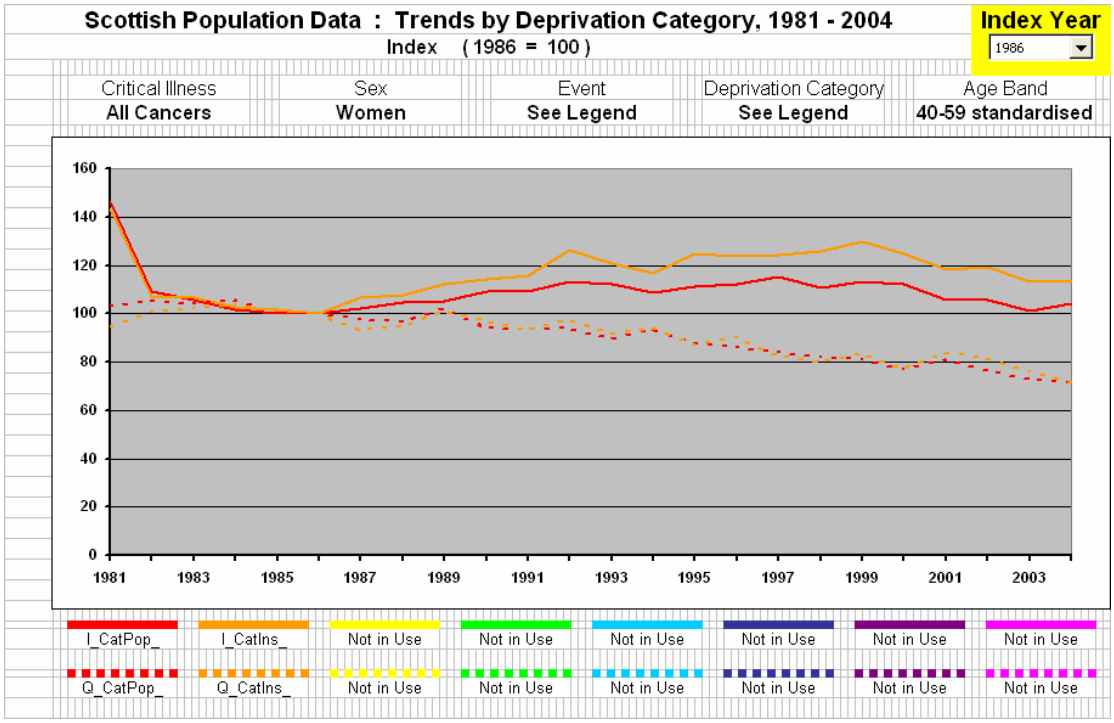
(Section 8.6.5 – to explain early distortion in trend)

For females, the incidence rate was fairly flat over the 1980's but has deteriorated for the insured population and general population since 1987 (Graph 3.1n). Female cancer is dominated by breast cancer which can explain the deterioration observed and why the affluent group of insured lives have deteriorated to a greater extent (breast cancer 3.1.4). Mortality has improved steadily over the whole period with slightly stronger improvements for the general population.

Overall, the trend in incidence is higher for the insured population compared to the general population. This means that over time the gap in the incidence rate between the affluent and the more deprived groups are narrowing over time. Similarly, the trend in mortality is showing slightly better improvements for the population.

Graph 3.1n – Incidence and Mortality rates for All Cancer relative to 1986, Females

Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.

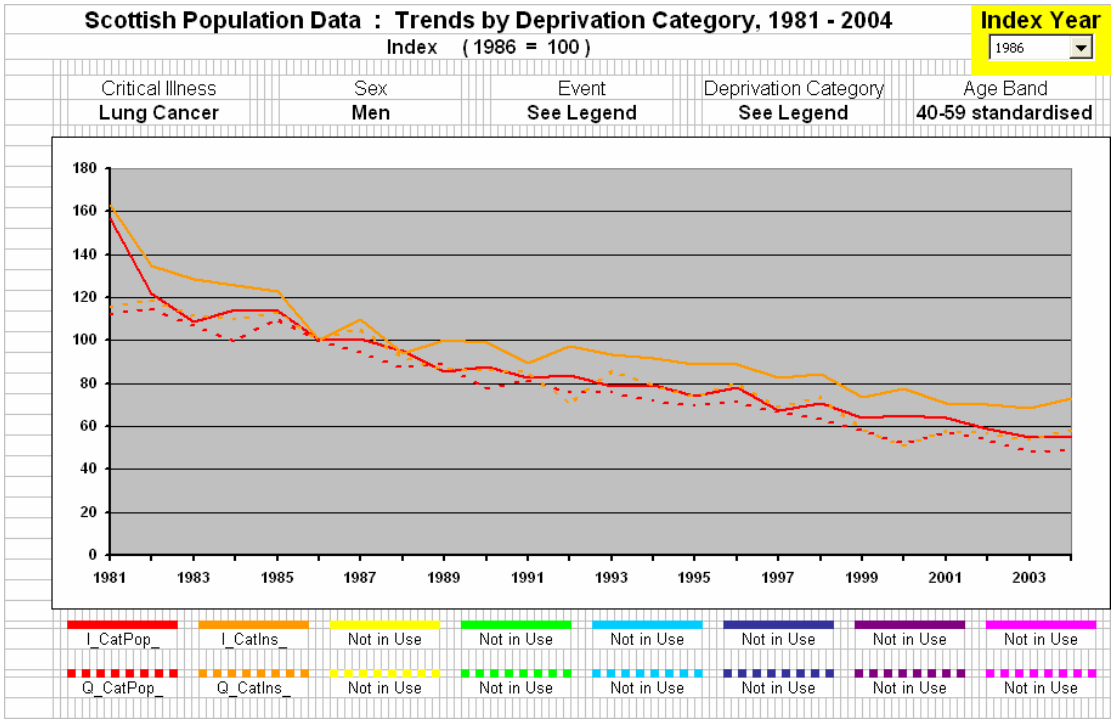


(Section 8.6.5 – to explain early distortion in trend)

Lung Cancer

For males, the trend in the incidence rates for the age group 40-59 is improving for both the insured and general population following smoking behaviour patterns for both populations (Graph 3.1o). 90% of cases of lung cancer are caused by smoking (section 3.2). The insured group has improved to a lower extent compared to the general population. Mortality in the general population has slightly greater improvements compared to the insured trend. The general population smoking behaviour had more scope for improvement than the insured population and this could explain the greater pace of improvement for the population as a whole.

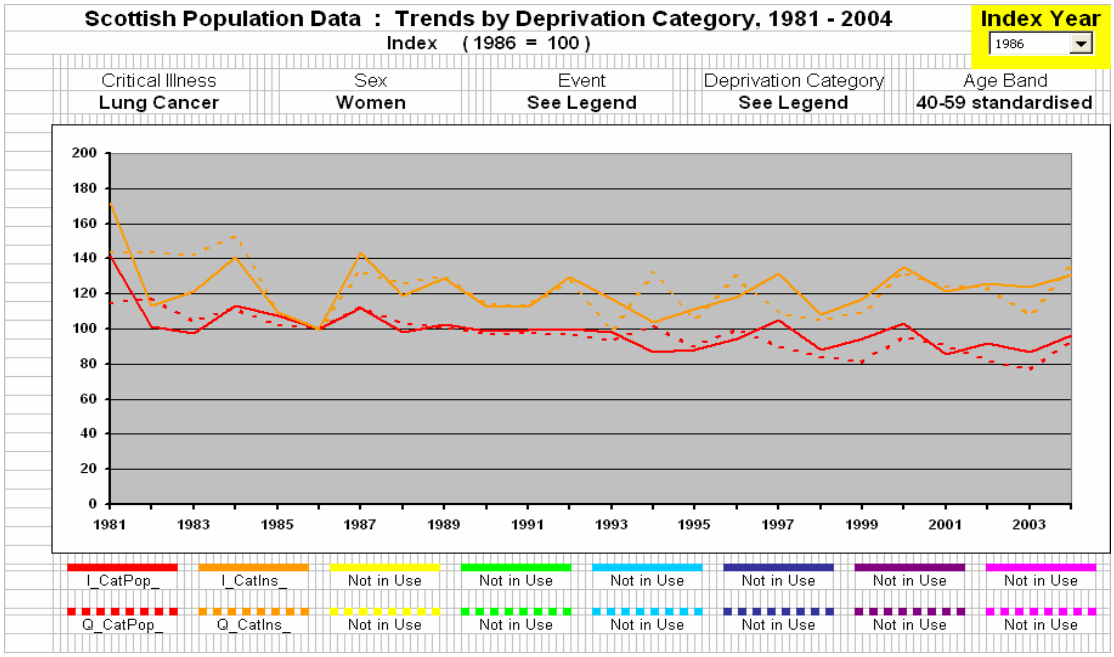
Graph 3.1o – Incidence and Mortality rates for Lung Cancer relative to 1986, Males
Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.



(Section 8.6.5 – to explain early distortion in trend)

For females, we do not observe an improvement in the incidence and mortality (Graph 3.1p) for the insured population. The trend for the insured group looks fairly flat. The insured group had a particularly low year in 1986 which has distorted the trend using 1986 as the index year. For the population there were modest improvements in mortality and incidence.

Graph 3.1p – Incidence and Mortality rates for Lung Cancer relative to 1986, Females
Bold red and orange represent Incidence for population and insured lives respectively; dotted red and orange represent Mortality for population and insured lives respectively.



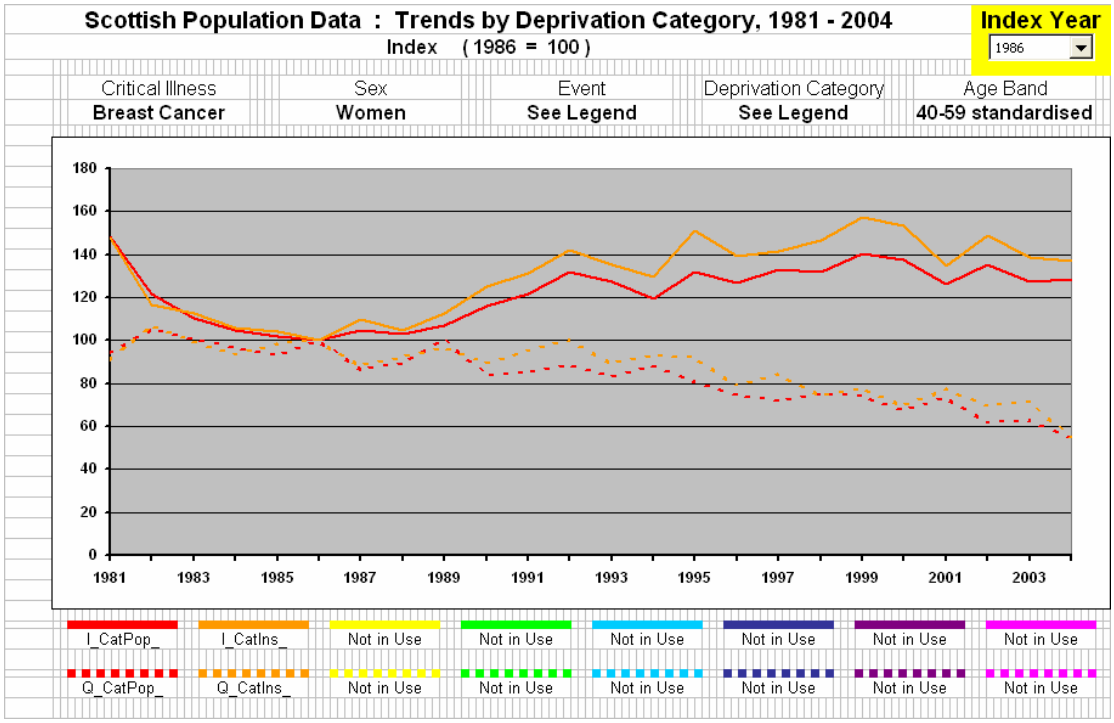
(Section 8.6.5 – to explain early distortion in trend)

Overall, the insured trend in incidence and mortality is shows lower improvements for males compared to the general population. Female trends show a deterioration for the insured group and improvements for general population for both mortality and incidence (Table 3.1c). This is consistent with there being more scope for reduction in the prevalence of smoking for the general population than the insured population.

Breast Cancer

Breast cancer has shown a higher rate of deterioration in incidence for the insured population since 1986 compared to the general population (Graph 3.1q). Mortality has improved more in the general compared to the insured population.

Graph 3.1q – Incidence and Mortality rates for Breast Cancer relative to 1986, Females
Bold red and orange represent Incidence for population and insured lives respectively;
dotted red and orange represent Mortality for population and insured lives respectively.



(Section 8.6.5 – to explain early distortion in trend)

This could be explained by early identification through screening. There could also be an underlying difference initially in prevalence between affluent (higher prevalence) and deprived females (lower prevalence) of breast cancer. We can reason that an insured population is more aware of the need for regular screening and has better access to facilities. Evidence suggests women in the more deprived categories are likely to seek treatment at a later stage of disease development.

The trend in incidence rate (Graph 3.1q) is similar for the insured group and the population before 1986. The insured deterioration trend then increases above the general population trend. More recently the trend in incidence appears to start converging again – perhaps the deprived group will catch up with the insured group in terms of screening.

The trend in mortality for the general population shows a greater improvement compared to the insured population. This may seem counter intuitive. If the insured group benefits more from national screening, we would expect its mortality rates to improve at a faster rate compared to the general population. However, the risk of breast cancer is believed to be lower for women who have children at a younger age, who breast feed and who have many children. From this we can speculate that women in the insured population may have a higher risk than the general population. This implies that if all women across all deprivation categories benefited from screening to the same extent, we would see even greater mortality improvements for the general population.

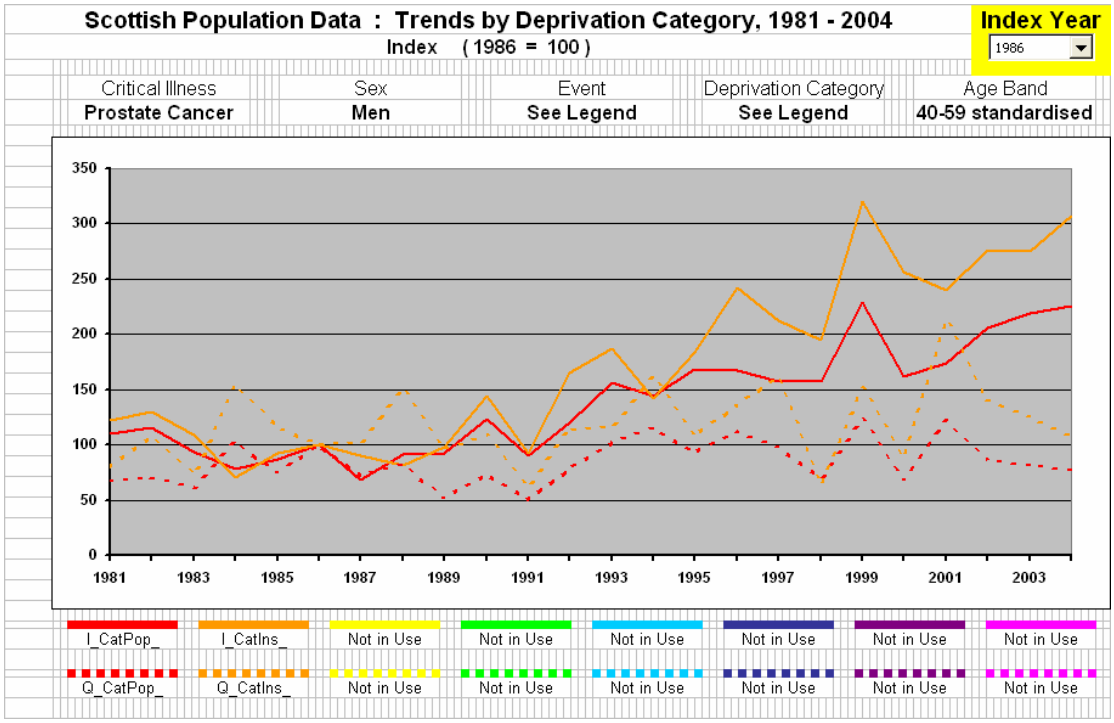
Prostate Cancer

For prostate cancer we see a higher deterioration trend of the incidence rate for the insured group compared to the general population (Graph 3.1r). However, mortality trends are only slightly higher in the insured population. Given the smaller number of deaths, the results are uncertain due to lower credibility and consequently have a wider confidence interval.

The higher deterioration rate for the insured population is likely to be caused by an increased awareness of symptoms, together with the range of diagnostic tests available to the more affluent groups in the population. Although there is no formal screening programme, many medicals would include tests such as a digital rectal examination (DRE) as standard.

Graph 3.1r – Incidence and Mortality rates for Prostate Cancer relative to 1986, Males
Bold red and orange represent Incidence for population and insured lives respectively;

dotted red and orange represent Mortality for population and insured lives respectively.



(Section 8.6.5 – to explain early distortion in trend)

Cancer Atlas of the United Kingdom and Ireland 1991-2000, Office for National Statistics (ONS)

Some cancer sites have a close association with deprivation category. Overall the trend in incidence and mortality rates vary little by region as some cancer sites, which are high in some regions, are balanced by other cancer sites that are lower in that region. The incidence in cancer by site will vary according to the deprivation category split within a region, (see section xxxx).

Table 3.1c

Cancer group/type	Chapter	Male-to-female ratio[1]	Trends in the 1990s[2]				Relationship to deprivation[3]	
			Incidence		Mortality		Incidence	Mortality
			Males	Females	Males	Females		
Smoking/alcohol								
Larynx	10	5.3	↓	..	↓	..	+++	+++
Lip, mouth and pharynx	12	2.3	↑	↑	0	0	+++	+++
Lung	13	2.3	↓↓↓	0	↓↓↓	0	+++	+++
Gastrointestinal								
Colorectal	7	1.5	(↑)	0	↓	↓	0	0
Oesophagus	13	2.2	↑↑	↑	↑↑	↑	+	+
Pancreas	19	1.3	↓↓	0	↓↓	0	(+)	(+)
Stomach	21	2.5	↓↓	↓↓	↓↓	↓↓	++	++
Single sex								
Breast	5	:	:	↑	:	↓↓↓	–	0
Cervix	6	:	:	↓↓↓	:	↓↓↓	+++	+++
Ovary	18	:	:	↑↑	:	0	–	(–)
Uterus	23	:	:	↑	:	↑	–	0
Prostate	20	:	↑↑↑	:	0	:	–	0
Testis	22	:	↑↑	:	0	:	–	x
Urological								
Bladder	3	3.5	↓	0	↓	0	0	0
Kidney	9	2.0	↑↑	↑↑	↑	↑	0	0
Brain, melanoma of skin								
Brain	4	1.5	0	0	0	0	–	–
Melanoma of skin	14	0.8	↑↑	↑↑	0	0	– – –	–
Lymphomas and leukaemias								
Hodgkin's disease	8	1.4	0	0	↓↓	↓↓	y	y
Non-Hodgkin's lymphoma	16	1.4	↑↑↑	↑↑↑	↑	↑	–	0
Leukaemia	11	1.7	0	0	0	0	–	0
Multiple myeloma	15	1.5	0	0	0	0	0	0

.. Not included : Not applicable x Not available (very low numbers of deaths) y Not available

1 Ratio of the age-standardised rates

2 ↑ Upward trend; 0 No trend; ↓ Downward trend
(England and Wales; strength of trend indicated by the number of arrows)

3 + Positive relationship with deprivation (higher rates in those living in deprived areas)
0 No relationship with deprivation
– Negative relationship with deprivation (that is higher rates in those living in affluent areas)
(England and Wales; strength of relationship indicated by the number of symbols)

Sources:

Quinn MJ, Babb PJ, Brock A, Kirby L, Jones J. Cancer Trends in England and Wales 1950-1999. Studies on Medical and Population Subjects No.66. London: The Stationery Office, 2001.

ONS. Cancer Statistics Registrations: Registrations of cancer diagnosed in 2000, England. Series MB1 No.31. London: Office for National Statistics, 2003.

ONS, "Cancer Atlas of the United Kingdom and Ireland 1991-2000,

Summary

The trends for mortality and incidence for 40-59 age band over the period from 1986 to 2004 for the insured and general population have been calculated using log-linear trends (Table 3.1c). However, it should be noted that different results would be obtained if a more recent time period was used. The percentage per year change is stated to nearest decimal place and an indication of the 95% confidence interval is shown in brackets. However, these numbers are dependent on the time period, method of fitting trend and the quality of the data.

Table 3.1c: log-linear trends of improvement (% per annum) in incidence and

mortality, in Scotland, from 1986 to 2004, for males and females, age group 40-59

Heart Attack	Male		Female	
	Mortality	**Incidence**	**Mortality**	**Incidence**
Population	**-7.9% (-8.3%, -7.6%)**	**-4.2% (-4.5%, -3.9%)**	**-8.5% (-9.2%, -7.8%)**	**-4.4% (-4.9%, -3.9%)**
Insured	**-8.3% (-8.7%, -7.9%)**	**-3.9% (-4.3%, -3.5%)**	**-9.1% (-9.9%, -8.2%)**	**-4.3% (-4.9%, -3.6%)**
Stroke				
Population	**-3.2% (-3.7%, -2.7%)**	**0.5% (0%, 1.1%)**	**-3.4% (-4%, -2.8%)**	**0.5% (-0.1%, 1.1%)**
Insured	**-3.5% (-4.5%, -2.5%)**	**0.6% (-0.1%, 1.2%)**	**-3.3% (-4.2%, -2.4%)**	**0.9% (0.1%, 1.8%)**
All Cancer				
Population	**-1.8% (-2.2%, -1.4%)**	**-0.3% (-0.7%, 0.1%)**	**-1.8% (-2.1%, -1.6%)**	**0.1% (-0.2%, 0.5%)**
Insured	**-1.5% (-2%, -1%)**	**0.5% (-0.1%, 1.1%)**	**-1.6% (-2%, -1.3%)**	**0.6% (0.2%, 1.1%)**
Lung Cancer				
Population	**-3.8% (-4.1%, -3.5%)**	**-3.2% (-3.5%, -2.9%)**	**-1.3% (-1.8%, -0.7%)**	**-0.7% (-1.2%, -0.2%)**
Insured	**-3.5% (-4.2%, -2.9%)**	**-2.3% (-2.7%, -1.9%)**	**0.2% (-0.7%, 1%)**	**0.4% (-0.4%, 1.2%)**
Breast Cancer				
Population			**-2.6% (-3.1%, -2.1%)**	**1.5% (0.9%, 2%)**
Insured			**-2.4% (-3%, -1.7%)**	**1.8% (1.1%, 2.5%)**
Prostate Cancer				
Population	**1.2% (-0.9%, 3.3%)**	**5.8% (4.5%, 7.1%)**		
Insured	**1.4% (-1.1%, 3.9%)**	**7.7% (6.1%, 9.3%)**		

Source: Own calculations based on Information and Statistics Division data, NHS Scotland

3.2 Smoker-segregated rates

3.2.1 Overview

Smoking is a key risk factor for many of the critical illness conditions. In fact, a large proportion of the improvements in historical incidence and mortality trends are due to the significant reductions in smoker prevalence, consumption of cigarettes and tar levels over time. In 1972, 52% of men and 41% of women smoked cigarettes – nearly half of the population. However, in 2003, smoker prevalence reduced to 28% of men and 24% of women - about a quarter of the population. This change in smoking behaviour has lead to improvements in historical incidence and mortality rates for many critical illness conditions such as heart attack, stroke and many cancer sites.

In order to understand how the trend in critical illness incidence and mortality rates vary from an aggregate population to smoker-segregated groups, we need to build a model. The aim of the model is to help our understanding of how the trend changes between the general population and an insured portfolio split by smoker status. It will also help us to understand the key parameters and sensitivities within the model.

Smoking behaviour can be explained by a cohort effect as smoking has a strong link with year of birth. This cohort pattern can be understood more readily by modelling the lung cancer incidence and mortality rates by age and year as lung cancer is directly linked to smoking behaviour.

3.2.2 Smoking as a key risk factor

Smoking is a key risk factor for incidence and mortality for many cancer sites, heart attack and stroke (Table 3.2a). In order to strip out the reduction in smoker prevalence it is important to understand how smoking will impact each condition. For example, lung cancer has the highest proportion of smoking related deaths at approximately 89% for males and 75% for women.

Smoking behaviour impact on incidence and mortality depends on a number of factors including:

- Duration of smoking
- For ex-smokers, the number of years since giving up
- Consumption of cigarettes
- Tar content
- Form of tobacco – manufactured cigarettes, hand-rolled, pipes and cigars

Smoking behaviour has a high correlation to socio-economic group which in turn has strong links to region. (www.ash.org.uk - contains a mapping across English boroughs that show in detail the prevalence of smoking map by deprivation category.)

Smoking does not have such a direct link for heart attack and stroke compared to lung cancer. It is more difficult to understand the impact of smoking on these conditions due to the many other risk factors which may also be interrelated.

Table 3.2a

Estimated percentages and numbers of deaths attributable to smoking in the UK by cause
(based on 2002 mortality data)

	Number			Deaths from disease estimated to be caused by smoking: As % of all deaths from disease		
	Men	**Women**	**Total**	**Men**	**Women**	**Total**
Cancer						
Lung	18002	10032	28034	89	75	84
Upper respiratory	525	85	610	74	50	66
Oesophagus	3248	1743	4991	71	65	68
Bladder	1521	318	1839	47	19	37
Kidney	788	72	860	40	6	27
Stomach	1385	266	1651	35	11	26
Pancreas	670	923	1593	20	26	23
Unspecified site						
Myeloid Leukaemia	264	131	395	19	11	15
Respiratory						
Chronic obstructive lung disease	13193	10685	23878	86	81	84
Pneumonia	3162	2900	6062	23	13	17
Circulatory						
Ischemic heart disease	14182	6361	20543	22	12	17
Cerebrovascular disease	3064	3764	6828	12	9	10
Aortic aneurysm	3652	1939	5591	61	52	57
Myocardial degeneration	6670	2936	9606	22	12	15
Atherosclerosis	63	56	119	15	7	10
Digestive						
Ulcer of the stomach or duodenum	907	1008	1915	45	45	45
Total caused by smoking	71,296	43,219	114,597			
Preventable by smoking * :						
Parkinson's	1369	549	1918	55	28	43
Cancer of the endometrium		260	260		17	17
Total prevented by smoking						
Deaths from all causes due to smoking (causes less prevented)	69,927	42,410	112,337			

** Studies have shown that smoking appears to have a protective effect against the onset of some diseases such as endometrial cancer. However, the positive effect is so small in comparison with the overwhelming toll of death and disease caused by smoking that there is no direct public health benefit.*
(source: www.ash.org.uk)

3.2.3 Impact of trend on smoker-segregated policies

We will firstly give a brief overview of a smoker model that has been constructed, then we will discuss the key parameters and then we will show differences in trend by smoker category.

3.2.4 Overview of the model

The model that has been constructed is a multi-state with three states: “Never”, “Ex-smokers” and “Smoker”. The “Ex-smokers” were analysed according to duration since giving up.

The model has a number of simplifications:

- We only consider three main conditions: cancer, heart attack and stroke.
- We assume that ex-smokers will not take up smoking again and that "Never smokers" do not take up smoking.
- We have assumed relative risk factors for heart, stroke and cancer. These factors are ratios between incidence or mortality of a smoker compared to incidence or mortality for a non-smoker.
- The ex-smoker has a relative risk factor for the age when they gave up and this relative risk reduces over time by duration since they gave up.
- The model does not incorporate features such as change in consumption of cigarettes over time or tar level in cigarettes.
- We have considered log linear trends which may not be the most appropriate method of analysing historical trends in incidence.

In order to understand trends for non-smokers we created a group joining the "Never" and "Ex-smokers" together. Effectively, this assumes that smokers will selectively lapse their policy and take up a non-smoker policy. The non-smoker book will also contain a mixture of never smoked and ex-smokers from when policies were initially sold.

3.2.5 Key parameters

Relative risk factor

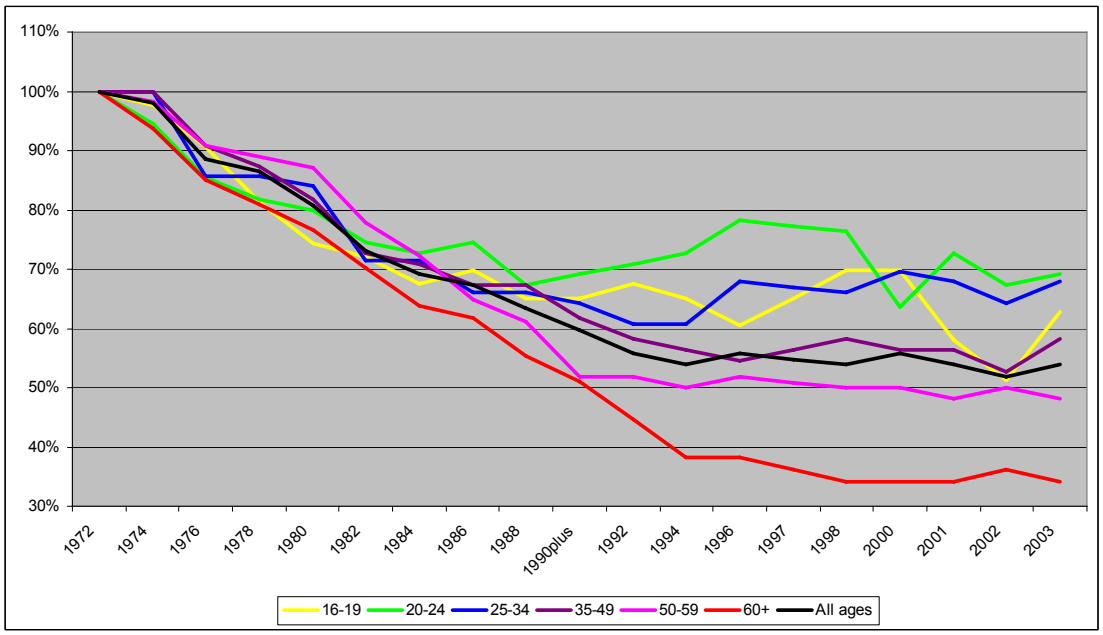
The main parameters in this study are the relative risk factors. These factors will vary as follows: age smoking was taken up; duration since smoking was given up; consumption of cigarettes; and changes in the tar yield. The studies also suggest a gender difference but perhaps this is more to do with differences in consumption or the types of cigarettes smoked.

There are a wide range of relative risk factors depending on the medical study used. Care has to be exercised when interpreting the results: sometimes they may refer to mortality and not incidence; cause investigated may not be an exact match e.g. coronary heart disease and not heart attack; and usually smoker status is based on the status at the start of the study. Section 6.2.4 has a discussion of the issues surrounding obtaining appropriate estimates for relative risk factors and some examples of sources of information and the relative risk factors that they suggest.

Smoker prevalence statistics

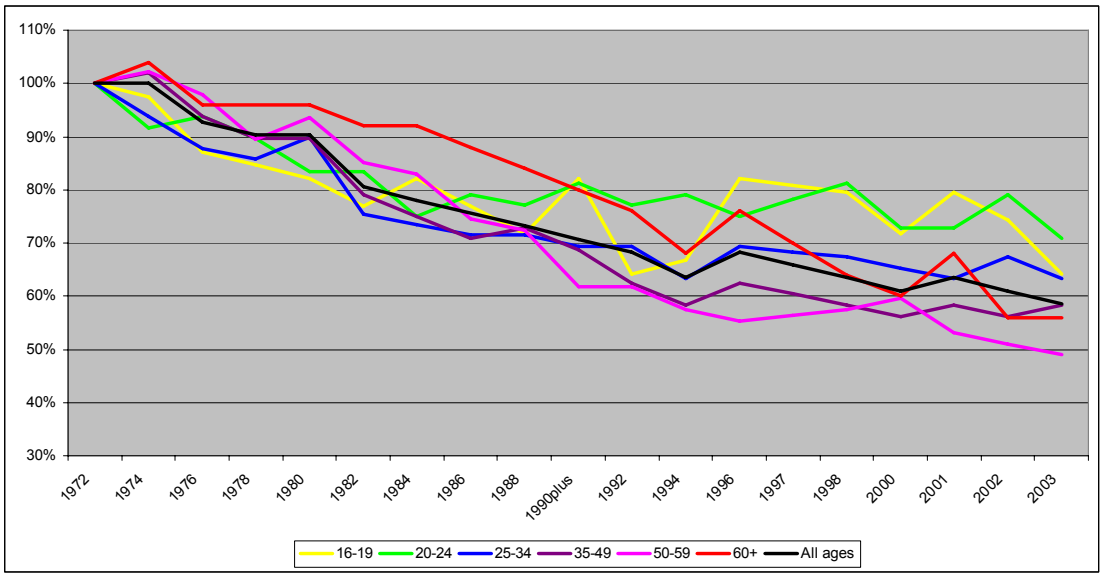
The Office for National Statistics (ONS) published smoker prevalence statistics (ONS website) from 1972 to 2003. This data is based on a large sample of adults being interviewed (13,000 addresses selected each year from the Postcode address book) which provides a credible and reliable source. The data is split by broad age groups and gender.

Graph 3.2a: Male prevalence from 1972 to 2003, expressed as a percentage of the 1972 prevalence rate.



The male prevalence has reduced over the past 30 years dramatically for all age groups. Over the 1990's all the trends by age have flattened, however, some younger age groups started to increase again. The 60+ age group has had the biggest fall to about 35% of the 1972 level.

Graph 3.2b: Female prevalence from 1972 to 2003, expressed as a percentage of the 1972 prevalence rate.



Female trend in prevalence has also reduced dramatically over the past 30 years, similar to the male prevalence. However, the female rates have overall not fallen to the same extend and for some age groups the trend is still downward. For the youngest age groups (16-19) there has been an increase in the prevalence over the 1990's. The oldest age group (60+) has not reduced by the same extend as the male prevalence but we expect further reductions in this age group over the next few years.

Overall, the female smoking epidemic peaked later than the males and whilst we expect further reductions in the female prevalence, the male prevalence looks likely to stabilise at a flat level into the future if all other external factors such as government intervention remain unchanged (section 3.2.8).

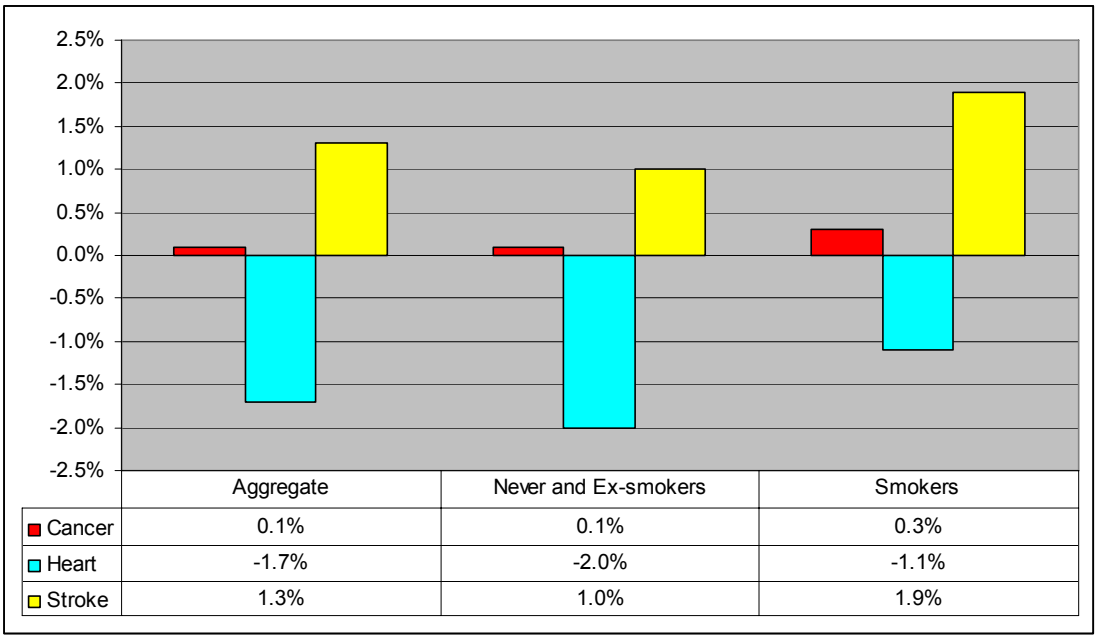
3.2.6 Results split by condition

The smoker model considers each critical illness cancer, heart and stroke separately. The model suggests that the different smoker categories trends should differ between the "Never and Ex-smokers" and "Smoker" categories. "Never and Ex-smokers" compared to the "smokers" appear to have the following features: slightly lower levels of deterioration for cancer; higher rates of improvement for heart; and lower deteriorations for stroke.

Males

For males, the "Never and Ex-smokers" experience a higher level of improvement and lower deteriorations compared to the "Smoker" category (Graph 3.2) for the three critical illnesses. The reason for this is the proportion of "Ex-smokers" in the "Never and Ex-smoker" category which will have a higher rate of improvement over time as the smoking related risk diminishes by duration since giving up. This is modelled by having a run down of the relative risk by duration for "Ex-smokers".

Graph 3.2c: Smoker model results, log-linear trends percentage per annum increase in incidence, Males, 1990 to 2003, for cancer, heart attack and stroke, for age group 40-59 age standardised



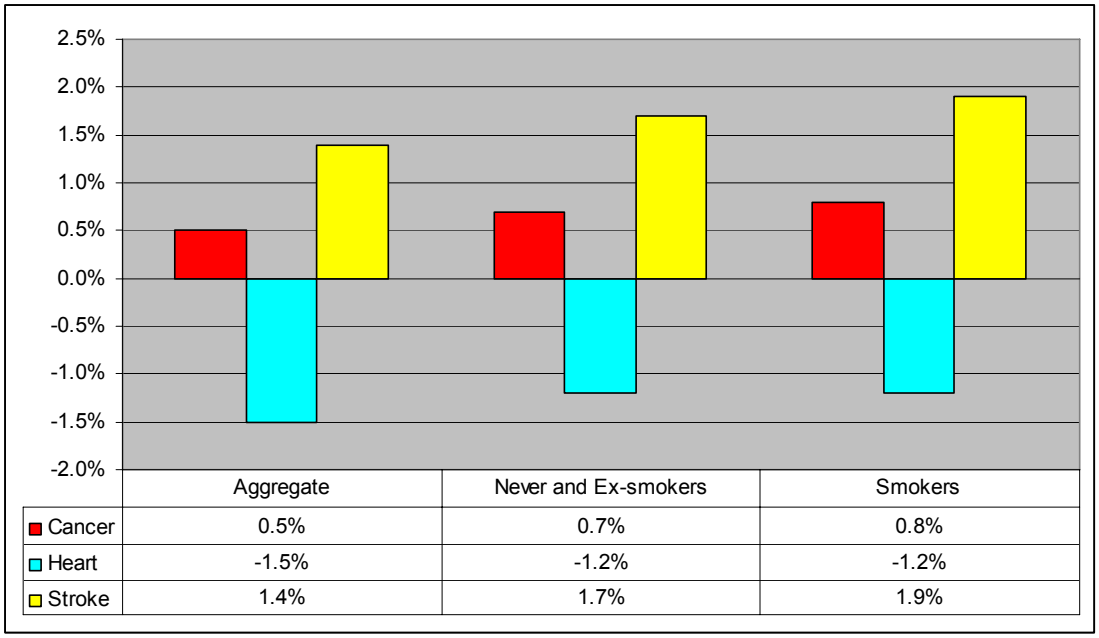
	Aggregate	Never and Ex-smokers	Smokers
Cancer	0.1%	0.1%	0.3%
Heart	-1.7%	-2.0%	-1.1%
Stroke	1.3%	1.0%	1.9%

Females

The pattern for females is similar to that of males but the extent of the difference is much lower (Graph 3.2d). The "Never and Ex-smoker" category trend compared to the "Smoker" category has the following features: lower deterioration for cancer and stroke but little difference in heart attack between the two categories.

Cancer is a much bigger proportion of the risk for women compared to men, however, it is far less smoking related. The cancer that dominates female experience is breast cancer. In fact, the IARC (International Agency for Research) review concluded that most epidemiological studies have found no association between active smoking and breast cancer. However, since its publication, a new study found that women who have smoked for 40 years or longer have about a 60% higher risk of developing breast cancer than those who have never smoked.

Graph 3.2d: Smoker model results, log-linear trends percentage per annum increase in incidence, Females, 1990 to 2003, for cancer, heart attack and stroke, for age group 40-59 age standardised.



	Aggregate	Never and Ex-smokers	Smokers
Cancer	0.5%	0.7%	0.8%
Heart	-1.5%	-1.2%	-1.2%
Stroke	1.4%	1.7%	1.9%

For males, the "Aggregate" lies between "Never and Ex-smokers" and "Smokers" as you would expect but for the females the "Aggregate" has a lower level of deterioration for cancer and stroke and higher improvements for heart attack which is not intuitive. This feature for the females can be explained by the method that has been used to fit a trend and it suggests that log-linear regression may not be the most appropriate method.

3.2.7 Results for Standalone and Accelerated Products

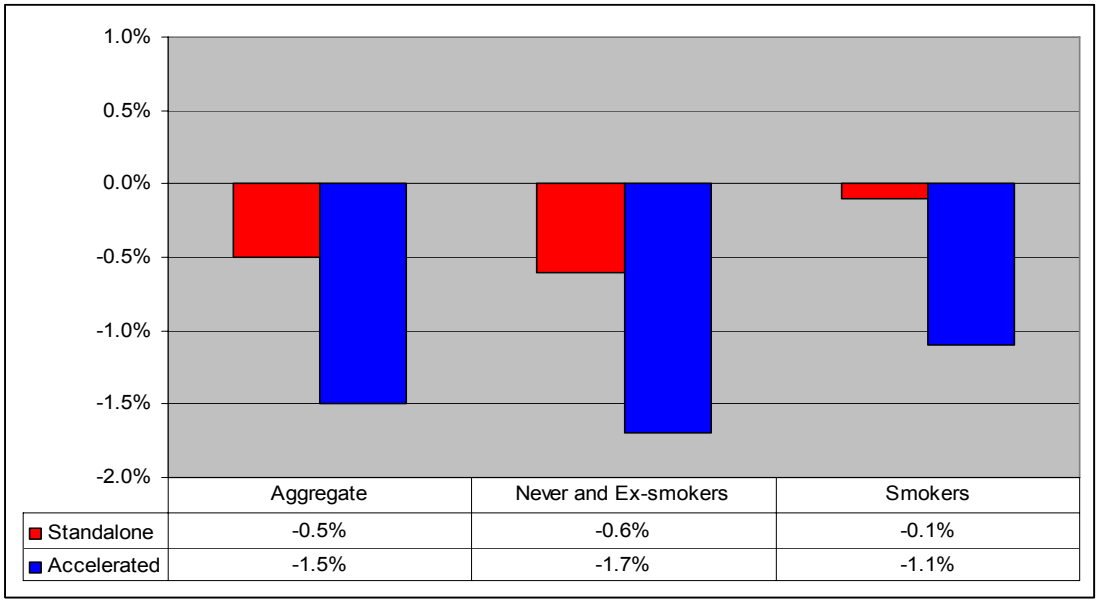
The purpose of this model is to give an understanding of how the trends should vary between the aggregate and the smoker segregated population for the accelerated and standalone products.

The standalone incidence rate is based on the incidence rates for cancer, heart attack and stroke taken from the CIBT02 table. The historical trend (1989 to 2003) is applied to each condition and the standalone trend is based on the aggregate trend.

The accelerated incidence rate is based on the CIBT02 table. The accelerated incidence is calculated by taking the sum of the incidence rates and non-CI mortality for each condition. The historical trend is applied to each condition and non-CI mortality and the accelerated trend is based on the aggregate trend.

Males

The standalone trend between the "Never and Ex-smoker" category and the "Smoker" category is markedly different with a slight improvement for smokers (-0.1% per year) and a stronger improvement (-0.6% per year) for "Never and Ex-smokers" (Graph 3.2e). The accelerated cost shows a much higher level of improvement due to non-CI deaths improving over time.
Graph 3.2e Smoker model results, Percentage per annum increase, Males, 1989 to 2003, for Standalone and accelerated risk rates, for age group 40-59 age standardised.

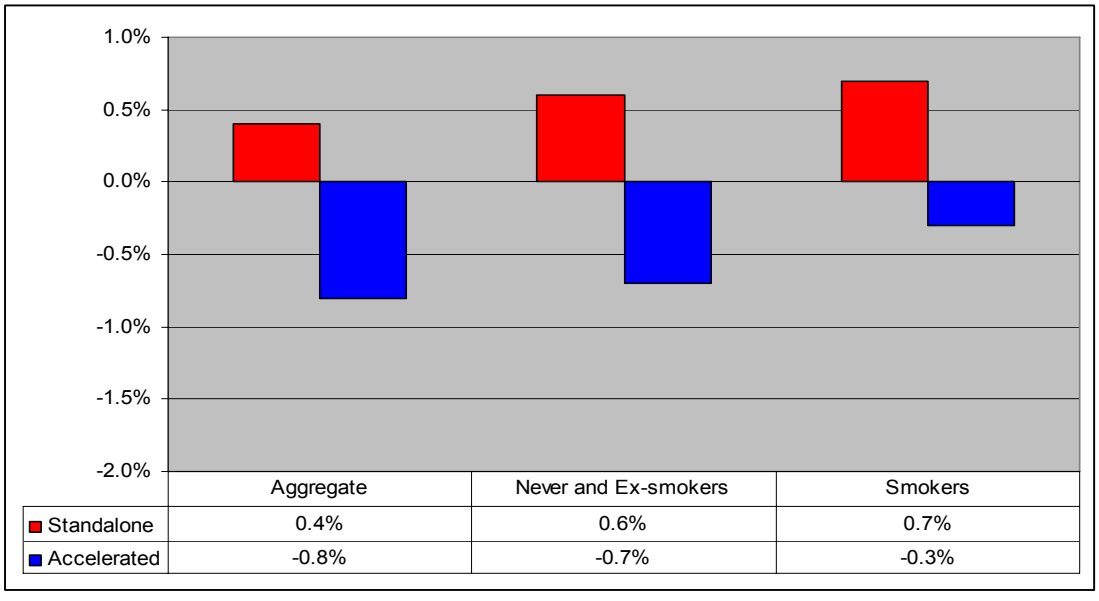


	Aggregate	Never and Ex-smokers	Smokers
Standalone	-0.5%	-0.6%	-0.1%
Accelerated	-1.5%	-1.7%	-1.1%

Females

For females, the pattern is significantly different. The standalone cost is deteriorating for both the "Never and Ex-smoker" and "Smoker" categories. Smokers are deteriorating marginally higher compared to the "Never and Ex-smoker". The accelerated cost shows a level of improvement due to non-CI deaths improving over time.

Graph 3.2f Smoker model results, Percentage per annum increase Females, 1989 to 2003, for Standalone and accelerated risk rates, for age group 40-59 age standardised.



	Aggregate	Never and Ex-smokers	Smokers
Standalone	0.4%	0.6%	0.7%
Accelerated	-0.8%	-0.7%	-0.3%

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Differences in trend in the context of historical differences

It is useful to consider the trends in incidence from the period 1989 to 2003 against historical rates based on the decades 1980's and the 1990's (Table 3.2b). The historical rates show how the trend can vary between the different categories over time particularly when prevalence rates were falling more steeply, contrary to the flat prevalence we have seen more recently for males. Historically, there was a bigger difference between "Never and Ex-smokers" and "Smoker" categories. For

example, in the 1990's "Never and Ex-smokers" trend was -4.3% per year and "Smoker" trend was -1.8% per year but for the period 1989-2003 this difference narrowed to -2.0% per year and -1.1% per year respectively.

In order to calculate the accelerated rate, it is necessary to consider the trend in mortality by cause and all deaths. Comparing those against historical trends (Table 3.2c) shows how trends vary considerably between "Never and Ex-smokers" and "Smoker" categories depending on the decade considered. For example, in the 1990's the heart attack cause of death rate "Never and Ex-smokers" was -8.9% and "Smoker" was -6.6% but for the period 1989-2003 this difference narrowed to -8.2% and -7.3% respectively.

Table 3.2b: Log-linear trends of the Incidence of cancer, heart and stroke, age standardised 40-59, for males and females (in brackets)

		Incidence Rates	
Critical Illness event	1980's	1990's	90 to 03
Aggregate			
Cancer	**-0.1% (1.1%)**	**0.0% (0.7%)**	**0.1% (0.5%)**
Heart		**-3.1% (-2.9%)**	**-1.7% (-1.5%)**
Stroke		**1.3% (2.0%)**	**1.3% (1.4%)**
Never and Ex-smokers			
Cancer	**0.7% (1.8%)**	**-0.1% (0.8%)**	**0.1% (0.7%)**
Heart		**-4.3% (-2.9%)**	**-2.0% (-1.2%)**
Stroke		**0.2% (2.1%)**	**1.0% (1.7%)**
Smokers			
Cancer	**1.0% (2.0%)**	**0.3% (1.1%)**	**0.3% (0.8%)**
Heart		**-1.8% (-2.3%)**	**-1.1% (-1.2%)**
Stroke		**2.6% (2.7%)**	**1.9% (1.9%)**

Source: own calculations based on cancer registration and HES data

Table 3.2b: Log-linear trends of the Incidence of cancer, heart and stroke, age standardised 40-59, for males and females (in brackets)

	Incidence Rates		
Critical Illness event	1980's	1990's	91 to 03
Aggregate			
Cancer	**-1.5% (-0.9%)**	**-2.1% (-2.2%)**	**-2.2% (-2.3%)**
Heart	**-6.1% (-5.5%)**	**-7.8% (-7.3%)**	**-7.8% (-7.6%)**
Stroke	**-4.7% (-5.4%)**	**-2.4% (-1.4%)**	**-2.4% (-1.8%)**
Deaths (all causes)	**-2.9% (-2.3%)**	**-2% (-1.5%)**	**-1.9% (-1.5%)**
Never and Ex-smokers			
Cancer	**-0.7% (-0.2%)**	**-2.1% (-2.1%)**	**-2.1% (-2%)**
Heart	**-6.1% (-4.9%)**	**-8.9% (-7.3%)**	**-8.2% (-7.3%)**
Stroke	**-4.9% (-4.8%)**	**-3.6% (-1.4%)**	**-2.8% (-1.5%)**
Deaths (all causes)	**-2.7% (-2.4%)**	**-2.6% (-1.8%)**	**-2% (-1.4%)**
Smokers			
Cancer	**-0.4% (0%)**	**-1.8% (-1.8%)**	**-2% (-1.9%)**
Heart	**-4% (-4.3%)**	**-6.6% (-6.8%)**	**-7.3% (-7.3%)**
Stroke	**-2.5% (-4.3%)**	**-1.1% (-0.9%)**	**-1.8% (-1.5%)**
Deaths (all causes)	**-0.9% (-0.6%)**	**-1.2% (-0.5%)**	**-1.6% (-0.8%)**

Source: own calculation based on cancer registration and HES data

3.2.8 Changes in Government Intervention

If smoking prevalence rates continue as a flat trend, the difference between the aggregate trend and the smoker differentiated trend will diminish over time. On the other hand, if smoker prevalence reduces more in line with government targets then we may see bigger differences in the trends between "Never and Ex-smokers" and "Smokers".

The Republic of Ireland introduced a full ban on smoking in all enclosed public places in March 2004. Likewise, the Scottish Parliament introduced a similar smoking ban in March 2006. Following on England, Wales and Northern Ireland are to introduce a full smoking ban in Summer 2007. According to Smoking-Free at Work (www.smokefreeatwork.ie) the Irish smoking ban has attributed to a decline of 33% in the prevalence of smoking 6 months into the ban. This indicates that the smoking ban may

introduce reductions in smoking prevalence which will lead to further aggregate improvements in the population.

Summary
This smoker model demonstrates that the trends should vary between the different smoker categories (Table 3.2c). The differences in trend by smoker category depend on the change in the smoker prevalence over time.

Table 3.2c: Log-linear trends of the Incidence of standalone and accelerated critical illness, age standardised 40-59, for males and females

Critical Illness event	Males	Females
Aggregate		
Standalone CI	**-0.5%**	**0.4%**
Accelerated CI	**-1.5%**	**-0.8%**
Never and Ex-smokers		
Standalone CI	**-0.6%**	**0.6%**
Accelerated CI	**-1.7%**	**-0.7%**
Smokers		
Standalone CI	**-0.1%**	**0.7%**
Accelerated CI	**-1.1%**	**-0.3%**

Source: own calculated based on cancer registration, HES, ONS and CIBT02

3.3 Lung Cancer

3.3.1 Overview

The main cause of lung cancer mortality and incidence rates is smoking, a relation first shown clearly in UK and the US 50 years ago (Doll and Hill 1950; Wynder and Graham 1950; Doll 1998). Secular trends in the tumour mainly reflect changes in smoking habit and the tar content of cigarettes. In fact, approximately 90% of lung cancer cases are believed to be related to smoking. Lung cancer with its poor prognosis is still the most common cause of cancer death in the UK, accounting for 6% of all deaths and 22% of all cancer deaths in the UK (www.ash.org.uk).

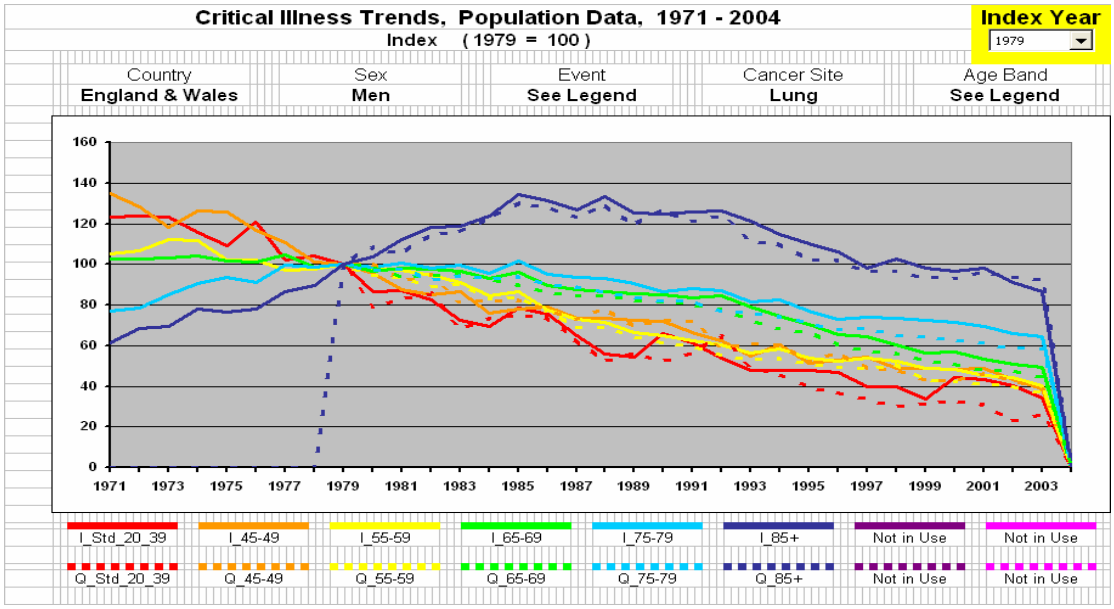
We have good quality data from ONS for all the cancer sites and this enabled us to model the interaction between smoking habits and mortality/morbidity rates over time by age group. We have used a Doll & Peto formula (JofECH, Vol 32, 303-313, R Doll and R Peto) to model the relationship between smoking and lung cancer incidence.

Insurers pricing critical illness would not have benefited from the strong historical improvements in mortality/morbidity from lung cancer as smoker segregated policies were sold. Incidence rate from this cause have improved for all male age groups but not for older female age groups. However, understanding the relationship between smoking and lung cancer will enhance our understanding of smoking as an important risk factor.

3.3.2 Historical Trends

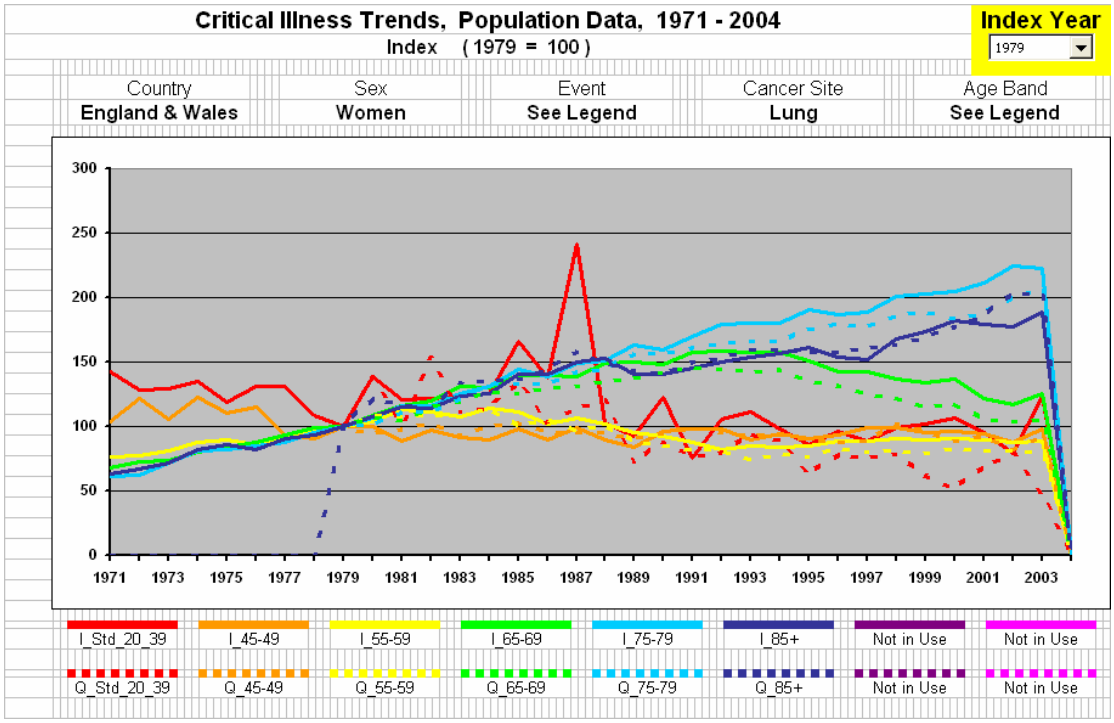
For males, the younger age groups have the highest improvements since 1979 and the older age groups the least (Graph 3.3a). Incidence and mortality rates up to age 60 are below 50% of the 1979 rate where the 85+ group is about 90% of the 1979 level. A further feature to notice is that the peak was reached much earlier for the younger age group compared to the older age group. For example, the 75-79 age groups peaked about 1980 while the 85+ age group peaked about 1985. The mortality trend is generally below the incidence trend which indicates that improvements in medical treatment have reduced mortality rates to a greater extent.

Graph 3.3a – Relative level of Lung cancer incidence and mortality by age group based on the 1979 index



Females have shown a distinctively different pattern compared to the males. The trend has been greater than the 1979 level for age groups above 60 for mortality and incidence rates. The younger age groups have not reduced to the same level as males falling between 75% and 100% of the 1979 level. The age groups up to age 70 have peaked and have started to reduce again; however, the older age groups 70+ have not peaked yet and are still continuing to increase.

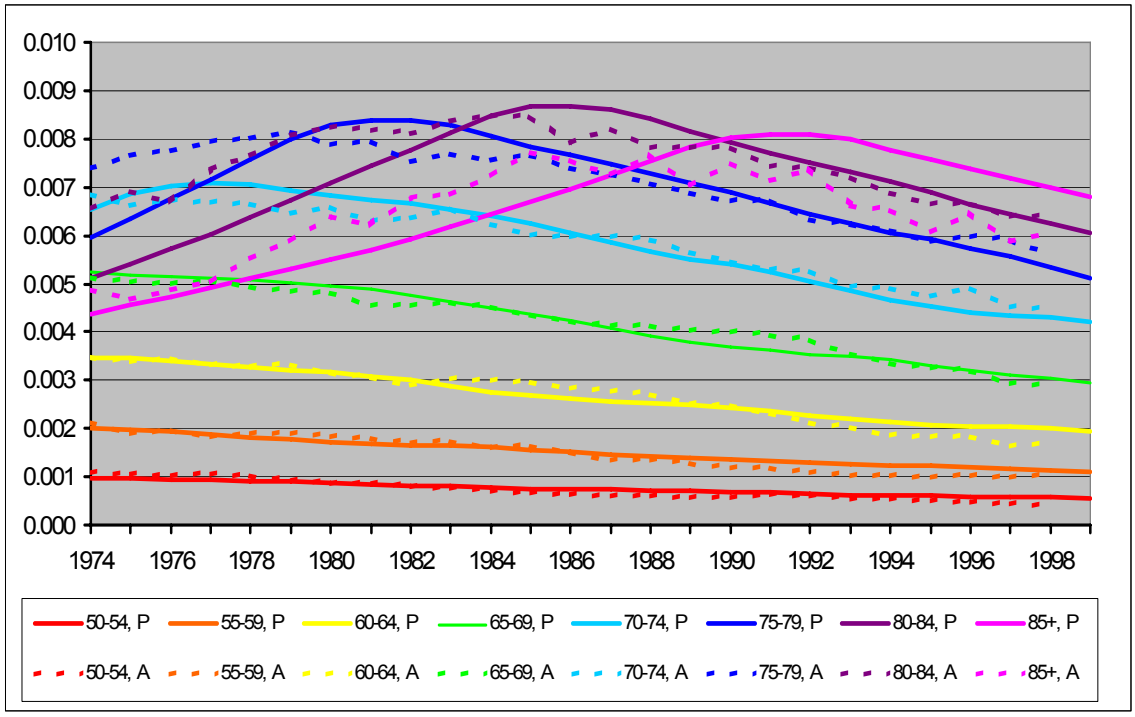
Graph 3.3b – Relative level of Lung cancer incidence and mortality by age group based on the 1979 index



3.3.3 Doll & Peto style formula

In order to understand the trends (3.3.2) in lung cancer and smoking it is useful to model the historical smoking habit by dose of cigarettes. Doll & Peto created an empirical formula for lung cancer mortality. This formula appeared to be a good fit to the data of a 20-year prospective study of British doctors in which smoking habits were ascertained by questionnaire and lung cancer incidence was monitored. Among cigarette smokers who started smoking at ages 16-25 and who smoked 40 cigarettes or less per day, the annual lung cancer incidence in the age range 40-79 was: $0.273*10^{-12}*(\text{cigarettes/day} + 6)^2*(\text{age} - 22.5)^{4.5}$.

Graph 3.3c - Fit of model against actual for males for lung cancer deaths



Using the Doll & Peto method, we constructed a model that gives an insight into what is driving the incidence and mortality rates. The model produced a good fit to the actual historical data (Graph 3.3c). The age of people who started smoking is assumed to be 22.5 and as the age increases the incidence also increases exponentially. The level of the incidence is also related to the dose of cigarettes per day. The impact of smoking is cumulative and slow acting.

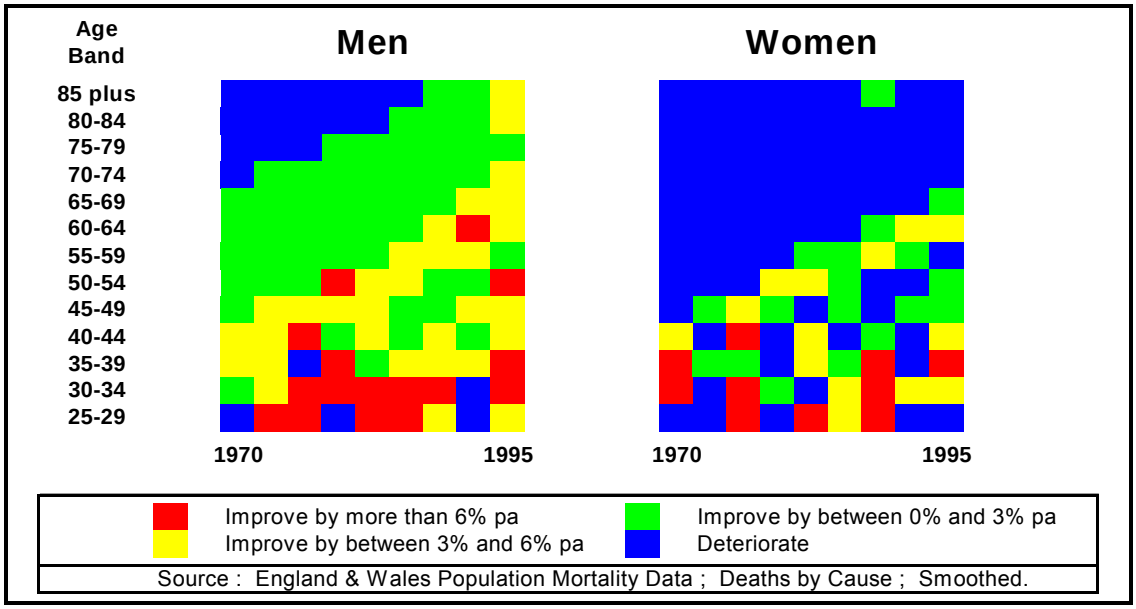
This pattern also suggests that incidence and mortality rates follow a cohort pattern where males born in the same year will exhibit a similar lung cancer pattern.

3.3.4 Cohort effect

The pattern by year of birth can be more effectively seen by plotting the improvement by age and calendar year (Graph 3.3d). This is similar to the cohort effect reported in mortality studies over recent years centred on men born around 1930s.

For women the benefit from smoking trends is less marked, but a cohort effect can still be seen. Although lung cancer rates are still rising at ages over 60, they appear to have peaked for the key insurance age groups.

Graph 3.3d - Average rate of change in Deaths from Lung Cancer by age, sex and year



3.4 Differences between Medical Definitions and ABI Critical Illness Definitions

Many of the ABI definitions are not consistent with the medical definitions for a particular condition. We will highlight some of the differences for the main critical illness conditions referring to the latest ABI Statement of Best Practice. The differences in definition, are one the reasons why insured and population trends may differ.

The ABI definitions have changed a number of times since the first Statement of Best Practice was first published in April 1999. The changes to the definitions have generally not had a material impact on the expected level of incidence rates but may have more of an impact on the expected future trends. In particular, the latest Statement of Best Practice published in April 2006 introduced a number of changes to future proof the definitions against advances in medical treatment.

In this section, we will firstly cover a brief history of the changes to the ABI definitions, a comparison against medical definition and then finally discuss some of the changes in the latest statement of best practice.

History of ABI definition changes

The first Statement of Best Practice was published in 1999, where the critical illness definitions were a minimum standard that companies had to comply with in order to sell "Critical Illness" products. There have been several changes over time (Table 3.4a).

Table 3.4a

Date Statement of Best Practice Published	Brief Description of the Changes
April 2006	**This was a major change to the ABI wording after a lengthy period of consultation. Each condition was reviewed and changed to improve clarity or to future proof.**
January 2004	**No change to the ABI definitions. Main changes were: to describe critical illness cover to potential**

	buyers; and to clarify that it applies to group critical illness.
May 2002	**There was a change to the cancer and heart attack definitions. The cancer definition change was driven by concerns over PSA testing that could detect minor prostate cancers and without this change a substantial increase in claims cost could occur. The heart attack definition was driven by changes in medical practice.**
April 1999	**This was the first statement that was published to implement recommendations by the OFT. The aim was to standardise definitions to help consumers to compare different products across the industry.**
Pre-April 1999	**Offices writing Critical Illness business used their own definitions. This resulted in a range of definition being used across the industry.**

(ABI statement of Best Practice April 1999, May 2002, January 2004, April 2006)

Comparison of medical definitions against ABI

The definitions typically use medical terms to describe the illness but in some cases the cover may be limited. For each of the main conditions we will briefly highlight the main differences between the ABI definition and the medical definition (Table 3.4b).

Table 3.4b

Critical illness Condition	**Main Differences between ABI and Medical Definition**
Cancer	**The ABI definition excludes some specific less advanced cancers and makes it clear that non malignant tumours are not covered. The medical definition includes all cancers and classifies them in great detail to cover the full spectrum of severity. The April 2006 statement introduced excluding "Chronic lymphocytic leukaemia Binet stage 1" with the aim of improving the future proofing of the definition. The January 2004 statement removed less aggressive prostate cancer for the same reason.**
Heart Attack	**The medical definition has undergone a**

	process of change since 2000 due to the introduction of the new diagnostic test to detect Troponin. The ABI incorporated Troponin into their definition (January 2004) and introduced a severity criteria on the level of Troponin (April 2006) in order to future proof the definition against changing medical practice. They also extended the cover to include other supporting clinical symptoms to future proof.
Stroke	**There was a significant change in the April 2006 statement to the stroke definition. The aim was to future proof the definition against medical advances, particularly scanning technology where more minor strokes may be detected. In particular, silent infarct (this is a stroke which has no clinical symptoms but may cause lesions to the brain) is excluded with the new definition.**
Coronary Artery By-pass Graft	**The recent change included a restriction which was introduced to future proof the definition against possible advances in surgery using less invasive techniques which may become routine treatment in the future. The inclusion of the words with surgery to divide the breastbone is to ensure that definition covers only major surgery.**
Multiple Sclerosis (MS)	**This definition of multiple sclerosis has always had a level of severity. Clarification to the heading was introduced in April 2006 to ensure it is clear that symptoms must be persisting. The definition requires clinical impairment of motor or sensory function, which must have persisted for a continuous period of 6 months. The medical definition by contrast is based on a definite diagnosis by a consultant neurologist without a need for persisting symptoms.**
Kidney Failure (KF)	**The definition mirrors the medical definition of kidney failure. The medical definition includes the requirement for dialysis which introduces a degree of severity.**
Major Organ Transplant (MOT)	**This is a list of transplants that are covered and those that are not covered.**
Total and Permanent Disability (TPD)	**This is an insurance term and not a medical term.**
Other Critical Illnesses	**There are a number of other critical illness conditions that are covered by about three quarters of the market. These definitions were**

also reviewed and adjusted to future proof against medical advances or advancements in surgical treatment.

Impact on trends caused by the future proofing of the definitions

Insured and population trends differ partly as a result of having different definitions. We will briefly highlight differences in the definitions that may have an impact on the trends for each condition.

Cancer

The ABI cancer definition changed to include a restriction on prostate cancer in May 2002. In April 2006 the ABI introduced further restrictions on chronic lymphocytic leukaemia and malignant skin cancer to future proof the definition. However, these cancer sites are a small proportion of the total cancer incidence and there would be little difference between past trends between definitions. Possible differences in the population and insured trends may arise in the future but trying to quantify the impact is highly speculative.

Heart Attack

The ABI heart attack definition changed in May 2002 and April 2006. The change in May 2002 was just to recognise troponins as the new biochemical marker which will have no impact on the incidence between the medical and ABI definitions. The change in April 2006 may lead to a change in trends depending on the future medical diagnostic criteria. We can speculate that the medical criteria is likely to be less restrictive compared to the ABI wording in which case this would lead to lower insured trend. However, historically these changes would have little impact on the trend between the medical and ABI definitions.

Stroke

The ABI changed the stroke definition in April 2006. This change strengthened the definition of stroke. For example, a silent infarct, which does cause neurological damage but does not show clinical symptoms, may be covered under the pre-April 2006 Statement of Best Practice. Historically there is little difference between the definitions. Without this change however there may have been a rise in incidence in the future, with advances in brain imaging technology and possible changes in the clinicians' view of what defines a stroke event.

Silent strokes are a particular issue for older ages where they are prevalent in a large proportion of the population. Medical evidence suggests that prevalence of silent infarcts starts at around age 50 and increase up to 35% of the population in the age group 85 to 90. If these silent infarcts were all detected in the future, and classified as a stroke, then this could lead to an increase in incidence of about 4 times the existing incidence rate at older ages. (Silent strokes a signal of patients' further health risk (Medical Post) *Kylie Taggart;* 03-13-2001;Silent Brain Infarction on Magnetic Resonance Imaging and Neurological Abnormalities in Community-Dwelling Older Adults: The Cardiovascular Health Study).

Historically the incidence of stroke would not be impacted by the change in the ABI definitions. Looking ahead to the future, the new April 2006 ABI definition is more restrictive than the medical definition. We expect lower trends for the ABI definition, particularly at older ages, because it is the silent strokes which are excluded where there is the greatest potential for an increase in incidence.

Coronary Artery By-pass Graft (CABG)

Historically, the medical and insured definitions were very similar. The latest ABI changes to the Statement of Best Practice in April 2006 will lead to lower insured trends into the future if less invasive surgical techniques for CABG become widespread.

3.5 General Discussion on other influences

The focus on the last section will be a general discussion on other factors that may influence the trend between the general population and insured lives.

3.5.1 Evolution of the Product Market

The critical illness concept originated from the South African market and was introduced into the UK in the mid-1980's. The early products covered the high profile conditions: cancer; heart attack; stroke; coronary artery bypass graft (CABG); kidney failure; and major organ transplant (MOT). Total and Permanent Disability (TPD) was generally included as sweep up benefit to include a range of illnesses that have as severe impact on physical or mental capabilities and the policyholders lifestyle.

Over the years the list of the conditions expanded rapidly, as companies tried to gain a competitive edge, and now most products cover over 30 critical illness conditions. It could be argued that many of these conditions do not meet a consumer need or add little or no value to the product. Furthermore, analysis tools used by the IFAs give a disproportionate weight to extra conditions companies add to their products and to their perceived value. In fact, the CMI experience over the quadrennium 1999-2002 gives a proportion of 4% of the total accelerated claims due to other conditions outside the main seven conditions and TPD.

Additional conditions will have negligible impact on the trends as they are only a small component of the total cost. However, the more conditions added, the greater the uncertainty in projecting the claims cost into the future, particularly bearing in mind that population data is often scanty for some of these conditions.

The number of conditions will not necessarily cause a deviation of the insured trend from the general population. However, many of these extra conditions will have some form of restriction in the definition in order to have an element of future proofing or an element of severity criteria.

More recently, companies have started to deviate from the ABI definitions by offering ABI plus definitions in order to gain a marketing advantage. The ABI definitions are set as a minimum standard but there are no restrictions on wording your definitions to make them weaker compared to the ABI standard. This should in theory lead to a trend that is closer to the population for particular conditions that are ABI plus if specific restrictions or exclusions are removed. These changes may reduce the element of future proofing added in the latest Statement of Best Practice. These may not impact on the immediate incidence rates but could introduce trends in line with the general population trend.

Further innovations in the market such as: buy back options; second critical illness event cover; tiered benefits will lead to further heterogeneity and differentiation of the trend by product. However, since 2001 innovation in the various options and features of critical illness products has reduced to some extent and even some options and guarantees have been removed to improve the risk management of the product.

Over the past year, two innovative products – Scottish Widows'/Virgin Big V and also Prudential Health plans – have been launched. The Big V is not a critical illness product as it does not meet the ABI minimum standard. However, both of these products have a tiered benefit plan structure. This potentially may lead to further differentiation in the insured trend for these types of products from the general population experience.

A final consideration is the method of distribution. The sale of the critical illness products in the early days was through the DSF channel. However, over the 1990's the IFA channel share of the market grow to the detriment of the DSF share of the market. More recently, bancassurers have successfully entered the market. The principle reason for the growth in popularity of this product has been its inclusion as part of the mortgage benefits package sold in conjunction with mortgages. Overall the insured trend in aggregate will be distorted by the change in the mix of business over time. We also

know that large deviations in critical illness incidence occur by socio-economic group. The different distribution channel should lead to variation in the trend as well as the level.

3.5.2 Underwriting

Underwriting has a key influence on insured trends as it produces a selection effect. Emerging industry experience (CMI quadrennium 1999-2002) does indicate that critical illness business has a selection effect but it is too early to say how deep the selection discounts by duration will be and how long the selection effect will last. The impact of selection may cause insured trends to deviate from population trends.

Underwriting has evolved over time as the critical illness market developed. Initially underwriting of the critical illness product had some shortcomings that were identified as early claims emerged and the industry gained experience of the new product. Initially not all the risk factors were fully appreciated. Two examples of these would include: tingling or numbness of fingers and toes as an indication of possible increased risk of multiple sclerosis risk; and moles on the skin indicating a potentially higher risk for malignant melanoma.

The declinature rates for some of the illnesses have also been high. In particular, TPD has an extremely high rate of declinature and there has recently been a move towards the more functional assessment based tests such as Activities of Daily Work (ADW) or Activities of Daily Living (ADL). Early claims have been subject to a high declinature rates due to non-disclosure and because the definition of TPD was not met.

Improving underwriting over time will impact on the insured trends. It will be an improving influence on insured trends relative to the general population trends.

3.5.3 Claims Philosophy

Claims philosophy has evolved over time as the critical illness market has developed. The claims management process is important as weaknesses in underwriting, proposal forms or underwriting philosophy, are picked up at an early stage and fed back into the underwriting process. Claims and underwriting philosophies should both improve in tandem over time.

The profile of claims management has risen in the industry as being an important part of understanding critical illness business and in the reporting and the analysis of claims. Claims philosophies have evolved as the industry has gained experience and philosophies have been tested. They have become more detailed and technical so that future claims can be dealt with in a fair and consistent manor.

All ABI members are required to adopt changes recommended by the ABI in their Statement of Best Practice if they wish to call their product critical illness. Historically, some of the ABI definitions have been difficult to enforce in some instances and claims have been paid beyond the scope of the intention of the definition. However, the recent Statement of Best Practice April 2006 has lead to clearer definitions and more clarity to consumers which will enable the claims managers to stick to the actual ABI wording in future. On the other hand, some direct companies and reinsurers may chose to follow a wider and more generous definition of claim compared to the ABI wording for certain conditions, where the exclusion or restrictions are perceived to be consumer unfriendly or a retrenchment of a previous marketing message. .

3.5.4 Financial Ombudsman Service (FOS)

Weaknesses in past ABI definitions have been uncovered over time as they are tested in real situations. Also disputed claims referred to the FOS have further identified problems with past definitions. . The ABI, as part of their consultation process, has reflected the FOS view point on

certain wording and has also sought legal opinion on the appropriate wording to adopt. The recent Statement of Best Practice, as in previous statements, has endeavoured to remove, as far as possible, any wording that would lead to contentious claims. As we believe that the definitions are now clearer this should reduce the proportion of disputed claims in the future. Over time, this should act to reduce the insured trend relative to population trends as disputed claims should reduce.

An issue that has become important recently, in view of the high proportion of non-disclosure that occurs, is where material or inadvertent/innocent non-disclosure is picked up at claims stage. Legally, an insurer is entitled to void the policy and decline the claim if material non-disclosure occurs. For example, if a smoker applies for a policy and states he is a non-smoker then this would be deemed to be material non-disclosure if it became evident at claims stage that they were a smoker. However, historically the insurer would have paid this claim and perhaps reduced the claims payout by the extra premium that they should have paid. This tightening up should cause insured trends to reduce more over time compared to population trends.

3.6 Summary and broad conclusions

The focus of this section was to give an insight into insured trends and how they may vary compared to population trends. We considered socio-economic variations, smoker-segregated rates, ABI definitions and a general discussion of other factors.

For socio-economic variations, we looked at Scotland against England, Britain and Ireland by region and Scotland by deprivation category. This analysis suggested that there are wide variations in the trends by socio-economic group. However, for some cancer sites these variations were not so marked, particularly for women. Overall, the Insured population tends to be the first to benefit from medical advances or the introduction of screening.

The smoker-segregated analysis concluded that insured trends will be lower compared to the population as they will not benefit from reductions in smoker prevalence. However, trends for non-smokers and smokers varied for each critical illness condition. Non-smokers tend to benefit more from improvements and have lower deteriorations compared to smokers if it is assumed that ex-smokers lapse their policy and take out a non-smoker policy. At the same time, non-smokers will benefit from the improvements over time as ex-smokers have a diminishing risk of having a smoker related disease. These trends fed through into the standalone and accelerated costs.

The ABI definitions differ from medical definitions as the ABI has exclusions and restrictions on most of their definitions. The ABI definitions have also tightened up over time as the market developed and the ABI endeavour to future proof definitions. This will have an influence on the insured trend over time as future proofing should cause a lower level of deterioration.

Other factors that will cause a deviation of the insured trend from the population were discussed. These included the evolution of the product market, underwriting, claims philosophies and the financial ombudsman service. Overall, these factors will cause insured trends to deviate from the population.

4 CIBT02

4.1 Construction of an updated Population Critical Illness Base Table

4.1.1 Introduction

The authors of the SIAS paper 'A Critical Review'[1] developed a 'Base Table' as a benchmark against which CI insured experience could be assessed and as a reference point for pricing and reserving. The table, known as CIBT93, provides a set of estimated CI incidence rates, at the (UK) population level, and relating to calendar year 1993. The table is widely referenced by practitioners.

Our aim in this Section of the paper is to develop an updated population-level CI incidence rate table, centred on calendar year 2002 and to be known as CIBT02.

Whilst acknowledging that what practitioners really want is a set of incidence rates based on insured lives experience, it is clear that construction of a full insured lives table may still be some considerable time away. UK pooled (CMI) insured lives experience data remains highly select by duration, subject to significant and complex IBNS adjustments, and is rather limited in viable age range.

However, we know from the analysis in the previous Sections that trends have varied significantly by CI, by age and by sex, so that the 'shape' of CIBT93 may be becoming dangerously out of date. Furthermore, since CIBT93 was produced in 1999/00, largely from 1993/94 data, a wealth of new and generally better quality data has emerged to support the crude rates and adjustments required. This should enable use of a finer brush, to paint more detail through better differentiation of rates and adjustments by age and sex, than was available to the authors of CIBT93. Thus we have both the need and the information to produce an updated and refined population-level CI incidence rate table.

Production of CIBT02 allows an update on the 'shape' of the population table by sex and by age (beyond the range of CMI data) and a better estimate of the breakdown of the total incidence by CI. The result should then be a more useful benchmark or reference point for experience analyses, pricing and reserving. We also hope comparing CIBT02 to CIBT93 will help to summarise historic trends.

The following Sections describe the scope of the table and our general approach to the derivation of incidence rates, followed by a more detailed write-up on each of the CIs covered. We hope this record of the development of CIBT02, from first principles and data sources, will also enable a good understanding of the interactions and relative impacts of the various risks covered.

4.1.2 Scope

The basic scope of CIBT02 is deliberately matched to that of CIBT93:

- Population-level - not insured lives - incidence rates by age and sex
- Centred on calendar year 2002
- Age range 18 to 85 (a small extension over CIBT93's 20 to 80)
- Aggregate rather than differentiated between smokers and non-smokers
- Rates for Stand-Alone CI and Accelerated CI cover but not for more complex variants such as 'buy-back' or 'second event' cover
- Core CIs covered are Cancer, Heart Attack, Stroke, Coronary Artery Bypass Graft (CABG), Multiple Sclerosis (MS), Kidney Failure (KF), Major Organ Transplant (MOT) and Total and Permanent Disability (TPD).
- No adjustment has been made for the impact of selection arising from the underwriting process or from a different socio-economic mix.
- Given the data employed, the table relates most closely to England (rather than UK).

In deriving the incidence rates for each CI we have had regard to the recently revised ABI model definitions (SoBP April 2006)[1]. We have also commented where appropriate on the evolution of the definitions over time and the likely impact on incidence rates. In general, however, the incidence rate differences between generations of definitions are likely to be small in context of the overall estimation

uncertainty for insured lives experience. Likewise, the effect of variations in CI definitions between offices is likely to be dwarfed by other business-model differences driving incidence rate differentials.

4.1.3 General Approach

We have followed a standardised approach to the derivation of incidence rates wherever possible. The high-level methodology is the same as that adopted for CIBT93 and the key steps are set out below. For a minority of CIs it has been necessary to vary this approach as we have been unable to access data in the form required. The precise approach adopted for each CI is documented in Sections 4.2 to 4.9, with the detailed derivation of the rates shown in tables in Section 10.1. The complete CIBT02 table is summarised in Section 4.11 and the full tables of incidence rates are shown in Section 10.2.

We have tried throughout to state clearly the assumptions and judgements we have made, particularly where these tend more to the subjective, so that the reader may assess their impact and consider alternatives if desired.

4.1.3.1 Data Sources

The full list of data sources used in deriving the incidence rates for each CI is set out in the relevant Section. The primary data sources - Cancer Registrations (ONS)[37], HES data (Department of Health)[33], Mortality Statistics by Cause (ONS)[39] and National Population Estimates (ONS)[40] - have already been introduced to the reader in the preceding Sections on trends and are covered in some detail in Section 8 (Appendix 1 - Primary Data Sources).

Our decision to centre the table on calendar year 2002 was driven by availability of data from these main sources. In particular, the limiting factor was HES data for which the latest year of 'grossed' data available to us was the HES financial year 2002/03 (see Section 8.5.1).

4.1.3.2 Raw Observed Incidence Rates from Main Data Source

Our start point is the incidence rates calculated directly from the main data sources we have used for analysis of population trends (primarily), by dividing the observed number of incidences by the relevant population. We have generally accessed the data used at this stage of the calculations in 5-year age bands.

We have termed these **Raw Observed Rates** as the calculation is before any of the refinements brought in by subsequent steps.

Where possible we have used data for calendar year 2002. For HES data, which is based on NHS financial years (April to March), we have crudely interpolated reported data to restate incidence counts on a calendar year basis.

Where alternative data sources exist we have made cross-checks to test the reasonableness of our chosen main data source.

4.1.3.3 Adjustment to Count Only First Ever Incidences

For many of the CI events it is possible for an individual to suffer more than one actual occurrence (for example, to suffer a second heart attack or stroke) or to be counted more than once in the main data source even for a single occurrence (for example, in HES data, by being transferred between hospitals / consultants or through multiple admission for the same underlying illness). However, for CI cover we are only concerned with the first ever incidence for each individual, as that would trigger payment of the sum insured, and any subsequent CI-type event for that individual is outside of our scope.

To address this issue, CIBT93 made extensive use of the ratio of "first ever" to "new and first ever" consultation rates from Morbidity Statistics from General Practice (MSGP). This data source is no longer available but we have found new information sources to tackle the problem more directly.

4.1.3.4 Adjustment for Unreported Cases / Sudden Deaths

An adjustment may be required to allow for any understatement in the Raw Observed Rate due unreported incidence. This depends on the CI concerned and the data source used. For example, as HES data covers only NHS hospitals in England, unreported cases could arise from three sources:

- Where a patient dies suddenly following a CI event, without time for admission to hospital
- Where the patient is admitted to a private hospital
- Where the patient is not hospitalised at all.

In general we have adjusted where appropriate for **sudden deaths**, but have found little data to ascertain the significance of any other omissions.

4.1.3.5 Crude Incidence Rates

We have termed incidence rates calculated at this stage **Crude Rates.** These are Raw Observed Rates adjusted to a first ever incidence basis and grossed up for unreported cases, so have no particular significance other than our generally choosing this point, on practical grounds, to switch calculations from age-banded rates to individual age rates. The smoothing and interpolation techniques adopted are described in Section 4.1.3.12.

4.1.3.6 Adjustment to Remove Overlap with Other CIs

Where there is a strong correlation between two CI conditions it is necessary to adjust the incidence rates, for one or both of these, to eliminate the double counting which would otherwise exist.

For example, there is a significantly increased likelihood of CABG following a heart attack. As it is normally only possible to claim once under a CI policy, our approach has been to reduce the CABG incidence rates to remove those which follow a heart attack.

4.1.3.7 Adjustment for Prevalence

The Crude Rates have been calculated (as if) using the total population as the denominator. However, to derive true rates on a first ever incidence basis, the denominator should reflect only the 'healthy' population and so needs to exclude any individuals who have already suffered the relevant CI. For each CI, where the adjustment is material, we estimate the prevalence, C_x (% of population at each age), of lives who have already suffered that particular CI. The Crude Rates are then adjusted by dividing through by the factor 1 - C_x.

In most cases, the calculation of this adjustment for a particular CI need only reflect the prevalence of that one CI. This simplification relies on an assumption of no correlation with other CI conditions. For example, in calculating the prevalence adjustment for cancer it is reasonable to ignore the possibility of prior heart attack and stroke events provided an individual who has suffered a heart attack or stroke is not more or less likely to suffer cancer now than one who has not.

Where, however, we have identified a correlation between two CI conditions, and made an adjustment to remove the overlap, we must make a corresponding prevalence adjustment. For example, in making the prevalence adjustment for CABG it is appropriate to exclude all those who have previously suffered a heart attack, so that such individuals are consistently removed from both the numerator and denominator in deriving the true first ever incidence rate.

We can estimate prevalence, by age and sex, from other data used in deriving CIBT02. A simple multi-state model can be created using:

- 3 states - 'healthy', 'sick' (that is having suffered a specific CI) and 'dead'
- Crude Incidence Rates [I_x] - for transition from 'healthy' to 'sick'
- Mortality rate for specific CI [k_xq_x] - for transitions from 'sick' to 'dead'
- Mortality Rate for all other causes [$(1 – k_x).q_x$] - for transitions for 'healthy' or 'sick' to 'dead'.
- Various refinements are possible and correlations with other CIs can be built in.

For each of the main CIs, we have obtained and used independent data giving a direct estimate of prevalence. In these cases, we have then cross-checked against the results derived form the simple model outlined above to confirm reasonable consistency between the various data sources used.

In other cases, the simple model has been used to provide the required prevalence estimate or to confirm that prevalence is low enough for the adjustment to be reasonable ignored.

4.1.3.8 Derived Incidence Rates

We have termed incidence rates calculated at this stage **Derived Incidence Rates** and denote them as $\mathbf{I_x}$**.** These are Crude Rates adjusted for overlaps and prevalence, and so represent our best estimate of the incidence rate of each CI in a healthy (CI free) population.

4.1.3.9 Adjustment for Survival Period on Stand-Alone CI Cover

For CIBT02 (as for CIBT93) we have assumed a survival period of 28 days applies to Stand-Alone CI cover. That is, the claimant needs to survive 28 days after the CI event for the sum insured to become payable.

We have used various data sources to estimate the probability of dying within the first 28 days following a CI event. These estimates take account, where relevant, of the risk of failing to survive a major operation, and of the sudden deaths, if any, identified in step 4.1.3.4.

4.1.3.10 Stand-Alone CI Rates

The **Stand-Alone Rates** are calculated by multiplying the Derived Incidence Rates by the probability of survival beyond the 28 day period. We denote them as $\mathbf{I'_x}$.

4.1.3.11 Accelerated CI Rates

To calculate Accelerated CI rates, the model preferred by Dash & Grimshaw[16] has been used, except for TPD. The CI-specific additional risk cost, over and above the mortality risk cost, for products which have an Accelerated CI benefit is estimated as:

$$\mathbf{I_x - k_x.q_x}$$

where

I_x is the Derived Incidence Rate CI for the concerned (before adjustment for survival period),
k_x is the proportion of deaths due to the CI concerned,
q_x is the all-cause population mortality rate.

We have termed this the (CI-specific) **Addition for Accelerated Rates**.

For q_x we substituted the m_x values from Interim Life Tables[21], 2001-03, for England, published by the GAD[18] (m_x rather than q_x for consistency with the incidence rates calculated). These tables provide individual age rates which, although not graduated, progress reasonably by age by virtue of the larger data volume obtained by combining three years' observations. We applied further smoothing as noted below (Section 0)

We derived k_x values from Mortality Statistics: Cause for England & Wales[39] published by ONS[36], ignoring the minor geographic inconsistency with the q_x data. Average values over the period 2001 to 2003 were calculated, consistent with the q_x values, in 5-year age-bands. These were then interpolated to individual ages using the techniques noted below (Section 0).

4.1.3.12 Smoothing, Interpolation and Extrapolation

The data we have used comes in many different forms, particularly as regards age-banding:

- The main sources (Cancer Registrations, HES and ONS Mortality by Cause) were accessed for event counts or rates in 5-year age bands
- Interim Life Tables provide q_x values for individual ages
- Many of the data sources for the other adjustments were only available covering broader, irregular, age-bands with little consistency between sources.

We therefore have needs to :

- Graduate or smooth the data to remove variations caused by random 'sampling error'
- Interpolate values to individual ages for the final table
- Extrapolate values to the full age range where occasionally necessary
- Convert rates and adjustment data to a common age-band structure (usually individual ages) to allow the calculations to proceed.

To meet these needs we have applied a general penalised B-spline technique. As the basis, we adopt a series of 18 regular cubic B-splines with knots at each 5-year point on the age scale from 15 to 90. Each B-spline covers a 20-year age range and at any given age there are 4 non-zero B-splines.

Fitted individual-age rates are calculated as the weighted sum of the B-splines after the 18 weights are derived by minimising a suitably chosen fit statistic which allows for goodness-of-fit and a penalty to encourage a degree of smoothness.

The goodness-of-fit measure is of the form $\Sigma(E_i \div \sigma_i)^2$, where E_i is the difference between the observed value for the i^{th} age-band and the population-weighted average of fitted values over the i^{th} age-band, and σ_i is the standard deviation associated with sampling error on the observed value for the i^{th} age-band (so typically for rate $p_i = n_i \div N_i$, $\sigma_i \approx \sqrt{(p_i \div N_i)}$, where n_i is observed number of CI events and N_i is the sample population for the i^{th} age-band).

The penalty against erratic behaviour in the weights is of the form $\lambda \, . \, \Sigma((r_{i+1} \div r_i) - 1)^2$ where r_i is the ratio $w_i \div w_{i-1}$ of successive fitted weights. λ determines the relative importance in the solution of goodness-of-fit and smoothness; it could be set using statistical criterion but we have simply chosen λ to give results we felt were reasonable (generally using the same value of λ across all applications of this method to data from a single source).

The main advantages of this method are perceived to be:

- The same approach can be applied to each set of data regardless of the underlying age-band structure
- The fit is not constrained to belong to a particular class of formulae and so does not require a prior view on form and is less likely to override genuine features of the data
- The fit is tested across the whole of each age-band in which the data is available, rather than assigning the age-band average arbitrarily to a specific age and interpolating from point to point
- The fit allows appropriately for the random sampling error / sample size for each data observation and can effectively trade smoothness and goodness-of-fit.

We have generally applied this technique to smooth / interpolate / extrapolate age-banded rates to individual-age rates at the Crude Rates stage and also to convert all the subsequent adjustments to an individual-age basis before applying them.

4.1.3.13 Form of Resulting Incidence Rates

By following the method set out above, the derived incidence rates are akin to central m_x-type rates, rather than initial q_x-type rates.

We leave the reader to make any further adjustments desired but note the difference between q_x and m_x-type rates is very small in context of the approximations and uncertainty inherent in the table.

4.2 Cancer

4.2.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Cancer – *excluding less advanced cases*

Any malignant tumour positively diagnosed with histological confirmation and characterised by the uncontrolled growth of malignant cells and invasion of tissue.

The term malignant tumour includes leukaemia, lymphoma and sarcoma.

For the above definition, the following are not covered:

- All cancers which are histologically classified as any of the following:
  - pre-malignant, for example essential thrombocythaemia and polycythaemia rubra vera;
  - non-invasive;
  - cancer in situ;
  - having either borderline malignancy; or
  - having low malignant potential.
- All tumours of the prostate unless histologically classified as having a Gleason score greater than 6 or having progressed to at least clinical TNM classification T2N0M0.
- Chronic lymphocytic leukaemia unless histologically classified as having progressed to at least Binet Stage A.
- Any skin cancer other than malignant melanoma that has been histologically classified as having caused invasion beyond the epidermis (outer layer of skin).

The ABI model Cancer definition wording has evolved considerably over time, with a lengthening list of exclusions for very early stage cancers with low mortality risk. However, for the purpose of determining current risk rates, the most relevant feature remains the exclusion of most skin cancers; the other exclusions are primarily an attempt to provide a degree of future proofing, rather than a current impact, and we have not attempted to adjust the incidence rates for them.

4.2.2 Data Sources

- ONS - Cancer Statistics - Registrations; England; 2002; Series MB1, no. 33[37]
- ONS - Population Estimates; England; 2002[40]
- Cancer prevalence in the UK: results from the EUROPREVAL study; Forman et al; 2003[4]
- ONS - Cancer Survival: England, 1998-2003[38]
- GAD - Interim Life Tables; England; 2001-03[21]
- ONS - Mortality Statistics: Cause; England and Wales; 2001-03; Series DH2, nos 28, 29,30[39]

For our calculations we define Cancer by ICD-10 codes C00 to C97, excluding C44 (skin cancers other than malignant melanoma).

4.2.3 Calculation of Incidence Rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for Cancer are detailed below.

4.2.3.1 Raw Observed Incidence Rates

For raw cancer incidence data we have used the ONS Cancer Statistics - Registrations series[37]. This is a good quality dataset; for further details see Section 8.3 - Cancer Registrations (England ; E&W).

Our start point is counts of new cancer registrations in 2002 in 5-year age-bands. This raw data is shown, with the full individual-age calculations, in Tables 10.1.1 and 10.1.2 in Appendix 3: CIBT02 Calculations Detail and Tables.

For calendar year 2002, the report relates to cancer registrations in England only and so we use the ONS 2002 Population Estimate for England as the denominator.

Cancer is the most common of the CI conditions so incidence data volumes are large:

Cancer - Raw Incidence & Sample Size - 2002		
	Males	Females
New Cancer Registrations	112,579	111,210
Population at Risk	24,288,500	25,358,400

There is no other relevant source to use as a cross-check for England. However, we have compared the raw incidence rates for England with those for Scotland as a broad check on reasonableness.

4.2.3.2 Adjustment to Count Only First Ever Incidences

The cancer registration statistics are intended to cover only the first ever incidence of cancer for each patient. This is consistent with the requirements of the table so no further adjustment is necessary.

4.2.3.3 Adjustment for Unreported Cases / Sudden Deaths

In compiling cancer registration statistics data from death certificates is checked in order to incorporate any sudden deaths, so again the data is in the form we require and no further adjustment is necessary.

4.2.3.4 Adjustment to Remove Overlap with Other CIs

We are not aware of any firm evidence that the incidence of cancer is affected by the existence of co-morbidity linked to the other main CI events, and so make no overlap adjustment.

4.2.3.5 Adjustment for Prevalence

There are no regularly published statistics on cancer prevalence in England, partly reflecting the methodological difficulties arising from the need for long-term follow up of cancer patients. We have therefore used a one-off study[4] which suggests the following cancer prevalence rates for the UK:

Cancer Prevalence Rates in the UK		
Age Band	Males	Females
≤ 44	0.30%	0.44%
45 - 64	1.67%	3.76%
≥ 65	7.27%	7.82%
All Ages	**1.51%**	**2.53%**

Source: Cancer prevalence in the UK: results from the EUROPREVAL study; Forman et al; 2003

The study is based on data from cancer registries covering more than half the UK population. Although the study was published in 2003, the prevalence rates actually relate to 1992. However, the results compare reasonably well with more recent data available for Scotland and with estimated prevalence derived from our cancer crude incidence and mortality assumptions.

These prevalence percentages have been interpolated / extrapolated over the full age range and then excluded from the denominator for the rate calculation in order to obtain an incidence rate which is applicable to a population previously free from cancer.

4.2.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

There is no readily available data directly relating to 28-day survival from cancer diagnosis as it would be of little clinical interest. However, there is data for 1-year and 5-year survival[38]:

Cancer Survival - England - 1- and 5-year survival of patients diagnosed in 1998-2001				
Age Band	Males		Females	
	1-year	5-year	1-year	5-year
15 - 49	85%	72%	91%	76%
50 - 59	75%	56%	88%	71%
60 - 69	74%	55%	83%	67%
70 - 79	67%	47%	71%	54%
80 - 99	52%	31%	60%	42%
All Ages	**62%**	**43%**	**71%**	**54%**

Source: Own calculations based on Cancer Survival: England, 1998-2003 (ONS)

Mortality risk from cancer typically peaks during the first year after diagnosis; it will be lower in the first month but still markedly above overall population mortality rates as some cancers are only detected at a very late stage when the sufferer is already close to death. Expert opinion helped us conclude that setting 28-day mortality to $^1/_{24}{}^{th}$ of 1-year cancer mortality rates is reasonable. This is equivalent to assuming cancer deaths which occur within 28-days of diagnosis account for around 2% of all cancer deaths up to age 70, rising to say 6% at advanced ages.

These estimated 28-day mortality rates have been interpolated over the full age range and then applied to convert the Derived Incidence Rate to a Stand-Alone Rate.

4.2.3.7 Addition for Accelerated Rates

We followed our general approach to calculate $I_x - k_x.q_x$ for Cancer.

4.2.3.8 Summary of Rates and Adjustments

The calculations for Cancer are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.1 and 10.1.2.

Summary of Calculation of Incidence Rates: Cancer							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	4.59	29.02	174.63		7.75	42.31	117.46
% adj to First Ever basis	-	-	-		-	-	-
% adj for Sudden Deaths	-	-	-		-	-	-
% change by smoothing	-0%	-0%	-0%		-0%	+0%	-0%
% adj for Overlaps	-	-	-		-	-	-
% adj for Prevalence	+0%	+2%	+6%		+1%	+3%	+8%
Derived Incidence Rate, I_x	**4.60**	**29.37**	**184.56**		**7.75**	**43.80**	**126.05**
% adj for 28-day Mortality	-1%	-1%	-2%		0%	-1%	-1%
Stand-Alone Rate, I'_x	**4.57**	**29.06**	**181.72**		**7.72**	**43.57**	**124.57**
- CI-specific mort^y rate, $k_x.q_x$	-1.14	-13.61	-97.84		-1.47	-13.70	-66.75
Addition for Acc CI, $I_x - k_x.q_x$	**3.46**	**15.75**	**86.72**		**6.29**	**30.09**	**59.30**

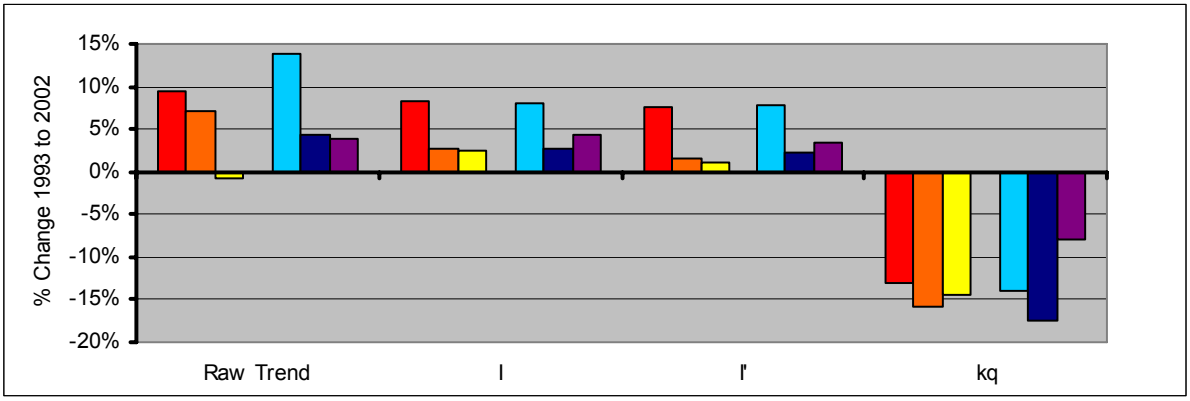
4.2.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in Cancer rates from CIBT93 to CIBT02.

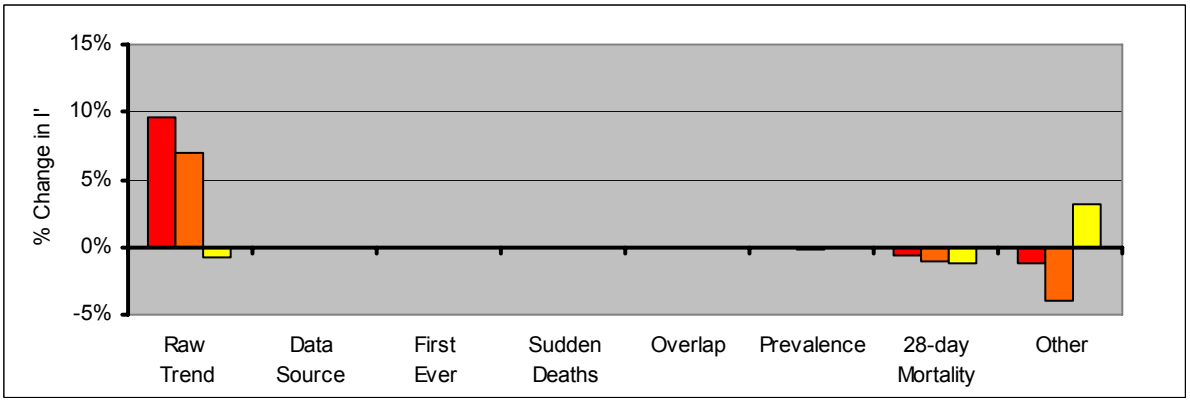
Stand-Alone CI rates for Cancer have increased modestly for most ages. These increases are largely driven by real trends in the Raw Observed Rates; the impact of updates and refinements for the calculation adjustments for Cancer are relatively small.

Overall increases in cancer incidence rates of +0.5% to +1.0% pa contrast with falls in cancer mortality of around -1.0% to -1.5% pa across a broad range of ages.

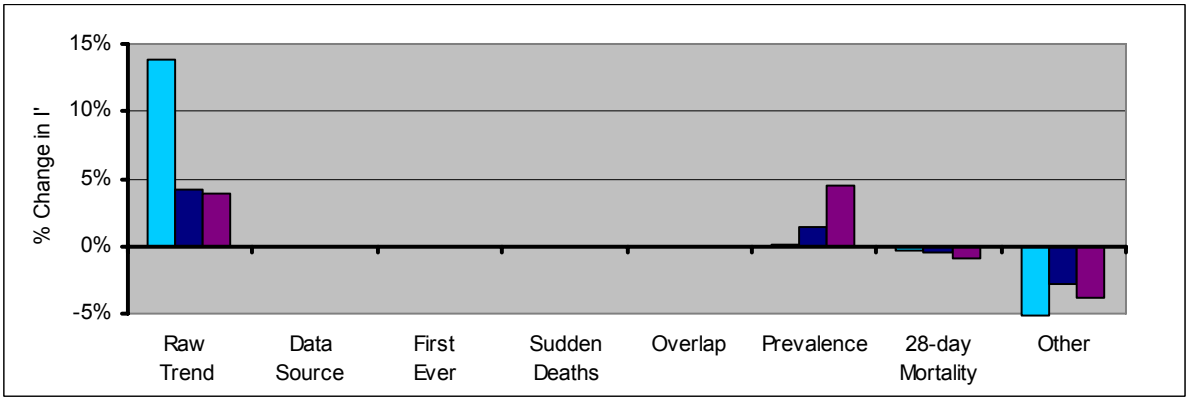
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for Cancer



Components of Change in Stand-Alone Rates (I') for Cancer - Males



Components of Change in Stand-Alone Rates (I') for Cancer - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for Cancer		
Component	Commentary	Real Trend ?
Raw Trend	Underlying trend gives modest increases; see Section 2.1	✓
Data Source	Consistent source (Cancer Regs) for CIBT93 and CIBT02	n/a
First Ever	No adjustments	n/a
Sudden Deaths	No adjustments	n/a
Overlap	No adjustments	n/a
Prevalence	New data source used for CIBT02; improved estimate	×
28-day Mortality	Refined basis adopted for CIBT02; improved estimate	×
Other	Differences arising from smoothing and CIBT93 timing adjustment	×

4.3 Heart Attack

4.3.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Heart Attack – *of specified severity*

Death of heart muscle, due to inadequate blood supply, that has resulted in all the following evidence of acute myocardial infarction:

- Typical clinical symptoms (for example, characteristic chest pain).
- New characteristic electrocardiographic changes.
- The characteristic rise of cardiac enzymes or Troponins recorded at the following levels or higher;
  - Troponin T > 1.0 ng/ml
  - AccuTnl > 0.5 ng/ml or equivalent threshold with other Troponin I methods.

The evidence must show a definite acute myocardial infarction.

For the above definition, the following are not covered:

- Other acute coronary syndromes including but not limited to angina.

The ABI model Heart Attack definition wording has evolved broadly in line with medical practice in the translation of clinical symptoms and test results to diagnoses of an acute myocardial infarction. In particular, the use of troponins as a diagnostic tool was recognised in the ABI's 2002 revision and specific troponin levels were introduced to the definition in 2006 to provide a degree of consistency and future proofing in light of the shifting sands of medical practice in this area.

4.3.2 Data Sources

- HES - Diagnoses of Acute Myocardial Infarction; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]
- Fatality outside of hospital from acute coronary events in three British health districts, 1994/95; RM Norris; BMJ 1998; 316: 1065-1070 (4 April)[17]
- Reduced risk at 28 days in patients taking a Beta Blocker before admission with MI; Nidorf, Parsons Thompson; BMJ 1990; 300: 71-4[44]
- Predicators for 30-day mortality in the area of reperfusion of acute MI; Lee, Woodlief, Topol Weaver et al; Circulation 1995; :91:1659-68[42]
- Health Survey for England 2003 Volume 1, Cardiovascular Disease[32], Table 1.1
- ISD Scotland - Trends in Acute Myocardial Infarction and Angina 30-Day Survival[30]
- GAD - Interim Life Tables; England; 2001-03[21]
- ONS - Mortality Statistics: Cause; England and Wales; 2001-03; Series DH2, nos 28, 29,30[39]

For our calculations we define Heart Attack by ICD-10 codes I21 and I22 for first ever and subsequent heart attacks respectively.

4.3.3 Calculation of the incidence rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for Heart Attack are detailed below.

4.3.3.1 Raw Observed Incidence Rates

For raw heart attack incidence data we have used our extract from Hospital Episode Statistics[33]. For further details of this dataset, and the filters used to select data for extract and for these calculations, see Section 8.5 - Hospital Episode Statistics (HES).

Our start point is counts of all heart attacks (both first ever, I21, and subsequent heart attacks, I22; this is for baseline consistency with the CIBT93 derivation) in 5-year age-bands. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate

the number of heart attacks in England in 2002. This constructed data is shown, with the full individual-age calculations, in Tables 10.1.3 and 10.1.4 in Appendix 3: CIBT02 Calculations Detail and Tables.

Having converted the HES data counts to a 2002 calendar year basis, we use the ONS 2002 Population Estimate for England as the denominator.

Heart Attack is the second / third most common of the CI conditions so incidence data volumes are large:

Heart Attack - Raw Incidence & Sample Size - 2002		
	Males	Females
All Heart Attacks (I21, I22)	91,925	57,456
First Ever Heart Attacks (I21)	77,407	49,658
Population at Risk	24,288,500	25,358,400

The raw incidence rates for England were compared against raw incidence rates for Scotland. The relationship between the two rate sets appeared reasonable.

A further check was carried out against British Heart Foundation (BHF) statistics. However, this source appeared unreliable, with little correspondence to the HES figures, and is in any case simply a recycling of data from other primary sources (including HES).

4.3.3.2 Adjustment to Count Only First Ever Incidences

To convert the Raw Incidence Rates to a first ever incidence basis we simply applied the ratio of event counts for I21 to the sum of those for I21 and I22. HES confirmed that classification between I21 and I22 was reliable and no further adjustment to this ratio was thought to be necessary.

4.3.3.3 Adjustment for Unreported Cases / Sudden Deaths

To allow for sudden deaths from heart attack (without time for hospital admission) we took the same start point as used in CIBT93 as we have been unable to identify a more up-to-date source. Norris's small-scale study of fatalities outside of hospital from acute coronary events[17] estimated heart attack sudden death rates in the early 1990s to be around 20% at age 40 rising to 35% or so at age 75.

However, as shown in the earlier Section on trends, the mortality rate from heart attacks has been falling rapidly, both in absolute terms and relative to the incidence of heart attacks, and expert opinion suggests a reduction in sudden deaths has been a major contributory factor in these trends. Further, if we simply took the rates direct from Norris, combined with the basic data we have for 28-day survival post hospital admission for heart attack, then our estimated early deaths from heart attack ($k_x.q_x$) would exceed all recorded deaths from heart attack ($k_x.q_x$) over a significant range of ages. This is clearly not reasonable so, after interpolating / extrapolating the crude sudden death percentages from Norris, we applied two further adjustments to allow broadly for the mortality rate improvement over time, convert to a first ever event basis, and correct this anomaly.

First we applied a scaling factor of 30% (independent of age and sex). We judged this appropriate through considering a combination of:

- The measured improvement in overall heart attack mortality rates over time, allowing for the trend data we have on 28-day survival post hospital admission[30]
- The measured trend over time in heart attack incidence (as the sudden death rates relate deaths to incidence)
- The introduction of troponin as a diagnostic tool probably increasing reported incidence rates, particularly of less severe heart attacks, and so reducing the ratio of deaths to incidence
- Testing assumed early deaths against all deaths for heart attack.

Second we reasoned that 28-day mortality rates (both sudden and post hospital admission) would be lower for first ever heart attacks than for subsequent heart attacks. Research by Nidorf[44] and Lee[42] support a mortality ratio assumption of around 2.0, that is $q^{subsequent} = 2 \times q^{first}$. As we have already estimated the ratio of first ever heart attacks to subsequent heart attacks at each age, we can readily calculate an age and sex dependent reduction factor to convert our base assumption to one applicable to first ever heart attack events.

Whilst these adjustments are not firmly data-based they have been guided by overall reasonableness checks (testing early deaths against all deaths for heart attack, and comparing the assumed ratio of $q^{subsequent} : q^{first}$ to that implied by the derived incidence and mortality rates), have some support in the research literature, and been tested against expert opinion for plausibility.

4.3.3.4 Adjustment to Remove Overlap with Other CIs

In considering the overlap between Heart Attack and other CIs, the correlation with Stroke and CABG has been reflected by appropriate adjustments to the Stroke and CABG incidence rates. It is not believed that the prevalence of stroke or CABG will have a significant impact on the incidence of heart attacks and this has been ignored.

4.3.3.5 Adjustment for Prevalence

The Health Survey for England 2003[32] gives estimates for prevalence of various CVD conditions including heart attacks. The survey was carried out in 2003 with around 15,000 interviewees.

Heart Attack Prevalence Rates in England		
Age Band	Males	Females
16 - 24	0.0%	0.0%
25 - 34	0.0%	0.0%
35 - 44	0.8%	0.3%
45 - 54	2.2%	0.8%
55 - 64	6.7%	2.1%
65 - 74	12.1%	4.2%
≥ 75	15.7%	8.1%
All Ages	**3.8%**	**1.7%**

Source: Health Survey for England 2003 Volume 1, Cardiovascular Disease, Table 1.1

These direct estimates compare reasonably well with estimated prevalence derived from our heart attack crude incidence and mortality assumptions.

The prevalence percentages in the table have been interpolated / extrapolated over the full age range and then excluded from the denominator for the rate calculation in order to obtain an incidence rate which is applicable to the population subset who have never yet suffered a heart attack.

4.3.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

For the mortality rate during the 28-day survival period for Stand-Alone CI cover, we combine our estimate of sudden deaths from heart attack (without time for hospital admission) with data on survival following emergency hospital admissions for heart attack. For the latter we obtained data from ISD Scotland and averaged the 30-day survival rates[30] presented over the 3 years 2001-03. The effective sample size was around 22,000 hospital admissions for heart attack.

30-day Heart Attack Survival Rates in Scotland		
Age Band	Males	Females
≤ 44	97.0%	96.8%
45 - 64	95.4%	92.6%
65 - 74	87.0%	84.2%
≥ 75	72.0%	69.6%
All Ages	**87.0%**	**79.1%**

Source: ISD Scotland - Trends in Acute Myocardial Infarction and Angina 30-Day Survival, 2001-03

These survival rates cover all heart attacks (first ever and subsequent events), so we have made an adjustment to convert the estimated 28-day post-admission mortality rates to a first ever heart attack basis, using the same $q^{subsequent} = 2 \times q^{first}$ assumption and approach as described in Section 4.2.3.3 for the sudden deaths adjustment.
As this data relates to Scotland and we need to apply it to incidence rates for England, we have made a further adjustment to allow for the recent divergence in heart attack incidence trends between England and Scotland which probably relates to a slower take up of troponin as a diagnostic tool in

Scotland (see Section **3.1.2**). The relative increase in reported incidence in England will dilute the 28-day mortality rate, so we need to divide the observed Scottish rates by the approximate index factors shown in the table below:

Relative Change in Incidence - Eng:Scot - 1995-02		
Age Band	Males	Females
≤ 44	110%	110%
45 - 64	120%	143%
65 - 74	140%	150%
≥ 75	150%	165%

Source: Own calculations using heart attack incidence rate data from HES and ISD Scotland, 1995 to 2002

The adjusted 28-day mortality rates for post hospital admission have been interpolated / extrapolated over the full age range, combined with our estimated sudden death rates, and then applied to convert the Derived Incidence Rate to a Stand-Alone Rate.

4.3.3.7 Addition for Accelerated Rates

We followed our general approach to calculate $I_x - k_x.q_x$ for Heart Attack.

4.3.3.8 Summary of Rates and Adjustments

The calculations for Heart Attack are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.13 and 10.1.4.

Summary of Calculation of Incidence Rates: Heart Attack							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	2.36	35.43	126.25		0.53	8.39	61.32
% adj to First Ever basis	-6%	-10%	-17%		-7%	-8%	-14%
% adj for Sudden Deaths	+6%	+7%	+9%		+6%	+7%	+10%
% change by smoothing	+2%	-0%	0.0%		+7%	-0%	0.0%
% adj for Overlaps	-	-	-		-	-	-
% adj for Prevalence	+0%	+4%	+14%		+0%	+1%	+5%
Derived Incidence Rate, I_x	**2.42**	**35.12**	**129.77**		**0.56**	**8.38**	**61.04**
% adj for 28-day Mortality	-8%	-9%	-16%		-8%	-11%	-19%
Stand-Alone Rate, I'_x	**2.23**	**31.79**	**108.41**		**0.51**	**7.46**	**49.73**
- CI-specific mort^y rate, $k_x.q_x$	-0.22	-4.35	-32.71		-0.06	-1.02	-16.21
Addition for Acc CI, $I_x - k_x.q_x$	**2.20**	**30.77**	**97.07**		**0.49**	**7.36**	**44.83**

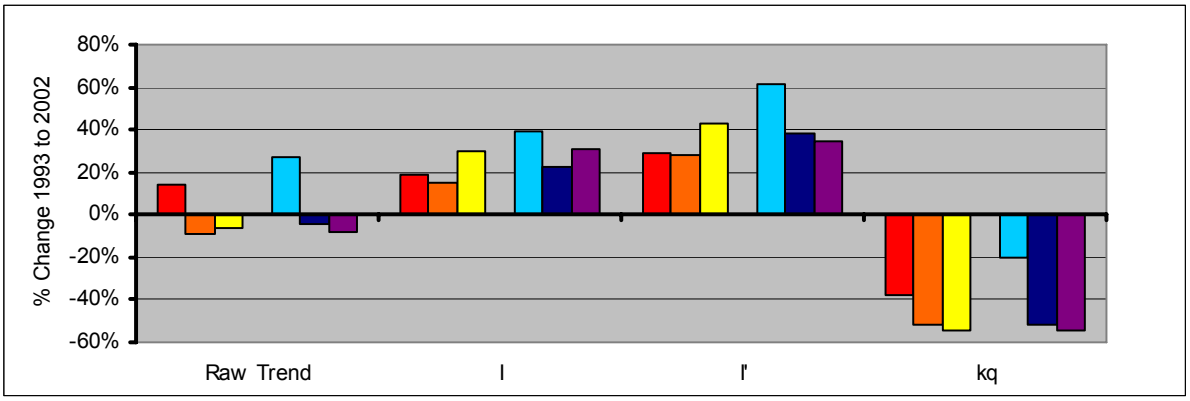
4.3.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in Heart Attack rates from CIBT93 to CIBT02.

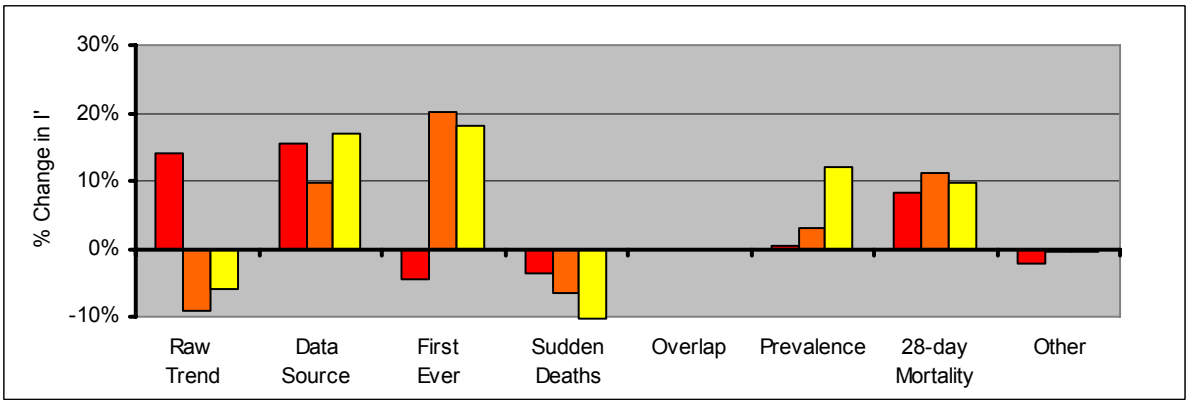
Raw Observed Rates for heart attack are modestly down at most ages, with improved preventative care for those at risk being partially offset by the change in measurement following the introduction of troponin tests as a diagnostic tool. However, this underlying trend is swamped by changes to data (notably the HES filters; see Section **8.5.10**) and adjustments (notably a more robust estimate of the ratio of first ever to all heart attacks) so that the calculated Stand-Alone CI rates for Heart Attack have increased significantly from CIBT93 to CIBT02.

Heart attack mortality rates have fallen spectacularly, roughly halving over the decade to 2002. A marked fall in 28-day mortality contributes to Stand-Alone Rates increasing relative to Incidence rates.

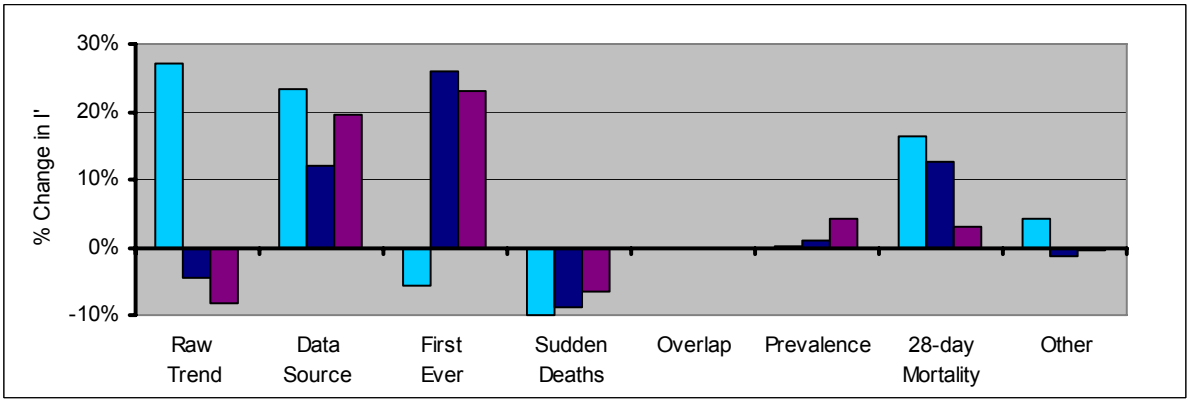
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for Heart Attack



Components of Change in Stand-Alone Rates (I') for Heart Attack - Males



Components of Change in Stand-Alone Rates (I') for Heart Attack - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for Heart Attack		
Component	Commentary	Real Trend ?
Raw Trend	Underlying trends complex; see Section 2.2	✓
Data Source	Same source (HES) but different filters for CIBT93 and CIBT02	×
First Ever	New data source for CIBT02; much improved estimate	Mixed
Sudden Deaths	No new data for CIBT02 but adj modified to satisfy cross-checks	Mostly ✓
Overlap	No adjustments	n/a
Prevalence	New data source used for CIBT02; improved estimate	×
28-day Mortality	New data source used for CIBT02; improved estimate	Mostly ✓

Other	Differences arising from smoothing	×

4.4 Stroke

4.4.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Stroke – *resulting in permanent symptoms*

Death of brain tissue due to inadequate blood supply or haemorrhage within the skull resulting in permanent neurological deficit with persisting clinical symptoms.

For the above definition, the following are not covered:
- Transient ischaemic attack.
- Traumatic injury to brain tissues or blood vessels.

The 2006 review of model definitions introduced the generic term 'permanent neurological deficit with persisting clinical symptoms'. This is further defined as:

Symptoms of dysfunction in the nervous system that are present on clinical examination and expected to last throughout the insured person's life.

Symptoms that are covered include numbness, hyperaesthesia (increased sensitivity), paralysis, localised weakness, dysarthria (difficulty with speech), aphasia (inability to speak), dysphagia (difficulty in swallowing), visual impairment, difficulty in walking, lack of coordination, tremor, seizures, lethargy, dementia, delirium and coma.

The following are not covered:
- An abnormality seen on brain or other scans without definite related clinical symptoms
- Neurological signs occurring without symptomatic abnormality, e.g. brisk reflexes without other symptoms
- Symptoms of psychological or psychiatric origin.

This addresses a key perceived risk in the previous Stroke definition's vulnerability to the increasing ability to detect 'silent strokes'. The new 'permanent symptoms' requirement, whilst arguably subjective and yet to be tested, is expected to provide a degree of protection against advances in diagnostic capabilities. There is little impact on incidence as currently measured.

4.4.2 Data Sources

- HES - Diagnoses of stroke; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]
- ISD Scotland - Counts of first ever strokes and of all strokes; 2002 (unpublished)
- WHO collaborative study: A study into cerebrovascular diseases in the community.[57]
- Community-Based Stroke Incidence in a Scottish Population; Stroke; 2005[10]
- Health Survey for England 2003 Volume 1, Cardiovascular Disease[32]; Table 1.1
- Stroke: Increasing Stroke Incidence and Decreasing Case Fatality, 1989-1998: A study from the Stroke Register in Malmo Sweden; Pessah-Rasmussen et al; Stroke (AHA journals); 2002[51]
- ISD Scotland - Trends in Cerebrovascular Disease / Stroke 30-Day Survival[31]
- GAD - Interim Life Tables; England; 2001-03[21]
- ONS - Mortality Statistics: Cause; England and Wales; 2001 -03; Series DH2, nos 28, 29,30[39]

For our calculations we define Stroke by ICD-10 codes I60 to I69. These include all strokes (first ever and subsequent) but not transient ischaemic attacks (as these are excluded by the definition).

4.4.3 Calculation of the incidence rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for Stroke are detailed below.

4.4.3.1 Raw Observed Incidence Rates

For raw stroke incidence data we have used our extract from Hospital Episode Statistics[33]. For further details of this dataset, and the filters used to select data for extract and for these calculations, see Section 8.5 - Hospital Episode Statistics (HES).

Our start point is counts of strokes in 5-year age-bands. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of strokes in England in 2002. This constructed data is shown, with the full individual-age calculations, in Tables 10.1.5 and 10.1.6 in Appendix 3: CIBT02 Calculations Detail and Tables.

Having converted the HES data counts to a 2002 calendar year basis, we use the ONS 2002 Population Estimate for England as the denominator.

Stroke is the second / third most common of the CI conditions so incidence data volumes are large although more heavily weighted to older ages than for heart attacks:

Stroke - Raw Incidence & Sample Size - 2002		
	Males	Females
All Stroke Diagnoses	91,323	99,001
Population at Risk	24,288,500	25,358,400

The raw incidence rates for England were compared against raw incidence rates for Scotland. The relationship between the two rate sets appeared reasonable.

4.4.3.2 Adjustment to Count Only First Ever Incidences

We requested a further dataset from ISD Scotland to enable us to make the required adjustment to convert the Raw Incidence Rates to a first ever basis. The ISD Scotland dataset is well-ordered and allows views on both a patient basis and an episode basis. We obtained data for 2002, in 5-year age-bands, on two bases :

- First ever strokes, derived from patient-based records
- All strokes (first and subsequent), derived from episode-based records consistent with the filters used for our HES data extract.

The adjustment factors were then calculated by taking the ratios of the first ever stroke counts to the all strokes counts.

4.4.3.3 Adjustment for Unreported Cases / Sudden Deaths

To allow for sudden deaths from stroke (without time for hospital admission) we took a WHO study[57] as our start point; this is the same as used in CIBT93 as we have been unable to identify a more up-to-date source. The study suggests day-1 fatality from stroke is about 10%, although perhaps 50% of such cases might go unreported, and so a sudden deaths factor of 5% was adopted for CIBT93. Expert opinion suggests 5% is still a reasonable 'all strokes' average sudden death figure for the UK today.

However, if we simply took this assumption, combined with the basic data we have for 28-day survival post hospital admission for stroke, then our estimated early deaths from stroke would exceed all recorded deaths from stroke ($k_x.q_x$) over a significant range of ages. This is clearly not reasonable so we have made two further adjustments.

First we have differentiated the 5% factor by age and sex, by reference to the pattern we observe in the data for 28-day survival post hospital admission for stroke. Intuitively this shape seems more reasonable than a flat 5% across all ages.

Second we reasoned that 28-day mortality rates (both sudden and post hospital admission) would be lower for first ever strokes than for subsequent strokes. We have assumed this mortality ratio is 2.0, that is $q^{subsequent} = 2 \times q^{first}$. As we have already estimated the ratio of first ever strokes to subsequent strokes at each age, we can readily calculate an age and sex dependent reduction factor to convert our base assumption to one applicable to first ever stroke events.

Whilst these adjustments are not firmly data-based they have been guided by overall reasonableness checks (testing early deaths against all deaths for stroke, and comparing the assumed ratio of $q^{subsequent} : q^{first}$ to that implied by the derived incidence and mortality rates) and tested against expert opinion for plausibility.

As well as sudden deaths, there may be stroke cases which do not result in hospital admission and so would not register in the HES data. A small-scale Scottish stroke study[10] reported that 7% of patients were treated by their GP without hospital admission. However, we do not feel we have firm enough evidence to make an adjustment for stroke patients treated outside of hospital, either by their GP or privately; it is however possible there are such additional cases which would meet the Stroke definition.

4.4.3.4 Adjustment to Remove Overlap with Other CIs

There is evidence of correlation between strokes, heart attacks and CABGs. The WHO study[57] suggested 7% of stroke victims had previously suffered a heart attack. A more recent study, based in Sweden[51], identified prior heart attacks in 12% of male stroke victims and 6% of female stroke victims. We have reduced Crude Incidence Rates by 12% for males and 6% for females to allow for this overlap; we do not have sufficient information to differentiate the adjustment by age.

4.4.3.5 Adjustment for Prevalence

The Health Survey for England 2003[32] gives estimates for prevalence of various CVD conditions including strokes. The survey was carried out in 2003 with around 15,000 interviewees.

Stroke Prevalence Rates in England		
Age Band	Males	Females
16 - 24	0.1%	0.2%
25 - 34	0.4%	0.3%
35 - 44	0.3%	0.6%
45 - 54	1.2%	0.9%
55 - 64	2.2%	2.5%
65 - 74	7.5%	5.3%
≥ 75	13.3%	8.8%
All Ages	**2.4%**	**2.2%**

Source: Health Survey for England 2003 Volume 1, Cardiovascular Disease, Table 1.1

These direct estimates compare reasonably well with estimated prevalence derived from our stroke crude incidence and mortality assumptions.

The prevalence percentages have been interpolated / extrapolated over the full age range and then excluded from the denominator for the rate calculation in order to obtain an incidence rate which is applicable to the population subset who have never yet suffered a stroke.

In principle we should also make an allowance for the prevalence of prior heart attacks, the 'flip side' of the adjustment made for overlaps. However, the effect would be small at most ages, certainly compared to the uncertainty inherent in the other calculation steps, and such refinement has not been applied.

4.4.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

For the mortality rate during the 28-day survival period for Stand-Alone CI cover, we combine our estimate of sudden deaths from stroke (without time for hospital admission) with data on survival following emergency hospital admissions for stroke. For the latter we obtained data from ISD Scotland and averaged the 30-day survival rates[31] presented over the 3 years 2001-03. The effective sample size was almost 23,000 hospital admissions for stroke.

30-day Stroke Survival Rates in Scotland		
Age Band	Males	Females
≤ 44	89.5%	88.1%
45 - 64	89.0%	86.2%
65 - 74	85.5%	81.9%
≥ 75	76.0%	73.0%
All Ages	**82.6%**	**77.2%**

Source: ISD Scotland - Trends in Cerebrovascular Disease / Stroke 30-Day Survival, 2001-03

These survival rates cover all strokes (first ever and subsequent events), so we have made an adjustment to convert the estimated 28-day post-admission mortality rates to a first ever stroke basis, using the same $q^{subsequent} = 2 \times q^{first}$ assumption and approach as described in Section 4.3.3.3 for the sudden deaths adjustment.

The adjusted 28-day mortality rates for post hospital admission have been interpolated / extrapolated over the full age range, combined with our estimated sudden death rates, and then applied to convert the Derived Incidence Rate to a Stand-Alone Rate.

4.4.3.7 Addition for Accelerated Rates

We followed our general approach to calculate $I_x - k_x.q_x$ for Stroke.

4.4.3.8 Summary of Rates and Adjustments

The calculations for Stroke are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.5 and 10.1.6.

Summary of Calculation of Incidence Rates: Stroke							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	2.86	20.24	129.14		2.71	13.77	91.25
% adj to First Ever basis	-44%	-51%	-56%		-51%	-53%	-55%
% adj for Sudden Deaths	+2%	+2%	+3%		+2%	+2%	+3%
% change by smoothing	+0%	-0%	-0%		-0%	-0%	0%
% adj for Overlaps	-12%	-12%	-12%		-6%	-6%	-6%
% adj for Prevalence	+0%	+1%	+9%		+0%	+1%	+6%
Derived Incidence Rate, I_x	**1.43**	**8.99**	**55.40**		**1.28**	**6.24**	**42.61**
% adj for 28-day Mortality	-9%	-9%	-13%		-10%	-11%	-16%
Stand-Alone Rate, I'_x	**1.30**	**8.20**	**48.38**		**1.15**	**5.57**	**35.91**
- CI-specific mort^y rate, $k_x.q_x$	-0.22	-1.89	-22.13		-0.19	-1.50	-18.66
Addition for Acc CI, $I_x - k_x.q_x$	**1.21**	**7.10**	**33.27**		**1.08**	**4.74**	**23.95**

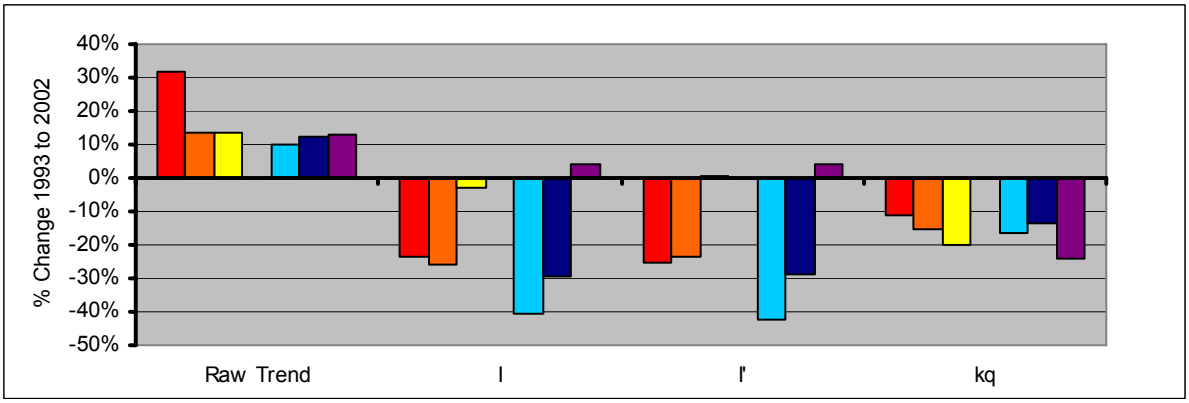
4.4.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in Stroke rates from CIBT93 to CIBT02.

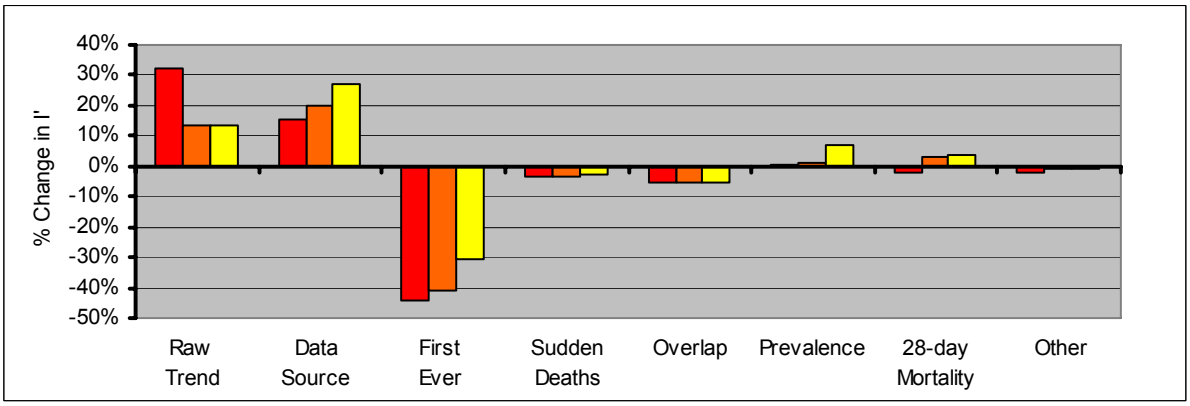
Raw Observed Rates for strokes have increased by around 10% across a broad range of ages. One contributory factor is improved detection techniques of minor strokes through advances in scanning technologies. However, this underlying trend is swamped by changes to data (notably the HES filters; see Section **8.5.10**) and to the estimate of the ratio of first ever to all strokes (we believe we have a more robust estimate for CIBT92 using data from ISD Scotland), so that the calculated Stand-Alone CI rates for Stroke have decreased significantly from CIBT93 to CIBT02.

Stroke mortality rates have fallen by 1.5% to 2.5% pa in contrast to the increasing incidence of recorded strokes.

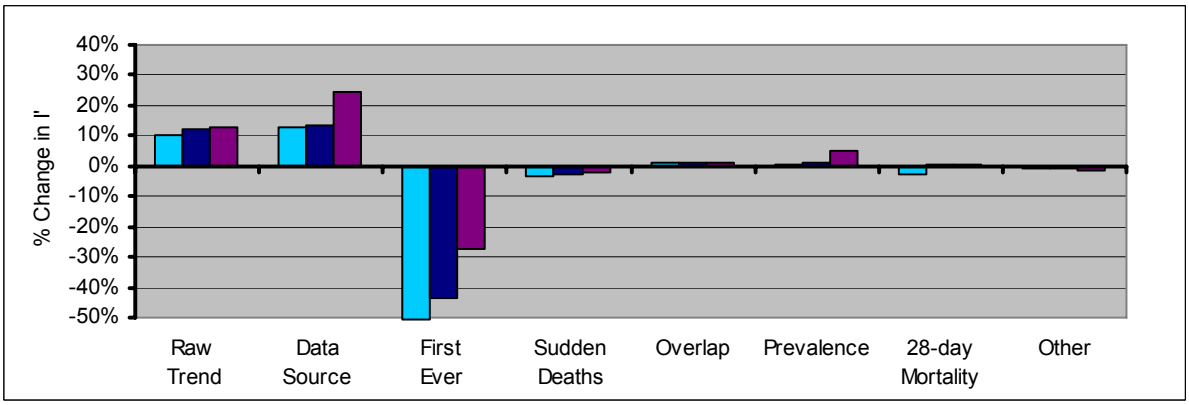
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for Stroke



Components of Change in Stand-Alone Rates (I') for Stroke - Males



Components of Change in Stand-Alone Rates (I') for Stroke - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for Stroke		
Component	Commentary	Real Trend ?
Raw Trend	Underlying trends show increasing recorded incidence; see 2.3	✓
Data Source	Same source (HES) but different filters for CIBT93 and CIBT02	×
First Ever	New data source for CIBT02; improved estimate	Mixed
Sudden Deaths	No new data for CIBT02 but adj modified to satisfy cross-checks	Mostly ✓
Overlap	New data source used for CIBT02, but still only a crude estimate	×

Prevalence	New data source used for CIBT02; improved estimate	×
28-day Mortality	New data source used for CIBT02; improved estimate	Mostly ✓
Other	Differences arising from smoothing	×

4.5 Coronary Artery By-pass Graft (CABG)

4.5.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Coronary artery by-pass grafts – *with surgery to divide the breastbone*

The undergoing of surgery requiring median sternotomy (surgery to divide the breastbone) on the advice of a Consultant Cardiologist to correct narrowing or blockage of one or more coronary arteries with by-pass grafts.

The requirement for median sternotomy has replaced the term 'open heart surgery' in the 2006 revision of the model definition. This is designed to give a degree of future proofing, in light of rapid advances in operative techniques to tackle the underlying arterial problem, and has little impact on the current incidence rates.

4.5.2 Data Sources

- HES - CABG operations; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]
- National Adult Cardiac Surgical Database Reports; 1999/00 and 2000/01[35]
- Health Survey for England 2003 Volume 1, Cardiovascular Disease[32]
- GAD - Interim Life Tables; England; 2001-03[21]

For our calculations we define CABG by the following OPCS4 codes:
K401 - K404, K408, K409, K411 - K414, K418, K419, K421 - K424, K428, K429, K431 - K434, K438, K439, K441, K442, K448, K449, K451, K452 - K455, K458, K459, K461 - K464, K468, K469.

4.5.3 Calculation of the incidence rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for CABG are detailed below.

4.5.3.1 Raw Observed Incidence Rates

For raw CABG incidence data we have used our extract from Hospital Episode Statistics[33]. For further details of this dataset, and the filters used to select data for extract and for these calculations, see Section 8.5 - Hospital Episode Statistics (HES).

Our start point is counts of CABG operations in 5-year age-bands. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of CABG operations conducted in England in 2002. This constructed data is shown, with the full individual-age calculations, in Tables 10.1.7 and 10.1.8 in Appendix 3: CIBT02 Calculations Detail and Tables.

Having converted the HES data counts to a 2002 calendar year basis, we use the ONS 2002 Population Estimate for England as the denominator.

CABG is the most common of the CI operations but even so the incidence data volumes are very much smaller than for the 3 major CIs covered so far:

CABG - Raw Incidence & Sample Size - 2002		
	Males	Females
CABG operations	36,293	9,266
Population at Risk	24,288,500	25,358,400

The counts of operations in HES were compared to the counts in the National Adult Cardiac Surgical Database (CSD). The total counts are much higher in HES, even though HES only covers England

and CSD covers much of the UK. However, examining the list of hospitals involved shows that many major hospitals or trusts do not contribute data to CSD and this may explain the discrepancy. It is difficult to reconcile the absolute numbers in the two data sources but the distribution of the counts by age and gender in HES is very similar to that for CSD.

The CABG operation counts available free from the HES website only include counts of the cases where CABG was recorded as the main or primary operation. In our data extract all CABG operations were included in the counts whether or not they were recorded as the main or primary operation. The number of counts of CABG in the free website data are far lower than the counts when all operations are included. We might expect the number of occasions where CABG is not the primary or main operation to be small but this is apparently not the case. One possibility is that operations have been recorded in chronological order with the first procedure being recorded as primary rather than the operation with the greatest implications being recorded as primary.

The observed incidence rates derived from HES data by using only the main or primary operation were also compared to those derived from Scottish data which also relate to the main or primary operation. The relation between these two sources appeared reasonable. (See Section 8.6 for a description of the data available through Information and Statistics Department (ISD) NHS Scotland).

4.5.3.2 Adjustment to Count Only First Ever Incidences

A proportion of these operations will relate to repeated surgery. The data therefore needs to be adjusted to estimate the proportion of operations that would be a first ever CABG.

The National Adult Cardiac Surgical Database Report 1999/00[35] shows that during the 1990s the number of patients undergoing repeat heart surgery has remained relatively constant with about 95% of CABG patients being those undergoing their first operation. We could speculate that younger people are more likely to be undergoing their first operation than their second or subsequent operation, but age and gender specific information is not available. However, we have not attempted to differentiate and a 95% adjustment factor has been applied for all ages to the Raw Observed Rate to convert it to a first ever incidence basis.

4.5.3.3 Adjustment for Unreported Cases / Sudden Deaths

No adjustments are needed for sudden deaths prior to admission to hospital, as the definition relates to the number of CABG operations in hospital.

4.5.3.4 Adjustment to Remove Overlap with Other CIs

There is an increased likelihood of undergoing CABG for people who have previously had a heart attack. The National Adult Cardiac Surgical Database Report 2000/01[35] shows that, in 2001, 58% of patients presenting for surgery had previously had one or more heart attacks. The definition used in this study for a heart attack was based on electrocardiographic evidence. This is comparable to the definition used for coding HES data at the time. The percentage of patients who had previously had a heart attack in the CSD should therefore give a good guide to the overlap in heart attack and CABG. Younger people and women are less likely to have had a heart attack but there is a correlation between CABG and heart attack. So it is not clear whether or not an age or gender differential in the overlap assumption would be appropriate and no further information is available by age and gender. We have not attempted to differentiate and have reduced Crude Incidence Rates by 58% for males and females, at all ages, to allow for overlap with other CI conditions.

4.5.3.5 Adjustment for Prevalence

As the numerator of the incidence rates has been reduced to allow for people who have previously suffered a heart attack, it is appropriate to also remove people who have suffered a heart attack from the denominator of the incidence rate. The crude incidence rates were therefore adjusted for prevalence of heart attack using data from the Health Survey for England 2003 (see Section 4.3.3.5).

A further adjustment should in theory be made for the actual prevalence of lives who have undergone CABG operations. However, the additional prevalence of people who have had a CABG, but who have not had a heart attack, over the prevalence of people who have suffered a heart attack is relatively very small. This further adjustment was therefore ignored.

4.5.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

Post operative mortality (death rates in the 28 days or month following surgery) is reported in the National Adult Cardiac Surgical Database Report 2000/01[35]. Age specific 28-day crude survival rates for 2001 for all CABG operations are:

Age at surgery	28-day Post-CABG Survival
<56	99.0%
56-60	98.8%
61-65	98.1%
66-70	97.7%
71-75	96.4%
>75	94.1%

Source: National Adult Cardiac Surgical Database Report 2000/01

The same source shows that mortality rates for a patient's first surgery are lower than post operative mortality rates for all CABG operations. As most operations are first surgeries, no adjustment is made to allow for better survival after first ever surgery compared to after second or subsequent surgeries. Patients who have not previously suffered a heart attack have lower post operative mortality, 1.8% mortality rate, than those who have had a heart attack, 3.0% mortality rate. The weighted combined rate is 2.3% and so the mortality rates by age were adjusted by a factor of 1.8% ÷ 2.3%. There is some indication that females have higher post operative mortality rates than males. This may be due to their smaller size making the operations more complex, but the results are confounded by differences in average age and any adjustment is not expected to be significant. Therefore we have used the same rates for both males and females.

These estimated 28-day mortality rates have been interpolated over the full age range and then applied to convert the Derived Incidence Rate to a Stand-Alone Rate.

4.5.3.7 Addition for Accelerated Rates

Population mortality data following a CABG is not available after the post-operative period. There will be an overlap with deaths due to heart attack and it was assumed that there were no additional deaths from CABG beyond those in the immediate post-operative period. We therefore followed our general approach to calculate $l_x - k_x.q_x$ for CABG but with $k_x.q_x$ set equal to the 28-day mortality rate.

4.5.3.8 Summary of Rates and Adjustments

The calculations for CABG are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.7 and 10.1.8.

Summary of Calculation of Incidence Rates: CABG							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	0.32	16.72	64.00		0.08	2.60	16.20
% adj to First Ever basis	-5%	-5%	-5%		-5%	-5%	-5%
% adj for Sudden Deaths	-	-	-		-	-	-
% change by smoothing	+11%	0%	-1%		+6%	0%	-1%
% adj for Overlaps	-58%	-58%	-58%		-58%	-58%	-58%
% adj for Prevalence	+0%	+4%	+13%		+0%	+1%	+5%
Derived Incidence Rate, l_x	**0.14**	**6.97**	**28.64**		**0.04**	**1.05**	**6.72**
% adj for 28-day Mortality	-1%	-1%	-2%		-1%	-1%	-2%
Stand-Alone Rate, l'_x	**0.14**	**6.90**	**27.99**		**0.04**	**1.04**	**6.55**
- CI-specific mort^y rate, $k_x.q_x$	0.00	-0.07	-0.65		0.00	-0.01	-0.16
Addition for Acc CI, $l_x - k_x.q_x$	**0.14**	**6.90**	**27.99**		**0.04**	**1.04**	**6.55**

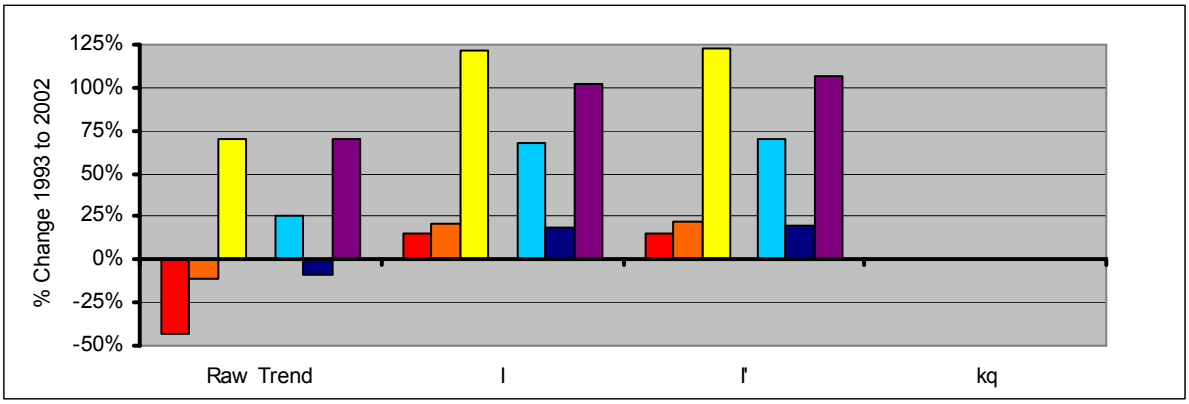
4.5.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in CABG rates from CIBT93 to CIBT02.

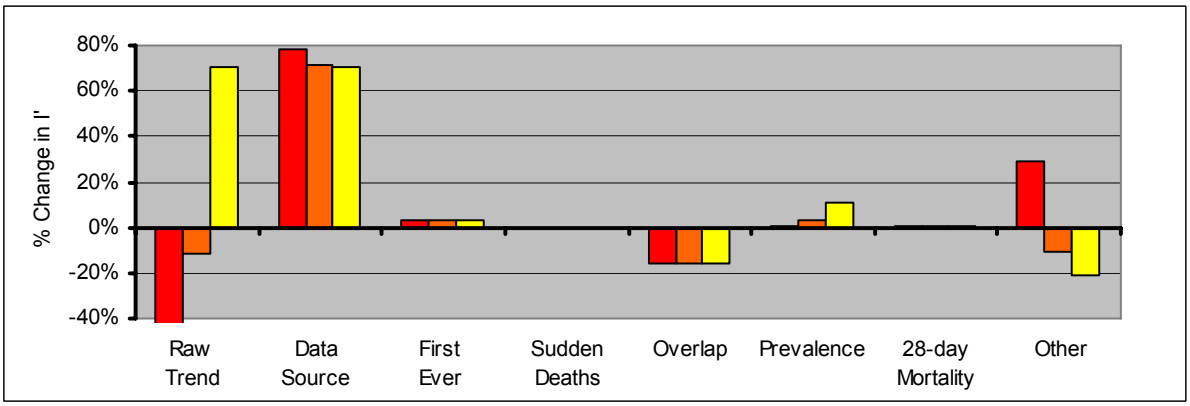
Raw Observed Rates for CABG have increased very significantly at older ages, as procedures have improved and operation risks reduced, but have fallen at young and middle ages, due to a switch towards earlier intervention with less invasive procedures.

Whilst these differential trends by age show clearly in the change in Stand-Alone CI rates for CABG, there is also an across the board increase of around 70% arising from differences in the HES data used for CIBT02 and that used for CIBT93; these differences have not been fully explained and independent checks on the overall number of CABG operations have proved inconclusive.

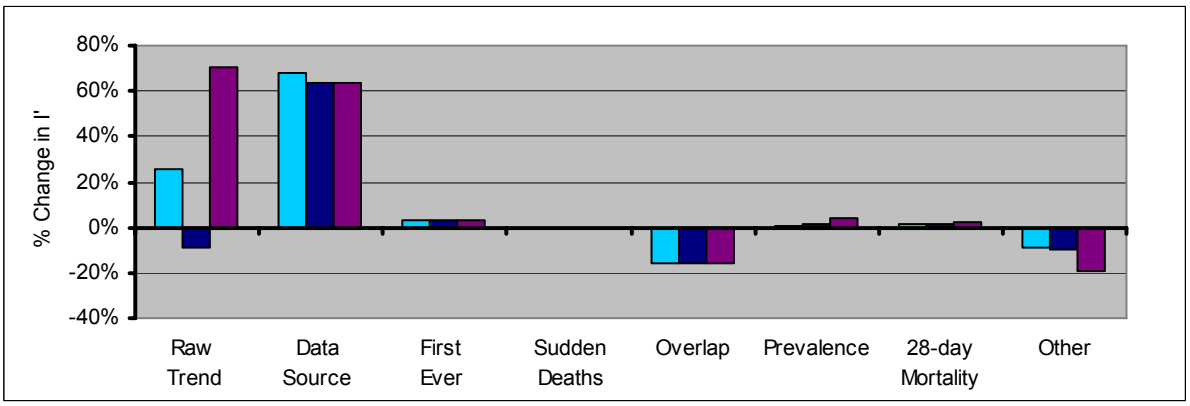
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for CABG



Components of Change in Stand-Alone Rates (I') for CABG - Males



Components of Change in Stand-Alone Rates (I') for CABG - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for CABG		
Component	Commentary	Real Trend ?
Raw Trend	Underlying trend varies significantly by age; see Section 2.4	✓
Data Source	Same source (HES) but different filter; change not fully understood	×
First Ever	Updated data source used for CIBT02; improved estimate	×
Sudden Deaths	No adjustments	n/a
Overlap	Updated data source used for CIBT02; improved estimate	×
Prevalence	New data source used for CIBT02; improved estimate	×
28-day Mortality	Updated data source used for CIBT02; improved estimate	Mostly ✓
Other	Differences arising from smoothing and CIBT93 timing adjustment	×

4.6 Multiple Sclerosis (MS)

4.6.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Multiple sclerosis – *with persisting symptoms* A definite diagnosis of Multiple Sclerosis by a Consultant Neurologist. There must be current clinical impairment of motor or sensory function, which must have persisted for a continuous period of at least 6 months.

An important point here is that the model MS definition is not met until the disease has reached its so called "progressive stage" where there is a continued deterioration in the debilitating effect of MS. It can be many years from onset before the disease reaches this stage.

4.6.2 Data Sources

- High incidence and prevalence of multiple sclerosis in South-East Scotland: Evidence of a genetic predisposition; P M Rothwell, D Charlton; J Neuerol Neurosurg Psychiatry; 1998; 64[22]
- General Register Office for Scotland - Population Estimates; Scotland by Region; 1994[19]
- HES - Count of hospital episodes with MS as diagnosis; financial years 2001/02 and 2002/03[33]
- ISD Scotland - Count of first ever hospital admissions for MS[29]
- Multiple Sclerosis; Bernie O'Brien; Office of Health Economics; 1987[34]
- GAD - Interim Life Tables; England; 2001-03[21]
- ONS - Mortality Statistics: Cause; England and Wales; 2001 -03; Series DH2, nos 28, 29,30[39]

For our calculations we define MS by ICD-10 code G35.

4.6.3 Calculation of the incidence rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for MS are detailed below.

4.6.3.1 Raw Observed Incidence Rates

MS is a progressive disease, often striking in a form that causes significant but intermittent symptoms at first, but with increasing frequency and severity until a state of continuous incapacity is reached.

There are no population data sources corresponding directly with the insurance definition of MS. HES records hospitalisation episodes in each year and these may be frequent during the relapsing / remitting stage of the disease. ISD Scotland figures give patient-based first hospitalisation statistics but these will understate incidence as many sufferers will never be hospitalised. Thus both data sources can be used to support a model as to the progression of the disease, and to some extent for trends analysis, but neither give great insight into the number of new incidences by age.

There have been a number of medical studies aimed at uncovering the incidence rates of new cases of MS in the population. We chose the Rothwell and Charlton study[22] as it was one of the few to cover a large enough population to be statistically significant by age groupings. The study covered new MS diagnoses in the Borders and Lothian regions in South-East Scotland, over a 4-year period centred on 1994, and gives counts of new diagnoses in 5-year age bands (but not by sex).

We use the GRO-Scotland 1994 Population Estimate for the relevant regions of Scotland as the denominator.

Given no strong evidence of trends (see Section 2.5) we have made no timing adjustment but have simply assumed the rates derived are reasonably applicable for 2002.

This raw data is shown, with the full individual-age calculations, in Tables 10.1.9 and 10.1.10 in Appendix 3: CIBT02 Calculations Detail and Tables.

As is clear from the table below, for MS we must work with much smaller incidence data volumes than for the main CIs:

MS - Raw Incidence & Sample Size - 2002		
	Probable & Definite cases	All (including. possible cases)
MS diagnoses	316	449
Population at Risk	362,400 lives x 4 years	

To estimate Raw Incidence Rates for new MS diagnoses for England, we needed to make two adjustments to the Rothwell and Charlton numbers:

- Prevalence of MS in Scotland is some 1.8 times higher than in England (see Rothwell and Charlton **and various presentations by the CI trends group over the last few years**) so we divided through by this factor.
- MS is more common in females than males, but the female to male ratio declines with age. As the Rothwell and Charlton data was not gender distinct, we derived separate MS incidence rates for males and females by enforcing a ratio of female:male incidence equal to 2.6:1 at age 17 decreasing linearly to 1.4:1 at age 77. This formula was determined by fitting a straight line to the incidence-by-gender ratios observed in the HES and ISD data on hospitalisation for MS.

The rates were smoothed and interpolated to individual ages at this stage.

4.6.3.2 Adjustment to Count Only First Ever Incidences

By the nature of the study, the Raw Observed Rates are already in the form of first incidence (rather than subsequent episodes) but relate to the "onset of illness" (new diagnoses) rather than the "onset of progressive form of illness". These rates, therefore, need further adjustments to bring them onto a progressive basis and in line with the model MS definition.

We have followed exactly the approach taken to this issue in CIBT93. Data from O'Brien[34] suggests the normal pattern of events is that around 10% of sufferers will experience the disease in its progressive form from outset. The remaining 90% will go through a sequence of relapse and remission. Most of these sufferers will convert to the progressive stage at some point. Around 65% of sufferers will have entered the progressive stage within 10 years from onset. However, even 20 years after onset, 20% of the original sufferers will still not have experienced the illness in its progressive form. To adjust the rates to progressive form, we assume (as in CIBT93):

- 80% of all MS diagnoses convert to progressive form at some point
- Of these, 10% occur immediately and the remaining 70% are spread evenly over the following 14 years.

It is important to note that this adjustment has a considerable impact at younger ages and so could significantly underestimate the true cost of MS if claims are paid closer to initial diagnosis. It is believed some offices do pay MS claims at an earlier stage and so readers may wish to amend this assumption to reflect their office's own practice.

4.6.3.3 Adjustment for Unreported Cases / Sudden Deaths

Given the progressive nature of MS, no sudden death adjustment is required.

4.6.3.4 Adjustment to Remove Overlap with Other CIs

We are not aware of any firm evidence that the incidence of MS is affected by the existence of co-morbidity linked to the other main CI events, and so make no overlap adjustment.

4.6.3.5 Adjustment for Prevalence

The prevalence of MS is sufficiently low to make adjustment for it immaterial. We have no direct data estimates for this, but estimated prevalence derived from our MS crude incidence and mortality assumptions is less than 1.0% for females and 0.5% for males at all ages.

4.6.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

28-day mortality post diagnosis for MS is immaterial; we have simply used population mortality rates.

4.6.3.7 Addition for Accelerated Rates

We followed our general approach to calculate I_x - $k_x.q_x$ for MS.

4.6.3.8 Summary of Rates and Adjustments

The calculations for MS are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.9 and 10.1.10.

Summary of Calculation of Incidence Rates: MS							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	1.25	1.03	0.15		2.89	2.04	0.24
% change by smoothing	-3%	-4%	+21%		-4%	-3%	+16%
% adj to Progressive Form	-49%	+0%	+81%		-47%	+6%	+99%
% adj for Sudden Deaths	-	-	-		-	-	-
% adj for Overlaps	-	-	-		-	-	-
% adj for Prevalence	-	-	-		-	-	-
Derived Incidence Rate, I_x	**0.62**	**0.99**	**0.32**		**1.47**	**2.10**	**0.55**
% adj for 28-day Mortality	-0%	-0%	-0%		-0%	-0%	-0%
Stand-Alone Rate, I'_x	**0.62**	**0.99**	**0.32**		**1.47**	**2.10**	**0.55**
- CI-specific mort^y rate, $k_x.q_x$	-0.03	-0.19	-0.33		-0.04	-0.37	-0.57
Addition for Acc CI, I_x- $k_x.q_x$	**0.59**	**0.80**	**-0.01**		**1.43**	**1.73**	**-0.02**

4.6.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in MS rates from CIBT93 to CIBT02.

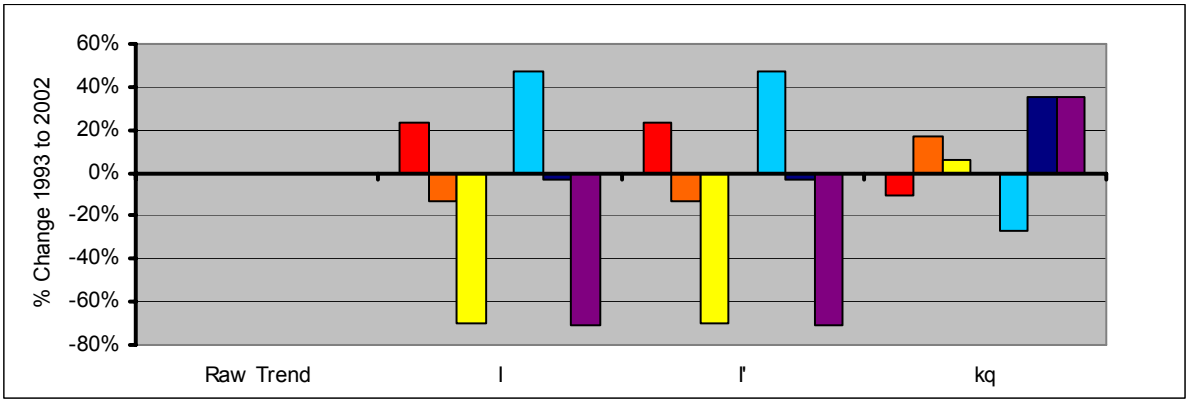
It is difficult to establish a clear picture of the raw trends in MS.

The change in MS rates from CIBT93 to CIBT02 arises almost entirely through switching to a different data source. The source used for CIBT02 does give direct estimates of rates by age for new MS diagnoses and so even though is not a large-scale study, as it relates only to South-East Scotland, it provides a much better base for estimating the shape and level of Stand-Alone CI rates for MS.

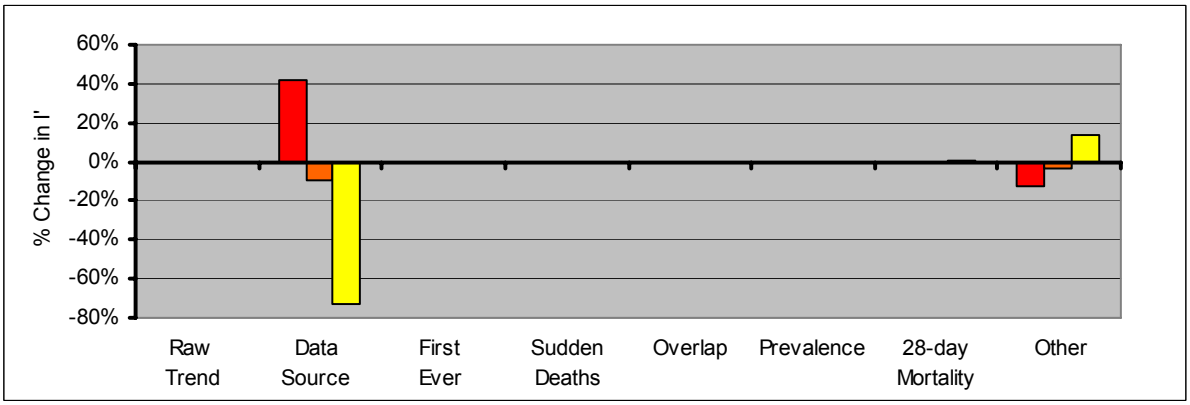
The new data used for CIBT02 shows a materially different profile of rates by age compared to CIBT93. We believe this to be a more realistic. However, significant room remains along the degenerative paths MS cases follow for changes in both the point of diagnosis and the point of CI claims admission. Such changes may affect experience over time or between insurers.

MS mortality rates have generally increased over the period, perhaps indicating an underlying upwards trend in MS cases.

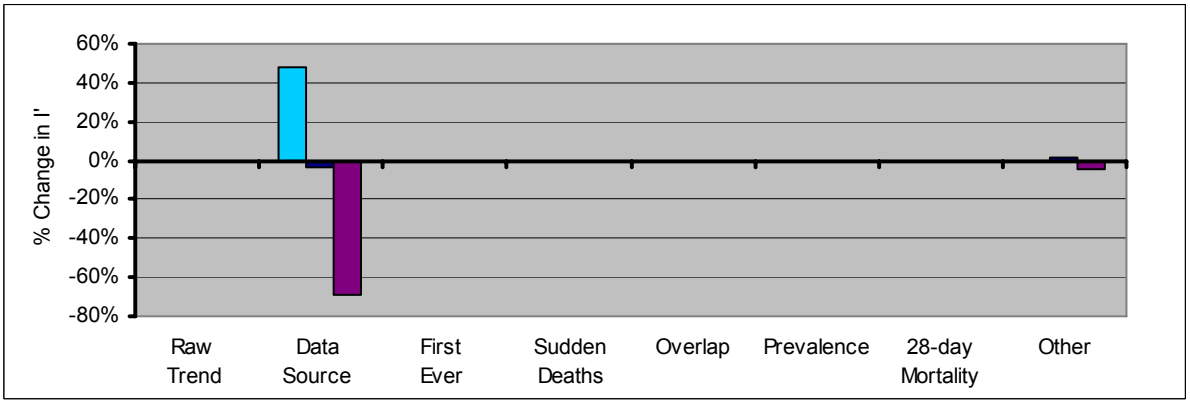
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for MS



Components of Change in Stand-Alone Rates (I') for MS - Males



Components of Change in Stand-Alone Rates (I') for MS - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for MS		
Component	Commentary	Real Trend ?
Raw Trend	We do not have a clear picture of underlying trend; see 2.5	n/a
Data Source	New data source used for CIBT02 for better direct rate estimate	×
First Ever	No adjustments (Progressive Adj included with Data Source)	n/a
Sudden Deaths	No adjustments	n/a
Overlap	No adjustments	n/a
Prevalence	No adjustments	n/a
28-day Mortality	Trivial adjustment	✓

Other	Differences arising from smoothing	×

4.7 Kidney Failure (KF)

4.7.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Kidney failure – *requiring dialysis* Chronic and end stage failure of both kidneys to function, as a result of which regular dialysis is necessary.

Prior to the 2006 model definitions review, the KF definition referred to initiation of regular dialysis or kidney transplant. However transplant would follow the initiation of Renal Replacement Therapy (RRT) (= regular dialysis) in any case.

The incidence of kidney failure rises sharply with age. However, RRT rates peak at around age 80 after which the risks and costs of treatment presumably start to outweigh the benefits. The model definition wording may be exposed in cases of end stage kidney failure at advanced ages as to whether RRT may be necessary (in a general sense) without treatment actually being initiated.

4.7.2 Data Sources

- The Renal Association UK Renal Registry; The 7th Annual Report; December 2004[47]
- The Renal Association UK Renal Registry; The 6th Annual Report; December 2003[46]
- Incidence of advanced chronic renal failure and the need for end stage renal replacement treatment; Feest TG, Mistry CD, Grimes DS, Mallick NP; BMJ 1990 Oct 20; 301: 897-900[27]
- Incidence of severe acute renal failure in adults: results of a community based study; Feest TG, Round A, Hamad S; BMJ 1993 Feb 20; 306: 481-3[28]
- Health Survey for England 2003 Volume 1, Cardiovascular Disease[32], Table 1.1
- GAD - Interim Life Tables; England; 2001-03[21]
- ONS - Mortality Statistics: Cause; England and Wales; 2001 -03; Series DH2, nos 28, 29,30[39]

For our calculations we define deaths from KF by ICD-10 codes N17 to N19.

4.7.3 Calculation of Incidence Rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for Kidney Failure are detailed below.

4.7.3.1 Raw Observed Incidence Rates

The KF definition rests on the need for regular dialysis. For raw KF incidence data we have used the rates of new adult cases accepted for RRT as reported in Table 4.3 of the 7th Annual Report of the UK Renal Registry, December 2004[47].

The report shows the numbers of new RRT patients in 2003, by gender and 5-year age-bands, together with estimates of the underlying population covered by the Registry, so that Raw Rates can readily be calculated. The Registry covers all of Wales and around 73% of England.

This raw data is shown, with the full individual-age calculations, in Tables 10.1.11 and 10.1.12 in Appendix 3: CIBT02 Calculations Detail and Tables. KF, as measured by new RRT cases, is relatively uncommon and incidence rates are very low.

KF - Raw Incidence & Sample Size - 2003		
	Males	Females
Patients starting RRT	2,052	1,302
Population at Risk	13,017,013	14,049,556

In adopting these Raw Rates as our base, we note there may be a slight understatement against all England or UK rates as ethnic minorities are under-represented in the population covered, but are

thought to have higher than average rate of kidney failure. Also note the 2003 base date as we could not access equivalent data for 2002. However given the low incidence levels as a proportion of the overall CI rate, these approximation are acceptable.

4.7.3.2 Adjustment to Count Only First Ever Incidences

Given the nature of end-stage renal failure and RRT, the data already relates to first ever incidences.

4.7.3.3 Adjustment for Unreported Cases / Sudden Deaths

At most ages it seems reasonable to assume negligible under-reporting or sudden deaths as the definition primarily relates to RRT becoming necessary.

However, whilst the Raw Observed Rates, based on RRT, start to decline by around age 75 or 80, the underlying incidence of kidney failure continues to rise steeply with age. A study by Feest et al[27] estimated annual incidence of advanced chronic renal failure rising from 58 per million in those aged 20-49 to 588 per million in those aged over 80; a further study, again by Feest et al[28], estimated annual incidence of severe acute renal failure rising from 17 per million in adults under 50 to 949 per million in the 80-89 age group. These marked increases at older ages are also reflected in the mortality rates attributed to renal failure which also rise to around 900 per million at age 85..

Currently these additional cases of renal failure at advanced ages, where RRT is not initiated, are likely to result in death fairly quickly. Therefore it is appropriate to allow for them as sudden deaths. We have achieved this by increasing the incidence rate at age 90 to be just above the mortality rate for kidney failure and blending back to the Raw Observed Rates at age 72. Whilst somewhat arbitrary, this adjustment is reasonably underpinned results of the two studies noted above and by the requirement that all deaths from kidney failure must follow an incidence of kidney failure!

4.7.3.4 Adjustment to Remove Overlap with Other CIs

Renal failure overall has a significant correlation with other CIs. Even though the KF definition rests on acceptance for dialysis, and such treatment is less likely to be given where renal failure is secondary to some other disease, a significant adjustment is still required.

The frequency of various co-morbidities at the time of starting RRT is given in Table 21.2 / Figure 21.2 in the 6th Annual Report of the UK Renal Registry, December 2003[46]. From this we have derived estimates of the proportions of new RRT patients, in each age-band, who have previously suffered a heart attack, stroke or CABG operation. These are shown in the table below:

Estimates of CI Co-morbidity and 90-day Survival for Patients Starting RRT		
Age Band	Co-morbidity	90-Day Mortality
18 - 34	3%	1%
35 - 44	8%	2%
45 - 54	18%	3%
55 - 64	29%	8%
65 - 74	42%	14%
75 - 84	36%	17%
≥ 85		32%

Source: The Renal Association UK Renal Registry; The Sixth Annual Report; December 2003
Co-morbidity = Prior heart attack, stroke or CABG operation ; derived from Table 21.2 / Figure 21.2
90-day mortality for patients starting RRT in 2001 ; derived from Table 15.4 / Figure 15.1

These estimated co-morbidity percentages were interpolated over the full age range then applied to reduce the Crude Incidence Rate to remove the overlap with other CIs.

4.7.3.5 Adjustment for Prevalence

As the numerator of the incidence rates has been reduced to allow for people who have previously suffered a heart attack or stroke, it is appropriate to also remove people who have suffered a heart attack or stroke from the denominator of the incidence rate. The crude incidence rates were therefore adjusted for prevalence of heart attack and stroke using data from the Health Survey for England 2003[32] (see Sections 4.3.3.5 and 4.4.3.5).

No further adjustment has been made for the actual prevalence of lives who have suffered KF. Estimated prevalence derived from our KF crude incidence and mortality assumptions is very low, only rising to around 0.5% by age 75.

4.7.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

90-day survival rates for new patients starting RRT in 2001 are given in Table 15.4 / Figure 15.1 in the 6th Annual Report of the UK Renal Registry, December 2003[46]. These survival rates have been tabulated, by age-band, in Section 4.7.3.4. We have no information differentiating survival rates by gender.

We have taken 50% of the corresponding 90-day mortality rate as our estimate for mortality in the first month, inferring from the general patterns of survival shown in Figure 15.2 of the report that a patient is most vulnerable during the early days on RRT.

These 28-day mortality rates have been interpolated over the full age range, combined with our estimated sudden death rates, and then applied to convert the Derived Incidence Rate to a Stand-Alone Rate.

4.7.3.7 Addition for Accelerated Rates

We followed our general approach to calculate $I_x - k_x.q_x$ for KF.

4.7.3.8 Summary of Rates and Adjustments

The calculations for KF are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.11 and 10.1.12.

Summary of Calculation of Incidence Rates: Kidney Failure							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	0.57	1.28	3.76		0.36	0.78	2.14
% adj to First Ever basis	-	-	-		-	-	-
% adj for Sudden Deaths	-	-	+11%		-	-	+19%
% change by smoothing	-6%	-3%	0%		-9%	+2%	0%
% adj for Overlaps	-5%	-19%	-39%		-5%	-19%	-39%
% adj for Prevalence	+1%	+4%	+24%		+0%	+2%	+11%
Derived Incidence Rate, I_x	**0.51**	**1.05**	**3.19**		**0.31**	**0.66**	**1.73**
% adj for 28-day Mortality	-1%	-2%	-17%		-1%	-2%	-23%
Stand-Alone Rate, I'_x	**0.51**	**1.03**	**2.63**		**0.31**	**0.65**	**1.33**
- CI-specific mort^y rate, $k_x.q_x$	-0.02	-0.11	-1.31		-0.02	-0.08	-0.82
Addition for Acc CI, $I_x - k_x.q_x$	**0.50**	**0.94**	**1.88**		**0.30**	**0.58**	**0.91**

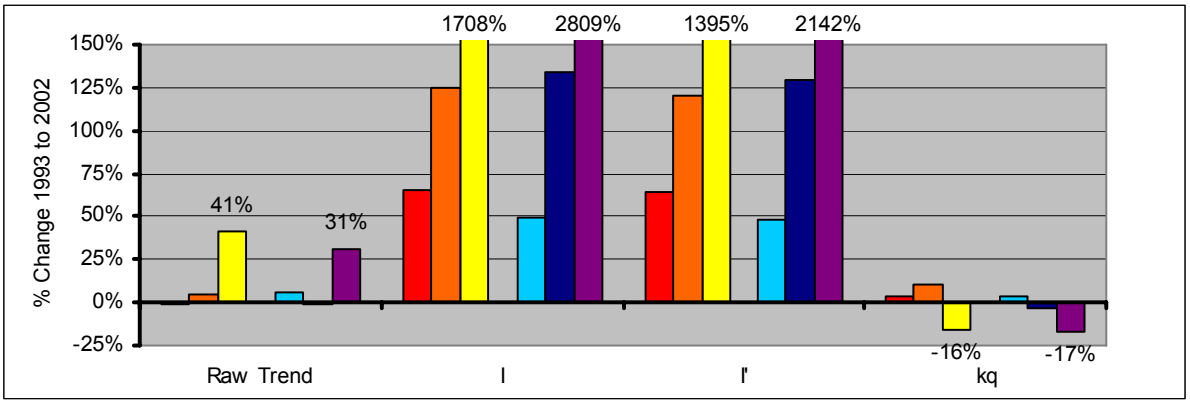
4.7.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in KF rates from CIBT93 to CIBT02.

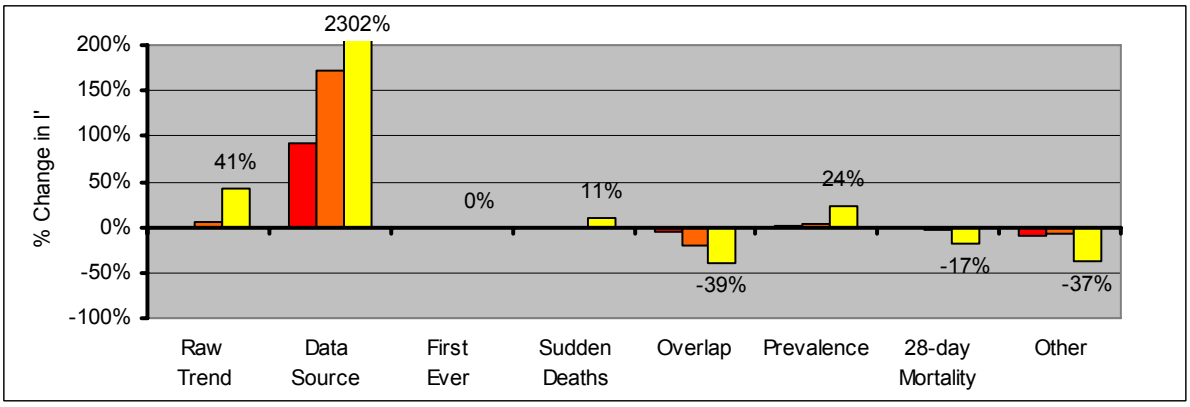
The underlying trend in KF is upwards and markedly so a older ages, in part reflecting advances in RRT treatments and net benefits. Mortality rates have fallen at older ages.

We have found and used a much better data source for KF in CIBT02, allowing a direct estimate of rates by age for new RRT patients and refined the other adjustments. Therefore much of the change simply reflects a more realistic picture. The percentage increases are huge at older ages (shown as figures on the charts as well outside the chart scales) but from a very low base.

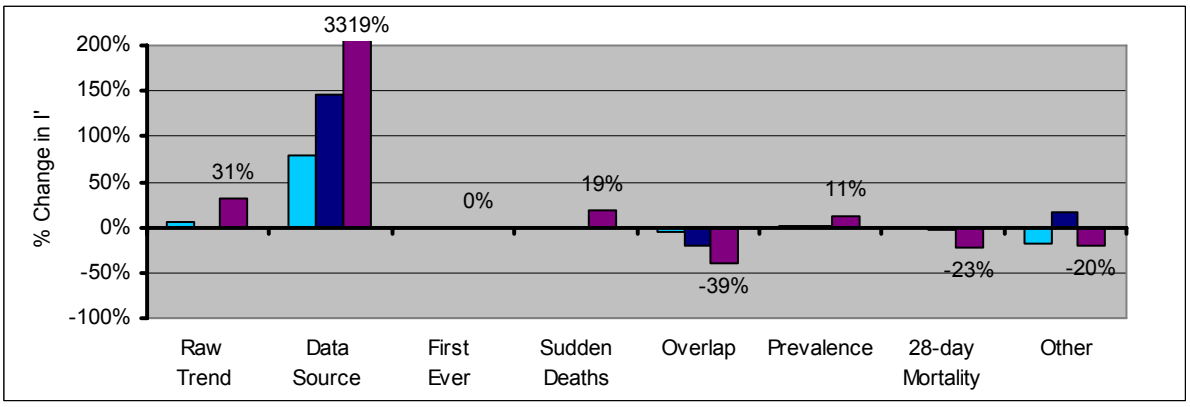
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for KF



Components of Change in Stand-Alone Rates (I') for KF - Males



Components of Change in Stand-Alone Rates (I') for KF - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for KF		
Component	Commentary	Real Trend ?
Raw Trend	Underlying trend is significant increases at older ages; see 2.6	✓
Data Source	New data source used for CIBT02 for better direct rate estimate	×
First Ever	No adjustments	n/a
Sudden Deaths	Adjustment introduced for CIBT02; improved estimate	×
Overlap	Adjustment introduced for CIBT02; improved estimate	×
Prevalence	Adjustment introduced for CIBT02; improved estimate	×

28-day Mortality	Refined basis adopted for CIBT02; improved estimate	×
Other	Differences arising from smoothing and CIBT93 timing adjustment	×

4.8 Major Organ Transplant (MOT)

4.8.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Major organ transplant

The undergoing as a recipient of a transplant of bone marrow or of a complete heart, kidney, liver, lung, or pancreas, or inclusion on an official UK waiting list for such a procedure.

For the above definition, the following is not covered:
- Transplant of any other organs, parts of organs, tissues or cells.

The MOT model definition covers transplants of complete organs but would likely be triggered earlier by inclusion on the national MOT transplant list.

Note that kidney and bone marrow transplants are listed but overlap close to 100% with KF and with Cancer (for example, leukaemia) respectively.

4.8.2 Data Sources

- HES - MOT operations; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]
- Transplant Activity in the UK; Annual reports by UK Transplant; 2002/3, 2003/4, 2004/5, 2005/6[55]
- GAD - Interim Life Tables; England; 2001-03[21]

For our calculations we define MOT by the following OPCS4 codes:

• Heart & Lung Transplants	K011, K018, K019
• Heart Transplants	K021, K022, K023, K024, K028, K029
• Lung Transplants	E538, E539
• Liver Transplants	J011, J012
• Pancreas Transplants	J541, J542, J543, J548, J549
• Kidney Transplants	M011, M012, M013, M018,M019
• Bone Marrow Transplants	W341, W342, W348, W349

4.8.3 Calculation of Incidence Rates

We followed the general approach set out in Section 4.1.3. Points of particular note for the calculation of incidence rates for Major Organ Transplant are detailed below.

4.8.3.1 Raw Observed Incidence Rates

For raw MOT incidence data we have used our extract from Hospital Episode Statistics[33]. For further details of this dataset, and the filters used to select data for extract and for these calculations, see Section 8.5 - Hospital Episode Statistics (HES).

Our start point is counts of MOT operations in 5-year age-bands. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of MOT operations conducted in England in 2002. This constructed data is shown, with the full individual-age calculations, in Tables 10.1.13 and 10.1.14 in Appendix 3: CIBT02 Calculations Detail and Tables.

Having converted the HES data counts to a 2002 calendar year basis, we use the ONS 2002 Population Estimate for England as the denominator.

MOT operations remain comparatively rare so data volumes are very small and incidence rates correspondingly tiny. The total constructed MOT counts for HES in 2002 are 2058 for males and 1347 for females, but only 535 and 419 respectively after excluding kidney and bone marrow transplants.

MOT - Raw Incidence & Sample Size - 2002		
	Males	Females
Heart & Lung Transplants	17	17
Heart Transplants	124	106
Lung Transplants	53	54
Liver Transplants	315	223
Pancreas Transplants	26	20
Kidney Transplants	922	580
Bone Marrow Transplants	602	347
Population at Risk	24,288,500	25,358,400

The HES data appears reasonable in comparison with MOT figures given by UK Transplant.

4.8.3.2 Adjustment to Count Only First Ever Incidences

We believe a very high proportion of these operations are "first event" transplants for the recipient, so no adjustment has been made to remove second and subsequent transplant events. An adjustment is, however, required to convert the Raw Incidence Rates onto a 'waiting list' basis.

The UK Transplant annual reports[55] present a high-level 'movements analysis' for the transplant waiting lists for each organ. These include the number of new registrations in the year and the end-year status (still active / suspended on list, transplanted, removed or died) of individuals on the list at the beginning of the year or registered during the year. The analyses are not split by age or gender.

We have analysed the last 4 years' reports to derive high-level estimates, for each organ, for:

- The ratio of new registrations on the waiting list to organ transplants in the same period
- The ratio of life-years on the waiting list to transplants carried out (a crude measure of turnover)
- The annualised rates of death and of removal from the waiting list.

Summary Statistics derived through Analysis of UK Transplant Reports on MOT Waiting Lists				
	New Registrations as % multiple of Transplants in period	Life Years on Waiting List per Transplant	Annualised Rate of Deaths on Waiting List	Annualised Rate of Removal from Waiting List
Heart & Lung Transplants	151	2.3	26%	16%
Heart Transplants	144	0.8	17%	41%
Lung Transplants	190	2.3	18%	8%
Liver Transplants	129	0.3	31%	33%
Pancreas Transplants	142	1.4	7%	11%
Kidney Transplants	155	3.9	4%	5%
Bone Marrow Transplants	n/a	n/a	n/a	n/a
Overall (Weighted)	**150**	**0.8**	**26%**	**29%**

Source: Own calculations based on Annual reports by UK Transplant; 2002/3, 2003/4, 2004/5, 2005/6
The overall weighted averages reflect the mix of MOTs after adjustment for overlap with other CIs

To convert onto a 'waiting list' basis we have multiplied the crude MOT operations incidence by the derived ratios of new registrations on the waiting list to organ transplants in the same period. We believe this 'grossing-up' approach should not significantly distort the age profile of the incidence rates as turnover on MOT waiting lists is very high as shown in the table.

4.8.3.3 Adjustment for Unreported Cases / Sudden Deaths

No adjustments are needed for under-reporting, such as sudden deaths prior to admission to hospital, as the definition relates to the number of MOT operations or new registrations on the transplant list.

4.8.3.4 Adjustment to Remove Overlap with Other CIs

There is considerable overlap with other CIs. Our assumptions and rationale, guided by expert opinion, are:

- Heart Transplants 50% About half are due to CHD (most others are cardiomyopathy)
- Lung Transplants 15% Small overlap through link to hypertension / vascular disease
- Heart & Lung Transplants 30% Amalgam of the two categories above
- Liver Transplants 15% Small overlap through CHD (most are hepatitis or cirrhosis)
- Pancreas Transplants 80% High proportion are joint kidney and pancreas transplants
- Kidney Transplants 100% KF definition will be met at same time or earlier
- Bone Marrow Transplants 100% Almost always linked to treatment of cancer (esp. leukaemia)

We applied these overlap percentages to the age-banded incidence rates for each organ before aggregating and smoothing / interpolating to produce individual-age rates. The overall average overlap factor is 81%.

4.8.3.5 Adjustment for Prevalence

The prevalence of MOT in the general population is clearly negligible. In principle we should make an allowance for the prevalence of prior CIs corresponding to the adjustments made for overlaps. However, given the uncertainty inherent in the other calculation steps and the immateriality of MOT incidence rates at the aggregate CIBT02 level, such refinement has not been applied.

4.8.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

Individuals entering the MOT waiting list are severely ill. The analysis of UK Transplant reports, set out in Section 4.8.3.2, gives an estimated overall annualised mortality rate of 26%. Furthermore, we assume a high proportion of lives removed from the list (annualised rate 29%) die shortly afterwards from their illness. Overall we have pitched 4% as our estimate for 28-day mortality post registration on the MOT waiting list. Inspection of other UK Transplant data also suggests 4% would not be an unreasonable estimate of operative mortality and so remains a valid assumption for those cases which proceed rapidly to transplant operation and trigger a CI claim that way.

4.8.3.7 Addition for Accelerated Rates

There will be an overlap with deaths due to heart attack and kidney failure and we have assumed no additional deaths from MOT beyond those in the immediate post-operative / post-registration period. We therefore followed our general approach to calculate $I_x - k_x.q_x$ for MOT but with $k_x.q_x$ set equal to the estimated 28-day mortality rate.

4.8.3.8 Summary of Rates and Adjustments

The calculations for MOT are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.13 and 10.1.14.

Summary of Calculation of Incidence Rates: Major Organ Transplant							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Raw Observed Rate	0.76	1.42	0.82		0.52	0.85	0.40
% adj to Waiting List basis	+52%	+49%	+49%		+52%	+50%	+49%
% adj for Sudden Deaths	-	-	-		-	-	-
% adj for Overlaps	-88%	-79%	-82%		-82%	-79%	-80%
% adj for Prevalence	-	-	-		-	-	-
% change by smoothing	-2%	+2%	-2%		-0%	+1%	-5%
Derived Incidence Rate, I_x	**0.13**	**0.46**	**0.22**		**0.14**	**0.27**	**0.11**
% adj for 28-day Mortality	-4%	-4%	-4%		-4%	-4%	-4%
Stand-Alone Rate, I'_x	**0.13**	**0.44**	**0.21**		**0.13**	**0.26**	**0.11**
- CI-specific mort^y rate, $k_x.q_x$	-0.01	-0.02	-0.01		-0.01	-0.01	0.00
Addition for Acc CI, I_x- $k_x.q_x$	**0.13**	**0.44**	**0.21**		**0.13**	**0.26**	**0.11**

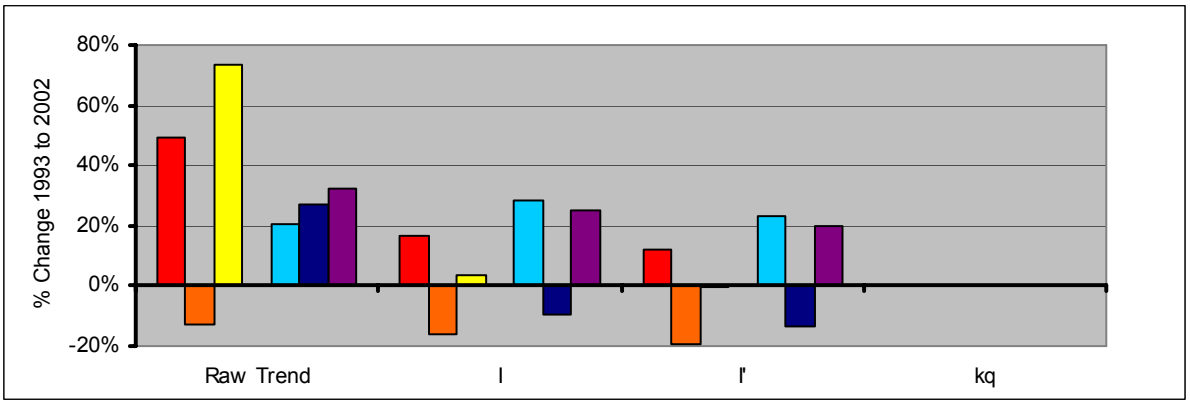
4.8.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in MOT rates from CIBT93 to CIBT02.

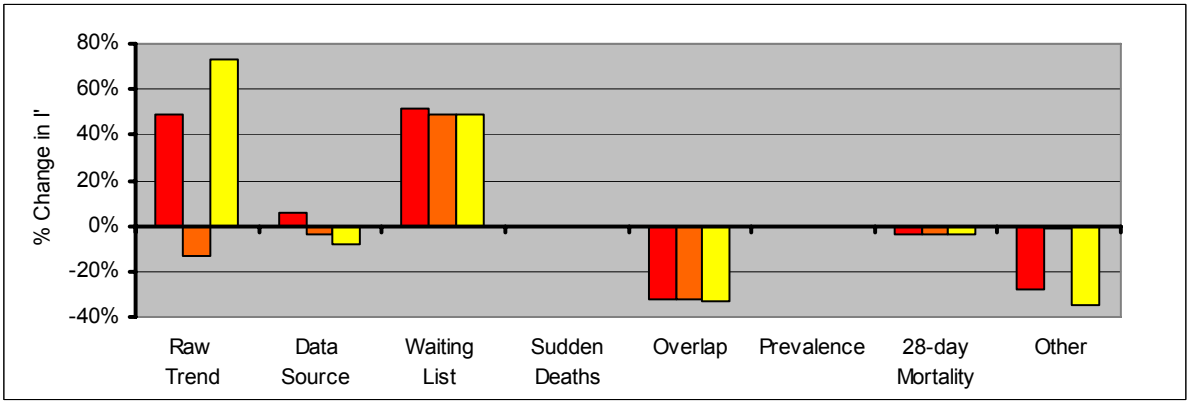
The underlying trend in MOT in upwards although the number of operations can vary significantly year-to-year.

CIBT93 was based solely on operations. However for CIBT02 we have found additional data to allow us to convert to a 'waiting list' basis in line with the model definition. We have also refined the adjustments for overlap with other CIs and for 28-day mortality. Therefore much of the change from CIBT93 to CIBT02 relates to improved data and methodology rather than underlying trends.

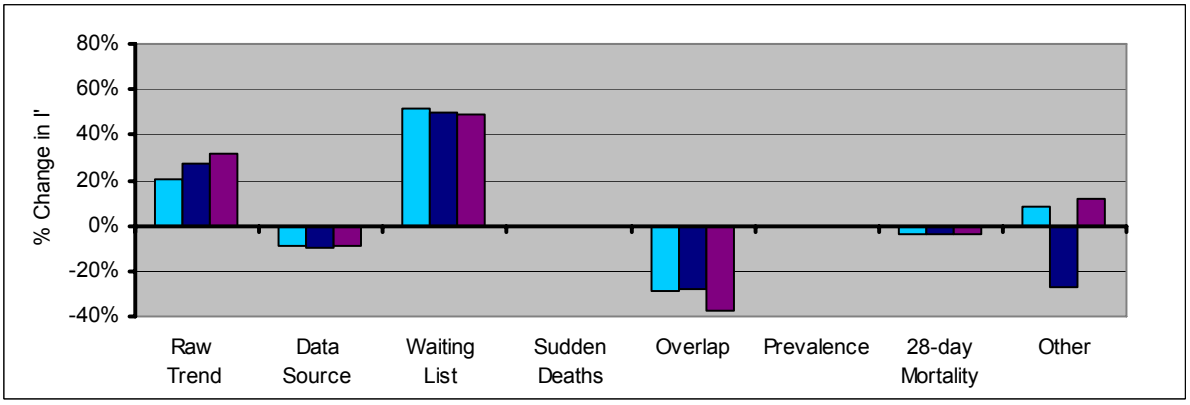
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for MOT



Components of Change in Stand-Alone Rates (I') for MOT - Males



Components of Change in Stand-Alone Rates (I') for MOT - Females



Commentary on Components of Change in Stand-Alone Rates (I') for MOT		
Component	Commentary	Real Trend ?
Raw Trend	Underlying trend shows increases for most ages; see 2.7	✓
Data Source	Same source (HES) but different filters for CIBT93 and CIBT02	n/a
Waiting List	Adjustment introduced for CIBT02; much improved estimate	×
Sudden Deaths	No adjustments	n/a
Overlap	Adjustment introduced for CIBT02; much improved estimate	×
Prevalence	No adjustments	n/a
28-day Mortality	Refined basis adopted for CIBT02; improved estimate	×
Other	Differences arising from smoothing and CIBT93 timing adjustment	×

4.9 Total and Permanent Disability (TPD)

4.9.1 Definition

There is no ABI model definition for Total and Permanent Disability (TPD) and there are a number of variations used in the market. For example, "total disability" may be measured by assessing the person's ability to perform certain of the following:

- The insured person's "own occupation"
- "Suited occupations"
- "Any occupation" whatsoever
- A number of specified activities - for example, activities of daily living or functional ability tests.

'Permanent' is generally taken to mean expected to last throughout the insured person's life, irrespective of when the cover ends or the insured person retires.

Within this Section our methodology leads naturally to an estimate of the cost on an "own occupation" definition. However, for the final CIBT02 table we have made an adjustment to try to reflect the mix of definitions in the market and so perhaps provide a better match to pooled industry experience. We have not attempted to offer any additional guidance on the variation in cost for different definitions.

We have illustrated TPD costs up to age 65. Higher ages have not been considered since most business written on an occupation-based definition would have an expiry age for the TPD benefit of 60 or 65.

4.9.2 Data Sources

- CMI Report 22; Sickness Experience 1999-2002 for Individual Income Protection Policies; 2005[8]
- CMI - Data on long-term Individual IP claims by cause of disability (unpublished)

4.9.3 Calculation of Incidence Rates

4.9.3.1 Raw Observed Incidence Rates

There is no published data as such for TPD in the UK. It is a condition invented by the insurance industry and is not directly comparable with other forms of data, such as long-term claimants of state sickness benefits, for example. In addition, its position within Critical Illness policies is of a 'safety net' / 'catch all', for disability that does not fall within any of the other specified events, so the overlap with conditions covered in the preceding Sections needs particular attention.

The approach we have adopted is based on experience under Individual Income Protection (IP) policies sold in the UK. Although it is perhaps anomalous to use insured data for a population table, it is the only viable source we have identified. In theory TPD-type rates could be derived from data on State Incapacity Benefit payments, but data is not readily available in the form we would require and the results may in any case be of limited relevance to TPD in insured CI cover.

Our start point, as for the construction of TPD rates for CIBT93, is to consider notional IP claims with a deferred period of 5 years as a proxy for TPD claims. Although this appears to be a very subjective method, it may not be far removed from the approach adopted by claims managers, who also face a subjective decision about the permanency of disability.

CMI results suggest that deferred period has a material influence on ultimate claims levels; for example, the ultimate claim level appears to be higher on policies with a 4 week deferred period than for those with longer deferred periods. For a TPD benefit it is probably appropriate to use a long deferred period, but there is very little data for deferred periods in excess of 26 weeks. We have therefore concentrated on data for policies with 13 and 26 week deferred periods.

We estimate the notional inception rates for sickness cover with a 5-year deferred period by:

- Starting with observed inception rates for 13 and 26 week deferred period IP policies
- Projecting forward the proportion of lives remaining sick, using observed IP claim terminations experience
- Taking the projected number of claims reaching a continuous sickness duration of 5 years, and dividing through by the original exposure to calculate a notional crude incidence rate for TPD.

For these calculations we used:

- The CMIR12 model, parameterised using the males, individual policies, Standard experience for 1975-78[7].
- Experience data, in the form of A/E ratios against CMIR12, from CMI Report 22; Sickness Experience 1999-2002 for Individual Income Protection Policies; 2005[8]
- Inceptions experience from Tables A3.3 (D13; males), A3.4 (D26; males), A3.8 (D13; females) and A3.9 (D26; females)
  - combining occupation classes 1 and 2 to match the range of occupations typically allowed an 'own occupation' TPD definition for CI cover
  - data in 5-year age bands for each gender
- Recoveries experience from Tables A5.6 (males) and A7.6 (females)
  - combining all occupations as little variation by occupation is observed in recovery rates
  - combining all ages (the nature of the reported results)
  - but retaining observed variations by duration sick, deferred period and gender
- Deaths (from sick) experience from Tables A6.6 (males) and A8.6 (females)
  - combining all occupations, ages, and deferred periods (as data volumes are rather low)
  - but retaining observed variation by duration sick and gender.

The data volumes available for this approach are modest, especially for females:

TPD - Sample Size from CMI Individual IP Experience 1999-02		
	Males	Females
D13 Claim Inceptions	1,514	495
D13 Life-years Exposure	395,000	115,000
D26 Claim Inceptions	1,226	537
D26 Life-years Exposure	425,000	145,000
Recoveries (D13 & D26)	1842	660
Deaths (from sick) (All DPs)	541	115

We have made two refinements to this approach. First, we recognise that the CMIR12 model, adjusted to 1999-02 observed IP experience, still projects significant recovery levels beyond the 5th year of sickness, particularly at younger ages. Although there seems to be a widely held view amongst claims managers that claimants who have been unable to work for 5 years are very unlikely ever to return to work, we suspect this view is biased by the relatively high average age of long-term claimants and would have less logic if applied, for example, to 30-year-olds. We have therefore reduced the resulting TPD rates by allowing for projected recoveries up to the 15th year of sickness.

Second, we note that cases where the illness becomes terminal would meet most TPD definitions at some point but may well result in death before the 5th year of sickness. We have therefore increased the resulting TPD rates by adding back all deaths occurring in the 3rd or subsequent years of sickness. This is a somewhat crude allowance, roughly offsetting earlier deaths in cases which may have qualified for TPD with sudden deaths in cases which may not.

Using this methodology we derived rates from both D13 and D26 start points. We then formed an exposure-weighted average of these two sets of rates to derive our base estimate of TPD incidence rates by gender and age-band. The rates were then smoothed and interpolated to individual ages using the technique described in 4.1.3.12.

This construction of the age-banded rates is shown in Tables 10.1.15 and 10.1.16 in Appendix 3: CIBT02 Calculations Detail and Tables, including detail of IP inception rates and modified 5-year recovery / conversion factors to produce TPD rates.

Since these TPD rates are derived from IP data they are implicitly based on an 'Own Occupation' definition of disability. There is very little readily available data to guide estimates of the relative level of incidence rates for other TPD definitions. However, we have applied a crude 80% factor, across all ages, to reflect:

- Much of the business making up current CI market exposure in the UK will have a more restrictive TPD definition than 'Own Occupation'. (We note that for CIBT93 a factor of 50% was applied to convert from an 'Own Occupation' to an 'Any Occupation' definition)
- Some long-term IP claims result in payment of a partial benefit, with the claimant working in some capacity, and so would not qualify under some TPD definitions.

Finally, we have allowed for a two-year shift in age at incidence to move from age at onset of sickness (as used for the IP data) to an average age for incidence of TPD, recognising that the TPD claim does not arise until evidence exists to support that the disability is both total and permanent. In some cases, the required evidence may be available within a few months of the onset of disability, but in others it could take many years for a prognosis to settle.

Rates derived with the IP inception-annuity methodology are notoriously sensitive to the input parameters, particularly for terminations, including the graduation of the underlying tables. Furthermore, the different nature of the lump sum benefit for TPD against an income benefit on IP could well distort the pattern of recoveries. However, we take some comfort as to the method's appropriateness and reasonability, by noting that applying the same approach to Australian insured IP data does produce notional TPD rates which are 'in the same ballpark' as observed insured TPD experience in Australia.

4.9.3.2 Adjustment to Count Only First Ever Incidences

As we are dealing with permanent disability, there can not be more than one incidence per sufferer.

4.9.3.3 Adjustment for Unreported Cases / Sudden Deaths

Deaths from log-term disability but occurring before the permanence of disability might be established have already been allowed for in the calculations described in Section 4.9.3.1.

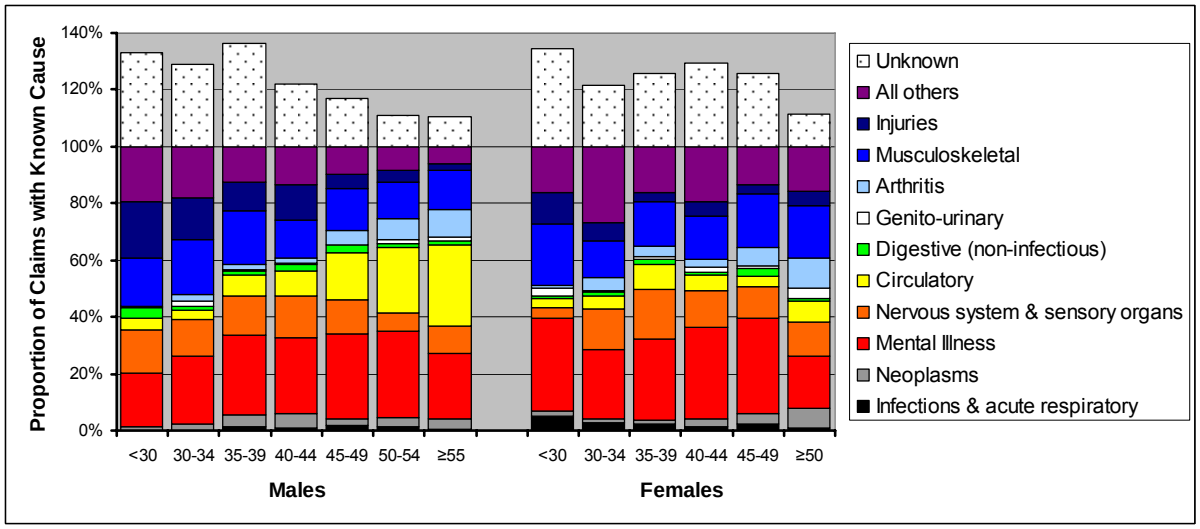
4.9.3.4 Adjustment to Remove Overlap with Other CIs

We need to exclude from TPD those long-term disability claims which arise from other CIs. To estimate the extent of overlap we have used some otherwise unpublished data kindly made available to us by the CMI[6].

The underlying data set is the CMI Individual IP pooled UK insurance experience for 1999-02. The extract we have used gives a breakdown of long-term IP claims across 11 broad categories of cause of disability. The actual measure used is the sum over all claims of the number of 'days in claim', during the observation period (1999-02), with duration of sickness between 5 and 11 years. The results can be analysed further by gender, age-band and occupation class. The data set, calculation of 'days in claim', and cause of disability categories are consistent with those used for CMI Working Paper 23: Analysis of Individual IP experience by cause of disability[9].

Unsurprisingly the mix by cause of disability varies by occupation class. To be consistent with the Crude Incidence Rates we have based our further calculations on a data set constructed as Class 1 plus ⅓ of all other classes.

The following chart illustrates the distribution of claims by cause, across age and gender, for long-term IP claims:



Source: CMI Individual IP Experience, Standard* data 1999-2002,
Deferred Period 4-52 weeks, Class 1 + ⅓ of extra for All Classes, Duration 5-11 years

The categories of cause of disability are broad and are certainly not a precise match for the CI definitions. However, as a rough estimate for overlap with other CIs we have taken the proportions of claims, by gender and age-band, made up by the following causes of disability:

- 100% of 'Neoplasms' (overlap with Cancer), plus
- 100% of 'Circulatory' (overlap with Heart Attack, Stroke and CABG), plus
- 40% of 'Nervous system & sensory organs' (overlap with MS).

By looking only at IP claims with duration of sickness of 5 years or more, these derived proportions are likely to understate the contribution of cancer. Deaths from cancer make up a high proportion of all deaths during long-term sickness. Such deaths, at durations of sickness 2 to 5 years, will contribute to our estimated Crude Incidence Rate for TPD but not to the cause of disability analysis. We have therefore made an adjustment to correct for this understatement, by reference to both our TPD / IP sickness model and to IP cause of disability data for duration of sickness between 2 and 5 years. The effect is to increase the overlap percentages by 1% - 2% for males and 2% - 3% for females.

These estimated co-morbidity percentages were interpolated over the full age range then applied to reduce the Crude Incidence Rate to remove the overlap with other CIs.

4.9.3.5 Adjustment for Prevalence

No attempt has been made to adjust for prevalence, either for TPD or for the co-morbidities we have allowed for in removing overlaps with other CIs. Such refinement seems spurious in light of the very approximate methods adopted in estimating the Crude Incidence Rates.

4.9.3.6 Adjustment for Survival Period on Stand-Alone CI Cover

By the nature of their construction these TPD rates already include implicit adjustment to a Stand-Alone / post-survival period basis.

4.9.3.7 Addition for Accelerated Rates

We can not follow our general approach of calculating $l_x - k_x.q_x$ for TPD as there is no data to make a direct estimate of the proportion of deaths due to TPD (k_x). We therefore need an alternative approach and have adopted the same methodology as used for this aspect of TPD in constructing CIBT93.

The cost of Accelerated cover can be expressed as:

$$I_x \times \{ 1 - \Sigma (q'_{x+t} \times {}_tp'_x \times v^t) \}$$

where q' and p' are based on mortality of those diagnosed as totally and permanently disabled, and the summation is over all future time periods.

Unfortunately there is no readily available mortality data on the relevant subgroup of lives, and the mortality rates are difficult to estimate as some claims may be in respect of mental or musculoskeletal conditions, with minimal extra mortality, whilst others may have significantly impaired mortality. Some data is available on mortality rates during sickness for Income Protection claimants, but of course the lives we are concerned with match only to a subset of those claimants by virtue of our removal of the overlap with disability arising from other CIs. Further, there is likely to be higher excess mortality initially, reducing with duration since the start of sickness, and we would expect the overall mortality rates to vary with the severity of the TPD definition. To produce the sample calculations for use in CIBT02 we have settled on assuming interest at 5%pa and average mortality of 100% TM92 ult + 7‰ for males (and swapping TM92 for TF92 for females).

This gives percentage reductions to apply to the Stand-Alone TPD rates, to obtain the corresponding addition for Accelerated rates, as around 5% at age 20 rising to around 40% at age 65. These figures are similar to those used in CIBT93.

Strictly, this methodology applies only to whole-of-life cover and the rates for Accelerated TPD benefit would need modification for limited-term cover. Also, as it uses a capitalised present value approach, it distorts the pattern of rates by age. However, given the more substantial issues of uncertainty surrounding many of the assumptions required in driving illustrative TPD rates, we have stuck by the approach for consistency with CIBT93.

4.9.3.8 Summary of Rates and Adjustments

The calculations for TPD are summarised in the table below. The detailed, individual-age, calculations are shown in Tables 10.1.15 and 10.1.16.

Summary of Calculation of Incidence Rates: TPD							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Crude rate from D26 IP	2.29	27.52			6.21	50.99	
Crude rate from D13 IP	2.82	27.39			5.95	40.89	
Weighted Avg Crude Rate	**2.57**	**27.46**			**6.07**	**46.48**	
% change by smoothing	-2%	-4%			+1%	-11%	
% adj for Occupation Def^n	-20%	-20%			-20%	-20%	
% adj for Age Def^n	-21%	-21%			-21%	-15%	
% adj for Overlaps	-15%	-32%			-13%	-19%	
% adj for Prevalence	-	-			-	-	
Derived Incidence Rate, I_x	**1.35**	**11.36**			**3.35**	**22.70**	
% adj for 28-day Mortality	-	-			-	-	
Stand-Alone Rate, I'_x	**1.35**	**11.36**			**3.35**	**22.70**	
- CI-specific mort^y rate, $k_x.q_x$	-0.14	-2.98			-0.27	-4.59	
Addition for Acc CI, I_x- $k_x.q_x$	**1.21**	**8.38**			**3.08**	**18.11**	

4.9.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in TPD rates from CIBT93 to CIBT02.

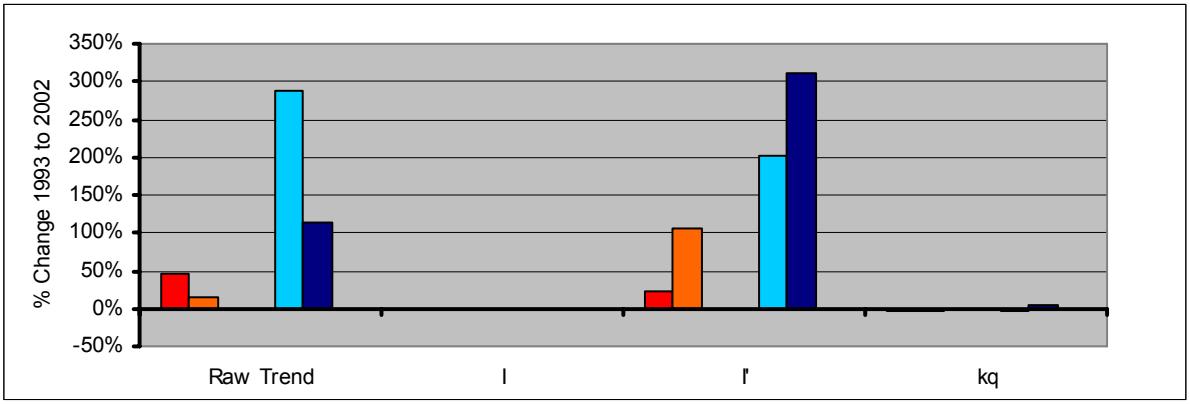
CMI Individual IP experience has shown small reductions in D26 inception rates over the 1990s but more than offset by lower claim recovery rates so that TPD rates, estimated on a basis consistent with CIBT93, have increased by around 45% at ages 20-39 and 15% at ages 40-59.

However, this underlying trend is hidden amongst a number of other significant changes to improve the methodology and reflect new data sources:

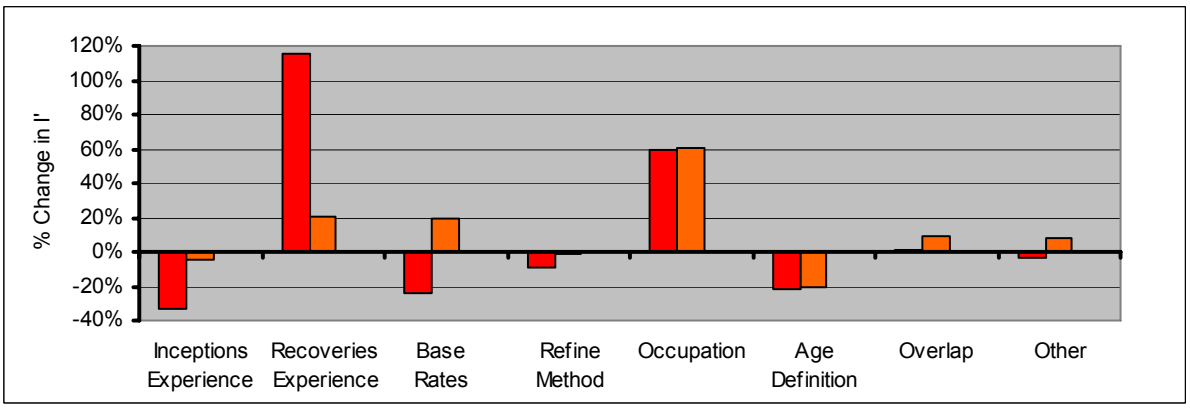
- Correcting the inception rates used in CIBT93 by using the CMIR12 graduation of 1975-78 experience rather than the CMIR7 version
- Refining the basis used to approximate TPD, using 5 years sick as the start point (as for CIBT93) but allowing for some subsequent recoveries and some earlier deaths
- Using D13 as well as D26 data
- Making a separate estimate of rates for females (CIBT93 only used data for males and set rates the same for both genders)
- Taking a different view on the mix of business by TPD definition and to the adjustment for this
- Introducing an age adjustment to recognise time taken to establish TPD
- Using up-to-date CMI data to revise the overlap adjustment.

Overall the increases are large and particularly so for females and ages 40-60. The changes made do have good supporting logic, although the whole approach stands or falls on the appropriateness of using Individual IP experience as a start point to infer TPD rates.

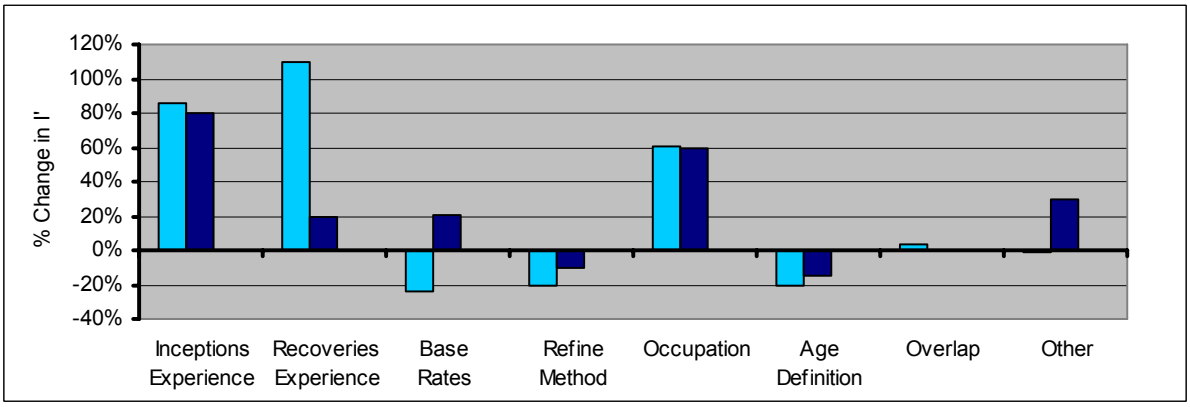
Raw Trend and Change in Incidence (I), Stand-Alone (I'), and Mortality Rates for TPD



Components of Change in Stand-Alone Rates (I') for TPD - Males



Components of Change in Stand-Alone Rates (I') for TPD - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

Commentary on Components of Change in Stand-Alone Rates (I') for TPD		
Component	Commentary	Real Trend ?
Inceptions	Males - lower inception rates; Females - introduced separate data	✓ M, × F
Recoveries	Much lower recovery rates at younger ages increase TPD costs	✓
Data Source	Consistent source (CMI Individual IP) for CIBT93 and CIBT02	n/a
Base Rates	Switch from CMIR7 to CMIR12 graduation (corrects CIBT93 error)	×
TPD Method	Refined methodology for CIBT02 as described in 4.9.3.1	×
Occupation	Taken different view for CIBT02 than in CIBT93	×
Age Definition	Introduced adjustment to recognise time taken to establish TPD	×
Overlap	Updated data source used for CIBT02; improved estimate	×
Other	Differences arising from smoothing	×

4.10 Other Commonly Covered CIs

Up to now we have derived incidence rates, applicable to the population of England, for the core eight CIs plus TPD, to match the coverage of CIBT93. However the majority of policies available on the market over recent years have offered a broader coverage. We have therefore attempted to provide a rough indication of incidence rates for a further 17 CIs.

In the latest ABI SoBP April 2006[1], model definitions are given for all CIs included in the coverage of at least 75% of Critical Illness policies on the market in early 2006. This naturally highlights an additional 16 CIs for our consideration; we have also added Angioplasty as, although it has become less common recently, it was covered on the majority of CI policies issued 5 years ago and so is relevant for experience analyses.

The incidence rates for these additional CIs are typically small relative to the total for the core eight CIs already considered. We have followed the same general methodology as laid out in Section 4.1.3 although data availability and quality, particularly for many of the adjustments to crude rates, is generally poor. We have therefore simplified the calculations where materiality allows us or practicality forces us.

To save repetition, the following general considerations apply to each of the additional CIs unless otherwise stated:

- Adjustment to count only first ever incidences is immaterial; a small proportion of the operations may relate to repeat operations but we have not attempted to adjust for this
- Adjustment for unreported cases / sudden deaths is immaterial or not relevant
- Overlaps with other conditions (except TPD) are immaterial; this simplification may become inappropriate at older ages
- Adjustment for prevalence is immaterial; again this simplification may become inappropriate at older ages but at least works in the opposite direction to the overlap adjustment
- Operative and 28-day post-event mortality are immaterial.

We have produced illustrative numbers for each additional CI for:

- Stand-Alone incidence rates
- The offset against TPD for overlap (as we assume claims are made and recorded against specific CIs where possible so that TPD only captures conditions not explicitly covered in the listed CIs
- The offset, $k_x q_x$, against non-CI deaths for the additional acceleration of death benefits through extending the coverage of listed CIs

Many of the estimates and adjustments we have made are highly subjective. However, we have been guided not just by the available data but also by crude reasonableness checks using:

- The indicative % additional costs for other CIs set out in section 3.11 of 'A Critical Review'[1]
- The incidence rates provided in Fabrizio & Gratton's 'Pricing Dread Disease Insurance'[43]
- The sum of TPD offsets, across all the additional CIs, compared against the TPD rates and data on causes of long-term disability shown in Section 4.9.3.

Commentary on the derivation of rates is set out in Sections 4.10.1 to 4.10.17. Summary tables in each section show the illustrative incidence rates and offsets, for broad age bands, and comparisons of the rates for each CI against the total rate for the core eight CIs and TPD.

Given the relatively simplified calculation approach, the incidence rates produced for these 17 additional CIs should be regarded as purely illustrative rather than as refined estimates.

4.10.1 Alzheimer's Disease

4.10.1.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Alzheimer's disease [before age x] – *resulting in permanent symptoms*

A definite diagnosis of Alzheimer's disease [before age x] by a Consultant Neurologist, Psychiatrist or Geriatrician. There must be permanent clinical loss of the ability to do all of the following:

- remember;
- reason; and
- perceive, understand, express and give effect to ideas.

For the above definition, the following are not covered:

- Other types of dementia.

4.10.1.2 Data Sources

- The Alzheimer's Society[3]
- The Incidence of Dementia in England & Wales: Findings from the Five Identical Sites of the MRC CFA Study; Fiona Matthews et al[24]
- Incidence of dementia: does gender make a difference; Ruitenberg A et al; Rotterdam study[23]
- Dementia Estimates and Projections, NSW and its regions; sources: Jorm and Jolley (1998), Gao et al (1998), Launer et al (1999) and Fratiglioni (2000)[11]
- Incidence of dementia and probable Alzheimer's disease in a general population: the Framingham Study[25]
- Very old women at highest risk of Dementia and Alzheimer's disease: incidence data from the Kungsholmen Project, Stockholm; Fratigliona L et al[56]
- Young Onset Dementia: Epidemiology, clinical symptoms, family burden, support and outcome; Imperial College[58]
- ONS - Mortality Statistics: Cause; England and Wales; 2001-03; Series DH2, nos 28, 29,30[39]
- ONS - Population Estimates; England & Wales; 2001-03[40]

For our calculations we define Alzheimer's Disease by ICD-10 code G30.

4.10.1.3 Derivation of Incidence Rates

Alzheimer's Disease has a progressive nature and is difficult to diagnose with certainty; historically most diagnoses have followed the ruling out of other causes of dementia. Medical drugs currently available can delay the pace of decline towards severe disability, and so how an insurance definition relates to diagnosis and progression of the disease, both now and in future, is quite subjective.

The available data for raw Alzheimer's Disease (or even dementia) incidence rates is weak. We have accessed and worked with the information summarised below on prevalence and incidence.

Dementia has a high prevalence at older ages; well-established prevalence rates for the UK are:

Prevalence of Dementia	
Age (years)	Prevalence
40-65	1 in 1000
65-70	1 in 50
70-80	1 in 20
80+	1 in 5

Source: The Alzheimer's Society[3]

It is difficult to establish prevalence at younger ages but it is very low; the Imperial College study suggests 21.7 per 100,000 (95% confidence interval 15.6-29.3)[58].

Alzheimer's disease is the most common form of dementia:

Causes of Dementia	
Alzheimer's disease	55%
Vascular dementia	20%
Dementia with Lewy bodies	15%
Fronto-temporal dementia including picking's disease	5%
Other dementia's	5%

Source: The Alzheimer's Society[3]

A range of medical studies, summarise in the table below, broadly outline show the incidence of dementia by age and sex:

Approximate Incidence of Dementia								
Age Band	MRC CFA[24]		Rotterdam[23]	NSW[11]		Framingham[25]	Kungsholman[56]	
	M	F	All	M	F	All	M	F
20-49			7.2					
50-54								
55-64				1	1			
65-69	10.1	8.2		4	4	7		
70-74	21.8	7.9		9	9			
75-80	27.7	20.9		20	21		12.4	19.6
80-84	37.6	46.4		38	39			
85-89	66.4	98.8		62	66	118		
90-94				96	106		15.0	86.7

We have based our raw incidence rate calculations on the MRC CFA study[24] as it seems to be the most relevant and to provide credible rates across age and gender. However, the key methodology of this study involved interviewing individuals and so is likely to produce incidence rates higher than those in the general population, through advancing diagnoses, as many dementia cases are not routinely diagnosed in their early stages.

We have taken the raw observed rates from this study, smoothed / interpolated to individual ages and then estimated prevalence consistent with the resulting incidence rates. We then made further adjustments as follows:

- Apply a factor of 55% to convert from dementia incidence to Alzheimer's Disease incidence
- Apply a further factor of 70% to reduce the incidence for the artificial acceleration of diagnoses in the study, guided by matching the resulting prevalence figures to the Alzheimer's Society figures noted above
- Tailored the incidence rate extrapolation to younger ages by matching the young age prevalence rates noted above.

It may be interesting to speculate on how the 70% factor could increase in future if Alzheimer's Disease could be routinely diagnosed earlier. However the interaction with improving treatments and with the severity requirements in the definition are difficult to assess, and the overall information basis here is in any case too weak to give great confidence in the indicative rates produced.

Whilst some other forms of dementia and strongly linked brain damage caused by strokes, Alzheimer's is not so we have not made any allowance for overlap with other CIs except TPD.

Mortality rates are significant for Alzheimer's Disease so we have derived the Addition for Accelerated CI in the usual way, $I_x - k_x.q_x$. For this we derived $k_x.q_x$ for 5-year age bands directly from ONS data for England & Wales, using calendar years 2001-03, and then smoothed / interpolated to produce full individual-age rates.

The overlap between Alzheimer's Disease and TPD is significant (before age 65), the key issue being the timing of when the degree of disability becomes "total". As it can be a slow developing disease,

we have assumed Alzheimer's Disease sufferers would satisfy the adopted TPD definition (see Section 4.9) on average 3 years after diagnosis of the disease; that is, % overlap with TPD ≈ $i_{x-3} \div i_x$.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Alzheimer's Disease							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.00**	**0.53**	**41.08**		**0.01**	**0.55**	**32.87**
as % of main CIs	0.0%	0.6%	10.8%		0.0%	0.7%	13.9%
Addition for Acc CI, $I_x - k_x.q_x$	**0.00**	**0.50**	**39.83**		**0.01**	**0.52**	**31.30**
as % of main CIs	0.0%	0.6%	10.4%		0.0%	0.6%	13.2%
TPD Reduction for Overlap	**0.00**	**-0.24**			**0.00**	**-0.28**	
as % of main CIs	0.0%	-0.3%			0.0%	-0.3%	

4.10.2 Angioplasty to two or more coronary arteries

4.10.2.1 Definition

Angioplasty was covered on the majority of CI policies issued 5 years ago but has become less common recently. There is no ABI model definition for Angioplasty but a typical wording was:

Angioplasty to two or more coronary arteries

The undergoing of open heart surgery on the advice of a Consultant Cardiologist to correct narrowing or blockage of two or more coronary arteries using Balloon Angioplasty and involving the use of transluminal coronary catheters to correct significant stenosis of at least 50% diameter narrowing. Angiographic evidence to support the necessity for the above operation will be required.

Some companies included Angioplasty as part of the CABG definition, other listed it separately.

4.10.2.2 Data Sources

- HES - Angioplasty (2 or more arteries) procedures; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]
- Population need for coronary revascularisation; Martin et al; Heart 2002; 88: 627-33[41]

For our calculations we define Angioplasty (2 or more coronary arteries) by OPCS4 codes K492.

4.10.2.3 Derivation of Incidence Rates

Our start point is counts, in 5-year age-bands, of angioplasty operations involving two or more coronary arteries. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of cases in England in 2002. We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age rates.

Overlaps with CABG, Heart Attack and TPD are sufficiently material to warrant attention:

- About 20% of people who receive a single or a multiple angioplasty go on to have a CABG (Martin et al[41]); estimates specifically for multiple angioplasty were not available. We have made a 20% reduction to the incidence rates for to allow for the overlap with CABG.
- Angioplasty was only introduced as an emergency treatment for heart attack in 2001 and numbers of angioplasty post heart attack in 2002 are thought to be very low. Angioplasty can also trigger a heart attack but only in a very small percentage of people. The incidence of angioplasty could be slightly reduced to allow for this overlap with heart attack but the adjustment was not considered significant.
- Less than 10% of the estimated incidence is thought overlap with TPD; we take 5% as our best estimate although it is subjective. However, in the calculation of TPD rates for CIBT02 we have already excluded all long-term disability attributed to 'circulatory' causes and so we believe the overlap with of angioplasty and TPD has already been implicitly allowed for and no further adjustment is required.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Angioplasty to 2 or more coronary arteries							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.09**	**1.75**	**3.99**		**0.01**	**0.32**	**1.46**
as % of main CIs	0.8%	1.9%	1.0%		0.1%	0.4%	0.6%
Addition for Acc CI, $I_x - k_x.q_x$	**0.09**	**1.75**	**3.99**		**0.01**	**0.32**	**1.46**
as % of main CIs	0.8%	1.9%	1.0%		0.1%	0.4%	0.6%
TPD Reduction for Overlap	**0.00**	**0.00**			**0.00**	**0.00**	
as % of main CIs	0.0%	0.0%			0.0%	0.0%	

4.10.3 Aorta Graft Surgery

4.10.3.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Aorta graft surgery – *for disease*

The undergoing of surgery for disease to the aorta with excision and surgical replacement of a portion of the diseased aorta with a graft.

The term aorta includes the thoracic and abdominal aorta but not its branches.

For the above definition, the following are not covered:
- Any other surgical procedure, for example the insertion of stents or endovascular repair.
- Surgery following traumatic injury to the aorta.

4.10.3.2 Data Sources

- HES - Aorta graft operations; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]

For our calculations we define Aorta Graft Surgery by the following OPCS4 codes:
L183-185, l192-195, l202-205, L212-215, L231, L233, L451-L452

4.10.3.3 Derivation of Incidence Rates

For raw aorta graft surgery incidence data we have used our extract from HES[33].

Our start point is counts, in 5-year age-bands, of aorta graft operations. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of cases in England in 2002. We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age rates.

There is overlap with the other coronary conditions and operations but we have allowed for this elsewhere; see Heart Value Replacement or Repair in particular.

The overlap with TPD warrants attention. Given the severity of the underlying condition, up to 20% of the estimated aorta graft surgery incidence is thought to overlap with TPD; we take 10% as our best estimate although it is subjective. However, in the calculation of TPD rates for CIBT02 we have already excluded all long-term disability attributed to 'circulatory' causes and so we believe the overlap of aorta graft surgery and TPD has already been implicitly allowed for and no further adjustment is required.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Aorta Graft Surgery							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.04**	**0.35**	**6.64**		**0.01**	**0.07**	**1.22**
as % of main CIs	0.4%	0.4%	1.7%		0.1%	0.1%	0.5%
Addition for Acc CI, I_x- $k_x.q_x$	**0.04**	**0.35**	**6.64**		**0.01**	**0.07**	**1.22**
as % of main CIs	0.4%	0.4%	1.7%		0.1%	0.1%	0.5%
TPD Reduction for Overlap	**0.00**	**0.00**			**0.00**	**0.00**	
as % of main CIs	0.0%	0.0%			0.0%	0.0%	

4.10.4 Benign Brain Tumour

4.10.4.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Benign brain tumour – *resulting in permanent symptoms*

A non-malignant tumour or cyst in the brain, cranial nerves or meninges within the skull, resulting in permanent neurological deficit with persisting clinical symptoms.

For the above definition, the following are not covered:
- Tumours in the pituitary gland.
- Angiomas.

4.10.4.2 Data Sources

- ONS - Cancer Statistics - Registrations; England; 2002; Series MB1, no. 33[37]
- ONS - Population Estimates; England; 2002[40]
- ONS - Mortality Statistics: Cause; England and Wales; 2002; Series DH2, nos 29[39]
- ONS - Population Estimates; England & Wales; 2002[40]

For our calculations we define Benign Brain Tumour by ICD-10 codes D33 and D43.

4.10.4.3 Derivation of Incidence Rates

For raw benign brain tumour incidence data we have used ONS Cancer Statistics[37].

Our start point is counts of new registrations for brain tumours which are classified as either benign or of uncertain malignancy, using data for 2002 in 5-year age-bands. For calendar year 2002, the report relates to cancer registrations in England only and so we used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and then smoothed / interpolated to produce full individual-age rates.

Mortality rates are significant for benign brain tumours so we have derived the Addition for Accelerated CI in the usual way, $I_x - k_x.q_x$. For this we derived $k_x.q_x$ for 5-year age bands directly from ONS data for England & Wales, using calendar year 2002 only, and then smoothed / interpolated to produce full individual-age rates.

We have not made any allowance for overlap with TPD.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Benign Brain Tumour							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.11**	**0.24**	**0.38**		**0.08**	**0.20**	**0.35**
as % of main CIs	1.1%	0.3%	0.1%		0.5%	0.2%	0.1%
Addition for Acc CI, $I_x - k_x.q_x$	**0.10**	**0.16**	**-0.01**		**0.07**	**0.14**	**-0.02**
as % of main CIs	0.9%	0.2%	0.0%		0.4%	0.2%	0.0%
TPD Reduction for Overlap	**0.00**	**0.00**			**0.00**	**0.00**	
as % of main CIs	0.0%	0.0%			0.0%	0.0%	

4.10.5 Blindness

4.10.5.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Blindness – *permanent and irreversible*

Permanent and irreversible loss of sight to the extent that even when tested with the use of visual aids, vision is measured at 3/60 or worse in the better eye using a Snellen eye chart.

The severity level in the latest model definition is now pitched at the level at which individuals can be registered as blind. Previously the model definition was far stricter:

Blindness

Total, permanent and irreversible loss of all sight in both eyes.

4.10.5.2 Data Sources

- Royal National Institute of the Blind (RNIB)[48]
- Registered blind and partially sighted people: year ending 31 March 2003 England; DoH[13]
- ONS - Population Estimates; England; 2002[40]

4.10.5.3 Derivation of Incidence Rates

The statutory definition of blindness is that a person should be "so blind as to be unable to perform any work for which eyesight is essential". In practice a person can be registered as severely sight impaired / blind if they can only read the top letter of the optician's eye chart from three metres or less ("3/60" vision). However, only a small proportion of the registered blind would meet the stricter definition: around 5% of registered blind are in 'total darkness', but it is estimated 10%-30% of the registered blind would be considered valid claimants on the stricter definition.

Our start point for raw incidence rates for blindness is the triennial report from the DoH[13] on the number of individuals registered as blind. This report shows the number of new registrations in England over the year to 31 March 2003, with a breakdown into broad age bands (but not by gender). We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age unisex rates.

Theses rates need no further adjustment to match the latest model definition. However, as the main use of CIBT02 is likely to be comparisons with emerging experience based on the previous, stricter version of the definition, we have applied a factor of 25%. This adjustment is highly subjective.

There may be a significant prevalence of unregistered blindness at older ages. There is also material overlap with deafness at advanced ages. However we have insufficient information to adjust for this.

The overlap with TPD is almost total (before age 65); we have assumed 100%.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Blindness							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.10**	**0.18**	**1.16**		**0.10**	**0.18**	**1.27**
as % of main CIs	0.9%	0.2%	0.3%		0.7%	0.2%	0.5%
Addition for Acc CI, $I_x - k_x.q_x$	**0.10**	**0.18**	**1.16**		**0.10**	**0.18**	**1.27**
as % of main CIs	0.9%	0.2%	0.3%		0.7%	0.2%	0.5%
TPD Reduction for Overlap	**-0.10**	**-0.18**			**-0.10**	**-0.18**	
as % of main CIs	-0.9%	-0.2%			-0.7%	-0.2%	

4.10.6 Coma

4.10.6.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Coma – *resulting in permanent symptoms*

A state of unconsciousness with no reaction to external stimuli or internal needs which:
- requires the use of life support systems for a continuous period of at least 96 hours; and
- results in permanent neurological deficit with persisting clinical symptoms.

For the above definition, the following is not covered:
- Coma secondary to alcohol or drug abuse.

4.10.6.2 Data Sources

- None used.

4.10.6.3 Derivation of Incidence Rates

Incidence rates for coma are difficult to determine as there is no hospital statistics coding for the coma condition in itself; recoding of episodes relates to the injury or disease leading to the coma.

However, the model definition is only likely to be satisfied as a result of a major accident, suffering another CI (particularly Stroke) or during the end stages (that is just prior to death) of other diseases. Furthermore, the severity of a 96-hour coma, even if survived, is likely to leave significant residual disability and may well qualify under TPD.

Therefore we believe the overlap with other CIs is almost total, or the coma will not be survived, so that the additional incidence rate for Coma is negligible in context of overall CI rates.

Summary of Indicative Incidence Rates: Coma							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**All Rates set to ZERO as residual incidence after removing overlap with other CIs is believed to be negligible in context of overall CI rates**						
as % of main CIs							
Addition for Acc CI, $I_x - k_x.q_x$							
as % of main CIs							
TPD Reduction for Overlap							
as % of main CIs							

4.10.7 Deafness

4.10.7.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Deafness – *permanent and irreversible*
Permanent and irreversible loss of hearing to the extent that the loss is greater than 95 decibels across all frequencies in the better ear using a pure tone audiogram.

The severity level in the latest model definition is now pitched at the level of profound deafness. Previously the model definition was far stricter:

Deafness
Total permanent and irreversible loss of all hearing in both ears.

4.10.7.2 Data Sources

- Royal National Institute for Deaf People (RNID)[49]
- People registered as deaf or hard of hearing: year ending 31 March 2004, England; DoH[14]
- ONS - Population Estimates; England; 2002[40]

4.10.7.3 Derivation of Incidence Rates

To be registered deaf a person should have "little useful hearing even with hearing aids". In practice a person can be registered if their loss of hearing is severe (> 65 decibels) or profound (>95). Only a small proportion, say an estimated 5%-20%, of the registered deaf would meet the stricter definition.

Our start point for raw incidence rates for deafness is the triennial reports from the DoH[14] on the number of individuals registered as deaf in England up to 31 March 2004. These reports show prevalence, with a breakdown into broad age bands (although not by gender) but do not give the number of new registrations. However, we have estimated new registrations from the movements in the total register, together with population and mortality assumptions. We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age unisex rates.

Theses rates need to be reduced by, say, ⅔ to restrict to profound loss of hearing only and match the latest model definition. However, as the main use of CIBT02 is likely to be comparisons with emerging experience based on the previous, stricter version of the definition, we have applied a factor of 15%. This adjustment is highly subjective.

There may be a significant prevalence of unregistered deafness at older ages. There is also material overlap with blindness at advanced ages. However we have insufficient information to adjust for this.

The overlap with TPD is significant (before age 65); we have assumed 50% of deafness claims would satisfy TPD on an 'own occupation' basis (for info, we estimate 25% would satisfy TPD on an 'any occupation' basis, but very few on an ADL basis).

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Deafness							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.05**	**0.09**	**0.44**		**0.05**	**0.09**	**0.47**
as % of main CIs	0.4%	0.1%	0.1%		0.3%	0.1%	0.2%
Addition for Acc CI, I_x- $k_x.q_x$	**0.05**	**0.09**	**0.44**		**0.05**	**0.09**	**0.47**
as % of main CIs	0.4%	0.1%	0.1%		0.3%	0.1%	0.2%
TPD Reduction for Overlap	**-0.02**	**-0.04**			**-0.02**	**-0.04**	
as % of main CIs	-0.2%	0.0%			-0.2%	-0.1%	

4.10.8 Heart Valve Replacement or Repair

4.10.8.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Heart valve replacement or repair – *with surgery to divide the breastbone*

The undergoing of surgery requiring median sternotomy (surgery to divide the breastbone) on the advice of a Consultant Cardiologist to replace or repair one or more heart valves.

4.10.8.2 Data Sources

- HES - Heart Valve operations; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]

For our calculations we define Heart Valve Replacement or Repair by the following OPCS4 codes: K251-255, K258-259, K261-265, K268-269, K271-276, K278-279, K281-285, K288-289, K291-295, K298-299, K311-314 ,K318-319, K321-324, K328-329, K341-344, K348-349, K351-355, K358-359.

4.10.8.3 Derivation of Incidence Rates

For raw heart valve operation incidence data we have used our extract from HES[33].

Our start point is counts, in 5-year age-bands, of heart valve replacement or repair operations. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of cases in England in 2002. We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age rates.

There is a significant overlap with CABG and probably also with Aorta Graft Surgery. Fabrizio and Grattan[43] quote statistics to show that 28% of patients for heart valve surgery had also undergone a CABG operation at the same hospital and that 53% of aorta repair operations also involved heart valve surgery. We have allowed for this overlap within the incidence rates for Heart Valve Replacement or Repair by reducing the crude rates by 30%.

The overlap with TPD also warrants attention. Given the severity of the underlying condition, up to 20% of the estimated heart value replacement or repair surgery incidence is thought to overlap with TPD; we take 10% as our best estimate although it is subjective. However, in the calculation of TPD rates for CIBT02 we have already excluded all long-term disability attributed to 'circulatory' causes and so we believe the overlap of aorta graft surgery and TPD has already been implicitly allowed for and no further adjustment is required.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Heart Valve Replacement or Repair							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.35**	**1.37**	**6.32**		**0.18**	**0.70**	**4.21**
as % of main CIs	3.2%	1.5%	1.7%		1.2%	0.8%	1.8%
Addition for Acc CI, $I_x - k_x.q_x$	**0.35**	**1.37**	**6.32**		**0.18**	**0.70**	**4.21**
as % of main CIs	3.2%	1.5%	1.7%		1.2%	0.8%	1.8%
TPD Reduction for Overlap	**0.00**	**0.00**			**0.00**	**0.00**	
as % of main CIs	0.0%	0.0%			0.0%	0.0%	

4.10.9 HIV Infection

4.10.9.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

HIV infection – *caught [in the UK] from a blood transfusion, a physical assault or at work in an eligible occupation*

Infection by Human Immunodeficiency Virus resulting from:
- a blood transfusion given as part of medical treatment;
- a physical assault; or
- an incident occurring during the course of performing normal duties of employment [from the eligible occupations listed below][1];

after the start of the policy and satisfying all of the following:
- The incident must have been reported to appropriate authorities and have been investigated in accordance with the established procedures.
- Where HIV infection is caught through a physical assault or as a result of an incident occurring during the course of performing normal duties of employment, the incident must be supported by a negative HIV antibody test taken within 5 days of the incident.
- There must be a further HIV test within 12 months confirming the presence of HIV or antibodies to the virus.
- [The incident causing infection must have occurred in the UK] [2].

For the above definition, the following is not covered:
- HIV infection resulting from any other means, including sexual activity or drug abuse.

[1]Note: include specified occupations if applicable
[2]Note: include geographic limits as applicable

4.10.9.2 Data Sources

- None used.

4.10.9.3 Derivation of Incidence Rates

Given the relatively low prevalence of HIV in the UK, controls on blood supplies for transfusions, and the restricted occupationally-at-risk group, the incidence is believed to be so low as to be negligible within the context of overall CI rates.

Summary of Indicative Incidence Rates: HIV Infection							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**All Rates set to ZERO as incidence is believed to be negligible in context of overall CI rates**						
as % of main CIs							
Addition for Acc CI, I_x- $k_x.q_x$							
as % of main CIs							
TPD Reduction for Overlap							
as % of main CIs							

4.10.10 Loss of Speech

4.10.10.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Loss of speech – *permanent and irreversible* Total permanent and irreversible loss of the ability to speak as a result of physical injury or disease.

4.10.10.2 Data Sources

- None used.

4.10.10.3 Derivation of Incidence Rates

The major causes of loss of speech are cancer and stroke, and so are already covered. The next most likely causes are head injury (which may be covered under Traumatic Head Injury), mental disorders (which are excluded by the definition), neurological diseases (such as MND) and accidents or infections to the vocal chords. Therefore we believe the overlap with other CIs is almost total. Further, even if loss of speech resulted from another cause it may well qualify under TPD, so that the additional incidence rate for Loss of Speech is negligible in context of overall CI rates.

Summary of Indicative Incidence Rates: Loss of Speech							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**All Rates set to ZERO as residual incidence after removing overlap with other CIs is believed to be negligible in context of overall CI rates**						
as % of main CIs							
Addition for Acc CI, $I_x - k_x.q_x$							
as % of main CIs							
TPD Reduction for Overlap							
as % of main CIs							

4.10.11 Loss or Hands or Feet

4.10.11.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Loss of hands or feet – *permanent physical severance*

Permanent physical severance of any combination of 2 or more hands or feet at or above the wrist or ankle joints.

4.10.11.2 Data Sources

- HES - Relevant amputation operations; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]

For our calculations we define Loss of Hands or Feet by OPCS4 codes X073-075 and X093-095.

4.10.11.3 Derivation of Incidence Rates

For raw incidence data for loss of hands or feet we have used our extract from HES[33].

Our start point is counts, in 5-year age-bands, of relevant amputations. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of cases in England in 2002. We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age rates.

The operation codes selected relate to the amputation of an arm or leg at different points. We assume all physical severances would be recorded as, or also lead to, an amputation. No information was found on multiple amputations and clearly the raw counts will overstate the incidence of events matching the model definition that requires any combination of 2 or more severances. We have adjusted for this by applying a factor of 25%; such adjustment is highly subjective.

The overlap with TPD is thought to be significant; we have allowed for an overlap of 15% up to age 17 rising linearly to 75% for ages 47 and above, recognising the general reduction in recovery and adaptive potential as age increases. This adjustment is highly subjective; say a range of 60% - 90% at age 50.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Loss of Hands or Feet							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.07**	**0.30**	**1.51**		**0.02**	**0.11**	**0.61**
as % of main CIs	0.6%	0.3%	0.4%		0.2%	0.1%	0.3%
Addition for Acc CI, $I_x - k_x.q_x$	**0.07**	**0.30**	**1.51**		**0.02**	**0.11**	**0.61**
as % of main CIs	0.6%	0.3%	0.4%		0.2%	0.1%	0.3%
TPD Reduction for Overlap	**-0.03**	**-0.22**			**-0.01**	**-0.08**	
as % of main CIs	-0.3%	-0.2%			-0.1%	-0.1%	

4.10.12 Motor Neurone Disease (MND)

4.10.12.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Motor neurone disease [before age x] – *resulting in permanent symptoms* A definite diagnosis of motor neurone disease [before age x] by a Consultant Neurologist. There must be permanent clinical impairment of motor function.

4.10.12.2 Data Sources

- ONS - Mortality Statistics: Cause; England and Wales; 2001-03; Series DH2, nos 28, 29,30[39]
- ONS - Population Estimates; England & Wales; 2001-03[40]

For our calculations we define Motor Neurone Disease by ICD-10 code G12.2.

4.10.12.3 Derivation of Incidence Rates

Motor Neurone Disease is a rare condition with a prevalence of about 1 to 2 per 100,000[5]. It is a steadily progressive disease typically going on to affect the muscles involved in breathing and swallowing and so leading to death within 2 to 4 years of onset. However, about 20% of sufferers survive for more than 5 years, and about 5% for more than 10 years.

We do not have data enabling a direct estimate of incidence rates for MND. Instead we have derived incidence rates indirectly from ONS Mortality Statistics by cause of death.

Our start point is counts of deaths from MND over 2001-03 in 5-year age-bands. We then used the corresponding ONS 2001-03 Population Estimates for England & Wales as the denominator to calculate crude mortality rates and smoothed / interpolated to produce full individual-age rates ($k_x.q_x$).

We have estimated MND incidence rates by working backwards from mortality rates, assuming death occurs on average 4 years after diagnosis of the disease; that is assuming $I_x \approx k_{x+4}.q_{x+4}$.

Clearly mortality rates are significant for MND so we have derived the Addition for Accelerated CI in the usual way, $I_x - k_x.q_x$, using the same underlying data.

The overlap between MND and TPD is almost complete (before age 65), the key issue being the timing of when the degree of disability from MND becomes "total". We have assumed MND sufferers would satisfy the adopted TPD definition (see Section 4.9) on average 1 year after diagnosis of the disease; that is, % overlap with TPD $\approx I_{x-1} \div I_x$.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Motor Neurone Disease							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.03**	**0.34**	**1.43**		**0.01**	**0.21**	**1.07**
as % of main CIs	0.3%	0.4%	0.4%		0.1%	0.3%	0.5%
Addition for Acc CI, $I_x - k_x.q_x$	**0.01**	**0.12**	**0.25**		**0.01**	**0.09**	**0.15**
as % of main CIs	0.1%	0.1%	0.1%		0.0%	0.1%	0.1%
TPD Reduction for Overlap	**-0.03**	**-0.30**			**-0.01**	**-0.19**	
as % of main CIs	-0.3%	-0.3%			-0.1%	-0.2%	

4.10.13 Paralysis of Limbs

4.10.13.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Paralysis of limbs – *total and irreversible*

Total and irreversible loss of muscle function to the whole of any 2 limbs.

4.10.13.2 Data Sources

- Spinal Injuries Association[50]
- ONS - Population Estimates; England; 2002[40]

4.10.13.3 Derivation of Incidence Rates

We have attempted to derive incidence rates for paralysis as a result of spinal cord injury only as most other causes of paralysis overlap with other CIs, notably Stroke, Traumatic Head Injury and Loss of Hands or Feet.

Information available through the Spinal Injuries Association[50] states there were 666 new patient admissions to all the Spinal Injury Centres in the UK and Ireland in the year 2000. Further, a breakdown of causes reveals:

- 37% were due to traffic accidents (including 11% motorbikes)
- 43% were due to falls (including 16% form height or jumps)
- 12% were due to sport (mainly diving, rugby, horse riding, and altitude and winter sports)
- 3% were due to assaults
- 5% other, including collisions and lifting.

Whilst we don't have a breakdown by age and sex, it is possible to infer a reasonable estimate from the mix of causes noted above, with younger males by far the most at risk, followed by the elderly (falls). We have: estimated crude splits by gender and 5-year age band for each of the major cause groups; summed across causes; applied a factor of 80% to crudely convert from UK and Ireland to England; divided through by ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates; and smoothed / interpolated to produce full individual-age rates.

There were a further 159 new patients admitted with paralysis caused not by trauma but by medical conditions such as infection, bleeding or disease. We have not included these as we expect a high degree of overlap with other CIs. There may also be other cases dealt with outside of the Spinal Injury Centres. Against this, not all patients in Spinal Injury Centres will suffer permanent paralysis.

The overlap with TPD is thought to be significant; we have allowed for an overlap of 15% up to age 17 rising linearly to 75% for ages 47 and above, recognising the general reduction in recovery and adaptive potential as age increases. This adjustment is highly subjective; say a range of 60% - 90% at age 50.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Paralysis of Limbs							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.23**	**0.09**	**0.14**		**0.10**	**0.07**	**0.15**
as % of main CIs	2.1%	0.1%	0.0%		0.7%	0.1%	0.1%
Addition for Acc CI, $I_x - k_x.q_x$	**0.23**	**0.09**	**0.14**		**0.10**	**0.07**	**0.15**
as % of main CIs	2.1%	0.1%	0.0%		0.7%	0.1%	0.1%
TPD Reduction for Overlap	**-0.09**	**-0.07**			**-0.04**	**-0.05**	
as % of main CIs	-0.8%	-0.1%			-0.3%	-0.1%	

4.10.14 Parkinson's Disease

4.10.14.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Parkinson's disease [before age x] – *resulting in permanent symptoms*

A definite diagnosis of Parkinson's disease [before age x] by a Consultant Neurologist. There must be permanent clinical impairment of motor function with associated tremor, rigidity of movement and postural instability.

For the above definition, the following is not covered:
- Parkinson's disease secondary to drug abuse.

4.10.14.2 Data Sources

- Incidence of Parkinson's Disease: Variation by Age, Gender, and race / Ethnicity; Kaiser Permanente medical care program; Am J Epidemiology 2003;157:1015-1022[26]
- Systematic review of incidence studies in Parkinson's Disease; D Twelves et al; Movement Disorders; 2003; 18:19-31[52]
- ONS - Mortality Statistics: Cause; England and Wales; 2001-03; Series DH2, nos 28, 29,30[39]
- ONS - Population Estimates; England & Wales; 2001-03[40]

For our calculations we define Parkinson's Disease by ICD-10 codes G20 and G21.

4.10.14.3 Derivation of Incidence Rates

Parkinson's Disease has a progressive nature. Medical drugs currently available can delay the onset and pace of decline towards severe disability, and so how an insurance definition relates to diagnosis and progression of the disease, both now and in future, is quite subjective.

The available data for raw Parkinson's Disease incidence rates is weak. We have accessed two studies as summarised in the table below but have based our calculations solely on the results from the Kaiser Permanente medical care program[26] as, although from the USA, we feel they are the most credible for determining a rate table by age and sex. We do not have sufficient information to adjust from the basis of diagnosis used in the study to an effective insurance incidence basis.

Estimates of Incidence Rates for Parkinson's Disease			
Age Bands	Kaiser Permanente[26]		D Twelves et al[52]
	Males	Females	All
<30	0.000	0.000	0.01
30-39	0.005	0.005	0.01
40-49	0.034	0.016	0.08
50-59	0.111	0.086	0.175
60-69	0.495	0.290	0.37
70-79	1.407	0.784	0.22
80-89	1.905	0.707	

The raw observed rates were smoothed / interpolated to produce full individual-age incidence rates.

Mortality rates are significant for Parkinson's Disease so we have derived the Addition for Accelerated CI in the usual way, $l_x - k_x.q_x$. For this we derived $k_x.q_x$ for 5-year age bands directly from ONS data for England & Wales, using calendar years 2001-03, and then smoothed / interpolated to produce full individual-age rates.

The overlap between Parkinson's Disease and TPD is significant (before age 65), the key issue being the timing of when the degree of disability becomes "total". As it can be a slow developing disease, we have assumed Parkinson's Disease sufferers would satisfy the adopted TPD definition (see

Section 4.9) on average 5 years after diagnosis of the disease; that is, % overlap with TPD ≈ $i_{x-5} \div i_x$. This assumption is highly subjective.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Parkinson's Disease							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.03**	**0.71**	**8.71**		**0.02**	**0.49**	**5.16**
as % of main CIs	0.3%	0.8%	2.3%		0.2%	0.6%	2.2%
Addition for Acc CI, $I_x - k_x.q_x$	**0.03**	**0.69**	**6.40**		**0.02**	**0.47**	**4.03**
as % of main CIs	0.3%	0.8%	1.7%		0.1%	0.6%	1.7%
TPD Reduction for Overlap	**-0.01**	**-0.36**			**-0.01**	**-0.23**	
as % of main CIs	-0.1%	-0.4%			-0.1%	-0.3%	

4.10.15 Terminal Illness

4.10.15.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Terminal illness

Advanced or rapidly progressing incurable illness where, in the opinions of an attending Consultant and our Chief Medical Officer, the life expectancy is no greater than 12 months.

4.10.15.2 Data Sources

- GAD - Interim Life Tables; England; 2001-03[21]
- ONS - Mortality Statistics: Cause; England and Wales; 2001-03; Series DH2, nos 28, 29,30[39]

4.10.15.3 Derivation of Incidence Rates

The inclusion of Terminal Illness as a CI condition under Stand-Alone CI cover is relatively uncommon. The main purpose of Stand-Alone CI cover is to provide a financial benefit following survival of an event, so the general view is that Terminal Illness benefit does not fit well with this aim, and with the survival period concept in particular. We therefore restrict ourselves to estimating rates for Terminal Illness as a CI condition under Accelerated CI cover only, where it represents a small acceleration of the death benefit in cases of terminal illness where there is no other prior CI.

In deriving the other elements of CIBT02, we have already used ONS Mortality Statistics to estimate the mortality rates for each CI cause, and so can easily derive the residual mortality rate for all other (that is, all non-CI) causes. This gives us the additional deaths for Accelerated CI cover, $(1 - \Sigma k_x).q_x$.

The additional cost of Terminal Illness at age x is made up of an acceleration of the additional non-CI deaths that would have occurred at age x+1 but meet the Terminal Illness definition at age x, less those additional deaths at age x that have been similarly accelerated to age x-1.

We have made the following key, but highly subjective, assumptions:

- 25% of deaths from non-CI causes are diagnosed as Terminal Illness. This allows in particular for sudden deaths (for example from accidents) not meeting the Terminal Illness definition.
- Terminal Illness is diagnosed on average 6 months in advance of the date of death (so that 50% of claims are brought forward from age x+1 to age x).

The additional cost for Terminal Illness cover at age x can be then represented and calculated as:

$$0.25 \times 0.50 \times [(1 - \Sigma k_{x+1}).q_{x+1} - (1 - \Sigma k_x).q_x]$$

Although each Terminal Illness would likely also qualify as TPD at some point, we have not made any deduction against the TPD incidence rates as we have no adequate basis for calculating such an adjustment.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Terminal Illness							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**	**0.00**
as % of main CIs	-	-	-		-	-	-
Addition for Accelerated CI	**0.03**	**0.19**	**1.87**		**0.02**	**0.10**	**1.42**
as % of main CIs	0.0%	0.2%	0.5%		0.0%	0.1%	0.6%
TPD Reduction for Overlap	**0.00**	**0.00**			**0.00**	**0.00**	
as % of main CIs	-	-			-	-	

4.10.16 Third Degree Burns

4.10.16.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Third degree burns – *covering 20% of the body's surface area*

Burns that involve damage or destruction of the skin to its full depth through to the underlying tissue and covering at least 20% of the body's surface area.

4.10.16.2 Data Sources

- HES - Hospital admissions for severe burns; financial years 2001/02 and 2002/03[33]
- ONS - Population Estimates; England; 2002[40]

For our calculations we define Third Degree Burns by the following ICD-10 codes:
T203, T213, T223, T243, T293, T210, T220, T240, T300.

4.10.16.3 Derivation of Incidence Rates

For raw data on severe burns we have used our extract from Hospital Episode Statistics[33].

Our start point is counts, in 5-year age-bands, of hospital admissions / episodes for ICD10 codes representing severe burns. We interpolated between HES data for financial years 2001/02 (weight 0.25) and 2002/03 (weight 0.75) to estimate the number of cases in England in 2002. We then used the ONS 2002 Population Estimate for England as the denominator to calculate crude incidence rates and smoothed / interpolated to produce full individual-age rates.

The ICD10 codes selected either relate specifically to a recording of an incidence of hospital treated third degree burn or were of unspecified severity but to a significant part of the body; the codes do not specify the coverage of the body's surface area.

Whilst we expect there to be a strong correlation between the extent of body surface burnt and the sustaining of third degree burns, in attempting to match the model definition we recognise:

- Not all the third degree burns counted will meet the severity requirement in terms of area covered; indeed even some of the other 'significant area' burns category may not.
- Not all the 'significant area' burns counted will meet the severity of being of third degree.

To adjust for this we have estimated and applied a factor of 30% to the crude rates (see also similar adjustment in Fabrizio & Grattan[43]). This adjustment is highly subjective.

As burns of this severity are about as severe as can be survived, a proportion of the estimated incidence is thought overlap with TPD; we have allowed for an overlap of 14% up to age 17 rising linearly to 50% for ages 47 and above, recognising the general reduction in recovery and adaptive potential as age increases. This adjustment is highly subjective; say a range of 30% - 70% at age 50.

The resulting indicative rates are summarised in the table below:

Summary of Indicative Incidence Rates: Third Degree Burns							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**0.29**	**0.26**	**0.27**		**0.16**	**0.15**	**0.20**
as % of main CIs	2.7%	0.3%	0.1%		1.1%	0.2%	0.1%
Addition for Acc CI, $I_x - k_x.q_x$	**0.29**	**0.26**	**0.27**		**0.16**	**0.15**	**0.20**
as % of main CIs	2.7%	0.3%	0.1%		1.1%	0.2%	0.1%
TPD Reduction for Overlap	**-0.09**	**-0.12**			**-0.05**	**-0.07**	
as % of main CIs	-0.8%	-0.1%			-0.3%	-0.1%	

4.10.17 Traumatic Head Injury

4.10.17.1 Definition

The latest (SoBP April 2006[1]) ABI model definition is:

Traumatic head injury – *resulting in permanent symptoms*

Death of brain tissue due to traumatic injury resulting in permanent neurological deficit with persisting clinical symptoms.

4.10.17.2 Data Sources

- None used.

4.10.17.3 Derivation of Incidence Rates

Prior to the April 2006 revision to the ABI model definitions, death of brain tissue due to traumatic injury would have been covered under the Stroke definition. The exclusion of traumatic injury from the Stroke definition and the creation of a separate definition for Traumatic Head Injury were made to allow insurers a clear choice over whether to offer cover for 'stroke' due to 'traumatic head injury' or not.

The data used to derive incidence rates for Stroke does not differentiate between death of brain tissue (strokes) due to disease or to injury. Therefore the incidence of Traumatic Head Injury is included within the rates already derived for Stroke and, in context of CIBT02, no further addition is required.

Summary of Indicative Incidence Rates: Traumatic Head Injury							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Stand-Alone Rate, I'_x	**All Rates set to ZERO as included within calculated rates for Stroke**						
as % of main CIs							
Addition for Acc CI, $I_x - k_x.q_x$							
as % of main CIs							
TPD Reduction for Overlap							
as % of main CIs							

4.10.18 Summary of Other Commonly Covered CIs

The illustrative Stand-Alone CI incidence rates for the other commonly covered CIs considered are summarised in the table below. The estimated offsets against TPD (for overlap) and non-CI deaths (for additional acceleration of death benefits) are also shown, summed across the other CIs. The full, individual-age, rates and offsets are shown in Tables 10.2.1 to 10.2.6.

Summary of CIBT02 Incidence Rates for Other Commonly Covered CIs							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Alzheimer's Disease	0.00	0.53	41.08		0.01	0.55	32.87
Angioplasty (2+ arteries)	0.09	1.75	3.99		0.01	0.32	1.46
Aorta Graft Surgery	0.04	0.35	6.64		0.01	0.07	1.22
Benign Brain Tumour	0.11	0.24	0.38		0.08	0.20	0.35
Blindness	0.10	0.18	1.16		0.10	0.18	1.27
Coma	0.00	0.00	0.00		0.00	0.00	0.00
Deafness	0.05	0.09	0.44		0.05	0.09	0.47
Heart Value Replace / Repair	0.35	1.37	6.32		0.18	0.70	4.21
HIV Infection	0.00	0.00	0.00		0.00	0.00	0.00
Loss of Speech	0.00	0.00	0.00		0.00	0.00	0.00
Loss of Hands or Feet	0.07	0.30	1.51		0.02	0.11	0.61
Motor Neurone Disease	0.03	0.34	1.43		0.01	0.21	1.07
Paralysis of Limbs	0.23	0.09	0.14		0.10	0.07	0.15
Parkinson's Disease	0.03	0.71	8.71		0.02	0.49	5.16
Third Degree Burns	0.29	0.26	0.27		0.16	0.15	0.20
Traumatic Head Injury	0.00	0.00	0.00		0.00	0.00	0.00
Sub-total for Other CIs	**1.40**	**6.21**	**72.07**		**0.74**	**3.14**	**49.05**
TPD Reduction for Overlap	-0.37	-1.54	-2.73		-0.24	-1.13	-1.92
Extra for Stand-Alone CI	**1.03**	**4.67**	**69.34**		**0.51**	**2.01**	**47.13**
as % of Core Cover CIs	9.5%	5.2%	18.2%		3.5%	2.4%	19.9%
Reduction in Additional Deaths	-0.03	-0.34	-5.13		-0.02	-0.24	-3.99
Terminal Illness	0.03	0.19	1.87		0.02	0.10	1.42
Extra for Accelerated CI	**1.03**	**4.52**	**66.09**		**0.50**	**1.88**	**44.57**
as % of Core Cover CIs	9.5%	5.0%	17.3%		3.4%	2.3%	18.8%

4.11 The Full CIBT02 Tables

4.11.1 Formulae for Building CIBT02

4.11.1.1 Incidence Rates for Stand-Alone CI Cover

Stand-Alone rates, I'_x, are calculated by summing the equivalent rates for each CI covered:

$$\textbf{Stand-Alone CI for CIBT02} = \sum I'_x$$

where the I'_x are Stand-Alone incidence rates for each CI and the summation is over all covered CIs.

4.11.1.2 Incidence Rates for Accelerated CI Cover

Incidence rates for Accelerated CI cover have been determined by adding the rates for "additional deaths" to the Stand-Alone rates. These “additional deaths” have been calculated using the formula:

$$\text{Additional Deaths for CIBT02} = q_x + \sum [(I_x - k_x \,.\, q_x) - I'_x]$$

where the summation is over all covered CIs and the

q_x	are population all-cause mortality rates,
$I_x - k_x \,.\, q_x$	are the rates for Additional cost for Accelerated Cover for each CI, and
I'_x	are Stand-Alone incidence rates for each CI.

So,

$$\textbf{Accelerated CI for CIBT02} = \sum I'_x + q_x + \sum [(I_x - k_x \,.\, q_x) - I'_x]$$

$$= \sum I_x + (1 - \Sigma k_x).q_x$$

This approach is consistent with CIBT93 and with the rules for classifying cause of claim in the CMI CI experience analyses.

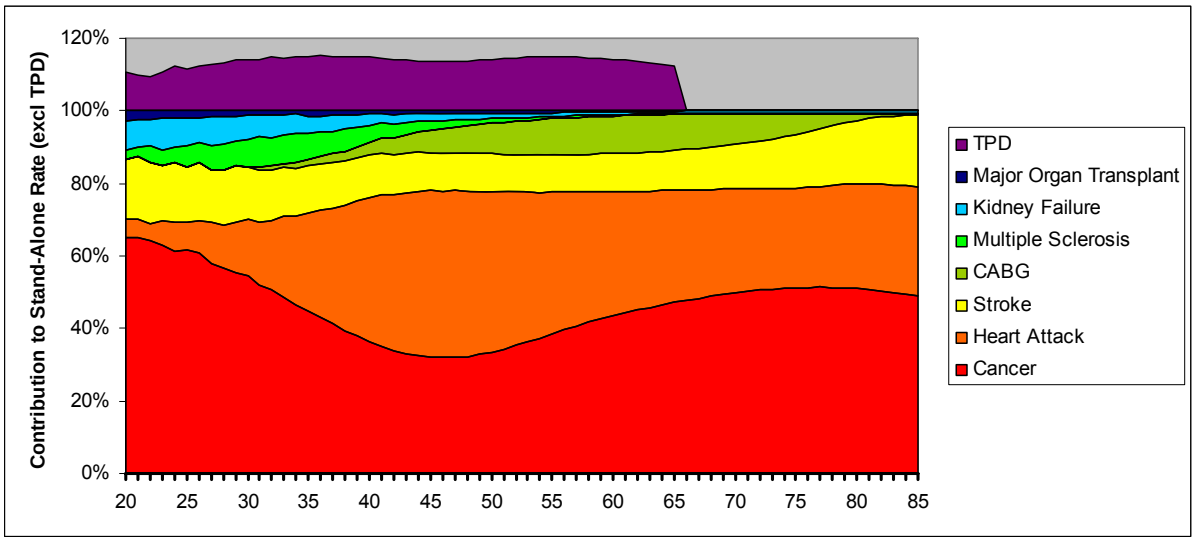
4.11.2 CIBT02 Core Cover

The build up of CIBT02 Core Cover Stand-Alone and Accelerated CI incidence rates, from the rates for the eight Critical Illness events covered in Sections 4.2 to 4.9, is summarised in the table below. The detailed, individual-age, component rates and totals are shown in Tables 10.3.1 and 10.3.2.

Summary of CIBT02 Core Cover Incidence Rates							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Cancer	4.6	29.1	181.7		7.7	43.6	124.6
Heart Attack	2.2	31.8	108.4		0.5	7.4	49.7
Stroke	1.3	8.2	48.4		1.1	5.6	35.9
CABG	0.1	6.9	28.0		0.0	1.1	6.6
Multiple Sclerosis	0.6	1.0	0.3		1.5	2.1	0.6
Kidney Failure	0.5	1.0	2.6		0.3	0.6	1.3
Major organ Transplant	0.1	0.4	0.2		0.1	0.3	0.1
TPD	1.3	11.4	11.7		3.3	22.7	17.7
Stand-Alone CI, I_x	**10.8**	**89.7**	**381.4**		**14.7**	**83.4**	**236.5**
Additional Deaths	8.5	22.7	157.1		3.0	7.3	101.3
Accelerated CI, $I_x+(1-k_x).q_x$	**19.4**	**112.5**	**538.5**		**17.6**	**90.6**	**337.7**
All-Cause Mortality	9.9	41.4	284.4		4.8	26.7	190.1

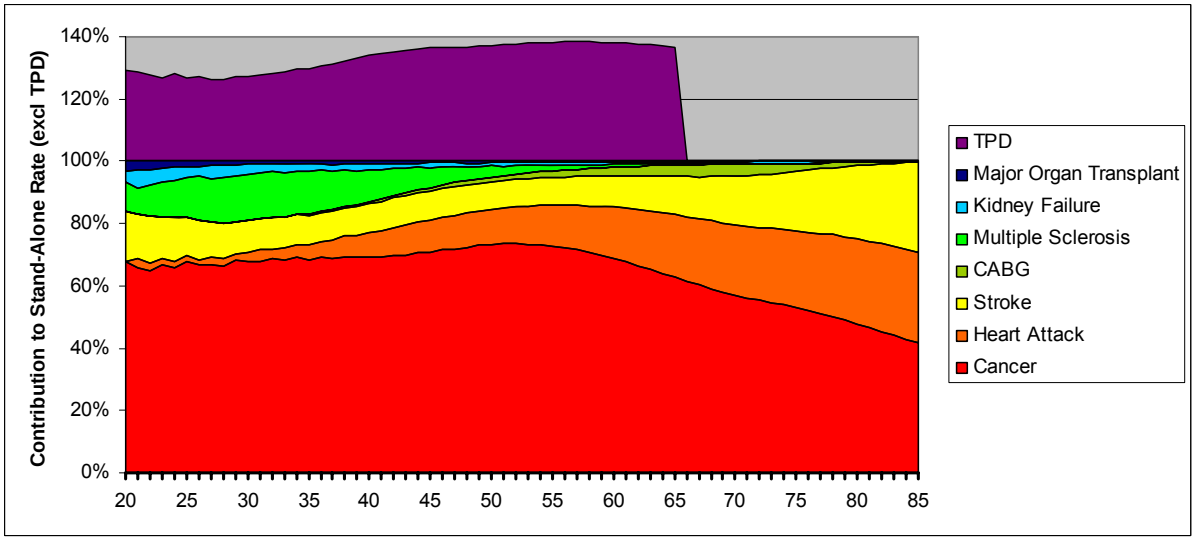
The following charts show the relative contribution of each CI covered to the total Stand-Alone incidence rate (excluding TPD to avoid a step change at age 65), by age and sex:

Contribution of each CI to CIBT02 Stand-Alone Rates (I') (excl TPD) - Males



For males, the chart shows the dominance of Cancer and Heart Attack, contributing around 70% of the Stand-Alone CI rate across most of the age range. TPD and Stroke each contribute around 10%. CABG accounts for most of the rest at middle and older ages, with MS and KF being more prominent in proportional terns at younger ages.

Contribution of each CI to CIBT02 Stand-Alone Rates (I') (excl TPD) - Females

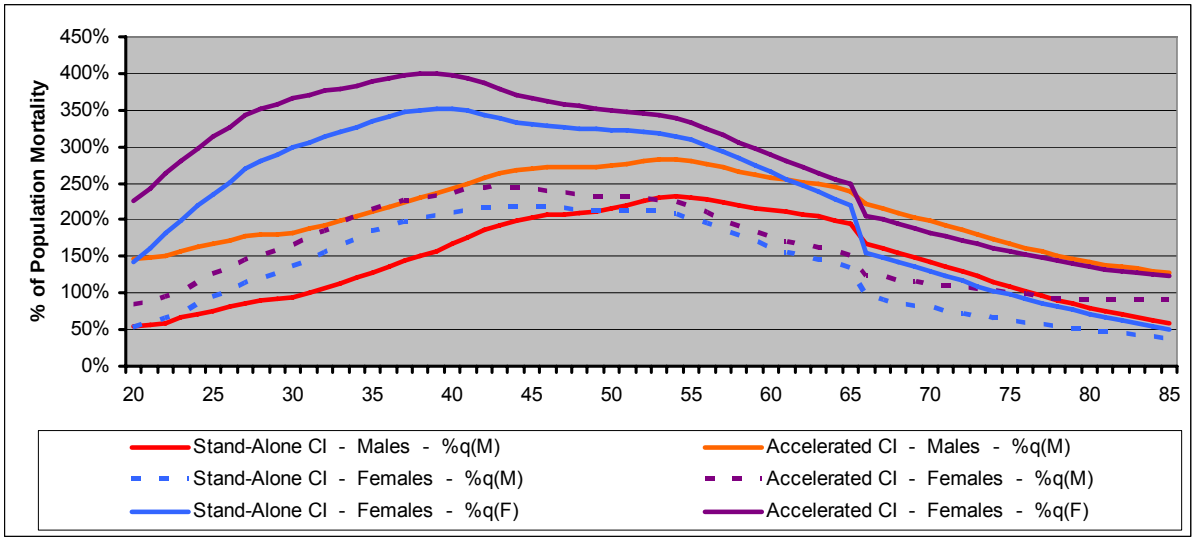


For females, Cancer is dominant contributing over 60% of the Stand-Alone CI rate for ages up to 60. Heart Attack and Stroke account for an increasing proportion as age increases but do not contribute significantly until age 50+; MS is a more important contributor at younger ages.

On the basis illustrated, TPD rates are the second biggest element of the Stand-Alone CI rate for females and proportionately much more significant for females than males. This arises through higher claim inception rates, for females than males, reported in Individual IP experience. However, it is not yet clear whether this gender differential seen in IP experience translates across to TPD.

4.11.3 Comparison of CIBT02 with Population Mortality

The following chart compares CIBT02 Stand-Alone and Accelerated CI rates with population mortality rates. The main comparisons match CI and mortality rates by gender, but the CI rates for females are also compared to mortality rates for males to allow a visual comparison of the four sets of CI rates, by gender and type of cover, against a common basis.



4.11.4 Analysis of Movement from CIBT93 to CIBT02

The following charts and commentary present a brief and summarised analysis of the change in overall Stand-Alone CI and Accelerated CI rates from CIBT93 to CIBT02.

The trend in Raw Observed Rates has resulted in increases of 1% to 2%pa at young ages and is modestly upwards, or at best neutral, for middle and older ages. The trend is generally more adverse (that is rising more quickly) for females than males.

However, other changes introduced to access more recent or better quality data, and to improve methodology, have resulted in non-trend movements from CIBT93 to CIBT02 of similar or greater magnitude than the real underlying trend. These other changes are not uniform by age and gender so do materially influence the shape of the final tables; overall we believe the greater depth and quality of information available for CIBT02, compared to CIBT93, should allow a little more confidence in the emerging shape of rates in the updated table

Overall Derived Incidence Rates have increased at most ages, with broad average increases of around 10% for males and nearer to 20% for females.

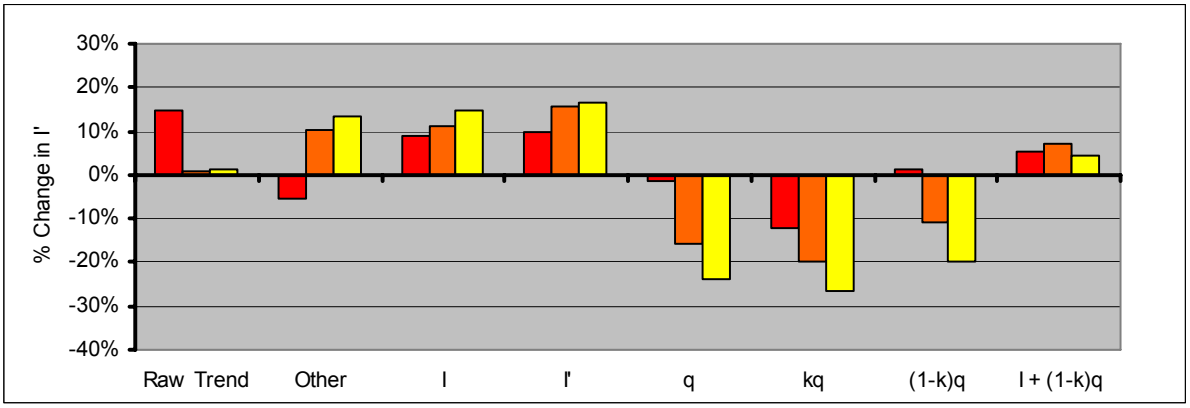
Stand-Alone CI rates have increased by a percentage point or two more than Derived Incidence Rates, reflecting falls in 28-day post-CI event mortality (in particular, sharp falls for Heart Attacks).

In contrast to the raw trend upwards in incidence rates, all-cause mortality rates have fallen significantly. The falls are largest at middle and older ages and generally more favourable (that is mortality rates decreasing more quickly) for males than females. Within this, at least for males, mortality has fallen more rapidly for CI-related causes (notably heart attacks and strokes) than for non-CI related causes.

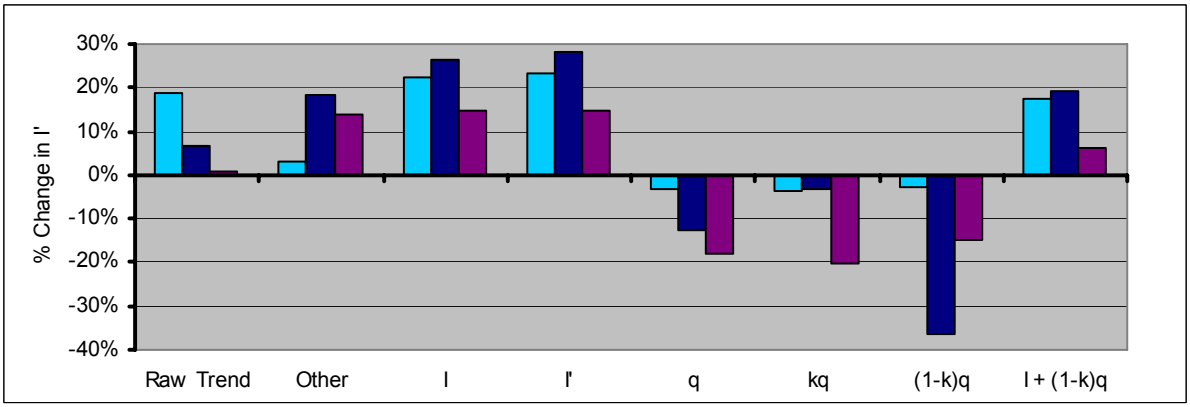
The rates for Accelerated CI benefit from falls in non-CI related mortality ($(1-\Sigma k).q$), so that they rise less than the Stand-Alone CI rates and the gap between Stand-Alone and Accelerated CI rates reduces.

Overall Accelerated CI rates have increased at most ages, with broad average increases of around 5% for males and nearer to 15% for females.

Components of Change Overall Stand-Alone and Accelerated CI Rates (I') - Males



Components of Change Overall Stand-Alone and Accelerated CI Rates (I') - Females



Male, 20-39; Male, 40-59; Male, 60-79; Female, 20-39; Female,40-59; Female, 60-79

The table on the next page gives shows the ratio of CIBT02 Core Cover to CIBT93 by CI, gender and 5-year age band.

Ratio of CIBT02 to CIBT93 by CI, gender and 5-year age band											
Age	**Cancer**	**Heart Attack**	**Stroke**	**CABG**	**MS**	**KF**	**MO**	**TPD**	**Total Stand-Alone CI**	**Additional Deaths**	**Total Accelerated CI**
	Males										
20-24	108%	163%	71%	-	100%	142%	100%	41%	**90%**	90%	**90%**
25-29	103%	162%	77%	-	105%	154%	100%	78%	**101%**	98%	**99%**
30-34	101%	116%	68%	125%	119%	187%	100%	130%	**104%**	106%	**105%**
35-39	100%	101%	65%	87%	119%	165%	125%	200%	**103%**	96%	**101%**
40-44	94%	113%	63%	96%	110%	190%	100%	240%	**106%**	92%	**102%**
45-49	93%	129%	76%	108%	95%	188%	83%	234%	**114%**	92%	**108%**
50-54	93%	127%	74%	113%	78%	225%	71%	209%	**111%**	79%	**103%**
55-59	101%	121%	75%	122%	62%	283%	72%	169%	**111%**	70%	**101%**
60-64	103%	128%	78%	153%	43%	482%	91%	128%	**112%**	67%	**100%**
65-69	99%	138%	97%	210%	31%	1097%	110%	109%	**114%**	73%	**101%**
70-74	99%	145%	104%	305%	19%	5278%	192%		**117%**	82%	**103%**
75-79	99%	156%	109%	424%	13%	-	-		**117%**	89%	**105%**
	Females										
20-24	103%	-	51%	-	116%	113%	100%	100%	**94%**	90%	**93%**
25-29	107%	157%	50%	-	128%	131%	100%	187%	**109%**	97%	**106%**
30-34	100%	116%	58%	-	140%	170%	100%	325%	**117%**	103%	**114%**
35-39	94%	138%	54%	167%	142%	162%	100%	498%	**117%**	94%	**114%**
40-44	93%	161%	59%	110%	129%	167%	100%	585%	**121%**	95%	**117%**
45-49	96%	149%	69%	150%	109%	200%	86%	532%	**125%**	88%	**120%**
50-54	100%	133%	71%	102%	85%	227%	83%	420%	**126%**	68%	**118%**
55-59	103%	120%	72%	111%	66%	335%	83%	300%	**124%**	57%	**114%**
60-64	99%	121%	75%	136%	45%	687%	109%	212%	**116%**	56%	**106%**
65-69	100%	128%	100%	180%	30%	1975%	100%	181%	**110%**	77%	**100%**
70-74	104%	134%	108%	249%	18%	-	-		**113%**	89%	**104%**
75-79	108%	145%	114%	376%	12%	-	-		**119%**	98%	**109%**
Note: Cells marked " - " have rate equal to zero in CIBT93 and so the ratio cannot be calculated											

4.11.5 CIBT02 Extended Cover

The build up of CIBT02 Extended Cover Stand-Alone and Accelerated CI incidence rates, from the rates for the eight CIs covered in Sections 4.2 to 4.9 and the 17 other commonly covered CIs, is summarised in the table below. The detailed, individual-age, rates and totals are shown in Tables 10.3.3 and 10.3.4.

Summary of CIBT02 Extended Cover Incidence Rates							
Rates per 10,000 lives	Males				Females		
Age Band	20-39	40-59	60-79		20-39	40-59	60-79
Cancer	4.6	29.1	181.7		7.7	43.6	124.6
Heart Attack	2.2	31.8	108.4		0.5	7.4	49.7
Stroke	1.3	8.2	48.4		1.1	5.6	35.9
CABG	0.1	6.9	28.0		0.0	1.1	6.6
Multiple Sclerosis	0.6	1.0	0.3		1.5	2.1	0.6
Kidney Failure	0.5	1.0	2.6		0.3	0.6	1.3
Major organ Transplant	0.1	0.4	0.2		0.1	0.3	0.1
sub-total	**9.4**	**78.4**	**369.6**		**11.2**	**78.4**	**369.6**
Alzheimer's Disease	0.0	0.5	41.1		0.0	0.6	32.9
Angioplasty (2+ arteries)	0.1	1.7	4.0		0.0	0.3	1.5
Aorta Graft Surgery	0.0	0.4	6.6		0.0	0.1	1.2
Benign Brain Tumour	0.1	0.2	0.4		0.1	0.2	0.4
Blindness	0.1	0.2	1.2		0.1	0.2	1.3
Coma	0.0	0.0	0.0		0.0	0.0	0.0
Deafness	0.0	0.1	0.4		0.0	0.1	0.5
Heart Value Replace / Repair	0.4	1.4	6.3		0.2	0.7	4.2
HIV Infection	0.0	0.0	0.0		0.0	0.0	0.0
Loss of Speech	0.0	0.0	0.0		0.0	0.0	0.0
Loss of Hands or Feet	0.1	0.3	1.5		0.0	0.1	0.6
Motor Neurone Disease	0.0	0.3	1.4		0.0	0.2	1.1
Paralysis of Limbs	0.2	0.10	0.1		0.1	0.1	0.2
Parkinson's Disease	0.0	0.7	8.7		0.0	0.5	5.2
Third Degree Burns	0.3	0.3	0.3		0.2	0.2	0.2
Traumatic Head Injury	0.0	0.0	0.0		0.0	0.0	0.0
sub-total	**1.4**	**6.2**	**72.1**		**0.7**	**3.1**	**49.1**
TPD	1.0	9.8	9.0		3.1	21.6	15.8
Stand-Alone CI, I_x	**11.9**	**94.4**	**450.7**		**15.1**	**85.4**	**283.6**
Terminal Illness	0.0	0.2	1.9		0.0	0.1	1.4
Additional Deaths	8.5	22.4	152.0		3.0	7.0	97.3
Accelerated CI, $I_x+(1-k_x).q_x$	**20.4**	**117.0**	**604.6**		**18.1**	**92.5**	**382.3**
All-Cause Mortality	9.9	41.4	284.4		4.8	26.7	190.1

5 CMI CI Experience - TO FOLLOW

CMI CI quad 1999-2002 experience against CIBT93, incl by CI
CMI CI quad 1999-2002 experience against CIBT02, incl by CI
Observations and Conclusions

6 Practical Applications of CIBT02

As an updated benchmark the population table CIBT02 does have its uses as well its limitations which are discussed in section 6.1. What we really want however, and we suspect so do you, is an insured lives table. Some ideas on methods to adjust CIBT02 so that it is more relevant for insured lives are discussed in section 6.2. We confine ourselves to techniques, thoughts and suggestions of information that could assist in moving CIBT02 towards an insured lives table. The adjustments that might be made to CIBT02 to convert it into an insured lives table are subjective and there is no single definitive answer. We have not therefore suggested an insured life table and it is doubtful that even within our group we would have been able to agree on a table for insured lives.

6.1 CIBT02 – Interpretation and Use in Practice

From our investigations into trends in incidence and mortality rates we know that since the early 1990s trends have been different for different conditions. Within each condition trends are also different for different ages, sexes and for incidence and mortality. This variation in trends by condition, age and gender was one of the reasons that we felt an update to CIBT93 was needed. Using CIBT93, which uses 1993 as a base year, as a benchmark to interpret up-to-date industry experience could be leading to mistaken conclusions.

For example, a rise in the incidence in the population of one condition, such as cancer for females, might be expected to also lead to higher incidence rates for insured lives if the increase in incidence was due to earlier diagnosis. Claims ratios, where the expected is a constant and out of date CIBT93, and the actual claims are insured experience would therefore be expected to increase over time. Increasing claims ratios would be consistent with higher incidence due to earlier diagnosis but might be mistaken for a deterioration in underwriting standards if calendar year effects are not understood.

If calendar year effects are not also taken into account trends can also lead to the impact of initial selection being under or overstated especially when combined with an increasing portfolio of business. Similarly not understanding how trends differ by age and gender could lead to mistaken conclusions about why insured lives claims ratios vary by these factors.

CIBT02 is based on the most up-to-date and relevant data we could find. But many assumptions and adjustments where necessary to construct the table as the data was not of consistently good quality and relevance. CIBT02 is more up-to-date than CIBT93 but as a consequence of imperfect data it still has its limitations which are described below. Many of these problems also applied to CIBT93.

6.1.1 Interpreting Results of Insured life Experience using CIBT02

6.1.1.1 By Condition

A number of different data sources were used in the production of CIBT02. The quality and the level of detail of the data available for different conditions varied. The level of approximation or degree of error for different conditions will therefore differ. For example, the incidence rates used for cancer are of good quality, covered both England and Wales, were available in age bands for both males and females and few additional assumptions where needed to derive the cancer rates. By contrast the statistics available for MS came from a single regional study, where for wide ages bands, where not gender specific and needed a quite a heroic assumption to estimate how the data should be adjusted to be appropriate for the UK. Our degree of confidence and the expected level of error in the rates for these two conditions is very different.

If the ratios of insured experience compared to CIBT02 vary by condition this may be because there is a real difference between conditions in terms of the impact that underwriting has on the emerging experience. Another possible explanation is that CIBT02 has a greater error for one condition than the other. Possible examples of this effect in action are:

- Compare CMI experience for multiple sclerosis (MS) to CIBT93. For MS the ratios of actual versus expected are higher than for most other conditions. This may imply that underwriting is less effective for MS than other conditions, or it may imply that that CIBT93 understated the population incidence of MS compared to other conditions.

- The rates in CIBT02 for TPD are derived from insured life data not population data as for all other conditions. It might be reasonable to expect the ratios of actual versus expected for insured experience against CIBT02 to be higher for TPD than other conditions as both the actual and expected will relate to underwritten lives. In fact an actual versus expected of 100% might be expected for TPD but 100% would be a surprise for heart attack where insured experience for heart attack is expected to be lower than in the population. The difficulties that we had deriving rates for TPD are explained in Section 4.9.

6.1.1.2 Base Year

All the data used in CIBT02 was applicable to 2002 or was an average of the data centred on 2002. If using the table to understand experience from prior or later calendar years, the trends in the incidence rates over time should be allowed for. Historical trend factors for the population are discussed in detail in Section 2.

6.1.1.3 IBNR / IBNS

The CMI has issued useful guidance in respect of allowing for IBNR/IBNS for insured lives. Certainly allowance needs to be made in insured experience for late reported or settled claims.

In constructing the base table adjustments for late reporting of incidence or death were not considered necessary. The data for most sources is reported quickly and the datasets are fairly final before publication. Some data sources are subsequently updated but the number of late reported events is minimal.

6.1.1.4 Using CIBT02 to Help Form Views about Insured Experience at Older Ages

CMI data is sparse above age 50 and there is little insured data to help form a view on rates over this age. One of the aims of CIBT02 was to closely reflect the shape of population rates by age. This is one of the pieces of information that can be helpful when estimating the shape of rates at older ages for insured lives. See section 6.2.1.

We have had partial success in our aim. CIBT02 covers ages up to 80 but above this age most data sources only provided grouped data. There is therefore a large degree of uncertainly about the estimation of the age, over 80, to which the data applies. In addition some of the other assumptions by age were very approximate e.g. assumptions for sudden death rates or adjustments for overlaps with other conditions that did not vary by age. Some of our checks on the prevalence of conditions implied by our population incidence and mortality rates showed far higher prevalence than we had assumed. That is, especially at older ages, the prevalence that we modelled based on our rates was higher than we had assumed in our calculations based on the data that we could find. This could imply an underestimation of the population incidence rates at older ages.

6.1.2 Comparing CIBT93 to CIBT02

In producing a more up-to-date population table one of the group's intentions was that a comparison of CIBT93 to CIBT02 would provide a useful summary of the trends in incidence over the time period in question. This comparison however is not helpful when interpreting trends because the same data sources are not used in both tables.

Better quality or more detailed data is now available for many of the conditions and for others the sources used no longer exist or have not been updated. (The analysis of the change in incidence rates between CIBT93 and CIBT02, under each CI in Section 4, gives more detail.) As the data sources are not consistent for some conditions a significant part of the change is not due the change in the underlying incidence but is due to a restatement of data.

No conclusions can therefore be drawn about the overall change in incidence in the population between 1993 and 2002 by comparing the two base tables. They are simply two different benchmarks intended for different calendar years.

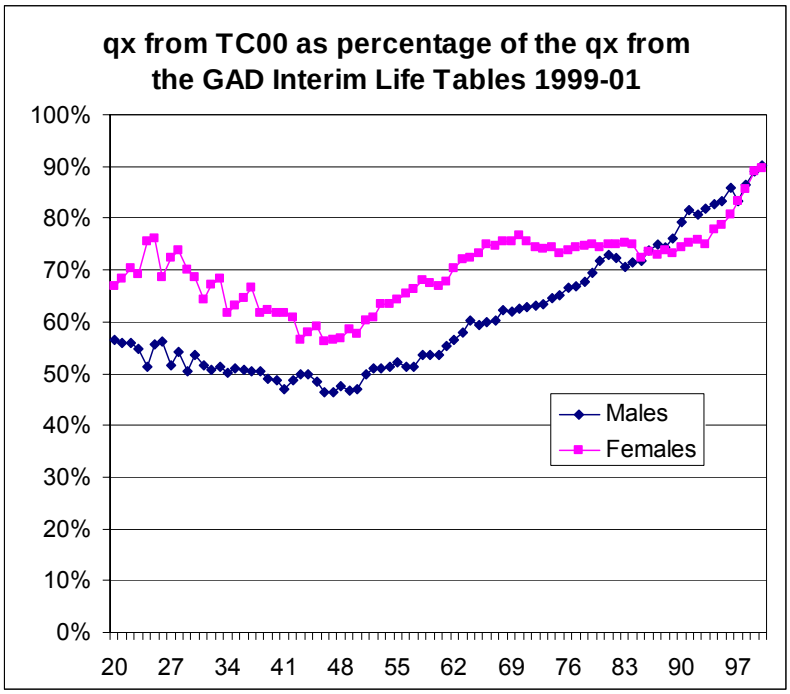
6.2 What We Want Is An Insured Lives Table!

There is only limited insured life experience data published for critical illness. The data mostly relates to very early durations and a limited age range. The CMI critical illness working party decided that it was not appropriate to graduate the data that they have to this point, (CMI Working Paper 14 - Methodology underlying the 1999-2002 CMI Critical Illness experience investigation). As well the limitations of industry data in terms of its maturity and age range, there is insufficient data to produce meaningful graduations by condition.

The population table CIBT02 is broken down by condition and covers a reasonable age range. CIBT02 could therefore be used as a starting point to generate an insured lives table. To do this all the factors that impact incidence and mortality and that vary between insured lives and the population need to be identified and assessed. The aspects covered below are the impact of underwriting, socio-economic group, smoking and geographic region.

6.2.1 Comparison of Insured versus Population Mortality

There is very good quality information regarding mortality rates in the UK population. This can be compared to insured life mortality tables, such as the latest tables adopted by the profession, the 00 series. An example of the ratio of insured mortality for permanent and term assurances, TM/F00, compared to population mortality for the comparable calendar year, the government actuaries department (GAD) interim population tables, is illustrated in the chart below. Duration 5+ mortality, assumed to be ultimate mortality, is shown for TM/F00.



The ratio of insured versus population mortality tends to increase with age and is usually lower for males than for females.

These ratios could be assumed to be the same for critical illness and applied to CIBT02 in order to derive an insured life table. For this assumption to be valid the following would also have to be true.

- The impact of initial selection following underwriting would have to be the same for mortality and critical illness in terms of both its absolute impact and its duration.
- The socio-economic mix of insured lives would need to be the same for people who buy life cover and people who buy critical illness cover. Also the difference in incidence rates by socio-economic group and the difference in mortality rates by socio-economic group would need to be the same. Or the combined effect of any difference in rate by socio-economic group and the mix by socio-economic group could fortuitously balance out.

- The experience of mortality and morbidity varies by office so, if the first point above was true, then the same offices would need to write critical illness as mortality and write it in the same proportions.

Therefore we believe that the ratios derived for insured versus population mortality would only be appropriate to use to derive an insured life table for the offices who write critical illness business by chance.

The CMI has published insured life data for CI and Section 5 describes the results of the comparison of CMI data to CIBT02 in detail. **Graph 2** illustrates ratios comparable to the ones shown for mortality. Duration 2+ has been used for insured critical illness experience. Less is known, however, about the duration of any initial selection for critical illness than mortality. If the select periods are not 2 years for critical illness and 5 years for mortality then this could be one reason why the ratios in graph 1 and graph 2 are different.

INSERT GRAPH 2

Other reasons are socio-economic effects and different mixes or weights of business by office. Another important consideration is delays in claim reporting and settlement. The insured mortality tables are assumed to include the majority of late reported claims. Insured critical illness experience published so far by the CMI needs adjustment for late claims. The CMI has provided some information regarding late reported or settled claims to assist in determining an appropriate adjustment.

Insured data is very limited over 50 and the shape of CIBT02 at older ages should be of some assistance in determining rates at old ages. For the reasons explained above, it would be invalid to assume that that ratio of insured versus population critical illness experience at older ages will be the same as for mortality. For similar reasons it is probably not appropriate to assume that the ratios of insured versus population rates at older ages for critical illness will be the same as at younger ages. The impact of underwriting could be different at different ages even when the significance of different conditions is at different ages is taken into account. This certainly seems to be the case for mortality where the level of initial selection varies by age. There is also some CMI data, although a little out-of-date, that shows the degree of initial selection varies by cause of death for mortality. As the significance of a condition will vary by age then it is likely that the selection discount will vary by age as well.

To obtain rates for older assured lives some assumptions will be needed. The ratios for critical illness should be adjusted for IBNR/IBNS. Assumptions or adjustments for socio-economic group and mix of office effects are needed. The differences between the ratios (insured versus population) for critical illness and mortality across the age ranges where there is data for both can help inform the judgements needed.

6.2.2 Impact of Deprivation Category on Incidence and Mortality

About 20% of people in the UK have critical illness cover. Similar to other types of life insurance there is thought to be a higher take up of critical illness insurance amongst people in higher socio-economic groups than amongst lower socio-economic groups. The differentials in mortality by socio-economic group are well publicised but the differentials in incidence of conditions such as cancer and heart disease are not as well documented.

To allow for the different socio-economic mix in the insured population compared to the population as a whole, assumptions are needed regarding the mix by socio-economic group in the insured population and the impact on incidence and mortality of socio-economic group. Information is not available directly on the impact of socio-economic group but data from Scotland is available that shows incidence and mortality by deprivation category, (see Section 8.6 for a full description of the data).

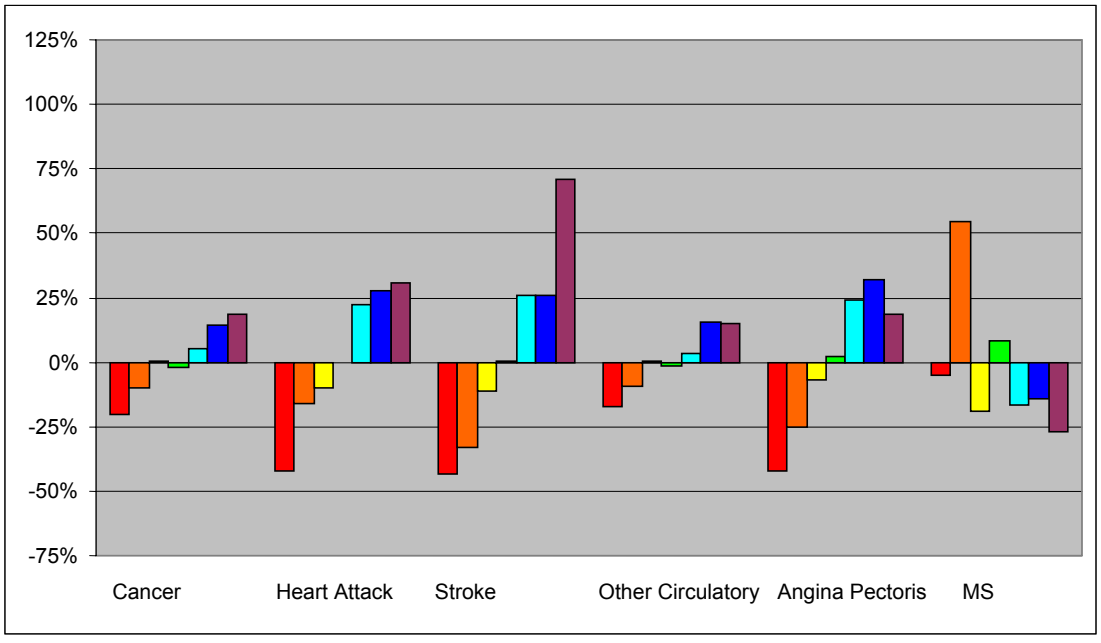
The deprivation category used is based on the Carstairs and Morris index (see Section 8.6.6). The population is categorised into seven groups from deprivation category 1 the most affluent group to deprivation category 7 the most deprived group.

To describe the differences in incidence or mortality for different deprivation categories, we have focused on the correlation between incidence or mortality and deprivation category for each major condition. Positive correlation is where the most affluent groups have a lower incidence or mortality rate compared to the most deprived groups, the pattern you may expect. Negative correlation is where the most affluent groups have the highest incidence or mortality rate compared to the most deprived groups. There are also some conditions for which there is no clear pattern.

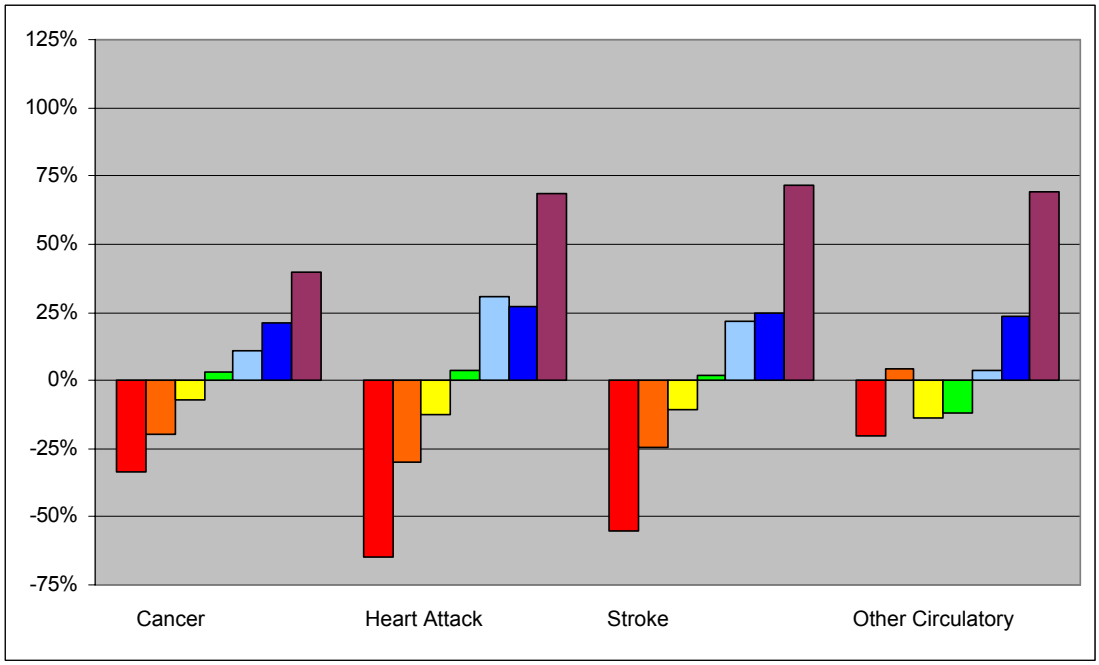
For each deprivation category, the level of the incidence or mortality rate can be compared to the overall rate. Graphs 1 to 4 below illustrate the comparison of the incidence or mortality rate for each condition to the overall rate for all deprivation categories combined. The slope of the bars indicates if the correlation is positive, (height of the bars increases with increasing deprivation category), negative, (height of the bars reduces with increasing deprivation category), or, inconclusive, (no clear pattern).

The bar charts in graphs 1 to 4 use red for the most affluent group through to purple the most deprived group. For each deprivation category the excess or reduction in the rate compared to the all category rate is shown as a percentage. The age group 40-59 is used being the key insured age group.

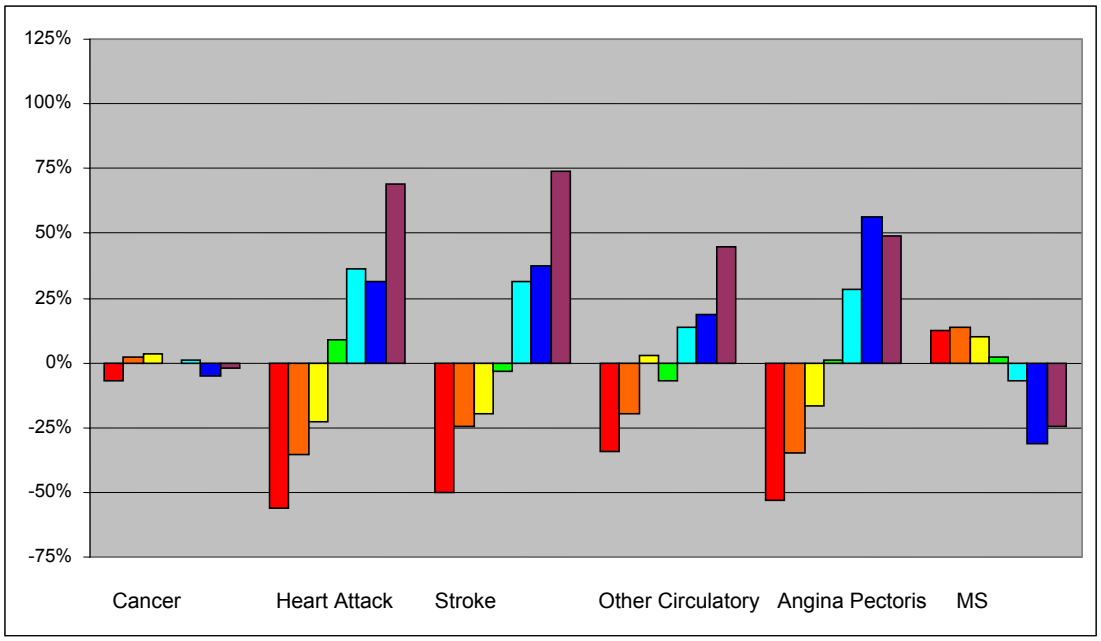
Graph 1: Relative Critical Illness Incidence Rates by Deprivation Category Scotland, 2001-2004, Ages 40-59, Males



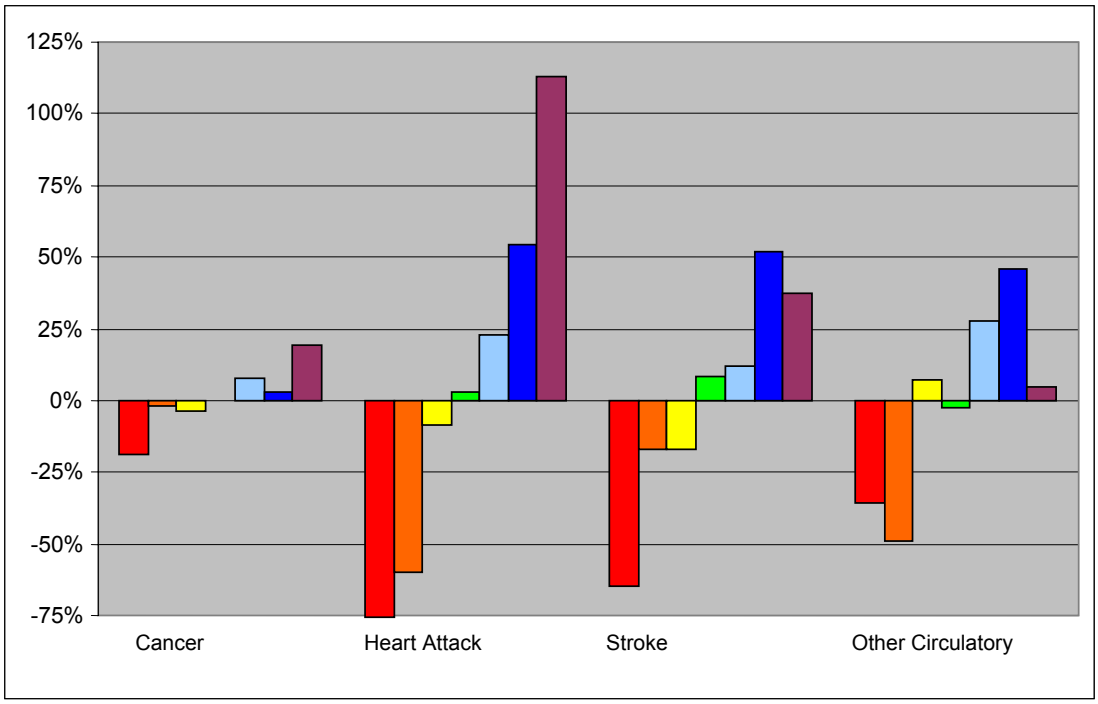
Graph 2: Relative Mortality Rates by Deprivation Category Scotland, 2001-2004, Ages 40-59, Males



Graph 3: Relative Critical Illness Incidence Rates by Deprivation Category Scotland, 2001-2004, Ages 40-59, Females



Graph 4: Relative Mortality Rates by Deprivation Category Scotland, 2001-2004, Ages 40-59, Females



Heart attack and stroke show a strong positive correlation by deprivation category for both mortality and incidence. Similarly other circulatory conditions have a positive correlation for incidence and mortality. The positive correlation seems to be a feature of circulatory disease with the incidence of angina also showing a positive correlation. Generally the correlations are stronger for mortality than incidence. The reasons for these correlations are thought to be variations in the main risk factors, smoking and diet, by deprivation category.

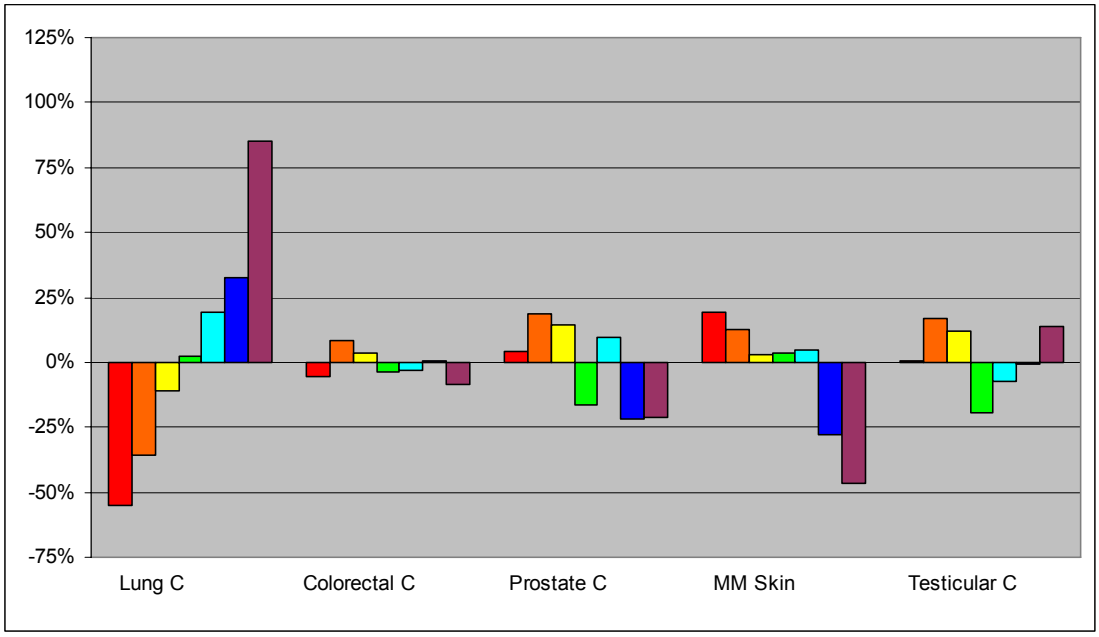
The risks of heart attack, stroke and other circulatory conditions are all significantly higher for smokers than non-smokers. Smoking varies from 14% in the most affluent group to 41% in the most deprived group (Table 6.80, p152, Scotland's People: results from the 2005 Scottish Household Survey).

Poor diet can lead to high cholesterol levels and increased risks of heart attack and strokes. Consistent and direct information on diet and cholesterol levels by deprivation category is difficult to obtain but we do have the prevalence of obesity which is known to be a risk factor for heart attack. Obesity is defined as having a Body Mass Index (BMI) above 30. The prevalence (Source: Scottish Health Survey 2003) is lower in the most affluent group and highest in the least affluent group (19.6% to 25.5% for male, 21.0% to 32.1% for female) – a stronger gradient for women than men. Interestingly, the prevalence of being overweight (BMI between 25 and 30) is in the opposite direction. The prevalence of overweight males, from affluent to least affluent, goes from 47.5% to 35.4% for males and 33.2% to 30.5% for females. However, the prevalence of obesity is the more important factor, outweighing the importance of the prevalence of being overweight in terms of heart attack risk. Overall the risk of heart attack is higher in the most deprived groups.

For females multiple sclerosis has a negative correlation with deprivation category. The relation is not conclusive for males but does seem to be more negative than positive. As the numbers are relatively low in each subgroup and, for MS, are not true incidence rates but rather first hospitalisation rates, it is difficult to draw firm conclusions. We could speculate that people in more affluent groups may be hospitalised earlier, especially perhaps women who arguably are less likely to be cared for at home.

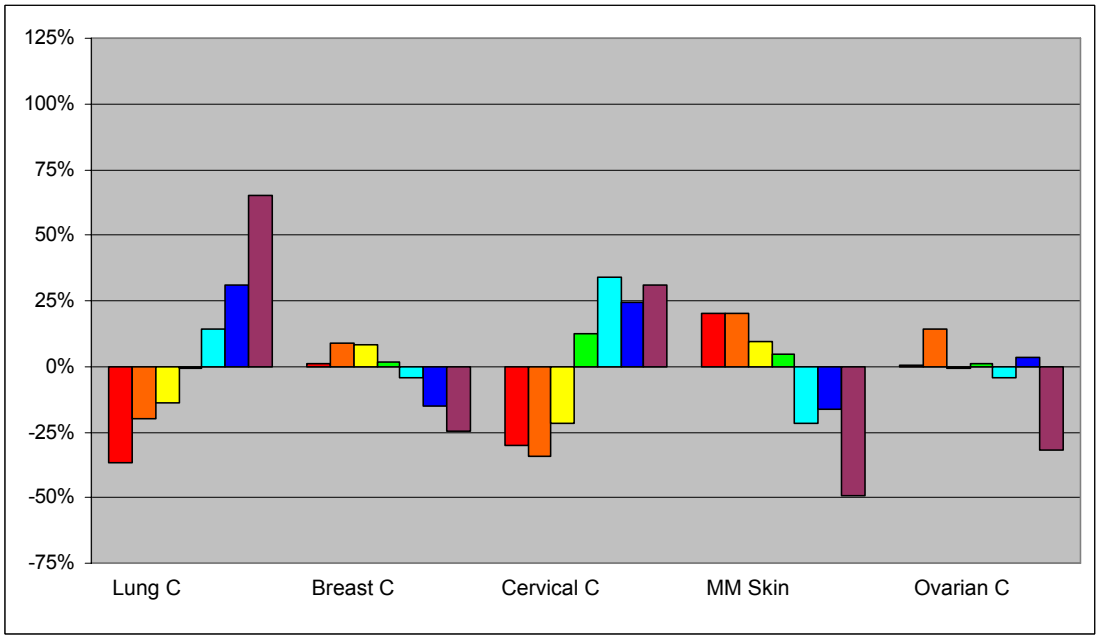
Cancer also shows a positive correlation with deprivation category, except for incidence rates for females, but the correlations are not as strong as for heart attack and stroke. Correlations for cancer are more noticeable for mortality than incidence but, for cancer, are relatively weak for females compared to males. For females, there is no correlation between the incidence of cancer and deprivation category. The link between incidence and deprivation category is less clear for cancer when we consider cancer by primary tumour site (graphs 5 and 6)).

Graph 5: Relative Cancer Incidence Rates by Deprivation Category Scotland, 2001-2004, Ages 40-59, By Primary Tumour, Males



For males, lung cancer (graph 5), is the only condition what shows a clear positive correlation. Smoking has been demonstrated to be a very significant risk factor for lung cancer. As the prevalence of smoking is higher in more deprived groups it is therefore not surprising that such a strong positive correlation exists. Prostate cancer shows a negative correlation perhaps because of the greater awareness or access to PSA testing for prostate cancer amongst more affluent groups. Malignant melanoma (MM Skin) also shows a negative correlation. The links between incidence and deprivation category for the other main cancers for males are inconclusive.

Graph 6: Relative Cancer Incidence Rates by Deprivation Category Scotland, 2001-2004, Ages 40-59, By Primary Tumour, Females



Females have a similarly strong correlation between the incidence of lung cancer and deprivation category as for males, again linked to smoking habits. There is also a clear positive correlation for

cervical cancer. Females have a negative correlation for the incidence of breast cancer and malignant melanoma (MM skin) but the relationship between deprivation category and the incidence of ovarian cancer is not conclusive.

Summary Table of Correlations by Condition

	Males		Females	
Condition	Incidence	Mortality	Incidence	Mortality
Heart Attack	Positive	Positive	Positive	Positive
Stroke	Positive	Positive	Positive	Positive
Other circulatory	Positive	Positive	Positive	Positive
Angina Pectoris	Positive	n/a	Positive	n/a
Multiple Sclerosis	Negative	Inconclusive	Negative	Inconclusive
Lung Cancer	Positive	Positive	Positive	Positive
Breast Cancer	n/a	n/a	Negative	Inconclusive
Cervical Cancer	n/a	n/a	Positive	Positive
Malignant Melanoma	Negative	Inconclusive	Negative	Inconclusive
Ovarian Cancer	n/a	n/a	Inconclusive	Inconclusive
Colorectal Cancer	Inconclusive	Positive	Inconclusive	Positive
Prostate Cancer	Negative	Negative	n/a	n/a
Testicular Cancer	Inconclusive	Inconclusive	n/a	n/a

6.2.3 Impact of Geographic Region on Incidence and Mortality

CIBT02 is based on cancer incidence for England and Wales and the majority of the rest of the incidence data is derived from HES which applies to England only. If an insured life table for the whole of the UK is needed, CIBT02 would need to be adjusted. England represents 84% of the total population and so it will be reasonably representative but it is known that, for example, mortality due to heart attack and cancer is higher in Scotland than England.

Some of the differences will be explained by regional differences in socio-economic mix in the population. Information on the mix of the population of the UK by deprivation category is available (see **graph 3g** in section 3.1.3). So it is possible to estimate some of the variation in incidence and mortality rates by region based on the weight of different deprivation categories for those regions. Not all regional differences can be explained by different mixes of deprivation category. We expect other factors such as NHS services, diet, alcohol consumption, ethnicity and smoking prevalence to also impact rates.

For other conditions the data that we have is not strictly comparable between regions. For example, HES are hospital based episode statistics (section 8.5) whereas the Scottish data, ISD, (section 8.6) are based on first hospitalisation in the investigation period with sudden deaths added in. So for example HES for stroke, will include counts for each time someone who has suffered a stroke is admitted to hospital even if it is the same stroke but will not include people who die from stroke outside of hospital. ISD will only count the first time that someone visits a hospital, although a second stroke that leads to a new admission to hospital would be counted, and will also include deaths outside of hospital. HES and ISD therefore are not comparable and many assumptions would be needed to try and adjust the two sets of data to a consistent basis. The validity of any such comparison would therefore depend on the quality of the assumptions to such an extent as to make the comparisons uninformative.

6.2.4 Estimating Rates for Non-smokers and Smokers

CIBT 02 is based on the population aggregate for smokers (with varying habits in terms of the number of cigarettes smoked, their tar levels and the duration of their habit), ex-smokers (with varying lengths of times since they quit smoking) and never smokers. For an insured lives table we need smoker specific rates that match the definitions of non smokers and smokers applicable for insured lives.

Smoker and non-smoker rates can be estimated using the relative risk of incidence for smokers compared to non-smokers for each condition and the proportion of smokers and non-smokers in the population.

That is solve for ix (NS) in the following equation, assuming that the other unknown variables can be estimated.

$$i_x\,(pop) = i_x\,(NS) \times Prop_x\,(NS) \;+\; RR_x \times i_x\,(NS) \times Prop_x\,(S)$$

i_x (pop) = the incidence rate at age x of a condition from CIBT02
i_x (NS) = the incidence rate at age x of a condition for a non-smoker
RR_x = the relative risk of incidence at age x of a condition for a smoker compared to a non-smoker
$RR_x * i_x$ (NS) = the incidence rate at age x of a condition for a smoker
$Prop_x$ (NS) = the proportion of non-smokers in the population at age x
$Prop_x$ (S) = the proportion of smokers in the population at age x

The proportion of smokers and non-smokers in the population need to be estimated at each age (band) for both males and females. Assumptions regarding the relative risks of smoking are needed for males and females at each age (band), for each condition.

The Office of National Statistics regularly publishes smoker prevalence statistics. The prevalence data is based on a large sample of adults being interviewed, (13,000 addresses selected each year from the postcode address book), which provides a credible and reliable source. The data is split into age groups and by gender and is based on self reported smoking habits.

For any year it is therefore possible to estimate the proportion of non-smokers (that is never smokers and ex-smokers) and smokers in the population. For insured lives, non-smokers should only include ex-smokers who have given up for at least one year at commencement of their policy. But realistically non-smokers will also include ex-smokers who have lapsed and gone back to smoking and people who have non-disclosed their smoking habits. Smokers should not include very heavy smokers who would be rated. It is possible to estimate for males and females, for each age band, the proportion of the population who would be classified as smokers and the proportion who would be classified as non-smokers in an insured portfolio.

There are many studies into the impact of smoking on mortality but there are fewer on the impact on the incidence of different conditions. There are some medical studies available but these are often not ideal as they only relate to a small sample size, they may relate to some time too far in the past or not tie in exactly with the conditions that we are interested in. (E.g. they may relate to heart disease generally rather than heart attack specifically.) Importantly they are often not large enough to give age gender specific results and may also be based, on average, on lives much older than the ages that are important for an insured portfolio. Different studies can also give significantly different relative risk ratios.

Some examples of the types of sources and the relative risks stated are given below:

Lung Cancer
Smokers of 14 to 25 cigarettes per day have a death rate 13 times that of a non-smoker. Doll and Peto: BMJ 1976.

Stroke
Tobacco smoking increases the risk of stroke about three-fold. There is a strong relationship between the number of cigarettes smoked and increased risk. Those smoking less than 10 cigarettes a day have a relative risk of stroke of about 2.5. Those who smoke more than 20 a day have relative risk of about four. Pipe and cigar smokers have about a two-fold increase. The Stroke Association.

Heart Attack
Overall a smoker has two to three times the risk of having a heart attack than a non-smoker. Doll and Peto: Mortality in relation to smoking: 40 years' observations on male British doctors: BMJ 1994.

The lack of refinement in the assumptions regarding the relative risks are potentially significant in terms of the smoker and non-smoker rates derived. Inaccuracies in the assumptions in relative risk are likely to outweigh those in the estimation of the prevalence of smokers and non-smokers in the population.

6.2.5 Impact of Underwriting

One of the main differences between insured lives and the population is of course that insured lives will have been underwritten. Emerging industry experience published by the CMI gives some indication of the potential effect of underwriting on incidence of critical illness and on non critical illness mortality. Industry experience provides support for a select period but it is too immature for the depth of selection and especially the duration of the initial selection to be confirmed. The depth and duration of the select period appears to vary by condition. See Section 5.

Examining the select pattern of mortality by cause of death can provide some additional insight into the select period by condition for critical illness. For example, if someone dies from cancer two years into a policy we know that this would have been a critical illness claim at some point before this.

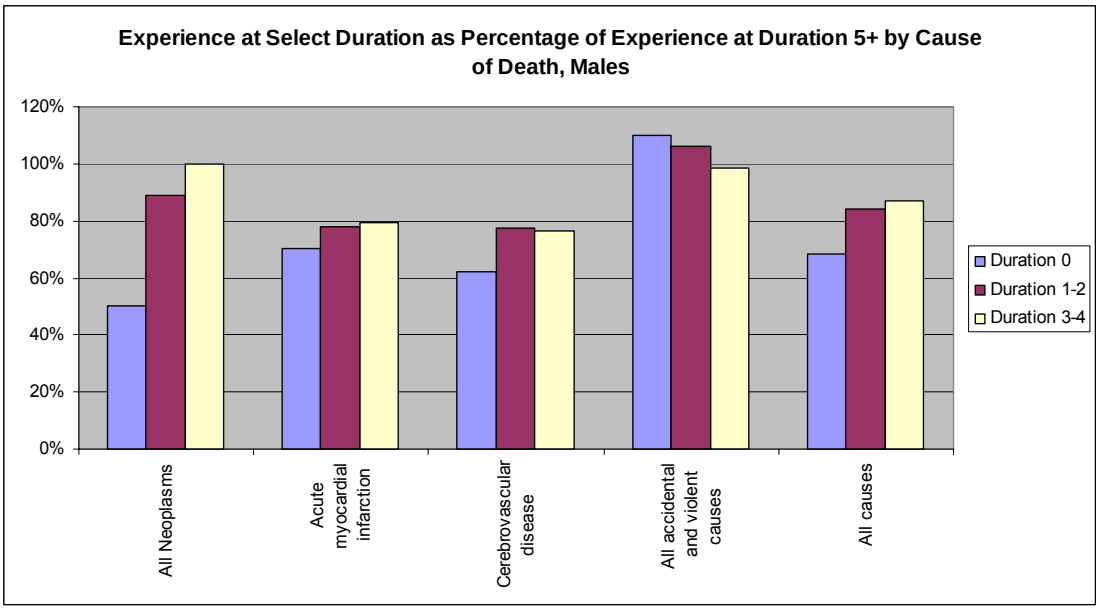
The select patterns for mortality by cause of death are interesting but not directly applicable to critical illness. Generally the profile of lives in the pool of standard lives for mortality cover will be different to the profile of lives in the critical illness standard pool. For example, even if the same application form is used for a mortality cover and critical illness, (often more questions are asked for critical illness cover than life cover), the underwriting decision may be different for critical illness than mortality cover. A higher proportion of people are typically rated or offered special terms for critical illness than mortality. Other effects such as socio-economic profile, the impact of generally lower medical limits for critical illness than mortality, will also have an impact on selection.

Unfortunately the only industry data on mortality by cause is quite old, pre 1995, and this investigation by cause of death has been discontinued. From our investigation into trends we know that some causes of mortality, such a heart attack, have fallen substantially over the 1980s and 1990s. Incidence rates for heart attack have taken a different path and have not fallen as much, so it is difficult to interpret how relevant historic death by cause selection patterns might be for a current insured life table. The causes of death used also do not always correspond closely to critical illness condition. Lastly the experience by cause at early durations is only available for all ages combined. The degree of selection varies by age for mortality, perhaps partly due to different causes of death being more or less significant at some ages. It is less clear if the degree of selection would vary by age when looking at individual causes of death or critical illness conditions.

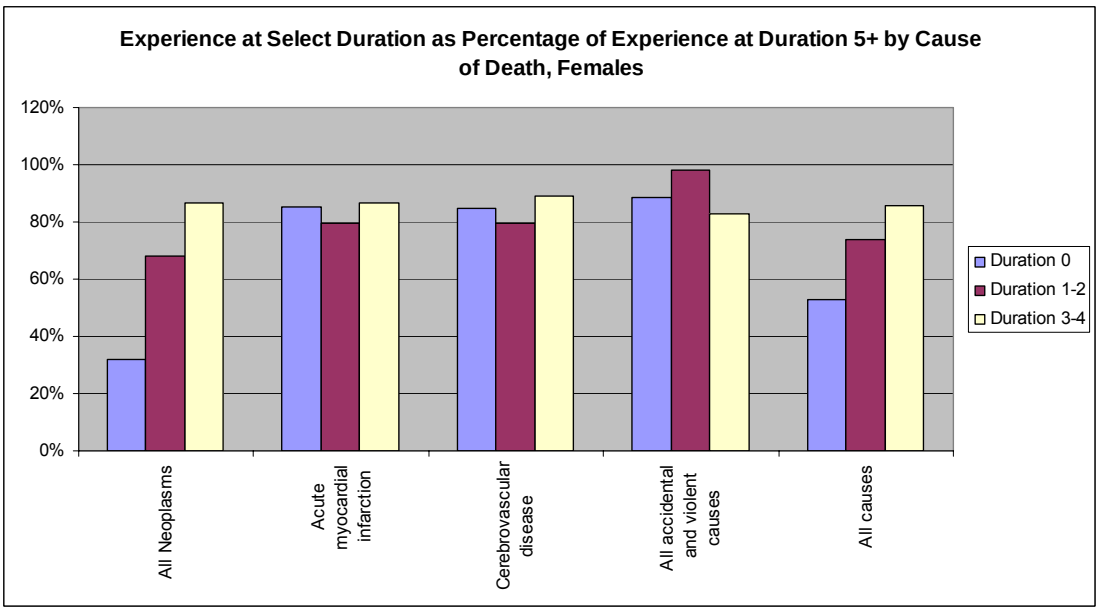
Graphs 1 (males) and 2 (females) illustrate the impact of selection for some of the main causes of death that are relevant to critical illness.

Source: CMIR 9, 13 and 20. Cause of death investigation 1979 to 1994 combined. Both medical and non-medical data is included. The reported ratio of actual to expected claims at each duration is expressed as a percentage of the actual versus expected ratio at duration 5+ for selected causes of death for all ages combined. The expected experience is the same at each duration.

Graph 1



Graph 2

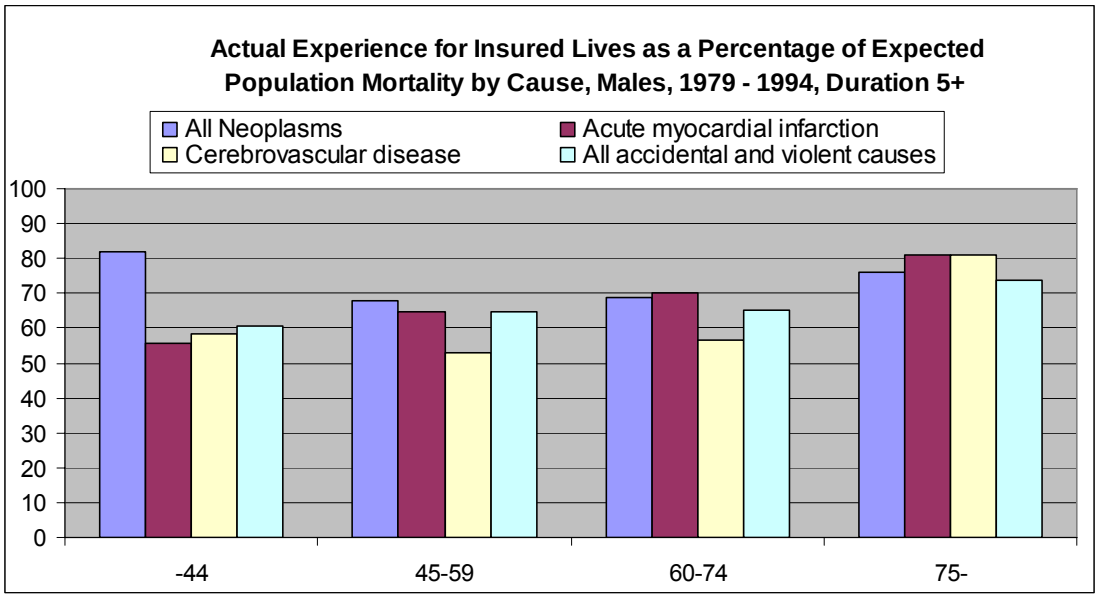


For both males and females selection is very significant for cancer deaths with the selection discount being greater and lasting longer for females than males. Looking at the breakdown by specific cancer site the difference between males and females appears to be largely driven by the greater weighting for males to cancers of the respiratory system and the digestive system. Selection for death due to these causes is less pronounced that for some other major cancer sites. A high proportion of cancer suffers will survive at least 1 year. So we could speculate that for critical illness were the claims will be paid on diagnosis that the select discount will not be as large as on death.

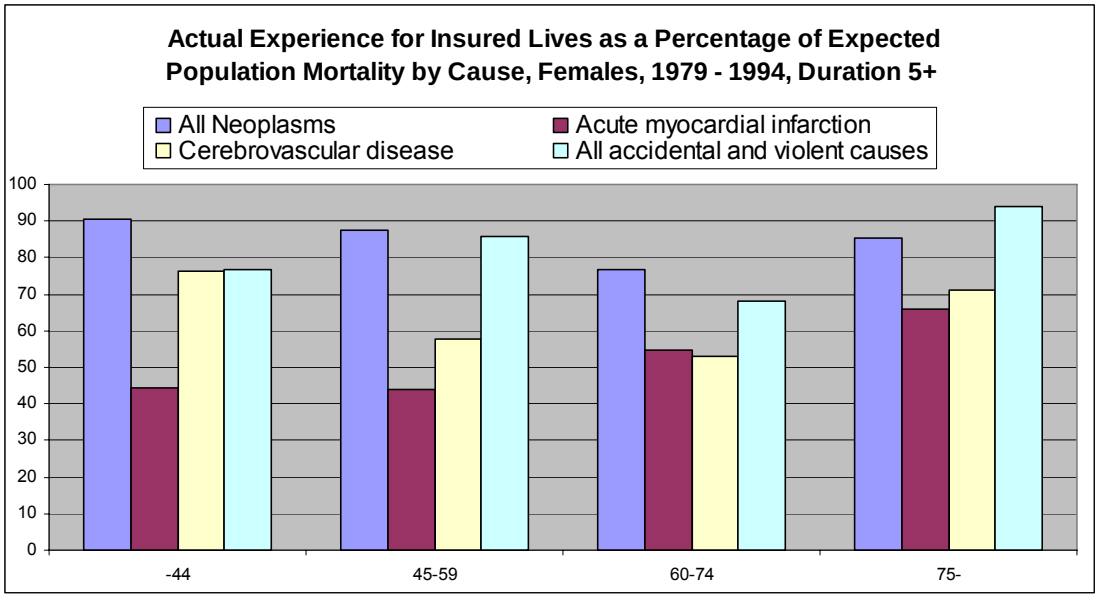
For heart attack (acute myocardial infarction) and stroke (cerebrovascular disease) there appears to be a select discount that lasts at least 5 years for both males and females. There appears to be a slightly greater select discount for males at duration 0 but otherwise the discount appears to be a fairly level at 20% compared to duration 5+ experience. For critical illness we would not expect the select discount to be greater for incidence than death but neither is there any clear reason for it to be less.

Deaths due to accidental and violent causes will form a significant proportion of the non critical illness deaths for an accelerated policy. For males there appears to be an anti-selective pattern of early deaths. This is driven by the accidental causes, with the other significant cause in this category, suicide, showing earlier select discounts. For females there is a moderate level of early selection for death due to accidental and violent causes.

The ratio of actual insured life experience by cause to the expected population mortality by cause is also interesting in its absolute level. The expected experience is based on population mortality for calendar years comparable to the broad grouping of the insured experience and is adjusted to allow for the difference in the socio-economic mix of lives in the insured population and the population as a whole. This adjustment is however the same for all causes of death and therefore it is unlikely that the allowance for the difference in socio-economic class is a good estimate. The actual versus expected percentages illustrated in the graphs below aim to show, at duration 5+, how mortality rates by cause for insured lives compare to those in of a population with the same socio-economic mix as insured lives. At duration 5+ the mortality by cause data is split into broad age bands, enabling the longer term impact of underwriting on insured life experience to be seen by age group and cause.



For males, the ratios of actual to expected experience (A/E) generally increase with age and are between 50% to 80%. The exception is cancer where the A/E is highest at ages under 44 at just over 80%.



For females, the pattern of the A/E by age is less clear except for acute myocardial infarction where there is a strong gradient by age. The A/E for females are generally lower than for males for acute myocardial infarction and stroke but are higher for cancer and accidental and violent causes. Some of the apparent difference in the A/E for males and females may be as a consequence of the broad brush allowance for socio-economic group.

6.2.6 Variations in Interoffice Experience

Underwriting practice will vary between office and over time. Credible historic industry experience would help form a better picture of the impact of initial selection and how ultimate insured experience compares to the population. (At the point we have mature and credible insured life data a population table will be largely redundant!) The industry experience would still need to be modified for an individual office's underwriting and claims practices as well as recognising that some early underwriting practices have improved across the industry. For example, when critical illness was first introduced information was not being requested for all the potential risk factors for some conditions which probably caused some anti-selection e.g. cancer where some early application forms did not ask about moles.

6.2.7 Overlaps in the Impacts of the Suggested Adjustments to CIBT02

The factors discussed in section 6.2 provide some suggestions for relatively simple steps to move from a population table to an insured life table. All of the factors, however, overlap to some extent and they are not simple to unravel. Examples of the issues are listed below.

- Variations by geographical region are strongly correlated to variation in deprivation category but there are residual impacts by region that cannot be fully explained by deprivation category alone. These are thought to be the impact of NHS services, diet, alcohol consumption, ethnicity and smoking prevalence.
- Adjusting for the difference in deprivation category between insured lives and the population will include an allowance for the different in the prevalence of smoking for insured lives and the population. Prevalence of smoking is available by socio-economic group and so it should be possible to produce smoker non–smoker rates after adjusting for deprivation category. In theory a further refinement to the relative risk assumptions would be needed as ideally they should be the relative risks for people in the deprivation categories for insured lives.
- Select discounts to allow for underwriting based on the mortality by cause investigation which is aggregate, may not be appropriate to smoker, non-smoker specific rates. This issue may be mitigated to an extent if the select discounts are available separately for conditions where smoking is a major risk factor and those where it is less of an issue.

7 Conclusion - TO FOLLOW

TO FOLLOW OR MERGE WITH ABSTRACT / EXECUTIVE SUMMARY

8 Appendix 1 - Primary Data Sources

8.1 Population Counts

Source:	ONS	Age bands:	< 1, 1-4, …75-79, 80-84, 85+
Population:	England	Sex:	Male, Female specific
Period:	1971 to 2003	Aggregate:	Not smoker specific
Coding basis:	ICD 8 - ICD 10	Socio-economic group:	Not specific

Our population counts for England & Wales are taken from the Office of National Statistics (ONS) who calculate a mid-year estimate of the resident population each year, supported by a census every 10 years.

The census aims to identify the usually resident population. Mid-year estimates for other years are then derived using the cohort component method. This is a common demographic method that takes the previous mid-year resident population and ages it by one year. It is then adjusted for births, deaths, migration, and any change in the number of armed forces and dependants stationed in England & Wales.

Births and deaths are taken from the registration system, and there is a small adjustment for deaths reported after the closure date for a particular year. The most difficult element to estimate is the migration numbers. There is no single source for these and so estimates are built up from four components: the International Passenger Survey, flows to and from Republic of Ireland, visitor switches from non-migrant to migrant status, and asylum seekers plus their dependants.

Census development

The first national census in England & Wales took place in 1801 and a Census has taken place every 10 years since (except for 1941). The 1971 Census gave larger discrepancies from the rolled-forward 1961 Census than typically seen and led to some changes in estimates methodology. The 1981 Census results were considered reliable and used to generate the 1980's estimates, with more minor changes to methodology. With the 1991 Census however, the population of England & Wales was 1.1m lower than the rolled-forward estimate. Further investigation raised questions over issues such as implausible sex ratios among young adults, and perceived under-reporting of groups such as young males, ethnic minorities, people in rented accommodation, and populations in the inner-cities. The 1991 rolled-forward estimate with some small adjustments was therefore used instead. Finally, in 2001 the Census was used as the basis for the 2001 mid-population estimate, as differences from the rolled-forward population could be explained by over estimate of the 1991 population and revised estimates to 1990's migration.

Each decade has also seen refinements to the methodology used for mid-year population estimates, in particular refining the way to monitor migration.

Overall we can conclude that although even a Census can only provide a population estimate, and methodology for estimates has been greatly refined over the last 30 years, we would not expect the use of this data to have distorted the trends analysed in this paper, particularly for the typical insured ages.

For Scotland we have used the estimates produced by the General Register Office (GRO). They use a similar approach, with a 10-yearly Census reviewed against mid-year population estimates. The GRO also maintains the registers of births and deaths in Scotland, and uses similar sources to ONS to estimate migration.

8.2 Population Mortality by Cause

Source:	ONS	Age bands:	< 1, 1-4, …75-79, 80-84, 85+
Population:	England	Sex:	Male, Female specific
Period:	1971 to 2003	Aggregate:	Not smoker specific
Coding basis:	ICD 8 - ICD 10	Socio-economic group:	Not specific

Data on causes of death for England & Wales is compiled from the data collected when deaths are certified and registered. These certificates are then used to identify the underlying cause of death, defined by WHO as:
a) the disease or injury which initiated the train of events directly leading to death; or
b) the circumstances of the accident or violence which produced the fatal injury.

The cause may not be that listed on the death certificate and there are rules to derive a single cause of death from a death certificate, and ensure interpretation of several factors is treated consistently both around the country and over time.

The diagnosis groups have been coded using the International Statistics Classification of Disease and Related Health Problems, 8th, 9th and 10th revisions. The 8th revision is applicable for incidence years 1971-1978, the 9th revision is applicable for incidence years 1979-1994, and the 10th revision from 1995 onwards.

Most deaths are coded automatically using standard software that identifies key words and converts them to International Classification of Diseases (ICD) codes, and then applies rules to assign the cause of death. Since 1992 the data looks at those deaths occurring in the relevant period, but prior to that looked at the number of deaths registered. That change is believed to have minimal impact on the total deaths for a year.

8.3 Cancer Registrations (England ; E&W)

Source:	ONS	Age bands:	< 1, 1-4, …75-79, 80-84, 85+
Population:	England	Sex:	Male, Female specific
Period:	1971 to 2003	Aggregate:	Not smoker specific
Coding basis:	ICD 8 - ICD 10	Socio-economic group:	Not specific

8.3.1 Description and Quality

The Office for National Statistics (ONS) is responsible for collating, compiling and analysing cancer registrations data collected by the nine independent regional registries in England. ONS are not however responsible for the collection and analysis of data for Scotland and Wales.

A key feature of the data is that it is person-specific, recording the first incidence of a primary cancer. The registries submit data according to a prescribed minimum data set, and the data is then loaded on to a person-based database and validated. Checks include ensuring recorded cancer site and histology are compatible, and dates are valid (e.g. incidence is before death). Records on the database can be modified or deleted, and new records added, as updated information is received. Although this means prior years incidence rates are open to change, improvements to the reporting timeliness of registries have helped to reduce the time for stability to be reached.

Data is reviewed for incidences appearing on more than one registry, for example where a patient has moved to another area, but with records examined to make sure true multiple primary cancers are included.

The incidence data includes cases of cancer only identified after death, if cancer was from a contributory cause (i.e. stated on the death certificate). Here though, incidence date is unknown and date of death will be recorded as incidence date. ONS are aware that a registry with a high “death certificate only” (DCO) rate is likely to understate incidence as not all cancer patients will die from the disease.

The ONS admit that the completeness of cancer registries records is likely to vary, but the most recent review concluded that the results were largely complete, accurate and reliable. ONS use a number of monitoring factors, including DCO rates, mortality to incidence ratios and number of records with incomplete data, to ensure this quality is maintained.

8.3.2 ICD Codes and Critical Illness Definitions

Our analysis of total cancer incidence is based on ICD-9 codes 140-208, excluding 173 and ICD-10 codes C00 to C97, excluding C44. The exclusions refer to “Other malignant neoplasms of the skin”, which is excluded from the standard critical illness product. Malignant melanoma of the skin has been included. Carcinomas in situ, benign neoplasms, and neoplasms of unspecified behaviour or uncertain behaviour are all excluded (codes D00 – D48).

8.4 ISD Scotland Cancer Statistics

Source:	ISD (NHS)	Age bands: < 5, 5-9, …75-79, 80-84, 85+
Population:	Scotland	Sex: Male, Female specific
Period:	1975 to 2003	Aggregate: Not smoker specific
Coding basis:	ICD 8 - ICD 10	Socio-economic group: Split available

8.4.1 Description and Quality

The Information and Statistics Divison (ISD) of NHS Scotland is responsible for managing the Scottish Cancer Registry, and collating, compiling and analysing the cancer registrations data collected.

As for the English data, this data is also person-specific, recording the first incidence of a primary cancer. The registry monitors data quality using routine indicators, computer validation and ad hoc studies. Data items collected are consistent with those collected in England & Wales, and records for any year are continually open to be updated and amended.

Incidences are recorded from a variety of sources including hospital systems and discharge notes, hospital records (e.g. radiology, oncology, pathology), deaths from the General Register Office for Scotland and private hospital records.

8.4.2 ICD Codes and Critical Illness Definitions

The analysis of total incidence is based on ICD-9 codes 140-208 excluding 173 (other malignant neoplasms of skin), 236.2 (neoplasm of uncertain behaviour of ovary) and 238.6 (neoplasm of uncertain behaviour of plasma cells). The exclusions are slightly different to those for England & Wales, but not enough to be of any significance. For ICD-10, the data is for codes C00-C96 excluding C44 (other malignant neoplasms of skin).

8.5 Hospital Episode Statistics (HES)

Source:	NHS	Age bands:	Age bands were selected
Population:	England	Sex:	Male, female specific
Period:	1989 - 2003	Aggregate:	Not smoker specific
Coding basis:	ICD 9 and 10		

8.5.1 Description and Quality

HES records are collected annually by the National Health Service (NHS). Each record has personal patient details (removed in our extract of the data), age, gender, area of residence, admission information, diagnosis information and details of any operations. The records are in respect of ordinary admissions and elective day cases. Data is collected on a financial year basis from 1 April to 31 March. Some NHS Trusts have private facilities and their data flows into HES.

The problems and quality of HES reflect those that apply to any data process where rigorous validation is not applied to the data at source. To ensure that HES is consistent and unambiguous a number of checks are applied including verifying, cleaning and validating the data. Of particular interest for us is the check that establishes how completely the HES have captured all the patient records. This is judged by comparing HES to independent annual returns. Each years' data is "grossed" up for missing or invalid diagnoses, i.e. a factor is applied selectively by consultant speciality to compensate for missing or invalid diagnoses. This helps ensure consistency across the whole database but does mean that different years' data are not fully comparable until this grossing factor has been applied. Currently 2003/4, the last year for which we have data, has not been grossed.

Variations in the way that HES records have been collected mean that comparisons between data years can be difficult.

8.5.2 Episodes versus Incidence

HES provide a count of episodes, the number of times a patient is under the care of a consultant in a year. A patient may be under the care of more than one consultant during a hospital stay and/or they may be readmitted in the same year. Both would count as another episode although about 94% of cases relate to a single stay in hospital in a year under the care of a single consultant. If a patient returns to hospital in another year this would also count as an episode in the year in question. Counting the number of episodes for a condition in a year is not the same as counting the number of incidences of a condition as some episodes may be in relation to a condition that has already been diagnosed.

8.5.3 Main Diagnosis versus All Diagnoses

During a hospital stay a patient may be diagnosed with more than one condition. It may be thought that the conditions that we are interested in for critical illness would always be recorded as the main diagnosis. This is not always the case. From inspection of the data it seems that occasionally the first diagnosis, or, the condition which was the most resource intensive during the hospital stay, is recorded as the main diagnosis. Therefore in our dataset we obtained all diagnoses of the conditions that were relevant to a critical illness whether or not they were recorded as the main diagnosis. Changes in practices or guidance in what might be considered as the main diagnosis from time to time will not distort trends. (Also see notes on individual conditions below.)

8.5.4 Primary Operation versus All Operations

There are similar issues with counting operations. A repeated operation would be counted twice, in the same year or a later year. It is also thought that operations are often recorded in chronological order and the most resource intensive operation may not be recorded as the primary operation. In our data we chose to capture all operations in the data so that changes in practice or in guidance as to what might be considered the primary operation will not distort trends.

8.5.5 Exposed Population

This is limited to England and is not therefore representative of the incidence rates for the whole of the UK. Incidence data is available from Scotland and, although it is not directly comparable to HES data as it relates to true incidence rates, rates appear to be significantly higher in Scotland than in England.

HES only include people who go to an NHS hospital. Therefore HES do not include people admitted to private hospitals for treatment nor people who are diagnosed and treated by their GP. HES also do not include people who die suddenly and who do not reach hospital.

8.5.6 ICD Code and Critical Illness Definition

ICD code(s) were identified as being that (or those) that most closely reflected the critical illness condition that we were trying to model. We do not suggest that there is exact correspondence between the selected ICD code(s) and the definition of a critical illness condition in any particular ABI statement of best practice.

The coding basis used by HES changed from ICD 9 to10 in 1995. Appropriate codes can be selected for both coding series. The change in coding could feasibly have distorted trends. Generally, however, this does not appear to have occurred with the exception of some types of stroke. Overall, for the different types of stroke combined, the change in coding basis does not appear to have distorted the combined trend. For some subcategories of stroke, however, the change of coding appears to coincide with a step change in their trends.

The ICD codes used for each critical condition are listed below.

Heart Attack

ICD codes used:

ICD 9	410
ICD 10	I210, I211, I212, I213, I214, I219, I220, I221, I228, I229

Under ICD 10 there is a specific code for recording the first ever heart attack, (ICD I21). Rates calculated using this code will be closer to a true incidence rate as second and subsequent heart attacks should not be counted in the numerator of the rate.

Since 1995 trends in ICD I21 (first ever heart attack) and ICD I21 plus ICD I22 (second and subsequent heart attack) have been very similar.

Stroke

ICD codes used:

ICD 9	430-436, 4374 excluding 435
ICD 10	I676, I677, I600, I601, I602, I603, I604, I605, I606, I607, I608, I609, I610, I611, I612, I613, I614, I615, I616, I618, I619, I620, I621, I629, I630, I631, I632, I633, I634, I635, I636, I638, I639, I64X, I650, I651, I652, I653, I658, I659, I660, I661, I66

HES data for strokes is very limited in its usefulness as only people suffering a stroke and who are admitted to hospital are counted. It is thought many people who have a minor stroke are not admitted to hospital and may only be seen by their GP. The number of repeat strokes is also quite high making HES data very difficult to interpret with any confidence.

Coronary Artery By-pass Graft (CABG)

OPCS4 codes used

OPCS4 codes	K401 - K404, K408, K409, K411 - K414, K418, K419, K421 - K424, K428, K429, K431 - K434, K438, K439, K441, K442, K448, K449, K451, K452 - K455, K458, K459, K461 - K464, K468, K469.

8.5.7 Description of Data Extract and the Filters Applied

Different data extracts of HES are available by specifying different filters to be applied to HES. Our extract used two filters.

Classpat = 1 (ordinary admissions) and 2 (day cases)
Epistat = 3 (Finished Consultant Episodes)

The second filter ensures that a hospital stay that starts in one financial year and ends in the next is only counted in one year, the later year in which the episode finishes.

Counts of Finished Consultant Episodes (FCE) were banded into 5 year age bands and were gender specific. Counts of FCE were obtained for each ICD code and each operation code.

Other filters are possible but were not applied. For example counts of FCE could be limited to only counts of a main diagnosis or a primary operation. The data published on websites usually relates to only the main diagnosis or primary operation. FCE could also be limited to only the diagnosis at admission, and subsequent diagnosis where the patient moved to the care of another consultant would be ignored. As explained above all diagnoses and all operations were included as otherwise some counts relevant to a critical condition would have been missed. It is not possible to filter out the diagnosis or operation count for a patient who has a second or subsequent hospital stay in a year.

Data from activity within private facilities operated by NHS Trusts is included within the data extract.

8.5.8 Incidence Rates

HES data is collected on a financial year basis. For CIBT02 the number of episodes in a calendar year is estimated by linear interpolation to be consistent with other data, such as the exposed population, which is available on a calendar year basis. This interpolation step introduced a small degree of smoothing between years which is helpful especially at younger ages where counts are volatile due to the low frequency of episodes for specific conditions.

For analysing trends, the incidence rate was calculated as the estimated number of episodes in a financial year divided by the population of England. Linear interpolation was used to estimate population figures for a financial year from population figures based on a calendar year. This was preferred to adjusting the number of episodes to be on a calendar year basis because the data for the first financial year 1989/90 was not wasted. If we had adjusted rates to be on a calendar year basis the first full year would have been 1990. The incidence rates based on HES data therefore apply to a time period that is a quarter of a year later and out of step with the rates derived for mortality.

Using the whole population as the denominator is not correct if “true” incidence rates are required. People who have previously had a critical illness should be removed from the exposure. Where refined estimates of incidence rates were needed, such as for CIBT02, the crude ratios used for trends work were adjusted for prevalence and other factors. The derivation of incidence rates for CIBT02 are described in detail in section 4. This level of complexity was not feasible when deriving rates for trends as many of these adjustments are not available by calendar year.

8.5.9 The Main Drawbacks and Limitations of HES

HES contain not only the first occurrence of a condition but also any new occurrence of a condition and therefore the number of episodes should be adjusted before being used to calculate the numerator of an incidence rate. Similarly the exposure, taken to be the population of England, should be adjusted to remove people who have already suffered a critical illness. We do not suggest that these two factors counterbalance each other.

Other problems are:

- Sudden deaths that occur before someone is admitted to hospital will not be included in the statistics.
- People treated in private hospitals not operated by NHS Trusts or people treated by their GPs will not be included in the statistics.
- The coding basis changed in 1995 from ICD code from 9 to 10 and although detailed conversions from one coding basis to another are available it is possible that the coding change has distorted trends.
- ICD codes or operation codes do not correspond directly to definitions of critical illnesses included in any ABI statement of best practice.

8.5.10 HES Data Used For CIBT93 and CIBT02

The same HES data and filters were applied to both the data used for the investigation into trends and to that used as a starting point for some of the conditions included in CIBT02. The HES data incorporated into CIBT02 was therefore consistent with that used for investigating trends.

For 1992/93 and 1993/4, the HES data used in this paper was compared to that used in the derivation of CIBT93. It was clear that the HES data used to calculate CIBT93 and that used in this paper were not consistent. More detail on the differences by condition is given in the main body of the paper which analyses the reasons for the changes between CIBT93 and CIBT02.

The filters applied to the HES extract used in the production of CIBT93 are not known. As the datasets do not match it is likely that different filters were used than are used in CIBT02. A possible difference is that in CIBT93 only the main diagnosis or the primary operation was included in the data extract. It has not been possible to reconcile the differences.

8.6 ISD Scotland deprivation category analysis

Information Statistics Division NHS Scotland (ISD)

Source:	NHS	Age bands: < 30, 30-34, …75-79, 80-84, 85+
Population:	Scotland	Sex: Male, Female specific
Period:	1981 to 2004	Aggregate: Not smoker specific
Coding basis:	ICD 9 and ICD 10	Socio-economic group: by deprivation category

8.6.1 Description and Quality

ISD data requested from "The Information Statistics Division NHS Scotland" is based on calendar year. This is a central database that collects data from different sources: Scottish morbidity records which cover all non-obstetric and non-psychiatric discharges from NHS hospitals in Scotland; mental health inpatient records; cancer registration records; and Registrar General's deaths records. All patient records including deaths for each patient are linked together using 'probability matching' – record linkage. The 'probability matching' algorithm uses all available identifying information (name, date of birth, postcode, hospital patient reference number etc.) to link the records.

The ISD linked data set started in 1981 and holds data on over 5 million patients with over 20 million contacts within the acute hospital sector.

It is estimated that the probability matching algorithm, which links the death records, morbidity records, cancer registration records and mental health records has 98% accuracy.

ISD Scotland has a Data Quality Unit that checks a 1% sample of the Morbidity records and compares them to the clinical case notes. Quality of coding of the principal diagnosis on the SMR01 hospital discharge for 2001/02 data had an accuracy of 88% for recording 3-digit level diagnosis, with a 95% confidence interval of 87% to 89%.

8.6.2 Incidence of specific disease

The ISD information will give a patient based, rather than episode based record, and therefore no adjustment has been made to remove double counting of incidence.

8.6.3 Main Diagnosis against All Diagnosis

During a hospital stay a patient may be diagnosed with more than one condition. However, within the 'patient records sets', the records are grouped into continuous stays. A continuous stay is a continuous period of time spent as an inpatient or day case in hospital regardless of any transfers between specialities or hospitals. For example in practice, a patient may be admitted with an acute myocardial infarction in a speciality of general medicine then be transferred to Cardiology and then finally transferred to Geriatric Assessment before discharge. This single continuous stay would have generated three separate records which linkage can bring together. The incidence data requested from ISD will count the first and new incidence of a particular disease for each continuous stay regardless of when during the stay it is diagnosed.

The principal diagnosis that should be recorded for all patients in each episode of care is the main condition that they are being treated for. However, occasionally this is not always the case and the most serious condition is recorded instead. For example, if a patient has been in hospital for 5 days being treated for angina and then has a heart attack, then angina would usually be recorded as the principal diagnosis. There will be cases though where heart attack is recorded as the principal diagnosis.

The information that ISD have provided us are based on the principal diagnosis only, and it is therefore possible that a small number of incidences of some critical illnesses may have been missed.

8.6.4 Exposed Population

This data is limited to Scottish population which represents less than 10% of the UK population. Scotland has a higher incidence of cancer, heart and stroke due to differences in socio-economic categories, smoking and health. However, this dataset is of better quality and reflects the true incidence of the disease compared to the HES dataset. Whilst HES being more representative of the UK is episode based and is of poorer quality. Therefore, the ISD dataset will provide a useful benchmark when comparing against HES incidence to ensure that the adjustment for first ever incident is sensible. It will also provide useful information on trends over time (from 1981 compared to HES which starts from 1989) and it will have fewer distortions from year to year.

8.6.5 ICD Code and Critical Illness Definitions

On the morbidity records, up to 6 ICD-code diagnoses can be recorded (1 principle, 5 secondary). For this analysis, only the principle diagnosis position has been considered.

8.6.5.1 Incidence

This is based on a count on the number of new or first occurrences of a particular disease. A search of all in-patient records is made for the first occurrence in the principal diagnostic position of each individual code in the groupings in the table below:

Diagnosis (principal position)	ICD 9 codes	ICD 10 codes
Stroke	430-437 excluding 435	I60-I69
Acute myocardial infarction	410	I21, I22
Angina pectoris	413	I20
Other circulatory	415-429	I26-I51
All malignant neoplasms	140-208	C00-C97
Lung cancer	162	C33-C34
Breast cancer	174-175	C50
Cervical cancer	180	C53
Colorectal cancer	153-154	C18-C20
Malignant Melanoma	172	C43
Prostate cancer	185	C61
Ovarian cancer	183	C56
Bladder cancer	188	C67
Hodgkin's Lymphoma	201	C81
Testicular	186	C62
Other cancers	140-152, 155-161, 163-171, 176-179, 181-182,184,187, 189-200, 202-208, 185-208	C00-C17, C21-C32, C35-C42, C45-C49, C51, C52, C54-C55, C57-C60, C62-C97C63-C66,C68-C80,C82-C97
Other Skin Cancers	173	C44
Carcinoma in situ	232	D04
Other benign neoplasm	216	D23
Multiple Sclerosis	340	G35
All causes (Mortality only)	All	All

8.6.5.2 Mortality

Using data from the General Registers Office for Scotland (GRO), a data extract has been created for those who have died from one of diseases in the tables above.

8.6.6 Deprivation Scores and Categories

Ideally the key measures of material deprivation would be based on income, education or occupation. In practice, this information is often not available, and other proxies are used to measure an individual's deprivation. The ISD NHS Scotland uses two measures of deprivation: Carstairs and

Morris index; and Scottish Index of Multiple Deprivations. We have chosen the Carstairs and Morris index for the reasons discussed below:

8.6.6.1 Carstairs and Morris index

This index was originally developed in the 1980's. It uses four indicators at postcode level: overcrowding, male unemployment, general social class and lack of car ownership. The deprivation score is distributed over seven categories, from 1 (the most affluent) to 7 (the most deprived), designed to retain the discriminatory features of the distribution of the deprivation score, rather than to ensure equality of numbers between each deprivation category. We have based our analysis on this index as it goes back to 1981. We have also used the postcode deprivation scores derived from 1991 data over the whole period to ensure trends by deprivation category are consistent over time.

From the 1991 census data, the population in Scotland is approximately normally distributed over the 7 categories so that the percentage population in each category is as follows:

Deprivation Category	% Population	Deprivation Score	
		Minimum	Maximum
1	6%	-5.7	-4.0
2	14%	-4.0	-2.5
3	22%	-2.4	-0.8
4	25%	-0.8	1.2
5	15%	1.2	3.0
6	11%	3.0	6.0
7	7%	6.1	12.8

8.6.6.2 Scottish Index of Multiple Deprivations

This is a new index that will apply from 1997. It has six domains - income, employment, education, housing, health and geographical access - and it splits the population into equal quintile groups. This is a more accurate measure of deprivation and overcomes some of the weaknesses in the Carstairs and Morris index. We have not used this index in our analysis as it only goes back to 1997. This will not provide the trend in deprivation category for particular sectors of the population over time.

9 Appendix 2 - References

9.1 References

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9.2 Critical Illness Trends Research Group - Other Published Works

9.2.1 Presentations

- Healthcare Conference 2001 (workshop B1)
- Healthcare Conference 2002 (plenary, workshops A1, B1, C3)
- Healthcare Conference 2003 (workshop A1)
- CI Seminar at Staple Inn, 23 May 2003
- Healthcare Conference 2004 (workshop B1/D3)
- Life Convention 2004 (concurrent session D09)
- CI Seminar at Staple Inn, 02 December 2004
- Healthcare Conference 2005 (plenary)
- Healthcare Conference 2006 (workshop)

9.2.2 Articles

- The Actuary, May 2003
- The Actuary, June 2003

All available via www.actuaries.org.uk

10 Appendix 3: CIBT02 Calculations Detail and Tables

10.1 CIBT02 Individual-Age Calculations for Main CIs

The following tables show the raw or constructed data used and the full individual-age calculations for the main CIs, as described in Sections 4.2 to 4.9.

10.1.1 CIBT02 Calculations Detail - Cancer - Males

Age	Age Group	Number of New Cancer Registrations	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from Cancer k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		2.12	0%	0.1%	2.12	0.4%	2.12	6.15	8.9%	1.57	18
19							0%		2.26	0%	0.1%	2.26	0.4%	2.26	6.99	8.6%	1.66	19
20							**0%**		**2.41**	**0%**	**0.1%**	**2.41**	**0.4%**	**2.40**	**7.54**	**8.3%**	**1.79**	**20**
21							0%		2.56	0%	0.1%	2.57	0.4%	2.56	7.79	8.1%	1.94	21
22	20 - 24	440	1520.4	2.89	100%	100%	0%	2.89	2.72	0%	0.1%	2.73	0.4%	2.71	7.82	7.9%	2.11	22
23							0%		2.89	0%	0.1%	2.89	0.4%	2.88	7.73	7.8%	2.29	23
24							0%		3.06	0%	0.2%	3.06	0.4%	3.05	7.63	7.8%	2.46	24
25							**0%**		**3.23**	**0%**	**0.2%**	**3.24**	**0.5%**	**3.22**	**7.62**	**7.9%**	**2.63**	**25**
26							0%		3.41	0%	0.2%	3.42	0.5%	3.40	7.77	8.1%	2.79	26
27	25 - 29	574	1596.8	3.59	100%	100%	0%	3.59	3.60	0%	0.2%	3.60	0.5%	3.59	8.07	8.4%	2.93	27
28							0%		3.79	0%	0.2%	3.80	0.5%	3.78	8.47	8.8%	3.06	28
29							0%		4.00	0%	0.2%	4.01	0.5%	3.99	8.90	9.2%	3.19	29
30							**0%**		**4.22**	**0%**	**0.2%**	**4.23**	**0.6%**	**4.21**	**9.33**	**9.7%**	**3.32**	**30**
31							0%		4.46	0%	0.3%	4.47	0.6%	4.45	9.71	10.3%	3.47	31
32	30 - 34	915	1895.4	4.83	100%	100%	0%	4.83	4.72	0%	0.3%	4.73	0.6%	4.70	10.07	11.0%	3.63	32
33							0%		5.01	0%	0.3%	5.02	0.6%	4.99	10.44	11.7%	3.80	33
34							0%		5.33	0%	0.3%	5.35	0.7%	5.31	10.88	12.5%	3.99	34
35							**0%**		**5.70**	**0%**	**0.4%**	**5.72**	**0.7%**	**5.68**	**11.40**	**13.2%**	**4.21**	**35**
36							0%		6.11	0%	0.4%	6.13	0.7%	6.09	12.04	14.0%	4.44	36
37	35 - 39	1275	1969.9	6.47	100%	100%	0%	6.47	6.58	0%	0.4%	6.60	0.7%	6.56	12.81	14.8%	4.70	37
38							0%		7.11	0%	0.5%	7.15	0.7%	7.09	13.71	15.7%	4.99	38
39							0%		7.74	0%	0.5%	7.77	0.8%	7.71	14.73	16.6%	5.33	39
40							**0%**		**8.45**	**0%**	**0.5%**	**8.49**	**0.8%**	**8.43**	**15.86**	**17.6%**	**5.70**	**40**
41							0%		9.27	0%	0.6%	9.32	0.8%	9.25	17.12	18.7%	6.13	41
42	40 - 44	1839	1782.8	10.32	100%	100%	0%	10.32	10.21	0%	0.6%	10.28	0.9%	10.19	18.54	19.8%	6.60	42
43							0%		11.30	0%	0.7%	11.37	0.9%	11.27	20.19	21.0%	7.13	43
44							0%		12.54	0%	0.7%	12.63	0.9%	12.52	22.11	22.2%	7.72	44
45							**0%**		**13.97**	**0%**	**0.8%**	**14.08**	**0.9%**	**13.95**	**24.36**	**23.5%**	**8.35**	**45**
46							0%		15.59	0%	0.8%	15.72	0.9%	15.57	26.96	24.8%	9.04	46
47	45 - 49	2800	1570.4	17.83	100%	100%	0%	17.83	17.45	0%	0.9%	17.61	1.0%	17.44	29.86	26.1%	9.82	47
48							0%		19.60	0%	1.0%	19.79	1.0%	19.60	32.95	27.5%	10.74	48
49							0%		22.07	0%	1.1%	22.30	1.0%	22.08	36.15	28.9%	11.87	49
50							**0%**		**24.90**	**0%**	**1.1%**	**25.19**	**1.0%**	**24.93**	**39.37**	**30.3%**	**13.26**	**50**
51							0%		28.15	0%	1.2%	28.50	1.0%	28.20	42.57	31.8%	14.95	51
52	50 - 54	5136	1595.2	32.20	100%	100%	0%	32.20	31.85	0%	1.3%	32.28	1.1%	31.94	45.96	33.3%	16.96	52
53							0%		36.06	0%	1.4%	36.58	1.1%	36.19	49.81	34.8%	19.26	53
54							0%		40.83	0%	1.5%	41.46	1.1%	41.02	54.40	36.1%	21.82	54
55							**0%**		**46.20**	**0%**	**1.7%**	**46.98**	**1.1%**	**46.47**	**59.99**	**37.3%**	**24.61**	**55**
56							0%		52.22	0%	1.8%	53.17	1.1%	52.59	66.78	38.3%	27.63	56
57	55 - 59	8984	1516.3	59.25	100%	100%	0%	59.25	58.88	0%	1.9%	60.03	1.1%	59.37	74.66	39.0%	30.91	57
58							0%		66.15	0%	2.1%	67.55	1.1%	66.79	83.45	39.6%	34.52	58
59							0%		74.02	0%	2.2%	75.70	1.1%	74.85	92.95	40.0%	38.53	59
60							**0%**		**82.45**	**0%**	**2.4%**	**84.47**	**1.1%**	**83.52**	**102.99**	**40.2%**	**43.03**	**60**
61							0%		91.43	0%	2.6%	93.85	1.1%	92.78	113.48	40.4%	48.05	61
62	60 - 64	11816	1176.1	100.47	100%	100%	0%	100.47	100.92	0%	2.8%	103.80	1.2%	102.60	124.66	40.4%	53.49	62
63							0%		110.88	0%	3.0%	114.28	1.2%	112.94	136.87	40.2%	59.22	63
64							0%		121.27	0%	3.2%	125.27	1.2%	123.78	150.46	40.0%	65.10	64
65							**0%**		**132.04**	**0%**	**3.4%**	**136.74**	**1.2%**	**135.08**	**165.76**	**39.7%**	**71.00**	**65**
66							0%		143.16	0%	3.7%	148.65	1.2%	146.81	183.13	39.2%	76.84	66
67	65 - 69	16312	1049.2	155.47	100%	100%	0%	155.47	154.66	0%	4.0%	161.04	1.3%	158.99	202.86	38.7%	82.57	67
68							0%		166.54	0%	4.3%	173.95	1.3%	171.67	225.30	38.1%	88.20	68
69							0%		178.84	0%	4.6%	187.41	1.4%	184.87	250.74	37.4%	93.74	69
70							**0%**		**191.57**	**0%**	**4.9%**	**201.47**	**1.4%**	**198.64**	**279.52**	**36.6%**	**99.24**	**70**
71							0%		204.72	0%	5.3%	216.12	1.5%	212.96	311.95	35.7%	104.70	71
72	70 - 74	19196	894.9	214.50	100%	100%	0%	214.50	218.05	0%	5.7%	231.14	1.5%	227.60	348.31	34.8%	109.89	72
73							0%		231.27	0%	6.1%	246.24	1.6%	242.29	388.89	33.9%	114.53	73
74							0%		244.09	0%	6.5%	261.14	1.7%	256.75	433.99	32.9%	118.31	74
75							**0%**		**256.25**	**0%**	**7.0%**	**275.56**	**1.8%**	**270.68**	**483.89**	**32.0%**	**120.92**	**75**
76							0%		267.49	0%	7.5%	289.25	1.9%	283.85	538.79	31.0%	122.13	76
77	75 - 79	19155	686.6	278.98	100%	100%	0%	278.98	277.78	0%	8.1%	302.18	2.0%	296.22	598.60	30.1%	122.17	77
78							0%		287.13	0%	8.7%	314.36	2.1%	307.82	663.15	29.1%	121.50	78
79							0%		295.53	0%	9.3%	325.83	2.2%	318.65	732.26	28.0%	120.62	79
80							**0%**		**303.00**	**0%**	**10.0%**	**336.59**	**2.3%**	**328.74**	**805.77**	**26.9%**	**120.16**	**80**
81							0%		309.61	0%	10.7%	346.74	2.5%	338.18	884.16	25.6%	120.65	81
82	80 - 84	13689	441.8	309.85	100%	100%	0%	309.85	315.69	0%	11.5%	356.68	2.6%	347.34	970.61	24.2%	121.94	82
83							0%		321.65	0%	12.3%	366.90	2.8%	356.69	1068.97	22.7%	123.86	83
84							0%		327.88	0%	13.2%	377.89	3.0%	366.71	1183.08	21.3%	126.35	84
85							**0%**		**334.80**	**0%**	**14.2%**	**390.21**	**3.2%**	**377.88**	**1316.78**	**19.8%**	**129.50**	**85**

10.1.2 CIBT02 Calculations Detail - Cancer - Females

Age	Age Group	Number of New Cancer Registrations	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from Cancer k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		1.64	0%	0.1%	1.64	0.3%	1.63	2.73	15.2%	1.22	18
19							0%		1.84	0%	0.1%	1.84	0.3%	1.84	2.79	15.2%	1.42	19
20							**0%**		**2.07**	**0%**	**0.1%**	**2.07**	**0.3%**	**2.07**	**2.79**	**15.2%**	**1.65**	**20**
21							0%		2.33	0%	0.1%	2.34	0.3%	2.33	2.79	15.5%	1.90	21
22	20 - 24	385	1515.9	2.54	100%	100%	0%	2.54	2.63	0%	0.1%	2.63	0.3%	2.62	2.81	15.9%	2.18	22
23							0%		2.96	0%	0.2%	2.96	0.3%	2.95	2.85	16.6%	2.49	23
24							0%		3.33	0%	0.2%	3.34	0.3%	3.33	2.93	17.4%	2.83	24
25							**0%**		**3.76**	**0%**	**0.2%**	**3.76**	**0.3%**	**3.75**	**3.03**	**18.5%**	**3.20**	**25**
26							0%		4.23	0%	0.2%	4.24	0.3%	4.23	3.19	19.8%	3.61	26
27	25 - 29	773	1592.5	4.85	100%	100%	0%	4.85	4.76	0%	0.3%	4.77	0.3%	4.76	3.38	21.4%	4.05	27
28							0%		5.35	0%	0.3%	5.36	0.3%	5.34	3.61	23.1%	4.53	28
29							0%		5.99	0%	0.3%	6.01	0.3%	5.99	3.89	24.8%	5.04	29
30							**0%**		**6.69**	**0%**	**0.3%**	**6.71**	**0.4%**	**6.69**	**4.20**	**26.6%**	**5.59**	**30**
31							0%		7.44	0%	0.4%	7.47	0.4%	7.44	4.55	28.4%	6.18	31
32	30 - 34	1621	1908.5	8.49	100%	100%	0%	8.49	8.25	0%	0.4%	8.29	0.4%	8.26	4.94	30.2%	6.80	32
33							0%		9.12	0%	0.5%	9.16	0.4%	9.13	5.35	31.9%	7.46	33
34							0%		10.04	0%	0.5%	10.10	0.4%	10.06	5.79	33.5%	8.16	34
35							**0%**		**11.02**	**0%**	**0.6%**	**11.08**	**0.4%**	**11.04**	**6.25**	**35.0%**	**8.90**	**35**
36							0%		12.05	0%	0.7%	12.13	0.4%	12.08	6.73	36.3%	9.68	36
37	35 - 39	2651	1993.0	13.30	100%	100%	0%	13.30	13.15	0%	0.7%	13.24	0.4%	13.19	7.25	37.6%	10.52	37
38							0%		14.34	0%	0.8%	14.46	0.4%	14.40	7.86	38.7%	11.42	38
39							0%		15.65	0%	0.9%	15.79	0.4%	15.73	8.57	39.8%	12.38	39
40							**0%**		**17.10**	**0%**	**1.0%**	**17.27**	**0.4%**	**17.20**	**9.43**	**40.8%**	**13.42**	**40**
41							0%		18.70	0%	1.1%	18.91	0.4%	18.83	10.46	41.7%	14.54	41
42	40 - 44	3655	1801.9	20.28	100%	100%	0%	20.28	20.49	0%	1.2%	20.74	0.4%	20.65	11.65	42.7%	15.77	42
43							0%		22.50	0%	1.3%	22.80	0.4%	22.70	12.99	43.7%	17.13	43
44							0%		24.76	0%	1.5%	25.13	0.4%	25.02	14.48	44.7%	18.65	44
45							**0%**		**27.30**	**0%**	**1.6%**	**27.75**	**0.5%**	**27.63**	**16.10**	**45.9%**	**20.37**	**45**
46							0%		30.15	0%	1.8%	30.69	0.5%	30.55	17.84	47.1%	22.28	46
47	45 - 49	5305	1594.7	33.27	100%	100%	0%	33.27	33.25	0%	2.0%	33.91	0.5%	33.75	19.69	48.5%	24.37	47
48							0%		36.55	0%	2.1%	37.35	0.5%	37.17	21.64	49.8%	26.58	48
49							0%		40.00	0%	2.3%	40.95	0.5%	40.76	23.68	50.9%	28.89	49
50							**0%**		**43.54**	**0%**	**2.5%**	**44.67**	**0.5%**	**44.45**	**25.81**	**51.9%**	**31.26**	**50**
51							0%		47.11	0%	2.7%	48.44	0.5%	48.20	28.02	52.7%	33.67	51
52	50 - 54	8419	1626.3	51.77	100%	100%	0%	51.77	50.72	0%	3.0%	52.27	0.5%	52.00	30.38	53.3%	36.09	52
53							0%		54.34	0%	3.2%	56.13	0.5%	55.84	32.97	53.6%	38.45	53
54							0%		57.98	0%	3.4%	60.04	0.5%	59.72	35.88	53.8%	40.72	54
55							**0%**		**61.63**	**0%**	**3.7%**	**63.98**	**0.5%**	**63.63**	**39.19**	**53.9%**	**42.85**	**55**
56							0%		65.29	0%	3.9%	67.95	0.6%	67.57	42.95	53.9%	44.80	56
57	55 - 59	10407	1545.1	67.35	100%	100%	0%	67.35	68.93	0%	4.2%	71.92	0.6%	71.51	47.20	53.8%	46.55	57
58							0%		72.53	0%	4.4%	75.88	0.6%	75.43	51.94	53.5%	48.11	58
59							0%		76.07	0%	4.7%	79.79	0.6%	79.30	57.16	52.9%	49.53	59
60							**0%**		**79.52**	**0%**	**4.9%**	**83.63**	**0.6%**	**83.10**	**62.89**	**52.2%**	**50.83**	**60**
61							0%		82.89	0%	5.2%	87.39	0.7%	86.82	69.14	51.1%	52.06	61
62	60 - 64	10714	1220.4	87.79	100%	100%	0%	87.79	86.21	0%	5.4%	91.12	0.7%	90.49	75.98	49.8%	53.25	62
63							0%		89.53	0%	5.6%	94.87	0.7%	94.18	83.51	48.5%	54.38	63
64							0%		92.91	0%	5.9%	98.69	0.8%	97.94	91.81	47.1%	55.45	64
65							**0%**		**96.41**	**0%**	**6.1%**	**102.65**	**0.8%**	**101.83**	**100.97**	**45.8%**	**56.41**	**65**
66							0%		100.09	0%	6.3%	106.81	0.8%	105.91	111.14	44.6%	57.20	66
67	65 - 69	11565	1126.9	102.63	100%	100%	0%	102.63	104.03	0%	6.5%	111.26	0.9%	110.27	122.71	43.6%	57.82	67
68							0%		108.33	0%	6.7%	116.11	0.9%	115.01	136.10	42.5%	58.31	68
69							0%		113.08	0%	6.9%	121.45	1.0%	120.23	151.77	41.3%	58.81	69
70							**0%**		**118.37**	**0%**	**7.1%**	**127.39**	**1.1%**	**126.03**	**170.15**	**39.9%**	**59.53**	**70**
71							0%		124.24	0%	7.3%	133.97	1.1%	132.44	191.59	38.2%	60.70	71
72	70 - 74	13863	1059.2	130.88	100%	100%	0%	130.88	130.49	0%	7.4%	140.98	1.2%	139.25	216.11	36.4%	62.28	72
73							0%		136.86	0%	7.6%	148.13	1.3%	146.20	243.64	34.5%	64.06	73
74							0%		143.10	0%	7.8%	155.16	1.4%	153.00	274.10	32.6%	65.76	74
75							**0%**		**148.95**	**0%**	**7.9%**	**161.79**	**1.5%**	**159.39**	**307.42**	**30.9%**	**66.94**	**75**
76							0%		154.20	0%	8.1%	167.78	1.6%	165.15	343.68	29.3%	67.15	76
77	75 - 79	14890	938.1	158.73	100%	100%	0%	158.73	158.89	0%	8.2%	173.18	1.7%	170.31	383.56	27.8%	66.36	77
78							0%		163.10	0%	8.4%	178.06	1.7%	174.95	427.88	26.5%	64.83	78
79							0%		166.91	0%	8.6%	182.52	1.8%	179.17	477.49	25.0%	62.98	79
80							**0%**		**170.40**	**0%**	**8.7%**	**186.65**	**1.9%**	**183.05**	**533.20**	**23.5%**	**61.48**	**80**
81							0%		173.67	0%	8.9%	190.53	2.0%	186.68	596.01	21.7%	61.06	81
82	80 - 84	12917	737.7	175.10	100%	100%	0%	175.10	176.79	0%	9.0%	194.28	2.1%	190.16	667.55	19.8%	61.96	82
83							0%		179.87	0%	9.1%	197.99	2.2%	193.58	749.61	17.8%	64.23	83
84							0%		183.01	0%	9.3%	201.77	2.3%	197.04	843.98	15.9%	67.88	84
85							**0%**		**186.28**	**0%**	**9.4%**	**205.72**	**2.5%**	**200.65**	**952.46**	**14.0%**	**72.84**	**85**

10.1.3 CIBT02 Calculations Detail - Heart Attack - Males

Age	Age Group	Number of Heart Attacks	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from HA k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							5%		0.12	0%	0.0%	0.12	7.6%	0.11	6.15	0.1%	0.11	18
19							5%		0.14	0%	0.0%	0.14	7.7%	0.13	6.99	0.2%	0.13	19
20							**5%**		**0.17**	**0%**	**0.1%**	**0.17**	**7.7%**	**0.16**	**7.54**	**0.2%**	**0.16**	**20**
21							6%		0.21	0%	0.1%	0.21	7.8%	0.19	7.79	0.2%	0.19	21
22	20 - 24	36	1520.4	0.24	100%	100%	6%	0.25	0.26	0%	0.1%	0.26	7.8%	0.24	7.82	0.3%	0.23	22
23							6%		0.31	0%	0.1%	0.31	7.8%	0.29	7.73	0.4%	0.29	23
24							5%		0.38	0%	0.1%	0.39	7.7%	0.36	7.63	0.5%	0.35	24
25							**5%**		**0.47**	**0%**	**0.1%**	**0.47**	**7.7%**	**0.44**	**7.62**	**0.6%**	**0.43**	**25**
26							5%		0.58	0%	0.1%	0.58	7.6%	0.53	7.77	0.7%	0.53	26
27	25 - 29	108	1596.8	0.68	100%	94%	5%	0.67	0.71	0%	0.1%	0.71	7.6%	0.66	8.07	0.8%	0.64	27
28							5%		0.87	0%	0.2%	0.88	7.6%	0.81	8.47	1.0%	0.79	28
29							5%		1.08	0%	0.2%	1.08	7.7%	1.00	8.90	1.2%	0.97	29
30							**5%**		**1.33**	**0%**	**0.2%**	**1.33**	**7.8%**	**1.23**	**9.33**	**1.4%**	**1.20**	**30**
31							6%		1.63	0%	0.2%	1.63	7.8%	1.51	9.71	1.7%	1.47	31
32	30 - 34	414	1895.4	2.18	100%	95%	6%	2.20	2.00	0%	0.3%	2.01	7.9%	1.85	10.07	1.9%	1.81	32
33							6%		2.46	0%	0.3%	2.47	7.9%	2.27	10.44	2.2%	2.24	33
34							6%		3.03	0%	0.3%	3.04	7.9%	2.80	10.88	2.6%	2.76	34
35							**6%**		**3.71**	**0%**	**0.4%**	**3.72**	**8.0%**	**3.43**	**11.40**	**2.9%**	**3.39**	**35**
36							6%		4.53	0%	0.4%	4.55	8.0%	4.19	12.04	3.4%	4.15	36
37	35 - 39	1090	1969.9	5.53	100%	94%	6%	5.52	5.52	0%	0.5%	5.55	8.1%	5.11	12.81	3.9%	5.06	37
38							6%		6.71	0%	0.6%	6.75	8.1%	6.21	13.71	4.4%	6.15	38
39							6%		8.13	0%	0.6%	8.18	8.1%	7.52	14.73	5.0%	7.44	39
40							**6%**		**9.80**	**0%**	**0.7%**	**9.88**	**8.1%**	**9.07**	**15.86**	**5.7%**	**8.97**	**40**
41							6%		11.75	0%	0.8%	11.85	8.2%	10.88	17.12	6.4%	10.75	41
42	40 - 44	2597	1782.8	14.57	100%	92%	6%	14.20	13.94	0%	0.9%	14.07	8.2%	12.92	18.54	7.2%	12.74	42
43							6%		16.32	0%	1.1%	16.50	8.3%	15.14	20.19	7.9%	14.91	43
44							6%		18.86	0%	1.2%	19.09	8.3%	17.50	22.11	8.6%	17.19	44
45							**6%**		**21.50**	**0%**	**1.4%**	**21.80**	**8.4%**	**19.96**	**24.36**	**9.2%**	**19.57**	**45**
46							6%		24.20	0%	1.5%	24.58	8.5%	22.49	26.96	9.6%	21.99	46
47	45 - 49	4394	1570.4	27.98	100%	91%	6%	27.18	26.95	0%	1.7%	27.43	8.6%	25.06	29.86	9.9%	24.46	47
48							6%		29.73	0%	2.0%	30.32	8.7%	27.68	32.95	10.2%	26.97	48
49							6%		32.52	0%	2.2%	33.25	8.8%	30.32	36.15	10.4%	29.51	49
50							**6%**		**35.31**	**0%**	**2.5%**	**36.21**	**8.9%**	**32.97**	**39.37**	**10.5%**	**32.06**	**50**
51							6%		38.10	0%	2.8%	39.18	9.1%	35.64	42.57	10.7%	34.64	51
52	50 - 54	6870	1595.2	43.06	100%	89%	6%	40.97	40.92	0%	3.1%	42.23	9.2%	38.34	45.96	10.8%	37.25	52
53							6%		43.83	0%	3.4%	45.39	9.4%	41.13	49.81	11.0%	39.92	53
54							7%		46.86	0%	3.8%	48.72	9.6%	44.04	54.40	11.1%	42.67	54
55							**7%**		**50.07**	**0%**	**4.2%**	**52.28**	**9.8%**	**47.14**	**59.99**	**11.2%**	**45.53**	**55**
56							7%		53.50	0%	4.7%	56.12	10.1%	50.44	66.78	11.4%	48.52	56
57	55 - 59	9046	1516.3	59.66	100%	88%	7%	56.67	57.13	0%	5.1%	60.23	10.4%	53.97	74.66	11.5%	51.66	57
58							7%		60.98	0%	5.6%	64.62	10.7%	57.71	83.45	11.6%	54.97	58
59							7%		65.02	0%	6.2%	69.28	11.0%	61.66	92.95	11.6%	58.46	59
60							**7%**		**69.24**	**0%**	**6.7%**	**74.22**	**11.3%**	**65.80**	**102.99**	**11.7%**	**62.17**	**60**
61							7%		73.64	0%	7.3%	79.41	11.7%	70.11	113.48	11.7%	66.09	61
62	60 - 64	9952	1176.1	84.62	100%	86%	8%	78.64	78.20	0%	7.8%	84.84	12.1%	74.57	124.66	11.8%	70.19	62
63							8%		82.90	0%	8.4%	90.50	12.5%	79.17	136.87	11.8%	74.39	63
64							8%		87.71	0%	9.0%	96.37	13.0%	83.87	150.46	11.8%	78.61	64
65							**8%**		**92.63**	**0%**	**9.6%**	**102.41**	**13.4%**	**88.65**	**165.76**	**11.8%**	**82.78**	**65**
66							8%		97.63	0%	10.1%	108.62	13.9%	93.49	183.13	11.9%	86.83	66
67	65 - 69	11797	1049.2	112.44	100%	83%	8%	102.34	102.76	0%	10.7%	115.04	14.4%	98.44	202.86	12.0%	90.77	67
68							8%		108.05	0%	11.2%	121.70	15.0%	103.48	225.30	12.0%	94.65	68
69							9%		113.55	0%	11.7%	128.66	15.5%	108.68	250.74	12.0%	98.53	69
70							**9%**		**119.31**	**0%**	**12.2%**	**135.96**	**16.1%**	**114.07**	**279.52**	**12.0%**	**102.51**	**70**
71							9%		125.38	0%	12.7%	143.65	16.7%	119.69	311.95	11.8%	106.69	71
72	70 - 74	13123	894.9	146.64	100%	82%	9%	131.72	131.79	0%	13.2%	151.80	17.3%	125.58	348.31	11.7%	111.10	72
73							9%		138.63	0%	13.6%	160.49	17.9%	131.79	388.89	11.5%	115.76	73
74							9%		145.93	0%	14.0%	169.77	18.5%	138.36	433.99	11.3%	120.62	74
75							**9%**		**153.77**	**0%**	**14.4%**	**179.74**	**19.1%**	**145.34**	**483.89**	**11.2%**	**125.59**	**75**
76							9%		162.19	0%	14.8%	190.44	19.8%	152.76	538.79	11.1%	130.57	76
77	75 - 79	13189	686.6	192.09	100%	80%	9%	169.88	171.15	0%	15.2%	201.86	20.4%	160.59	598.60	11.1%	135.61	77
78							9%		180.64	0%	15.6%	213.97	21.2%	168.67	663.15	11.0%	140.86	78
79							9%		190.60	0%	15.9%	226.74	21.9%	177.05	732.26	11.0%	146.54	79
80							**9%**		**201.01**	**0%**	**16.3%**	**240.14**	**22.7%**	**185.65**	**805.77**	**10.8%**	**152.98**	**80**
81							9%		211.81	0%	16.7%	254.14	23.5%	194.42	884.16	10.6%	160.47	81
82	80 - 84	11017	441.8	249.37	100%	80%	9%	219.87	222.97	0%	17.0%	268.67	24.3%	203.27	970.61	10.3%	168.90	82
83							9%		234.40	0%	17.4%	283.67	25.3%	211.96	1068.97	9.9%	178.10	83
84							9%		246.05	0%	17.7%	299.06	26.3%	220.52	1183.08	9.4%	188.00	84
85							**9%**		**257.85**	**0%**	**18.1%**	**314.78**	**27.3%**	**228.86**	**1316.78**	**8.8%**	**198.67**	**85**

10.1.4 CIBT02 Calculations Detail - Heart Attack - Females

Age	Age Group	Number of Heart Attacks	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from HA k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							5%		0.03	0%	0.0%	0.03	7.3%	0.03	2.73	0.3%	0.02	18
19							5%		0.04	0%	0.0%	0.04	7.3%	0.04	2.79	0.4%	0.03	19
20							**5%**		**0.05**	**0%**	**0.0%**	**0.05**	**7.4%**	**0.04**	**2.79**	**0.4%**	**0.04**	**20**
21							6%		0.06	0%	0.0%	0.06	7.5%	0.05	2.79	0.4%	0.04	21
22	20 - 24	10	1515.9	0.06	100%	100%	6%	0.07	0.07	0%	0.0%	0.07	7.5%	0.06	2.81	0.4%	0.06	22
23							5%		0.08	0%	0.0%	0.08	7.4%	0.08	2.85	0.5%	0.07	23
24							5%		0.10	0%	0.1%	0.10	7.3%	0.09	2.93	0.5%	0.09	24
25							**5%**		**0.12**	**0%**	**0.1%**	**0.12**	**7.1%**	**0.11**	**3.03**	**0.5%**	**0.10**	**25**
26							5%		0.15	0%	0.1%	0.15	7.0%	0.14	3.19	0.6%	0.13	26
27	25 - 29	26	1592.5	0.16	100%	83%	5%	0.14	0.18	0%	0.1%	0.18	6.8%	0.17	3.38	0.6%	0.16	27
28							5%		0.22	0%	0.1%	0.22	7.0%	0.20	3.61	0.7%	0.19	28
29							5%		0.27	0%	0.1%	0.27	7.1%	0.25	3.89	0.8%	0.24	29
30							**5%**		**0.32**	**0%**	**0.1%**	**0.32**	**7.3%**	**0.30**	**4.20**	**0.9%**	**0.29**	**30**
31							5%		0.39	0%	0.1%	0.39	7.5%	0.36	4.55	1.0%	0.35	31
32	30 - 34	106	1908.5	0.55	100%	90%	5%	0.53	0.48	0%	0.1%	0.48	7.6%	0.44	4.94	1.1%	0.42	32
33							5%		0.58	0%	0.1%	0.58	7.8%	0.54	5.35	1.2%	0.52	33
34							5%		0.70	0%	0.2%	0.70	7.9%	0.65	5.79	1.3%	0.63	34
35							**6%**		**0.85**	**0%**	**0.2%**	**0.85**	**8.1%**	**0.78**	**6.25**	**1.5%**	**0.76**	**35**
36							6%		1.03	0%	0.2%	1.03	8.3%	0.95	6.73	1.7%	0.92	36
37	35 - 39	227	1993.0	1.14	100%	95%	6%	1.15	1.24	0%	0.2%	1.24	8.5%	1.14	7.25	1.8%	1.11	37
38							6%		1.48	0%	0.2%	1.49	8.5%	1.36	7.86	2.0%	1.33	38
39							6%		1.77	0%	0.3%	1.78	8.6%	1.62	8.57	2.2%	1.59	39
40							**6%**		**2.10**	**0%**	**0.3%**	**2.11**	**8.7%**	**1.93**	**9.43**	**2.4%**	**1.89**	**40**
41							6%		2.48	0%	0.3%	2.49	8.8%	2.27	10.46	2.5%	2.23	41
42	40 - 44	578	1801.9	3.21	100%	93%	6%	3.17	2.91	0%	0.4%	2.92	8.9%	2.66	11.65	2.7%	2.61	42
43							6%		3.37	0%	0.4%	3.39	9.0%	3.08	12.99	2.8%	3.02	43
44							6%		3.88	0%	0.5%	3.89	9.1%	3.54	14.48	2.9%	3.47	44
45							**6%**		**4.41**	**0%**	**0.5%**	**4.43**	**9.3%**	**4.02**	**16.10**	**3.0%**	**3.94**	**45**
46							6%		4.96	0%	0.6%	4.99	9.5%	4.52	17.84	3.1%	4.44	46
47	45 - 49	935	1594.7	5.86	100%	93%	6%	5.83	5.56	0%	0.6%	5.59	9.6%	5.05	19.69	3.1%	4.97	47
48							6%		6.19	0%	0.7%	6.24	9.8%	5.62	21.64	3.2%	5.55	48
49							6%		6.88	0%	0.8%	6.93	10.0%	6.24	23.68	3.2%	6.16	49
50							**6%**		**7.62**	**0%**	**0.8%**	**7.69**	**10.2%**	**6.91**	**25.81**	**3.3%**	**6.84**	**50**
51							6%		8.44	0%	0.9%	8.52	10.4%	7.63	28.02	3.4%	7.57	51
52	50 - 54	1494	1626.3	9.19	100%	93%	7%	9.11	9.34	0%	1.0%	9.44	10.6%	8.44	30.38	3.5%	8.38	52
53							7%		10.36	0%	1.1%	10.48	10.9%	9.34	32.97	3.6%	9.28	53
54							7%		11.52	0%	1.2%	11.67	11.1%	10.37	35.88	3.8%	10.29	54
55							**7%**		**12.84**	**0%**	**1.4%**	**13.01**	**11.4%**	**11.53**	**39.19**	**4.0%**	**11.43**	**55**
56							7%		14.34	0%	1.5%	14.55	11.7%	12.85	42.95	4.3%	12.71	56
57	55 - 59	2503	1545.1	16.20	100%	92%	7%	15.98	16.03	0%	1.6%	16.29	12.0%	14.33	47.20	4.6%	14.13	57
58							7%		17.92	0%	1.8%	18.24	12.3%	15.99	51.94	4.9%	15.71	58
59							7%		20.03	0%	1.9%	20.42	12.6%	17.84	57.16	5.2%	17.45	59
60							**7%**		**22.36**	**0%**	**2.1%**	**22.83**	**13.0%**	**19.87**	**62.89**	**5.5%**	**19.36**	**60**
61							8%		24.92	0%	2.3%	25.49	13.3%	22.09	69.14	5.9%	21.45	61
62	60 - 64	3613	1220.4	29.60	100%	88%	8%	28.27	27.70	0%	2.4%	28.40	13.7%	24.51	75.98	6.2%	23.70	62
63							8%		30.71	0%	2.6%	31.54	14.2%	27.07	83.51	6.5%	26.10	63
64							8%		33.93	0%	2.8%	34.92	14.6%	29.81	91.81	6.9%	28.62	64
65							**8%**		**37.36**	**0%**	**3.0%**	**38.53**	**15.1%**	**32.70**	**100.97**	**7.2%**	**31.25**	**65**
66							8%		40.99	0%	3.3%	42.38	15.7%	35.75	111.14	7.6%	33.97	66
67	65 - 69	5245	1126.9	46.54	100%	88%	9%	44.72	44.85	0%	3.5%	46.48	16.2%	38.96	122.71	7.9%	36.77	67
68							9%		48.95	0%	3.7%	50.86	16.6%	42.40	136.10	8.2%	39.66	68
69							9%		53.33	0%	4.0%	55.55	17.1%	46.04	151.77	8.5%	42.65	69
70							**9%**		**57.99**	**0%**	**4.3%**	**60.57**	**17.6%**	**49.93**	**170.15**	**8.7%**	**45.77**	**70**
71							9%		62.97	0%	4.5%	65.97	18.0%	54.06	191.59	8.8%	49.05	71
72	70 - 74	7722	1059.2	72.91	100%	85%	9%	68.55	68.30	0%	4.8%	71.77	18.5%	58.48	216.11	8.9%	52.55	72
73							9%		74.01	0%	5.1%	78.02	19.0%	63.16	243.64	8.9%	56.28	73
74							9%		80.14	0%	5.5%	84.76	19.6%	68.17	274.10	8.9%	60.24	74
75							**9%**		**86.71**	**0%**	**5.8%**	**92.04**	**20.1%**	**73.53**	**307.42**	**9.0%**	**64.42**	**75**
76							10%		93.75	0%	6.1%	99.89	20.6%	79.26	343.68	9.1%	68.76	76
77	75 - 79	10061	938.1	107.25	100%	85%	10%	100.73	101.23	0%	6.5%	108.27	21.2%	85.33	383.56	9.1%	73.23	77
78							10%		109.09	0%	6.9%	117.17	21.7%	91.69	427.88	9.2%	77.80	78
79							10%		117.29	0%	7.3%	126.52	22.3%	98.29	477.49	9.2%	82.55	79
80							**10%**		**125.77**	**0%**	**7.7%**	**136.30**	**22.9%**	**105.09**	**533.20**	**9.1%**	**87.60**	**80**
81							10%		134.49	0%	8.2%	146.47	23.5%	112.06	596.01	9.0%	93.11	81
82	80 - 84	11126	737.7	150.82	100%	85%	10%	141.57	143.39	0%	8.6%	156.96	24.1%	119.13	667.55	8.7%	99.11	82
83							10%		152.38	0%	9.1%	167.71	24.7%	126.23	749.61	8.3%	105.61	83
84							10%		161.40	0%	9.7%	178.67	25.4%	133.31	843.98	7.8%	112.66	84
85							**10%**		**170.39**	**0%**	**10.2%**	**189.77**	**26.1%**	**140.30**	**952.46**	**7.3%**	**120.38**	**85**

10.1.5 CIBT02 Calculations Detail - Stroke - Males

Age	Age Group	Number of Strokes	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from Stroke k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							2%		0.74	12%	0.1%	0.65	9.0%	0.59	6.15	1.2%	0.58	18
19							2%		0.77	12%	0.1%	0.68	9.0%	0.62	6.99	1.2%	0.59	19
20							**2%**		**0.80**	**12%**	**0.1%**	**0.70**	**9.0%**	**0.64**	**7.54**	**1.2%**	**0.61**	**20**
21							2%		0.84	12%	0.1%	0.74	9.0%	0.67	7.79	1.3%	0.64	21
22	20 - 24	215	1520.4	1.41	100%	58%	2%	0.84	0.87	12%	0.1%	0.77	9.0%	0.70	7.82	1.3%	0.67	22
23							2%		0.92	12%	0.1%	0.81	9.0%	0.74	7.73	1.3%	0.70	23
24							2%		0.97	12%	0.1%	0.85	9.0%	0.77	7.63	1.4%	0.74	24
25							**2%**		**1.02**	**12%**	**0.1%**	**0.90**	**9.0%**	**0.82**	**7.62**	**1.4%**	**0.79**	**25**
26							2%		1.08	12%	0.1%	0.95	9.0%	0.87	7.77	1.5%	0.84	26
27	25 - 29	287	1596.8	1.79	100%	58%	2%	1.07	1.15	12%	0.1%	1.01	9.0%	0.92	8.07	1.6%	0.89	27
28							2%		1.22	12%	0.2%	1.08	9.0%	0.98	8.47	1.6%	0.94	28
29							2%		1.31	12%	0.2%	1.15	9.0%	1.05	8.90	1.7%	1.00	29
30							**2%**		**1.41**	**12%**	**0.2%**	**1.24**	**9.0%**	**1.13**	**9.33**	**1.8%**	**1.07**	**30**
31							2%		1.52	12%	0.2%	1.34	9.0%	1.22	9.71	1.9%	1.15	31
32	30 - 34	565	1895.4	2.98	100%	57%	2%	1.72	1.64	12%	0.2%	1.44	9.0%	1.31	10.07	2.0%	1.24	32
33							2%		1.77	12%	0.2%	1.56	8.9%	1.43	10.44	2.2%	1.34	33
34							2%		1.93	12%	0.3%	1.70	8.9%	1.55	10.88	2.3%	1.45	34
35							**2%**		**2.10**	**12%**	**0.3%**	**1.85**	**8.8%**	**1.69**	**11.40**	**2.5%**	**1.56**	**35**
36							2%		2.29	12%	0.3%	2.02	8.8%	1.85	12.04	2.8%	1.69	36
37	35 - 39	930	1969.9	4.72	100%	53%	2%	2.56	2.51	12%	0.3%	2.21	8.8%	2.02	12.81	3.0%	1.83	37
38							2%		2.75	12%	0.4%	2.43	8.7%	2.22	13.71	3.2%	1.99	38
39							2%		3.03	12%	0.4%	2.68	8.7%	2.45	14.73	3.5%	2.17	39
40							**2%**		**3.34**	**12%**	**0.4%**	**2.96**	**8.6%**	**2.70**	**15.86**	**3.7%**	**2.37**	**40**
41							2%		3.70	12%	0.5%	3.27	8.6%	2.99	17.12	3.9%	2.60	41
42	40 - 44	1397	1782.8	7.83	100%	49%	2%	3.91	4.10	12%	0.5%	3.63	8.5%	3.32	18.54	4.1%	2.87	42
43							2%		4.55	12%	0.6%	4.03	8.6%	3.68	20.19	4.3%	3.16	43
44							2%		5.05	12%	0.6%	4.48	8.6%	4.09	22.11	4.4%	3.50	44
45							**2%**		**5.62**	**12%**	**0.7%**	**4.98**	**8.6%**	**4.55**	**24.36**	**4.5%**	**3.88**	**45**
46							2%		6.25	12%	0.7%	5.54	8.7%	5.06	26.96	4.6%	4.31	46
47	45 - 49	2216	1570.4	14.11	100%	52%	2%	7.40	6.94	12%	0.8%	6.16	8.7%	5.62	29.86	4.6%	4.79	47
48							2%		7.70	12%	0.9%	6.84	8.7%	6.25	32.95	4.6%	5.33	48
49							2%		8.54	12%	1.0%	7.59	8.6%	6.93	36.15	4.6%	5.93	49
50							**2%**		**9.45**	**12%**	**1.1%**	**8.40**	**8.6%**	**7.68**	**39.37**	**4.6%**	**6.60**	**50**
51							2%		10.43	12%	1.2%	9.29	8.6%	8.49	42.57	4.6%	7.34	51
52	50 - 54	3772	1595.2	23.64	100%	47%	2%	11.42	11.51	12%	1.3%	10.26	8.6%	9.38	45.96	4.6%	8.15	52
53							2%		12.69	12%	1.4%	11.32	8.7%	10.34	49.81	4.6%	9.03	53
54							2%		13.98	12%	1.5%	12.49	8.7%	11.40	54.40	4.6%	9.98	54
55							**2%**		**15.39**	**12%**	**1.7%**	**13.78**	**8.8%**	**12.56**	**59.99**	**4.6%**	**11.00**	**55**
56							2%		16.94	12%	1.8%	15.18	8.9%	13.83	66.78	4.6%	12.08	56
57	55 - 59	5701	1516.3	37.60	100%	49%	2%	18.67	18.62	12%	2.0%	16.72	9.0%	15.22	74.66	4.7%	13.24	57
58							2%		20.44	12%	2.2%	18.40	9.1%	16.74	83.45	4.7%	14.48	58
59							2%		22.42	12%	2.5%	20.23	9.1%	18.38	92.95	4.7%	15.81	59
60							**2%**		**24.54**	**12%**	**2.7%**	**22.20**	**9.2%**	**20.16**	**102.99**	**4.8%**	**17.23**	**60**
61							2%		26.83	12%	3.0%	24.33	9.3%	22.07	113.48	4.9%	18.73	61
62	60 - 64	7655	1176.1	65.09	100%	45%	2%	29.55	29.29	12%	3.3%	26.65	9.4%	24.14	124.66	5.1%	20.33	62
63							2%		31.97	12%	3.6%	29.19	9.6%	26.39	136.87	5.2%	22.01	63
64							2%		34.88	12%	4.0%	31.97	9.8%	28.84	150.46	5.4%	23.77	64
65							**2%**		**38.06**	**12%**	**4.4%**	**35.02**	**10.0%**	**31.53**	**165.76**	**5.7%**	**25.61**	**65**
66							2%		41.53	12%	4.8%	38.38	10.2%	34.46	183.13	5.9%	27.52	66
67	65 - 69	10812	1049.2	103.05	100%	43%	2%	45.33	45.36	12%	5.2%	42.11	10.5%	37.70	202.86	6.2%	29.53	67
68							2%		49.58	12%	5.7%	46.27	10.8%	41.28	225.30	6.5%	31.65	68
69							2%		54.27	12%	6.2%	50.92	11.1%	45.25	250.74	6.8%	33.90	69
70							2%		**59.47**	**12%**	**6.8%**	**56.13**	**11.5%**	**49.66**	**279.52**	**7.1%**	**36.33**	**70**
71							2%		65.24	12%	7.3%	61.95	11.9%	54.55	311.95	7.4%	38.93	71
72	70 - 74	14266	894.9	159.41	100%	43%	3%	70.86	71.53	12%	7.9%	68.36	12.4%	59.88	348.31	7.7%	41.61	72
73							3%		78.31	12%	8.5%	75.34	12.9%	65.61	388.89	8.0%	44.25	73
74							3%		85.52	12%	9.2%	82.86	13.5%	71.70	433.99	8.3%	46.70	74
75							**3%**		**93.12**	**12%**	**9.8%**	**90.90**	**14.1%**	**78.11**	**483.89**	**8.7%**	**48.79**	**75**
76							3%		101.07	12%	10.5%	99.42	14.7%	84.78	538.79	9.1%	50.34	76
77	75 - 79	16427	686.6	239.26	100%	45%	3%	109.98	109.32	12%	11.3%	108.41	15.4%	91.69	598.60	9.5%	51.28	77
78							3%		117.81	12%	12.0%	117.83	16.1%	98.81	663.15	10.0%	51.62	78
79							3%		126.51	12%	12.8%	127.67	16.9%	106.09	732.26	10.4%	51.40	79
80							**4%**		**135.37**	**12%**	**13.6%**	**137.91**	**17.7%**	**113.47**	**805.77**	**10.8%**	**50.69**	**80**
81							4%		144.37	12%	14.5%	148.56	18.6%	120.95	884.16	11.2%	49.60	81
82	80 - 84	14387	441.8	325.63	100%	44%	4%	148.88	153.64	12%	15.4%	159.78	19.5%	128.63	970.61	11.5%	47.94	82
83							4%		163.31	12%	16.3%	171.78	20.5%	136.57	1068.97	11.8%	45.46	83
84							4%		173.55	12%	17.3%	184.77	21.5%	144.96	1183.08	12.1%	41.86	84
85							**5%**		**184.49**	**12%**	**18.4%**	**198.98**	**22.6%**	**153.93**	**1316.78**	**12.3%**	**36.86**	**85**

10.1.6 CIBT02 Calculations Detail - Stroke - Females

Age	Age Group	Number of Strokes	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from Stroke k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							2%		0.51	6%	0.1%	0.48	9.7%	0.43	2.73	1.4%	0.44	18
19							2%		0.55	6%	0.1%	0.52	9.7%	0.47	2.79	1.6%	0.47	19
20							**2%**		**0.60**	**6%**	**0.1%**	**0.56**	**9.8%**	**0.51**	**2.79**	**1.7%**	**0.51**	**20**
21							2%		0.64	6%	0.2%	0.60	9.8%	0.55	2.79	1.8%	0.55	21
22	20 - 24	189	1515.9	1.25	100%	58%	2%	0.74	0.69	6%	0.2%	0.65	9.9%	0.59	2.81	2.0%	0.60	22
23							2%		0.74	6%	0.2%	0.70	9.9%	0.63	2.85	2.1%	0.64	23
24							2%		0.80	6%	0.2%	0.75	10.0%	0.68	2.93	2.3%	0.68	24
25							**2%**		**0.86**	**6%**	**0.2%**	**0.81**	**10.0%**	**0.73**	**3.03**	**2.5%**	**0.73**	**25**
26							2%		0.91	6%	0.2%	0.86	10.0%	0.78	3.19	2.7%	0.78	26
27	25 - 29	356	1592.5	2.24	100%	58%	2%	1.33	0.98	6%	0.2%	0.92	10.1%	0.83	3.38	2.9%	0.82	27
28							2%		1.04	6%	0.2%	0.98	9.9%	0.89	3.61	3.1%	0.87	28
29							2%		1.12	6%	0.3%	1.05	9.8%	0.95	3.89	3.3%	0.92	29
30							**2%**		**1.19**	**6%**	**0.3%**	**1.13**	**9.6%**	**1.02**	**4.20**	**3.5%**	**0.98**	**30**
31							2%		1.28	6%	0.3%	1.21	9.4%	1.09	4.55	3.7%	1.04	31
32	30 - 34	514	1908.5	2.69	100%	42%	2%	1.15	1.38	6%	0.3%	1.30	9.3%	1.18	4.94	3.9%	1.10	32
33							2%		1.49	6%	0.3%	1.40	9.4%	1.27	5.35	4.2%	1.18	33
34							2%		1.61	6%	0.4%	1.52	9.5%	1.37	5.79	4.4%	1.27	34
35							**2%**		**1.75**	**6%**	**0.4%**	**1.65**	**9.6%**	**1.49**	**6.25**	**4.6%**	**1.36**	**35**
36							2%		1.91	6%	0.4%	1.80	9.7%	1.63	6.73	4.8%	1.48	36
37	35 - 39	844	1993.0	4.24	100%	47%	2%	2.04	2.09	6%	0.4%	1.97	9.8%	1.78	7.25	5.0%	1.61	37
38							2%		2.29	6%	0.5%	2.16	9.9%	1.95	7.86	5.2%	1.75	38
39							2%		2.51	6%	0.5%	2.37	10.0%	2.14	8.57	5.4%	1.91	39
40							**2%**		**2.76**	**6%**	**0.5%**	**2.61**	**10.1%**	**2.34**	**9.43**	**5.6%**	**2.08**	**40**
41							2%		3.03	6%	0.6%	2.86	10.2%	2.57	10.46	5.8%	2.26	41
42	40 - 44	1220	1801.9	6.77	100%	51%	2%	3.56	3.32	6%	0.6%	3.14	10.3%	2.82	11.65	6.0%	2.45	42
43							2%		3.64	6%	0.7%	3.44	10.3%	3.09	12.99	6.1%	2.65	43
44							2%		3.97	6%	0.7%	3.76	10.3%	3.37	14.48	6.2%	2.86	44
45							**2%**		**4.32**	**6%**	**0.8%**	**4.10**	**10.2%**	**3.68**	**16.10**	**6.3%**	**3.09**	**45**
46							2%		4.70	6%	0.8%	4.45	10.2%	4.00	17.84	6.3%	3.33	46
47	45 - 49	1717	1594.7	10.76	100%	46%	2%	5.05	5.09	6%	0.9%	4.82	10.2%	4.33	19.69	6.2%	3.60	47
48							2%		5.49	6%	1.0%	5.22	10.3%	4.68	21.64	6.1%	3.89	48
49							2%		5.93	6%	1.1%	5.63	10.4%	5.04	23.68	6.0%	4.21	49
50							**2%**		**6.38**	**6%**	**1.1%**	**6.07**	**10.5%**	**5.43**	**25.81**	**5.9%**	**4.55**	**50**
51							2%		6.86	6%	1.2%	6.53	10.6%	5.84	28.02	5.8%	4.92	51
52	50 - 54	2562	1626.3	15.76	100%	48%	2%	7.68	7.38	6%	1.3%	7.03	10.7%	6.27	30.38	5.6%	5.32	52
53							2%		7.94	6%	1.4%	7.57	10.8%	6.75	32.97	5.5%	5.75	53
54							2%		8.55	6%	1.6%	8.16	10.9%	7.28	35.88	5.4%	6.22	54
55							**2%**		**9.23**	**6%**	**1.7%**	**8.83**	**10.9%**	**7.86**	**39.19**	**5.3%**	**6.73**	**55**
56							2%		9.99	6%	1.8%	9.57	11.0%	8.51	42.95	5.3%	7.29	56
57	55 - 59	3546	1545.1	22.95	100%	44%	2%	10.40	10.84	6%	2.0%	10.40	11.1%	9.24	47.20	5.3%	7.91	57
58							2%		11.81	6%	2.1%	11.34	11.3%	10.06	51.94	5.3%	8.60	58
59							2%		12.90	6%	2.3%	12.42	11.5%	10.99	57.16	5.3%	9.37	59
60							**2%**		**14.15**	**6%**	**2.5%**	**13.64**	**11.7%**	**12.05**	**62.89**	**5.4%**	**10.23**	**60**
61							2%		15.56	6%	2.7%	15.03	11.9%	13.25	69.14	5.6%	11.19	61
62	60 - 64	4664	1220.4	38.21	100%	46%	2%	17.91	17.16	6%	2.9%	16.62	12.1%	14.61	75.98	5.7%	12.27	62
63							2%		18.99	6%	3.2%	18.43	12.3%	16.17	83.51	5.9%	13.47	63
64							3%		21.07	6%	3.4%	20.50	12.5%	17.94	91.81	6.2%	14.82	64
65							**3%**		**23.43**	**6%**	**3.7%**	**22.86**	**12.8%**	**19.94**	**100.97**	**6.5%**	**16.32**	**65**
66							3%		26.09	6%	3.9%	25.53	13.0%	22.21	111.14	6.8%	17.98	66
67	65 - 69	6996	1126.9	62.08	100%	45%	3%	28.47	29.10	6%	4.2%	28.56	13.3%	24.76	122.71	7.1%	19.80	67
68							3%		32.48	6%	4.5%	31.96	13.7%	27.59	136.10	7.5%	21.75	68
69							3%		36.25	6%	4.8%	35.79	14.1%	30.76	151.77	7.9%	23.80	69
70							3%		**40.45**	**6%**	**5.1%**	**40.07**	**14.5%**	**34.27**	**170.15**	**8.3%**	**25.94**	**70**
71							3%		45.11	6%	5.4%	44.83	14.9%	38.15	191.59	8.7%	28.11	71
72	70 - 74	11404	1059.2	107.66	100%	47%	3%	51.69	50.21	6%	5.7%	50.07	15.3%	42.39	216.11	9.2%	30.26	72
73							3%		55.76	6%	6.1%	55.80	15.7%	47.02	243.64	9.6%	32.31	73
74							3%		61.75	6%	6.4%	62.02	16.2%	51.99	274.10	10.2%	34.15	74
75							3%		**68.17**	**6%**	**6.8%**	**68.72**	**16.6%**	**57.29**	**307.42**	**10.7%**	**35.69**	**75**
76							3%		75.04	6%	7.1%	75.93	17.1%	62.93	343.68	11.4%	36.80	76
77	75 - 79	16581	938.1	176.75	100%	45%	4%	81.62	82.44	6%	7.5%	83.76	17.7%	68.97	383.56	12.1%	37.47	77
78							4%		90.51	6%	7.8%	92.33	18.3%	75.45	427.88	12.8%	37.73	78
79							4%		99.36	6%	8.2%	101.78	18.9%	82.50	477.49	13.4%	37.62	79
80							4%		**109.11**	**6%**	**8.6%**	**112.25**	**19.6%**	**90.22**	**533.20**	**14.1%**	**37.25**	**80**
81							4%		119.86	6%	9.0%	123.87	20.3%	98.67	596.01	14.6%	36.68	81
82	80 - 84	19959	737.7	270.56	100%	46%	4%	129.57	131.65	6%	9.5%	136.69	21.1%	107.89	667.55	15.1%	35.82	82
83							5%		144.50	6%	9.9%	150.78	21.9%	117.73	749.61	15.5%	34.52	83
84							5%		158.44	6%	10.4%	166.18	22.8%	128.28	843.98	15.8%	32.66	84
85							**5%**		**173.50**	**6%**	**10.9%**	**182.95**	**23.7%**	**139.54**	**952.46**	**16.0%**	**30.20**	**85**

10.1.7 CIBT02 Calculations Detail - Coronary Artery By-pass Graft - Males

Age	Age Group	Number of CABG Operations	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from CABG k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		0.00	58%	0.0%	0.00	0.5%	0.00	6.15	0.0%	0.00	18
19							0%		0.00	58%	0.0%	0.00	0.5%	0.00	6.99	0.0%	0.00	19
20							**0%**		**0.01**	**58%**	**0.1%**	**0.00**	**0.5%**	**0.00**	**7.54**	**0.0%**	**0.00**	**20**
21							0%		0.01	58%	0.1%	0.00	0.5%	0.00	7.79	0.0%	0.00	21
22	20 - 24	0	1520.4	0.00	100%	95%	0%	0.00	0.01	58%	0.1%	0.00	0.5%	0.00	7.82	0.0%	0.00	22
23							0%		0.01	58%	0.1%	0.01	0.5%	0.01	7.73	0.0%	0.01	23
24							0%		0.02	58%	0.1%	0.01	0.5%	0.01	7.63	0.0%	0.01	24
25							**0%**		**0.03**	**58%**	**0.1%**	**0.01**	**0.5%**	**0.01**	**7.62**	**0.0%**	**0.01**	**25**
26							0%		0.03	58%	0.1%	0.01	0.5%	0.01	7.77	0.0%	0.01	26
27	25 - 29	12	1596.8	0.07	100%	95%	0%	0.07	0.05	58%	0.1%	0.02	0.5%	0.02	8.07	0.0%	0.02	27
28							0%		0.06	58%	0.2%	0.03	0.5%	0.03	8.47	0.0%	0.03	28
29							0%		0.08	58%	0.2%	0.04	0.5%	0.03	8.90	0.0%	0.03	29
30							**0%**		**0.11**	**58%**	**0.2%**	**0.05**	**0.6%**	**0.05**	**9.33**	**0.0%**	**0.05**	**30**
31							0%		0.15	58%	0.2%	0.06	0.6%	0.06	9.71	0.0%	0.06	31
32	30 - 34	39	1895.4	0.20	100%	95%	0%	0.19	0.20	58%	0.3%	0.08	0.6%	0.08	10.07	0.0%	0.08	32
33							0%		0.27	58%	0.3%	0.11	0.6%	0.11	10.44	0.0%	0.11	33
34							0%		0.37	58%	0.3%	0.15	0.6%	0.15	10.88	0.0%	0.15	34
35							**0%**		**0.49**	**58%**	**0.4%**	**0.21**	**0.6%**	**0.21**	**11.40**	**0.0%**	**0.21**	**35**
36							0%		0.65	58%	0.4%	0.27	0.6%	0.27	12.04	0.0%	0.27	36
37	35 - 39	173	1969.9	0.88	100%	95%	0%	0.83	0.86	58%	0.5%	0.36	0.6%	0.36	12.81	0.0%	0.36	37
38							0%		1.14	58%	0.6%	0.48	0.6%	0.48	13.71	0.0%	0.48	38
39							0%		1.51	58%	0.6%	0.64	0.6%	0.63	14.73	0.0%	0.63	39
40							**0%**		**1.97**	**58%**	**0.7%**	**0.84**	**0.6%**	**0.83**	**15.86**	**0.0%**	**0.83**	**40**
41							0%		2.56	58%	0.8%	1.09	0.7%	1.08	17.12	0.0%	1.08	41
42	40 - 44	661	1782.8	3.71	100%	95%	0%	3.52	3.28	58%	0.9%	1.39	0.7%	1.38	18.54	0.1%	1.38	42
43							0%		4.15	58%	1.1%	1.76	0.7%	1.75	20.19	0.1%	1.75	43
44							0%		5.17	58%	1.2%	2.20	0.7%	2.18	22.11	0.1%	2.18	44
45							**0%**		**6.35**	**58%**	**1.4%**	**2.71**	**0.7%**	**2.69**	**24.36**	**0.1%**	**2.69**	**45**
46							0%		7.72	58%	1.5%	3.29	0.7%	3.27	26.96	0.1%	3.27	46
47	45 - 49	1583	1570.4	10.08	100%	95%	0%	9.57	9.26	58%	1.7%	3.96	0.7%	3.93	29.86	0.1%	3.93	47
48							0%		10.95	58%	2.0%	4.69	0.8%	4.66	32.95	0.1%	4.66	48
49							0%		12.80	58%	2.2%	5.50	0.8%	5.45	36.15	0.1%	5.45	49
50							**0%**		**14.79**	**58%**	**2.5%**	**6.37**	**0.8%**	**6.32**	**39.37**	**0.1%**	**6.32**	**50**
51							0%		16.92	58%	2.8%	7.31	0.8%	7.25	42.57	0.1%	7.25	51
52	50 - 54	3281	1595.2	20.57	100%	95%	0%	19.54	19.21	58%	3.1%	8.32	0.9%	8.25	45.96	0.2%	8.25	52
53							0%		21.69	58%	3.4%	9.43	0.9%	9.35	49.81	0.2%	9.35	53
54							0%		24.39	58%	3.8%	10.65	0.9%	10.55	54.40	0.2%	10.55	54
55							**0%**		**27.34**	**58%**	**4.2%**	**11.99**	**1.0%**	**11.88**	**59.99**	**0.2%**	**11.88**	**55**
56							0%		30.57	58%	4.7%	13.47	1.0%	13.33	66.78	0.2%	13.33	56
57	55 - 59	5287	1516.3	34.87	100%	95%	0%	33.12	34.02	58%	5.1%	15.06	1.1%	14.90	74.66	0.2%	14.90	57
58							0%		37.65	58%	5.6%	16.76	1.1%	16.57	83.45	0.2%	16.57	58
59							0%		41.42	58%	6.2%	18.54	1.2%	18.32	92.95	0.2%	18.32	59
60							**0%**		**45.26**	**58%**	**6.7%**	**20.37**	**1.2%**	**20.12**	**102.99**	**0.2%**	**20.12**	**60**
61							0%		49.12	58%	7.3%	22.24	1.3%	21.96	113.48	0.3%	21.96	61
62	60 - 64	6671	1176.1	56.72	100%	95%	0%	53.89	52.90	58%	7.8%	24.11	1.4%	23.77	124.66	0.3%	23.77	62
63							0%		56.51	58%	8.4%	25.91	1.5%	25.53	136.87	0.3%	25.53	63
64							0%		59.83	58%	9.0%	27.61	1.6%	27.18	150.46	0.3%	27.18	64
65							**0%**		**62.76**	**58%**	**9.6%**	**29.14**	**1.7%**	**28.66**	**165.76**	**0.3%**	**28.66**	**65**
66							0%		65.22	58%	10.1%	30.48	1.8%	29.94	183.13	0.3%	29.94	66
67	65 - 69	7275	1049.2	69.34	100%	95%	0%	65.87	67.24	58%	10.7%	31.62	1.9%	31.01	202.86	0.3%	31.01	67
68							0%		68.86	58%	11.2%	32.58	2.0%	31.91	225.30	0.3%	31.91	68
69							0%		70.15	58%	11.7%	33.38	2.2%	32.65	250.74	0.3%	32.65	69
70							0%		**71.14**	**58%**	**12.2%**	**34.05**	**2.3%**	**33.25**	**279.52**	**0.3%**	**33.25**	**70**
71							0%		71.82	58%	12.7%	34.56	2.5%	33.69	311.95	0.3%	33.69	71
72	70 - 74	6666	894.9	74.49	100%	95%	0%	70.76	71.86	58%	13.2%	34.77	2.7%	33.83	348.31	0.3%	33.83	72
73							0%		70.88	58%	13.6%	34.47	2.9%	33.47	388.89	0.3%	33.47	73
74							0%		68.48	58%	14.0%	33.46	3.1%	32.43	433.99	0.2%	32.43	74
75							**0%**		**64.27**	**58%**	**14.4%**	**31.55**	**3.3%**	**30.51**	**483.89**	**0.2%**	**30.51**	**75**
76							0%		58.04	58%	14.8%	28.62	3.5%	27.61	538.79	0.2%	27.61	76
77	75 - 79	3752	686.6	54.64	100%	95%	0%	51.91	50.36	58%	15.2%	24.95	3.8%	24.01	598.60	0.2%	24.01	77
78							0%		41.98	58%	15.6%	20.89	4.0%	20.05	663.15	0.1%	20.05	78
79							0%		33.67	58%	15.9%	16.82	4.3%	16.10	732.26	0.1%	16.10	79
80							**0%**		**26.16**	**58%**	**16.3%**	**13.13**	**4.6%**	**12.53**	**805.77**	**0.1%**	**12.53**	**80**
81							0%		20.06	58%	16.7%	10.11	4.9%	9.62	884.16	0.1%	9.62	81
82	80 - 84	792	441.8	17.92	100%	95%	0%	17.02	15.30	58%	17.0%	7.75	5.2%	7.34	970.61	0.0%	7.34	82
83							0%		11.66	58%	17.4%	5.93	5.5%	5.60	1068.97	0.0%	5.60	83
84							0%		8.91	58%	17.7%	4.55	5.9%	4.28	1183.08	0.0%	4.28	84
85							**0%**		**6.82**	**58%**	**18.1%**	**3.50**	**6.3%**	**3.28**	**1316.78**	**0.0%**	**3.28**	**85**

10.1.8 CIBT02 Calculations Detail - Coronary Artery By-pass Graft - Females

Age	Age Group	Number of CABG Operations	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from CABG k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		0.00	58%	0.0%	0.00	0.5%	0.00	2.73	0.0%	0.00	18
19							0%		0.00	58%	0.0%	0.00	0.5%	0.00	2.79	0.0%	0.00	19
20							**0%**		**0.00**	**58%**	**0.0%**	**0.00**	**0.5%**	**0.00**	**2.79**	**0.0%**	**0.00**	**20**
21							0%		0.01	58%	0.0%	0.00	0.5%	0.00	2.79	0.0%	0.00	21
22	20 - 24	2	1515.9	0.01	100%	95%	0%	0.01	0.01	58%	0.0%	0.00	0.5%	0.00	2.81	0.0%	0.00	22
23							0%		0.01	58%	0.0%	0.00	0.5%	0.00	2.85	0.0%	0.00	23
24							0%		0.01	58%	0.1%	0.00	0.5%	0.00	2.93	0.0%	0.00	24
25							**0%**		**0.01**	**58%**	**0.1%**	**0.01**	**0.5%**	**0.01**	**3.03**	**0.0%**	**0.01**	**25**
26							0%		0.02	58%	0.1%	0.01	0.5%	0.01	3.19	0.0%	0.01	26
27	25 - 29	2	1592.5	0.01	100%	95%	0%	0.01	0.02	58%	0.1%	0.01	0.5%	0.01	3.38	0.0%	0.01	27
28							0%		0.03	58%	0.1%	0.01	0.5%	0.01	3.61	0.0%	0.01	28
29							0%		0.03	58%	0.1%	0.01	0.5%	0.01	3.89	0.0%	0.01	29
30							**0%**		**0.04**	**58%**	**0.1%**	**0.02**	**0.6%**	**0.02**	**4.20**	**0.0%**	**0.02**	**30**
31							0%		0.05	58%	0.1%	0.02	0.6%	0.02	4.55	0.0%	0.02	31
32	30 - 34	9	1908.5	0.04	100%	95%	0%	0.04	0.07	58%	0.1%	0.03	0.6%	0.03	4.94	0.0%	0.03	32
33							0%		0.08	58%	0.1%	0.03	0.6%	0.03	5.35	0.0%	0.03	33
34							0%		0.10	58%	0.2%	0.04	0.6%	0.04	5.79	0.0%	0.04	34
35							**0%**		**0.13**	**58%**	**0.2%**	**0.05**	**0.6%**	**0.05**	**6.25**	**0.0%**	**0.05**	**35**
36							0%		0.16	58%	0.2%	0.07	0.6%	0.07	6.73	0.0%	0.07	36
37	35 - 39	47	1993.0	0.24	100%	95%	0%	0.22	0.20	58%	0.2%	0.08	0.6%	0.08	7.25	0.0%	0.08	37
38							0%		0.25	58%	0.2%	0.10	0.6%	0.10	7.86	0.0%	0.10	38
39							0%		0.31	58%	0.3%	0.13	0.6%	0.13	8.57	0.0%	0.13	39
40							**0%**		**0.38**	**58%**	**0.3%**	**0.16**	**0.6%**	**0.16**	**9.43**	**0.0%**	**0.16**	**40**
41							0%		0.46	58%	0.3%	0.19	0.7%	0.19	10.46	0.0%	0.19	41
42	40 - 44	117	1801.9	0.65	100%	95%	0%	0.62	0.56	58%	0.4%	0.23	0.7%	0.23	11.65	0.0%	0.23	42
43							0%		0.67	58%	0.4%	0.28	0.7%	0.28	12.99	0.0%	0.28	43
44							0%		0.80	58%	0.5%	0.34	0.7%	0.34	14.48	0.0%	0.34	44
45							**0%**		**0.96**	**58%**	**0.5%**	**0.40**	**0.7%**	**0.40**	**16.10**	**0.0%**	**0.40**	**45**
46							0%		1.13	58%	0.6%	0.48	0.7%	0.47	17.84	0.0%	0.47	46
47	45 - 49	255	1594.7	1.60	100%	95%	0%	1.52	1.33	58%	0.6%	0.56	0.7%	0.56	19.69	0.0%	0.56	47
48							0%		1.55	58%	0.7%	0.66	0.8%	0.65	21.64	0.0%	0.65	48
49							0%		1.80	58%	0.8%	0.76	0.8%	0.76	23.68	0.0%	0.76	49
50							**0%**		**2.09**	**58%**	**0.8%**	**0.89**	**0.8%**	**0.88**	**25.81**	**0.0%**	**0.88**	**50**
51							0%		2.41	58%	0.9%	1.02	0.8%	1.01	28.02	0.0%	1.01	51
52	50 - 54	464	1626.3	2.85	100%	95%	0%	2.71	2.78	58%	1.0%	1.18	0.9%	1.17	30.38	0.0%	1.17	52
53							0%		3.19	58%	1.1%	1.35	0.9%	1.34	32.97	0.0%	1.34	53
54							0%		3.66	58%	1.2%	1.56	0.9%	1.54	35.88	0.0%	1.54	54
55							**0%**		**4.20**	**58%**	**1.4%**	**1.79**	**1.0%**	**1.77**	**39.19**	**0.0%**	**1.77**	**55**
56							0%		4.81	58%	1.5%	2.05	1.0%	2.03	42.95	0.0%	2.03	56
57	55 - 59	874	1545.1	5.65	100%	95%	0%	5.37	5.49	58%	1.6%	2.35	1.1%	2.32	47.20	0.1%	2.32	57
58							0%		6.27	58%	1.8%	2.68	1.1%	2.65	51.94	0.1%	2.65	58
59							0%		7.13	58%	1.9%	3.06	1.2%	3.02	57.16	0.1%	3.02	59
60							**0%**		**8.10**	**58%**	**2.1%**	**3.47**	**1.2%**	**3.43**	**62.89**	**0.1%**	**3.43**	**60**
61							0%		9.17	58%	2.3%	3.94	1.3%	3.89	69.14	0.1%	3.89	61
62	60 - 64	1352	1220.4	11.08	100%	95%	0%	10.52	10.33	58%	2.4%	4.45	1.4%	4.38	75.98	0.1%	4.38	62
63							0%		11.56	58%	2.6%	4.99	1.5%	4.91	83.51	0.1%	4.91	63
64							0%		12.85	58%	2.8%	5.55	1.6%	5.47	91.81	0.1%	5.47	64
65							**0%**		**14.18**	**58%**	**3.0%**	**6.14**	**1.7%**	**6.04**	**100.97**	**0.1%**	**6.04**	**65**
66							0%		15.52	58%	3.3%	6.74	1.8%	6.62	111.14	0.1%	6.62	66
67	65 - 69	1961	1126.9	17.40	100%	95%	0%	16.53	16.83	58%	3.5%	7.33	1.9%	7.19	122.71	0.1%	7.19	67
68							0%		18.04	58%	3.7%	7.87	2.0%	7.71	136.10	0.1%	7.71	68
69							0%		19.09	58%	4.0%	8.35	2.2%	8.17	151.77	0.1%	8.17	69
70							**0%**		**19.91**	**58%**	**4.3%**	**8.74**	**2.3%**	**8.53**	**170.15**	**0.1%**	**8.53**	**70**
71							0%		20.44	58%	4.5%	9.00	2.5%	8.77	191.59	0.1%	8.77	71
72	70 - 74	2298	1059.2	21.70	100%	95%	0%	20.61	20.63	58%	4.8%	9.10	2.7%	8.86	216.11	0.1%	8.86	72
73							0%		20.40	58%	5.1%	9.03	2.9%	8.77	243.64	0.1%	8.77	73
74							0%		19.71	58%	5.5%	8.75	3.1%	8.48	274.10	0.1%	8.48	74
75							**0%**		**18.48**	**58%**	**5.8%**	**8.24**	**3.3%**	**7.97**	**307.42**	**0.1%**	**7.97**	**75**
76							0%		16.70	58%	6.1%	7.47	3.5%	7.21	343.68	0.1%	7.21	76
77	75 - 79	1426	938.1	15.20	100%	95%	0%	14.44	14.54	58%	6.5%	6.53	3.8%	6.29	383.56	0.1%	6.29	77
78							0%		12.19	58%	6.9%	5.50	4.0%	5.28	427.88	0.1%	5.28	78
79							0%		9.85	58%	7.3%	4.46	4.3%	4.27	477.49	0.0%	4.27	79
80							**0%**		**7.73**	**58%**	**7.7%**	**3.52**	**4.6%**	**3.36**	**533.20**	**0.0%**	**3.36**	**80**
81							0%		5.99	58%	8.2%	2.74	4.9%	2.61	596.01	0.0%	2.61	81
82	80 - 84	411	737.7	5.56	100%	95%	0%	5.29	4.62	58%	8.6%	2.12	5.2%	2.01	667.55	0.0%	2.01	82
83							0%		3.54	58%	9.1%	1.64	5.5%	1.55	749.61	0.0%	1.55	83
84							0%		2.72	58%	9.7%	1.26	5.9%	1.19	843.98	0.0%	1.19	84
85							**0%**		**2.08**	**58%**	**10.2%**	**0.97**	**6.3%**	**0.91**	**952.46**	**0.0%**	**0.91**	**85**

10.1.9 CIBT02 Calculations Detail - Multiple Sclerosis - Males

Age	Age Group	Number of New MS Diagnoses	Raw Data (Borders & Lothian) Population Thousands	Raw Observed Rate (4 yr Obs) per 10,000	Adjustments for Gender & Latitude	Adjustment to First Ever Basis (Not Used)	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	MS Diagnosis Incidence Rate per 10,000	Adjusted to Progressive Form l_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate l'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from MS k_x	Addition for Accelerated Rate $l_x - k_x q_x$ per 10,000	Age
18							0%		0.28	0%	0%	0.28	0.06	0.0%	0.06	6.15	0.06%	0.05	18
19							0%		0.33	0%	0%	0.33	0.08	0.0%	0.08	6.99	0.07%	0.07	19
20							**0%**		**0.40**	**0%**	**0%**	**0.40**	**0.10**	**0.0%**	**0.10**	**7.54**	**0.08%**	**0.09**	**20**
21							0%		0.48	0%	0%	0.48	0.13	0.0%	0.13	7.79	0.09%	0.12	21
22	20 - 24	25	27.3	2.29	32%	100%	0%	0.73	0.58	0%	0%	0.58	0.16	0.0%	0.16	7.82	0.10%	0.15	22
23							0%		0.67	0%	0%	0.67	0.20	0.0%	0.20	7.73	0.11%	0.19	23
24							0%		0.78	0%	0%	0.78	0.24	0.0%	0.24	7.63	0.12%	0.23	24
25							**0%**		**0.89**	**0%**	**0%**	**0.89**	**0.29**	**0.0%**	**0.29**	**7.62**	**0.14%**	**0.28**	**25**
26							0%		1.00	0%	0%	1.00	0.35	0.0%	0.35	7.77	0.15%	0.34	26
27	25 - 29	47	31.9	3.69	33%	100%	0%	1.21	1.11	0%	0%	1.11	0.41	0.0%	0.41	8.07	0.17%	0.40	27
28							0%		1.22	0%	0%	1.22	0.48	0.0%	0.48	8.47	0.19%	0.46	28
29							0%		1.31	0%	0%	1.31	0.55	0.0%	0.55	8.90	0.21%	0.53	29
30							**0%**		**1.39**	**0%**	**0%**	**1.39**	**0.61**	**0.0%**	**0.61**	**9.33**	**0.24%**	**0.59**	**30**
31							0%		1.45	0%	0%	1.45	0.68	0.0%	0.68	9.71	0.26%	0.65	31
32	30 - 34	59	33.1	4.46	34%	100%	0%	1.50	1.50	0%	0%	1.50	0.75	0.0%	0.74	10.07	0.29%	0.72	32
33							0%		1.52	0%	0%	1.52	0.81	0.0%	0.81	10.44	0.32%	0.78	33
34							0%		1.54	0%	0%	1.54	0.87	0.0%	0.87	10.88	0.34%	0.83	34
35							**0%**		**1.54**	**0%**	**0%**	**1.54**	**0.93**	**0.0%**	**0.93**	**11.40**	**0.37%**	**0.88**	**35**
36							0%		1.53	0%	0%	1.53	0.98	0.0%	0.98	12.04	0.40%	0.93	36
37	35 - 39	52	30.7	4.24	35%	100%	0%	1.47	1.52	0%	0%	1.52	1.02	0.0%	1.02	12.81	0.43%	0.97	37
38							0%		1.49	0%	0%	1.49	1.06	0.0%	1.06	13.71	0.45%	1.00	38
39							0%		1.46	0%	0%	1.46	1.10	0.0%	1.10	14.73	0.48%	1.03	39
40							**0%**		**1.43**	**0%**	**0%**	**1.43**	**1.12**	**0.0%**	**1.12**	**15.86**	**0.50%**	**1.04**	**40**
41							0%		1.40	0%	0%	1.40	1.14	0.0%	1.14	17.12	0.52%	1.05	41
42	40 - 44	41	29.0	3.53	36%	100%	0%	1.26	1.36	0%	0%	1.36	1.15	0.0%	1.15	18.54	0.54%	1.05	42
43							0%		1.32	0%	0%	1.32	1.15	0.0%	1.15	20.19	0.55%	1.04	43
44							0%		1.27	0%	0%	1.27	1.15	0.0%	1.15	22.11	0.56%	1.03	44
45							**0%**		**1.23**	**0%**	**0%**	**1.23**	**1.14**	**0.0%**	**1.14**	**24.36**	**0.56%**	**1.00**	**45**
46							0%		1.18	0%	0%	1.18	1.12	0.0%	1.12	26.96	0.56%	0.97	46
47	45 - 49	38	30.4	3.13	37%	100%	0%	1.16	1.13	0%	0%	1.13	1.10	0.0%	1.10	29.86	0.56%	0.94	47
48							0%		1.08	0%	0%	1.08	1.08	0.0%	1.08	32.95	0.55%	0.90	48
49							0%		1.02	0%	0%	1.02	1.05	0.0%	1.05	36.15	0.53%	0.86	49
50							**0%**		**0.97**	**0%**	**0%**	**0.97**	**1.02**	**0.0%**	**1.02**	**39.37**	**0.52%**	**0.81**	**50**
51							0%		0.91	0%	0%	0.91	0.98	0.0%	0.98	42.57	0.50%	0.77	51
52	50 - 54	23	24.7	2.33	38%	100%	0%	0.89	0.85	0%	0%	0.85	0.95	0.0%	0.95	45.96	0.49%	0.72	52
53							0%		0.79	0%	0%	0.79	0.91	0.0%	0.91	49.81	0.47%	0.68	53
54							0%		0.73	0%	0%	0.73	0.87	0.0%	0.87	54.40	0.45%	0.63	54
55							**0%**		**0.67**	**0%**	**0%**	**0.67**	**0.83**	**0.0%**	**0.83**	**59.99**	**0.42%**	**0.57**	**55**
56							0%		0.61	0%	0%	0.61	0.79	0.1%	0.79	66.78	0.40%	0.52	56
57	55 - 59	16	22.9	1.75	40%	100%	0%	0.69	0.55	0%	0%	0.55	0.74	0.1%	0.74	74.66	0.38%	0.46	57
58							0%		0.49	0%	0%	0.49	0.70	0.1%	0.70	83.45	0.35%	0.41	58
59							0%		0.44	0%	0%	0.44	0.65	0.1%	0.65	92.95	0.32%	0.35	59
60							**0%**		**0.40**	**0%**	**0%**	**0.40**	**0.61**	**0.1%**	**0.61**	**102.99**	**0.30%**	**0.30**	**60**
61							0%		0.35	0%	0%	0.35	0.57	0.1%	0.57	113.48	0.28%	0.25	61
62	60 - 64	5	20.7	0.60	41%	100%	0%	0.25	0.31	0%	0%	0.31	0.52	0.1%	0.52	124.66	0.25%	0.21	62
63							0%		0.28	0%	0%	0.28	0.48	0.1%	0.48	136.87	0.23%	0.16	63
64							0%		0.25	0%	0%	0.25	0.44	0.1%	0.44	150.46	0.21%	0.12	64
65							**0%**		**0.22**	**0%**	**0%**	**0.22**	**0.40**	**0.1%**	**0.40**	**165.76**	**0.19%**	**0.08**	**65**
66							0%		0.19	0%	0%	0.19	0.37	0.1%	0.36	183.13	0.18%	0.04	66
67	65 - 69	3	19.1	0.39	43%	100%	0%	0.17	0.17	0%	0%	0.17	0.33	0.2%	0.33	202.86	0.16%	0.00	67
68							0%		0.15	0%	0%	0.15	0.30	0.2%	0.30	225.30	0.15%	-0.03	68
69							0%		0.13	0%	0%	0.13	0.27	0.2%	0.27	250.74	0.13%	-0.07	69
70							**0%**		**0.12**	**0%**	**0%**	**0.12**	**0.24**	**0.2%**	**0.24**	**279.52**	**0.12%**	**-0.10**	**70**
71							0%		0.10	0%	0%	0.10	0.21	0.2%	0.21	311.95	0.11%	-0.13	71
72	70 - 74	1	17.4	0.14	44%	100%	0%	0.06	0.09	0%	0%	0.09	0.19	0.3%	0.19	348.31	0.10%	-0.15	72
73							0%		0.08	0%	0%	0.08	0.17	0.3%	0.17	388.89	0.09%	-0.18	73
74							0%		0.07	0%	0%	0.07	0.15	0.3%	0.15	433.99	0.08%	-0.20	74
75							**0%**		**0.06**	**0%**	**0%**	**0.06**	**0.13**	**0.4%**	**0.13**	**483.89**	**0.07%**	**-0.22**	**75**
76							0%		0.05	0%	0%	0.05	0.12	0.4%	0.12	538.79	0.06%	-0.23	76
77	75 and over	1	25.4	0.10	46%	100%	0%	0.05	0.05	0%	0%	0.05	0.10	0.5%	0.10	598.60	0.06%	-0.25	77
78							0%		0.04	0%	0%	0.04	0.09	0.5%	0.09	663.15	0.05%	-0.26	78
79							0%		0.04	0%	0%	0.04	0.08	0.6%	0.08	732.26	0.05%	-0.27	79
80							**0%**		**0.03**	**0%**	**0%**	**0.03**	**0.07**	**0.6%**	**0.07**	**805.77**	**0.04%**	**-0.27**	**80**
81							0%		0.03	0%	0%	0.03	0.06	0.7%	0.06	884.16	0.04%	-0.28	81
82							0%		0.03	0%	0%	0.03	0.05	0.7%	0.05	970.61	0.03%	-0.28	82
83							0%		0.02	0%	0%	0.02	0.05	0.8%	0.05	1068.97	0.03%	-0.29	83
84							0%		0.02	0%	0%	0.02	0.04	0.9%	0.04	1183.08	0.03%	-0.29	84
85							**0%**		**0.02**	**0%**	**0%**	**0.02**	**0.04**	**1.0%**	**0.04**	**1316.78**	**0.03%**	**-0.30**	**85**

10.1.10 CIBT02 Calculations Detail - Multiple Sclerosis - Females

Age	Age Group	Number of New MS Diagnoses	Raw Data (Borders & Lothian) Population Thousands	Raw Observed Rate (4 yr Obs) per 10,000	Adjustments for Gender & Latitude	Adjustment to First Ever Basis (Not Used)	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	MS Diagnosis Incidence Rate per 10,000	Adjusted to Progressive Form l_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate l'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from MS k_x	Addition for Accelerated Rate $l_x - k_x q_x$ per 10,000	Age
18							0%		0.70	0%	0%	0.70	0.14	0.0%	0.14	2.73	0.10%	0.14	18
19							0%		0.84	0%	0%	0.84	0.19	0.0%	0.19	2.79	0.12%	0.19	19
20							**0%**		**1.01**	**0%**	**0%**	**1.01**	**0.25**	**0.0%**	**0.25**	**2.79**	**0.14%**	**0.25**	**20**
21							0%		1.21	0%	0%	1.21	0.32	0.0%	0.32	2.79	0.16%	0.32	21
22	20 - 24	25	27.3	2.29	79%	100%	0%	1.82	1.42	0%	0%	1.42	0.40	0.0%	0.40	2.81	0.18%	0.40	22
23							0%		1.66	0%	0%	1.66	0.50	0.0%	0.50	2.85	0.21%	0.49	23
24							0%		1.90	0%	0%	1.90	0.61	0.0%	0.61	2.93	0.24%	0.60	24
25							**0%**		**2.16**	**0%**	**0%**	**2.16**	**0.73**	**0.0%**	**0.73**	**3.03**	**0.28%**	**0.72**	**25**
26							0%		2.41	0%	0%	2.41	0.86	0.0%	0.86	3.19	0.32%	0.85	26
27	25 - 29	47	31.9	3.69	78%	100%	0%	2.89	2.66	0%	0%	2.66	1.00	0.0%	1.00	3.38	0.36%	0.99	27
28							0%		2.88	0%	0%	2.88	1.16	0.0%	1.16	3.61	0.42%	1.14	28
29							0%		3.08	0%	0%	3.08	1.32	0.0%	1.32	3.89	0.47%	1.31	29
30							**0%**		**3.24**	**0%**	**0%**	**3.24**	**1.47**	**0.0%**	**1.47**	**4.20**	**0.53%**	**1.45**	**30**
31							0%		3.36	0%	0%	3.36	1.62	0.0%	1.62	4.55	0.60%	1.60	31
32	30 - 34	59	33.1	4.46	77%	100%	0%	3.45	3.43	0%	0%	3.43	1.77	0.0%	1.77	4.94	0.68%	1.74	32
33							0%		3.47	0%	0%	3.47	1.91	0.0%	1.91	5.35	0.76%	1.87	33
34							0%		3.47	0%	0%	3.47	2.04	0.0%	2.04	5.79	0.84%	1.99	34
35							**0%**		**3.45**	**0%**	**0%**	**3.45**	**2.16**	**0.0%**	**2.16**	**6.25**	**0.93%**	**2.10**	**35**
36							0%		3.40	0%	0%	3.40	2.27	0.0%	2.27	6.73	1.02%	2.20	36
37	35 - 39	52	30.7	4.24	76%	100%	0%	3.24	3.34	0%	0%	3.34	2.36	0.0%	2.36	7.25	1.11%	2.28	37
38							0%		3.26	0%	0%	3.26	2.44	0.0%	2.44	7.86	1.20%	2.34	38
39							0%		3.17	0%	0%	3.17	2.50	0.0%	2.50	8.57	1.30%	2.39	39
40							**0%**		**3.07**	**0%**	**0%**	**3.07**	**2.54**	**0.0%**	**2.54**	**9.43**	**1.39%**	**2.41**	**40**
41							0%		2.96	0%	0%	2.96	2.56	0.0%	2.56	10.46	1.48%	2.41	41
42	40 - 44	41	29.0	3.53	75%	100%	0%	2.66	2.86	0%	0%	2.86	2.57	0.0%	2.57	11.65	1.57%	2.38	42
43							0%		2.75	0%	0%	2.75	2.55	0.0%	2.55	12.99	1.64%	2.34	43
44							0%		2.63	0%	0%	2.63	2.52	0.0%	2.52	14.48	1.70%	2.28	44
45							**0%**		**2.51**	**0%**	**0%**	**2.51**	**2.48**	**0.0%**	**2.48**	**16.10**	**1.75%**	**2.20**	**45**
46							0%		2.39	0%	0%	2.39	2.43	0.0%	2.43	17.84	1.77%	2.11	46
47	45 - 49	38	30.4	3.13	74%	100%	0%	2.32	2.27	0%	0%	2.27	2.36	0.0%	2.36	19.69	1.77%	2.02	47
48							0%		2.15	0%	0%	2.15	2.29	0.0%	2.29	21.64	1.75%	1.91	48
49							0%		2.02	0%	0%	2.02	2.21	0.0%	2.21	23.68	1.71%	1.81	49
50							**0%**		**1.89**	**0%**	**0%**	**1.89**	**2.13**	**0.0%**	**2.13**	**25.81**	**1.66%**	**1.70**	**50**
51							0%		1.76	0%	0%	1.76	2.04	0.0%	2.04	28.02	1.60%	1.59	51
52	50 - 54	23	24.7	2.33	73%	100%	0%	1.69	1.62	0%	0%	1.62	1.95	0.0%	1.95	30.38	1.52%	1.48	52
53							0%		1.49	0%	0%	1.49	1.85	0.0%	1.85	32.97	1.44%	1.38	53
54							0%		1.36	0%	0%	1.36	1.75	0.0%	1.75	35.88	1.35%	1.27	54
55							**0%**		**1.23**	**0%**	**0%**	**1.23**	**1.66**	**0.0%**	**1.66**	**39.19**	**1.26%**	**1.16**	**55**
56							0%		1.11	0%	0%	1.11	1.56	0.0%	1.56	42.95	1.16%	1.06	56
57	55 - 59	16	22.9	1.75	71%	100%	0%	1.25	1.00	0%	0%	1.00	1.46	0.0%	1.46	47.20	1.06%	0.96	57
58							0%		0.89	0%	0%	0.89	1.36	0.0%	1.36	51.94	0.97%	0.86	58
59							0%		0.79	0%	0%	0.79	1.26	0.0%	1.26	57.16	0.88%	0.76	59
60							**0%**		**0.70**	**0%**	**0%**	**0.70**	**1.17**	**0.0%**	**1.17**	**62.89**	**0.79%**	**0.67**	**60**
61							0%		0.61	0%	0%	0.61	1.07	0.1%	1.07	69.14	0.72%	0.58	61
62	60 - 64	5	20.7	0.60	70%	100%	0%	0.42	0.54	0%	0%	0.54	0.98	0.1%	0.98	75.98	0.66%	0.48	62
63							0%		0.47	0%	0%	0.47	0.90	0.1%	0.90	83.51	0.60%	0.39	63
64							0%		0.41	0%	0%	0.41	0.81	0.1%	0.81	91.81	0.55%	0.31	64
65							**0%**		**0.36**	**0%**	**0%**	**0.36**	**0.74**	**0.1%**	**0.73**	**100.97**	**0.51%**	**0.22**	**65**
66							0%		0.31	0%	0%	0.31	0.66	0.1%	0.66	111.14	0.47%	0.14	66
67	65 - 69	3	19.1	0.39	68%	100%	0%	0.27	0.27	0%	0%	0.27	0.59	0.1%	0.59	122.71	0.44%	0.05	67
68							0%		0.24	0%	0%	0.24	0.53	0.1%	0.53	136.10	0.41%	-0.03	68
69							0%		0.21	0%	0%	0.21	0.47	0.1%	0.47	151.77	0.38%	-0.11	69
70							**0%**		**0.18**	**0%**	**0%**	**0.18**	**0.41**	**0.1%**	**0.41**	**170.15**	**0.35%**	**-0.18**	**70**
71							0%		0.16	0%	0%	0.16	0.36	0.1%	0.36	191.59	0.32%	-0.26	71
72	70 - 74	1	17.4	0.14	67%	100%	0%	0.10	0.14	0%	0%	0.14	0.32	0.2%	0.32	216.11	0.30%	-0.32	72
73							0%		0.12	0%	0%	0.12	0.28	0.2%	0.28	243.64	0.27%	-0.38	73
74							0%		0.10	0%	0%	0.10	0.25	0.2%	0.25	274.10	0.24%	-0.42	74
75							**0%**		**0.09**	**0%**	**0%**	**0.09**	**0.22**	**0.2%**	**0.21**	**307.42**	**0.22%**	**-0.45**	**75**
76							0%		0.08	0%	0%	0.08	0.19	0.3%	0.19	343.68	0.19%	-0.47	76
77	75 and over	1	25.4	0.10	65%	100%	0%	0.06	0.07	0%	0%	0.07	0.16	0.3%	0.16	383.56	0.17%	-0.47	77
78							0%		0.06	0%	0%	0.06	0.14	0.3%	0.14	427.88	0.14%	-0.47	78
79							0%		0.05	0%	0%	0.05	0.12	0.4%	0.12	477.49	0.12%	-0.45	79
80							**0%**		**0.05**	**0%**	**0%**	**0.05**	**0.11**	**0.4%**	**0.11**	**533.20**	**0.10%**	**-0.43**	**80**
81							0%		0.04	0%	0%	0.04	0.09	0.5%	0.09	596.01	0.08%	-0.40	81
82							0%		0.03	0%	0%	0.03	0.08	0.5%	0.08	667.55	0.07%	-0.38	82
83							0%		0.03	0%	0%	0.03	0.07	0.6%	0.07	749.61	0.06%	-0.35	83
84							0%		0.03	0%	0%	0.03	0.06	0.6%	0.06	843.98	0.05%	-0.32	84
85							**0%**		**0.02**	**0%**	**0%**	**0.02**	**0.05**	**0.7%**	**0.05**	**952.46**	**0.04%**	**-0.30**	**85**

10.1.11 CIBT02 Calculations Detail - Kidney Failure - Males

Age	Age Group	Number of Patients Starting RRT	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from KF k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		0.25	1.6%	0.1%	0.25	0.3%	0.25	6.15	0.14%	0.24	18
19							0%		0.28	1.7%	0.1%	0.27	0.3%	0.27	6.99	0.14%	0.26	19
20							**0%**		**0.30**	**1.9%**	**0.1%**	**0.29**	**0.3%**	**0.29**	**7.54**	**0.14%**	**0.28**	**20**
21							0%		0.32	2.0%	0.1%	0.31	0.3%	0.31	7.79	0.15%	0.30	21
22	20 - 24	46	1011.5	0.45	100%	100%	0%	0.45	0.34	2.2%	0.2%	0.34	0.4%	0.34	7.82	0.15%	0.33	22
23							0%		0.37	2.4%	0.2%	0.36	0.4%	0.36	7.73	0.15%	0.35	23
24							0%		0.39	2.6%	0.2%	0.39	0.4%	0.38	7.63	0.16%	0.37	24
25							**0%**		**0.42**	**2.8%**	**0.2%**	**0.41**	**0.4%**	**0.41**	**7.62**	**0.16%**	**0.40**	**25**
26							0%		0.44	3.0%	0.3%	0.43	0.4%	0.43	7.77	0.17%	0.42	26
27	25 - 29	57	1060.4	0.54	100%	100%	0%	0.54	0.47	3.2%	0.3%	0.45	0.5%	0.45	8.07	0.17%	0.44	27
28							0%		0.49	3.5%	0.3%	0.48	0.5%	0.47	8.47	0.17%	0.46	28
29							0%		0.52	3.8%	0.3%	0.50	0.5%	0.49	8.90	0.18%	0.48	29
30							**0%**		**0.54**	**4.1%**	**0.4%**	**0.52**	**0.5%**	**0.52**	**9.33**	**0.18%**	**0.50**	**30**
31							0%		0.56	4.4%	0.4%	0.54	0.6%	0.53	9.71	0.18%	0.52	31
32	30 - 34	72	1248.8	0.58	100%	100%	0%	0.58	0.58	4.7%	0.5%	0.56	0.6%	0.55	10.07	0.19%	0.54	32
33							0%		0.60	5.1%	0.5%	0.58	0.6%	0.57	10.44	0.19%	0.56	33
34							0%		0.63	5.5%	0.6%	0.60	0.7%	0.59	10.88	0.19%	0.57	34
35							**0%**		**0.65**	**5.9%**	**0.7%**	**0.62**	**0.7%**	**0.61**	**11.40**	**0.20%**	**0.59**	**35**
36							0%		0.67	6.4%	0.7%	0.64	0.7%	0.63	12.04	0.20%	0.61	36
37	35 - 39	89	1307.9	0.68	100%	100%	0%	0.68	0.70	6.9%	0.8%	0.66	0.8%	0.65	12.81	0.20%	0.63	37
38							0%		0.73	7.5%	0.9%	0.68	0.8%	0.67	13.71	0.21%	0.65	38
39							0%		0.76	8.1%	1.0%	0.70	0.9%	0.70	14.73	0.21%	0.67	39
40							**0%**		**0.79**	**8.7%**	**1.2%**	**0.73**	**0.9%**	**0.72**	**15.86**	**0.22%**	**0.69**	**40**
41							0%		0.82	9.4%	1.3%	0.76	1.0%	0.75	17.12	0.22%	0.72	41
42	40 - 44	90	1188.6	0.76	100%	100%	0%	0.76	0.86	10.1%	1.5%	0.79	1.1%	0.78	18.54	0.23%	0.74	42
43							0%		0.90	10.9%	1.6%	0.82	1.1%	0.81	20.19	0.23%	0.77	43
44							0%		0.94	11.7%	1.8%	0.85	1.2%	0.84	22.11	0.24%	0.80	44
45							**0%**		**0.99**	**12.6%**	**2.0%**	**0.88**	**1.3%**	**0.87**	**24.36**	**0.24%**	**0.82**	**45**
46							0%		1.04	13.5%	2.3%	0.92	1.4%	0.90	26.96	0.25%	0.85	46
47	45 - 49	144	1076.4	1.34	100%	100%	0%	1.34	1.09	14.5%	2.5%	0.95	1.5%	0.94	29.86	0.25%	0.88	47
48							0%		1.14	15.6%	2.8%	0.99	1.6%	0.97	32.95	0.25%	0.91	48
49							0%		1.19	16.7%	3.1%	1.03	1.7%	1.01	36.15	0.26%	0.93	49
50							**0%**		**1.25**	**17.8%**	**3.5%**	**1.06**	**1.8%**	**1.04**	**39.37**	**0.26%**	**0.96**	**50**
51							0%		1.31	19.0%	3.9%	1.10	2.0%	1.08	42.57	0.26%	0.99	51
52	50 - 54	149	1177.5	1.27	100%	100%	0%	1.27	1.37	20.2%	4.3%	1.14	2.1%	1.11	45.96	0.26%	1.02	52
53							0%		1.43	21.5%	4.8%	1.18	2.3%	1.15	49.81	0.26%	1.05	53
54							0%		1.50	22.8%	5.3%	1.22	2.5%	1.19	54.40	0.27%	1.08	54
55							**0%**		**1.57**	**24.2%**	**5.8%**	**1.27**	**2.7%**	**1.23**	**59.99**	**0.27%**	**1.10**	**55**
56							0%		1.65	25.6%	6.4%	1.31	3.0%	1.27	66.78	0.27%	1.13	56
57	55 - 59	183	969.6	1.89	100%	100%	0%	1.89	1.74	27.0%	7.1%	1.36	3.2%	1.32	74.66	0.27%	1.16	57
58							0%		1.83	28.5%	7.7%	1.42	3.5%	1.37	83.45	0.28%	1.19	58
59							0%		1.93	29.9%	8.5%	1.48	3.8%	1.42	92.95	0.28%	1.22	59
60							**0%**		**2.05**	**31.4%**	**9.2%**	**1.55**	**4.0%**	**1.49**	**102.99**	**0.29%**	**1.25**	**60**
61							0%		2.18	32.9%	10.0%	1.62	4.3%	1.55	113.48	0.30%	1.29	61
62	60 - 64	176	826.6	2.13	100%	100%	0%	2.13	2.32	34.3%	10.9%	1.71	4.6%	1.63	124.66	0.30%	1.33	62
63							0%		2.48	35.6%	11.7%	1.81	5.0%	1.72	136.87	0.31%	1.38	63
64							0%		2.66	36.9%	12.6%	1.92	5.3%	1.82	150.46	0.32%	1.43	64
65							**0%**		**2.85**	**38.0%**	**13.5%**	**2.05**	**5.6%**	**1.93**	**165.76**	**0.34%**	**1.49**	**65**
66							0%		3.08	38.9%	14.4%	2.20	5.9%	2.07	183.13	0.35%	1.56	66
67							**0%**		3.33	39.7%	15.3%	2.37	6.2%	2.22	202.86	0.36%	1.64	67
68							0%		3.60	40.3%	16.3%	2.57	6.4%	2.40	225.30	0.38%	1.72	68
69							0%		3.91	40.7%	17.2%	2.80	6.7%	2.61	250.74	0.39%	1.81	69
70	65 - 74	564	1347.4	4.19	100%	100%	0%	4.19	**4.24**	**40.9%**	**18.2%**	**3.06**	**6.9%**	**2.85**	**279.52**	**0.41%**	**1.91**	**70**
71							0%		4.61	40.8%	19.1%	3.37	7.1%	3.13	311.95	0.43%	2.03	71
72							**0%**		5.01	40.6%	20.1%	3.72	7.4%	3.44	348.31	0.45%	2.14	72
73							6%		5.44	40.3%	21.0%	4.11	13.1%	3.57	388.89	0.47%	2.27	73
74							12%		5.92	39.9%	21.9%	4.56	18.8%	3.70	433.99	0.50%	2.40	74
75							**18%**		**6.44**	**39.4%**	**22.9%**	**5.06**	**24.4%**	**3.82**	**483.89**	**0.52%**	**2.54**	**75**
76							24%		7.01	39.0%	23.8%	5.62	30.1%	3.92	538.79	0.54%	2.69	76
77	75 - 79	258	481.8	5.36	100%	100%	30%	7.63	7.64	38.6%	24.8%	6.24	35.7%	4.01	598.60	0.57%	2.83	77
78							34%		8.33	38.2%	25.7%	6.93	39.9%	4.17	663.15	0.60%	2.99	78
79							39%		9.10	37.8%	26.7%	7.71	44.0%	4.32	732.26	0.62%	3.14	79
80							**43%**		**9.95**	**37.6%**	**27.7%**	**8.59**	**48.2%**	**4.45**	**805.77**	**0.66%**	**3.31**	**80**
81							47%		10.89	37.4%	28.7%	9.56	52.3%	4.56	884.16	0.69%	3.46	81
82	80 - 84	159	280.3	5.67	100%	100%	52%	11.72	11.96	37.4%	29.8%	10.67	56.4%	4.65	970.61	0.73%	3.59	82
83							58%		13.16	37.4%	30.9%	11.92	62.3%	4.49	1068.97	0.77%	3.66	83
84							64%		14.54	37.5%	32.0%	13.36	68.2%	4.25	1183.08	0.82%	3.63	84
85							71%		**16.10**	**37.7%**	**33.2%**	**15.00**	**74.0%**	**3.90**	**1316.78**	**0.88%**	**3.44**	**85**

10.1.12 CIBT02 Calculations Detail - Kidney Failure - Females

Age	Age Group	Number of Patients Starting RRT	Raw Data Population Thousands	Raw Observed Rate per 10,000	Other Adjustment (Not used)	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from KF k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		0.12	1.6%	0.2%	0.12	0.3%	0.12	2.73	0.31%	0.11	18
19							0%		0.14	1.7%	0.2%	0.13	0.3%	0.13	2.79	0.31%	0.12	19
20							**0%**		**0.15**	**1.9%**	**0.2%**	**0.15**	**0.3%**	**0.15**	**2.79**	**0.31%**	**0.14**	**20**
21							0%		0.16	2.0%	0.2%	0.16	0.3%	0.16	2.79	0.31%	0.15	21
22	20 - 24	24	1007.3	0.24	100%	100%	0%	0.24	0.18	2.2%	0.2%	0.17	0.4%	0.17	2.81	0.31%	0.16	22
23							0%		0.19	2.4%	0.2%	0.19	0.4%	0.19	2.85	0.31%	0.18	23
24							0%		0.21	2.6%	0.2%	0.20	0.4%	0.20	2.93	0.31%	0.20	24
25							**0%**		**0.23**	**2.8%**	**0.3%**	**0.22**	**0.4%**	**0.22**	**3.03**	**0.31%**	**0.21**	**25**
26							0%		0.24	3.0%	0.3%	0.24	0.4%	0.24	3.19	0.31%	0.23	26
27	25 - 29	37	1097.1	0.34	100%	100%	0%	0.34	0.26	3.2%	0.3%	0.25	0.5%	0.25	3.38	0.31%	0.24	27
28							0%		0.28	3.5%	0.3%	0.27	0.5%	0.27	3.61	0.31%	0.26	28
29							0%		0.30	3.8%	0.4%	0.29	0.5%	0.29	3.89	0.31%	0.28	29
30							**0%**		**0.32**	**4.1%**	**0.4%**	**0.31**	**0.5%**	**0.31**	**4.20**	**0.31%**	**0.30**	**30**
31							0%		0.34	4.4%	0.4%	0.33	0.6%	0.32	4.55	0.31%	0.31	31
32	30 - 34	41	1300.0	0.32	100%	100%	0%	0.32	0.36	4.7%	0.4%	0.34	0.6%	0.34	4.94	0.31%	0.33	32
33							0%		0.38	5.1%	0.5%	0.36	0.6%	0.36	5.35	0.31%	0.35	33
34							0%		0.40	5.5%	0.5%	0.38	0.7%	0.38	5.79	0.31%	0.36	34
35							**0%**		**0.42**	**5.9%**	**0.6%**	**0.40**	**0.7%**	**0.40**	**6.25**	**0.31%**	**0.38**	**35**
36							0%		0.44	6.4%	0.6%	0.42	0.7%	0.41	6.73	0.32%	0.40	36
37	35 - 39	69	1342.0	0.51	100%	100%	0%	0.51	0.46	6.9%	0.7%	0.43	0.8%	0.43	7.25	0.32%	0.41	37
38							0%		0.48	7.5%	0.7%	0.45	0.8%	0.45	7.86	0.32%	0.43	38
39							0%		0.51	8.1%	0.8%	0.47	0.9%	0.46	8.57	0.32%	0.44	39
40							**0%**		**0.53**	**8.7%**	**0.9%**	**0.49**	**0.9%**	**0.48**	**9.43**	**0.31%**	**0.46**	**40**
41							0%		0.55	9.4%	0.9%	0.50	1.0%	0.50	10.46	0.31%	0.47	41
42	40 - 44	67	1207.2	0.55	100%	100%	0%	0.55	0.57	10.1%	1.0%	0.52	1.1%	0.51	11.65	0.31%	0.48	42
43							0%		0.59	10.9%	1.1%	0.53	1.1%	0.53	12.99	0.31%	0.49	43
44							0%		0.62	11.7%	1.2%	0.55	1.2%	0.54	14.48	0.31%	0.51	44
45							**0%**		**0.64**	**12.6%**	**1.3%**	**0.57**	**1.3%**	**0.56**	**16.10**	**0.30%**	**0.52**	**45**
46							0%		0.67	13.5%	1.4%	0.58	1.4%	0.58	17.84	0.30%	0.53	46
47	45 - 49	78	1092.4	0.71	100%	100%	0%	0.71	0.69	14.5%	1.5%	0.60	1.5%	0.59	19.69	0.30%	0.54	47
48							0%		0.72	15.6%	1.7%	0.62	1.6%	0.61	21.64	0.30%	0.56	48
49							0%		0.75	16.7%	1.8%	0.64	1.7%	0.63	23.68	0.30%	0.57	49
50							**0%**		**0.79**	**17.8%**	**2.0%**	**0.66**	**1.8%**	**0.65**	**25.81**	**0.30%**	**0.58**	**50**
51							0%		0.82	19.0%	2.2%	0.68	2.0%	0.67	28.02	0.30%	0.60	51
52	50 - 54	94	1189.6	0.79	100%	100%	0%	0.79	0.86	20.2%	2.3%	0.70	2.1%	0.69	30.38	0.30%	0.61	52
53							0%		0.90	21.5%	2.5%	0.73	2.3%	0.71	32.97	0.30%	0.63	53
54							0%		0.95	22.8%	2.8%	0.76	2.5%	0.74	35.88	0.31%	0.64	54
55							**0%**		**1.00**	**24.2%**	**3.0%**	**0.78**	**2.7%**	**0.76**	**39.19**	**0.31%**	**0.66**	**55**
56							0%		1.06	25.6%	3.3%	0.81	3.0%	0.79	42.95	0.32%	0.68	56
57	55 - 59	112	982.2	1.14	100%	100%	0%	1.14	1.12	27.0%	3.6%	0.85	3.2%	0.82	47.20	0.33%	0.69	57
58							0%		1.18	28.5%	3.9%	0.88	3.5%	0.85	51.94	0.33%	0.70	58
59							0%		1.25	29.9%	4.2%	0.91	3.8%	0.88	57.16	0.34%	0.72	59
60							**0%**		**1.32**	**31.4%**	**4.5%**	**0.95**	**4.0%**	**0.91**	**62.89**	**0.35%**	**0.73**	**60**
61							0%		1.39	32.9%	4.9%	0.98	4.3%	0.94	69.14	0.35%	0.74	61
62	60 - 64	140	854.2	1.64	100%	100%	0%	1.64	1.47	34.3%	5.3%	1.02	4.6%	0.97	75.98	0.36%	0.75	62
63							0%		1.56	35.6%	5.7%	1.06	5.0%	1.01	83.51	0.37%	0.76	63
64							0%		1.65	36.9%	6.1%	1.11	5.3%	1.05	91.81	0.37%	0.77	64
65							**0%**		**1.75**	**38.0%**	**6.6%**	**1.16**	**5.6%**	**1.09**	**100.97**	**0.38%**	**0.78**	**65**
66							0%		1.85	38.9%	7.1%	1.22	5.9%	1.14	111.14	0.38%	0.79	66
67							0%		1.97	39.7%	7.6%	1.28	6.2%	1.20	122.71	0.39%	0.81	67
68							0%		2.10	40.3%	8.1%	1.36	6.4%	1.27	136.10	0.39%	0.83	68
69							0%		2.24	40.7%	8.6%	1.45	6.7%	1.36	151.77	0.39%	0.86	69
70	65 - 74	348	1529.8	2.27	100%	100%	0%	2.27	**2.40**	**40.9%**	**9.1%**	**1.56**	**6.9%**	**1.45**	**170.15**	**0.40%**	**0.88**	**70**
71							0%		2.58	40.8%	9.7%	1.69	7.1%	1.57	191.59	0.40%	0.92	71
72							0%		2.78	40.6%	10.3%	1.84	7.4%	1.71	216.11	0.41%	0.96	72
73							8%		3.01	40.3%	10.9%	2.02	15.4%	1.71	243.64	0.42%	1.00	73
74							17%		3.27	39.9%	11.5%	2.22	23.4%	1.70	274.10	0.43%	1.05	74
75							**25%**		**3.56**	**39.4%**	**12.2%**	**2.46**	**31.3%**	**1.69**	**307.42**	**0.44%**	**1.10**	**75**
76							34%		3.89	39.0%	12.8%	2.72	39.2%	1.65	343.68	0.46%	1.15	76
77	75 - 79	166	669.4	2.48	100%	100%	42%	4.30	4.26	38.6%	13.5%	3.03	47.1%	1.60	383.56	0.48%	1.19	77
78							48%		4.67	38.2%	14.2%	3.36	52.8%	1.59	427.88	0.50%	1.23	78
79							54%		5.12	37.8%	14.9%	3.74	58.3%	1.56	477.49	0.52%	1.25	79
80							**60%**		**5.62**	**37.6%**	**15.7%**	**4.16**	**63.9%**	**1.50**	**533.20**	**0.55%**	**1.25**	**80**
81							66%		6.17	37.4%	16.5%	4.62	69.5%	1.41	596.01	0.57%	1.22	81
82	80 - 84	91	483.6	1.88	100%	100%	72%	6.77	6.77	37.4%	17.3%	5.13	75.0%	1.28	667.55	0.59%	1.17	82
83							76%		7.43	37.4%	18.2%	5.68	78.7%	1.21	749.61	0.62%	1.07	83
84							80%		8.15	37.5%	19.0%	6.29	82.4%	1.11	843.98	0.63%	0.94	84
85							**84%**		**8.93**	**37.7%**	**20.0%**	**6.95**	**86.0%**	**0.97**	**952.46**	**0.65%**	**0.76**	**85**

10.1.13 CIBT02 Calculations Detail - Major Organ Transplant - Males

Age	Age Group	Number of Major Organ Transplants	Raw Data Population Thousands	Raw Observed Rate per 10,000	Scaling Factor for Waiting List Admission	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from MOT k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		0.84	90.7%	0%	0.08	4.0%	0.08	6.15	0.05%	0.08	18
19							0%		0.85	90.5%	0%	0.08	4.0%	0.08	6.99	0.05%	0.08	19
20							**0%**		**0.85**	**90.2%**	**0%**	**0.08**	**4.0%**	**0.08**	**7.54**	**0.04%**	**0.08**	**20**
21							0%		0.86	90.0%	0%	0.09	4.0%	0.08	7.79	0.04%	0.08	21
22	20 - 24	83	1520.4	0.54	152%	100%	0%	0.83	0.87	89.9%	0%	0.09	4.0%	0.09	7.82	0.05%	0.09	22
23							0%		0.89	89.7%	0%	0.09	4.0%	0.09	7.73	0.05%	0.09	23
24							0%		0.91	89.5%	0%	0.10	4.0%	0.09	7.63	0.05%	0.09	24
25							**0%**		**0.93**	**89.4%**	**0%**	**0.10**	**4.0%**	**0.09**	**7.62**	**0.05%**	**0.09**	**25**
26							0%		0.95	89.2%	0%	0.10	4.0%	0.10	7.77	0.05%	0.10	26
27	25 - 29	100	1596.8	0.63	153%	100%	0%	0.96	0.98	89.1%	0%	0.11	4.0%	0.10	8.07	0.05%	0.10	27
28							0%		1.01	89.0%	0%	0.11	4.0%	0.11	8.47	0.05%	0.11	28
29							0%		1.04	88.8%	0%	0.12	4.0%	0.11	8.90	0.05%	0.11	29
30							**0%**		**1.08**	**88.7%**	**0%**	**0.12**	**4.0%**	**0.12**	**9.33**	**0.05%**	**0.12**	**30**
31							0%		1.12	88.6%	0%	0.13	4.0%	0.12	9.71	0.05%	0.12	31
32	30 - 34	142	1895.4	0.75	151%	100%	0%	1.13	1.17	88.4%	0%	0.14	4.0%	0.13	10.07	0.05%	0.13	32
33							0%		1.22	88.2%	0%	0.14	4.0%	0.14	10.44	0.05%	0.14	33
34							0%		1.26	87.9%	0%	0.15	4.0%	0.15	10.88	0.06%	0.15	34
35							**0%**		**1.31**	**87.6%**	**0%**	**0.16**	**4.0%**	**0.16**	**11.40**	**0.06%**	**0.16**	**35**
36							0%		1.36	87.2%	0%	0.17	4.0%	0.17	12.04	0.06%	0.17	36
37	35 - 39	206	1969.9	1.04	152%	100%	0%	1.58	1.41	86.7%	0%	0.19	4.0%	0.18	12.81	0.06%	0.18	37
38							0%		1.46	86.2%	0%	0.20	4.0%	0.19	13.71	0.06%	0.19	38
39							0%		1.50	85.6%	0%	0.22	4.0%	0.21	14.73	0.06%	0.21	39
40							**0%**		**1.55**	**84.9%**	**0%**	**0.23**	**4.0%**	**0.23**	**15.86**	**0.06%**	**0.23**	**40**
41							0%		1.60	84.1%	0%	0.25	4.0%	0.24	17.12	0.06%	0.24	41
42	40 - 44	187	1782.8	1.05	149%	100%	0%	1.56	1.65	83.3%	0%	0.28	4.0%	0.27	18.54	0.06%	0.27	42
43							0%		1.71	82.4%	0%	0.30	4.0%	0.29	20.19	0.06%	0.29	43
44							0%		1.76	81.5%	0%	0.33	4.0%	0.31	22.11	0.06%	0.31	44
45							**0%**		**1.83**	**80.7%**	**0%**	**0.35**	**4.0%**	**0.34**	**24.36**	**0.06%**	**0.34**	**45**
46							0%		1.90	79.8%	0%	0.38	4.0%	0.37	26.96	0.06%	0.37	46
47	45 - 49	198	1570.4	1.26	149%	100%	0%	1.87	1.98	79.1%	0%	0.41	4.0%	0.40	29.86	0.06%	0.40	47
48							0%		2.06	78.4%	0%	0.45	4.0%	0.43	32.95	0.05%	0.43	48
49							0%		2.15	77.7%	0%	0.48	4.0%	0.46	36.15	0.05%	0.46	49
50							**0%**		**2.23**	**77.2%**	**0%**	**0.51**	**4.0%**	**0.49**	**39.37**	**0.05%**	**0.49**	**50**
51							0%		2.32	76.8%	0%	0.54	4.0%	0.52	42.57	0.05%	0.52	51
52	50 - 54	269	1595.2	1.68	148%	100%	0%	2.50	2.41	76.5%	0%	0.56	4.0%	0.54	45.96	0.05%	0.54	52
53							0%		2.48	76.4%	0%	0.59	4.0%	0.56	49.81	0.05%	0.56	53
54							0%		2.54	76.3%	0%	0.60	4.0%	0.58	54.40	0.04%	0.58	54
55							**0%**		**2.59**	**76.3%**	**0%**	**0.61**	**4.0%**	**0.59**	**59.99**	**0.04%**	**0.59**	**55**
56							0%		2.61	76.5%	0%	0.61	4.0%	0.59	66.78	0.04%	0.59	56
57	55 - 59	262	1516.3	1.73	149%	100%	0%	2.57	2.61	76.8%	0%	0.61	4.0%	0.58	74.66	0.03%	0.58	57
58							0%		2.58	77.2%	0%	0.59	4.0%	0.57	83.45	0.03%	0.57	58
59							0%		2.53	77.6%	0%	0.57	4.0%	0.54	92.95	0.02%	0.54	59
60							**0%**		**2.44**	**78.2%**	**0%**	**0.53**	**4.0%**	**0.51**	**102.99**	**0.02%**	**0.51**	**60**
61							0%		2.32	78.8%	0%	0.49	4.0%	0.47	113.48	0.02%	0.47	61
62	60 - 64	174	1176.1	1.48	150%	100%	0%	2.21	2.18	79.6%	0%	0.44	4.0%	0.43	124.66	0.01%	0.43	62
63							0%		2.01	80.4%	0%	0.39	4.0%	0.38	136.87	0.01%	0.38	63
64							0%		1.83	81.3%	0%	0.34	4.0%	0.33	150.46	0.01%	0.33	64
65							**0%**		**1.64**	**82.2%**	**0%**	**0.29**	**4.0%**	**0.28**	**165.76**	**0.01%**	**0.28**	**65**
66							0%		1.46	83.1%	0%	0.25	4.0%	0.24	183.13	0.01%	0.24	66
67	65 - 69	98	1049.2	0.93	147%	100%	0%	1.38	1.27	83.8%	0%	0.21	4.0%	0.20	202.86	0.00%	0.20	67
68							0%		1.09	84.5%	0%	0.17	4.0%	0.16	225.30	0.00%	0.16	68
69							0%		0.93	85.1%	0%	0.14	4.0%	0.13	250.74	0.00%	0.13	69
70							0%		**0.78**	**85.7%**	**0%**	**0.11**	**4.0%**	**0.11**	**279.52**	**0.00%**	**0.11**	**70**
71							0%		0.65	86.3%	0%	0.09	4.0%	0.09	311.95	0.00%	0.09	71
72	70 - 74	32	894.9	0.36	152%	100%	0%	0.55	0.54	86.8%	0%	0.07	4.0%	0.07	348.31	0.00%	0.07	72
73							0%		0.44	87.3%	0%	0.06	4.0%	0.05	388.89	0.00%	0.05	73
74							0%		0.36	87.7%	0%	0.04	4.0%	0.04	433.99	0.00%	0.04	74
75							**0%**		**0.29**	**88.1%**	**0%**	**0.03**	**4.0%**	**0.03**	**483.89**	**0.00%**	**0.03**	**75**
76							0%		0.24	88.5%	0%	0.03	4.0%	0.03	538.79	0.00%	0.03	76
77	75 - 79	7	686.6	0.10	154%	100%	0%	0.15	0.19	88.9%	0%	0.02	4.0%	0.02	598.60	0.00%	0.02	77
78							0%		0.16	89.2%	0%	0.02	4.0%	0.02	663.15	0.00%	0.02	78
79							0%		0.13	89.6%	0%	0.01	4.0%	0.01	732.26	0.00%	0.01	79
80							**0%**		**0.10**	**89.9%**	**0%**	**0.01**	**4.0%**	**0.01**	**805.77**	**0.00%**	**0.01**	**80**
81							0%		0.08	90.2%	0%	0.01	4.0%	0.01	884.16	0.00%	0.01	81
82	80 - 84	1	441.8	0.03	151%	100%	0%	0.04	0.07	90.4%	0%	0.01	4.0%	0.01	970.61	0.00%	0.01	82
83							0%		0.05	90.7%	0%	0.00	4.0%	0.00	1068.97	0.00%	0.00	83
84							0%		0.04	91.0%	0%	0.00	4.0%	0.00	1183.08	0.00%	0.00	84
85							**0%**		**0.03**	**91.2%**	**0%**	**0.00**	**4.0%**	**0.00**	**1316.78**	**0.00%**	**0.00**	**85**

10.1.14 CIBT02 Calculations Detail - Major Organ Transplant - Females

Age	Age Group	Number of Major Organ Transplants	Raw Data Population Thousands	Raw Observed Rate per 10,000	Scaling Factor for Waiting List Admission	Adjustment to First Ever Basis	Adjustment for Sudden Deaths	Crude Rate per 10,000	Smoothed, Interpolated Crude Rate per 10,000	Adjustment for Overlap with other CIs	Adjustment for Prevalence	Derived Incidence Rate I_x per 10,000	Adjustment for 28-day Mortality	Stand-Alone CI Rate I'_x per 10,000	Population Mortality Rate q_x per 10,000	Proportion of Deaths from MOT k_x	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18							0%		0.61	79.0%	0%	0.13	4.0%	0.12	2.73	0.19%	0.12	18
19							0%		0.62	79.4%	0%	0.13	4.0%	0.12	2.79	0.18%	0.12	19
20							**0%**		**0.62**	**79.7%**	**0%**	**0.13**	**4.0%**	**0.12**	**2.79**	**0.18%**	**0.12**	**20**
21							0%		0.63	80.1%	0%	0.13	4.0%	0.12	2.79	0.18%	0.12	21
22	20 - 24	59	1515.9	0.39	151%	100%	0%	0.59	0.64	80.5%	0%	0.13	4.0%	0.12	2.81	0.18%	0.12	22
23							0%		0.65	80.8%	0%	0.12	4.0%	0.12	2.85	0.17%	0.12	23
24							0%		0.66	81.2%	0%	0.12	4.0%	0.12	2.93	0.17%	0.12	24
25							**0%**		**0.68**	**81.5%**	**0%**	**0.12**	**4.0%**	**0.12**	**3.03**	**0.16%**	**0.12**	**25**
26							0%		0.69	81.9%	0%	0.13	4.0%	0.12	3.19	0.16%	0.12	26
27	25 - 29	76	1592.5	0.47	151%	100%	0%	0.72	0.71	82.2%	0%	0.13	4.0%	0.12	3.38	0.15%	0.12	27
28							0%		0.72	82.5%	0%	0.13	4.0%	0.12	3.61	0.14%	0.12	28
29							0%		0.74	82.7%	0%	0.13	4.0%	0.12	3.89	0.13%	0.12	29
30							**0%**		**0.76**	**82.9%**	**0%**	**0.13**	**4.0%**	**0.13**	**4.20**	**0.12%**	**0.13**	**30**
31							0%		0.79	83.1%	0%	0.13	4.0%	0.13	4.55	0.12%	0.13	31
32	30 - 34	100	1908.5	0.52	152%	100%	0%	0.79	0.81	83.2%	0%	0.14	4.0%	0.13	4.94	0.11%	0.13	32
33							0%		0.83	83.3%	0%	0.14	4.0%	0.13	5.35	0.10%	0.13	33
34							0%		0.86	83.3%	0%	0.14	4.0%	0.14	5.79	0.10%	0.14	34
35							**0%**		**0.88**	**83.3%**	**0%**	**0.15**	**4.0%**	**0.14**	**6.25**	**0.09%**	**0.14**	**35**
36							0%		0.90	83.1%	0%	0.15	4.0%	0.15	6.73	0.09%	0.15	36
37	35 - 39	130	1993.0	0.65	151%	100%	0%	0.99	0.93	83.0%	0%	0.16	4.0%	0.15	7.25	0.09%	0.15	37
38							0%		0.95	82.7%	0%	0.16	4.0%	0.16	7.86	0.08%	0.16	38
39							0%		0.98	82.5%	0%	0.17	4.0%	0.16	8.57	0.08%	0.16	39
40							**0%**		**1.01**	**82.1%**	**0%**	**0.18**	**4.0%**	**0.17**	**9.43**	**0.08%**	**0.17**	**40**
41							0%		1.03	81.7%	0%	0.19	4.0%	0.18	10.46	0.07%	0.18	41
42	40 - 44	124	1801.9	0.69	150%	100%	0%	1.03	1.06	81.3%	0%	0.20	4.0%	0.19	11.65	0.07%	0.19	42
43							0%		1.09	80.9%	0%	0.21	4.0%	0.20	12.99	0.06%	0.20	43
44							0%		1.12	80.5%	0%	0.22	4.0%	0.21	14.48	0.06%	0.21	44
45							**0%**		**1.16**	**80.0%**	**0%**	**0.23**	**4.0%**	**0.22**	**16.10**	**0.06%**	**0.22**	**45**
46							0%		1.19	79.6%	0%	0.24	4.0%	0.23	17.84	0.05%	0.23	46
47	45 - 49	125	1594.7	0.79	149%	100%	0%	1.17	1.23	79.2%	0%	0.26	4.0%	0.25	19.69	0.05%	0.25	47
48							0%		1.27	78.9%	0%	0.27	4.0%	0.26	21.64	0.05%	0.26	48
49							0%		1.31	78.6%	0%	0.28	4.0%	0.27	23.68	0.05%	0.27	49
50							**0%**		**1.35**	**78.4%**	**0%**	**0.29**	**4.0%**	**0.28**	**25.81**	**0.05%**	**0.28**	**50**
51							0%		1.39	78.3%	0%	0.30	4.0%	0.29	28.02	0.04%	0.29	51
52	50 - 54	153	1626.3	0.94	150%	100%	0%	1.41	1.43	78.3%	0%	0.31	4.0%	0.30	30.38	0.04%	0.30	52
53							0%		1.47	78.3%	0%	0.32	4.0%	0.31	32.97	0.04%	0.31	53
54							0%		1.49	78.4%	0%	0.32	4.0%	0.31	35.88	0.04%	0.31	54
55							**0%**		**1.51**	**78.5%**	**0%**	**0.33**	**4.0%**	**0.31**	**39.19**	**0.03%**	**0.31**	**55**
56							0%		1.52	78.7%	0%	0.32	4.0%	0.31	42.95	0.03%	0.31	56
57	55 - 59	158	1545.1	1.02	151%	100%	0%	1.54	1.52	79.0%	0%	0.32	4.0%	0.31	47.20	0.03%	0.31	57
58							0%		1.50	79.2%	0%	0.31	4.0%	0.30	51.94	0.02%	0.30	58
59							0%		1.45	79.5%	0%	0.30	4.0%	0.29	57.16	0.02%	0.29	59
60							**0%**		**1.39**	**79.8%**	**0%**	**0.28**	**4.0%**	**0.27**	**62.89**	**0.02%**	**0.27**	**60**
61							0%		1.31	80.0%	0%	0.26	4.0%	0.25	69.14	0.02%	0.25	61
62	60 - 64	104	1220.4	0.85	148%	100%	0%	1.26	1.20	80.2%	0%	0.24	4.0%	0.23	75.98	0.01%	0.23	62
63							0%		1.08	80.4%	0%	0.21	4.0%	0.20	83.51	0.01%	0.20	63
64							0%		0.96	80.6%	0%	0.19	4.0%	0.18	91.81	0.01%	0.18	64
65							**0%**		**0.84**	**80.6%**	**0%**	**0.16**	**4.0%**	**0.16**	**100.97**	**0.01%**	**0.16**	**65**
66							0%		0.72	80.7%	0%	0.14	4.0%	0.13	111.14	0.01%	0.13	66
67	65 - 69	55	1126.9	0.49	149%	100%	0%	0.73	0.61	80.6%	0%	0.12	4.0%	0.11	122.71	0.00%	0.11	67
68							0%		0.51	80.4%	0%	0.10	4.0%	0.10	136.10	0.00%	0.10	68
69							0%		0.41	80.1%	0%	0.08	4.0%	0.08	151.77	0.00%	0.08	69
70							**0%**		**0.33**	**79.6%**	**0%**	**0.07**	**4.0%**	**0.07**	**170.15**	**0.00%**	**0.07**	**70**
71							0%		0.27	79.2%	0%	0.06	4.0%	0.05	191.59	0.00%	0.05	71
72	70 - 74	15	1059.2	0.14	149%	100%	0%	0.20	0.21	78.7%	0%	0.05	4.0%	0.04	216.11	0.00%	0.04	72
73							0%		0.17	78.1%	0%	0.04	4.0%	0.04	243.64	0.00%	0.04	73
74							0%		0.13	77.6%	0%	0.03	4.0%	0.03	274.10	0.00%	0.03	74
75							**0%**		**0.11**	**77.0%**	**0%**	**0.02**	**4.0%**	**0.02**	**307.42**	**0.00%**	**0.02**	**75**
76							0%		0.08	76.3%	0%	0.02	4.0%	0.02	343.68	0.00%	0.02	76
77	75 - 79	2	938.1	0.02	152%	100%	0%	0.03	0.06	75.6%	0%	0.02	4.0%	0.02	383.56	0.00%	0.02	77
78							0%		0.05	75.0%	0%	0.01	4.0%	0.01	427.88	0.00%	0.01	78
79							0%		0.04	74.3%	0%	0.01	4.0%	0.01	477.49	0.00%	0.01	79
80							**0%**		**0.03**	**73.6%**	**0%**	**0.01**	**4.0%**	**0.01**	**533.20**	**0.00%**	**0.01**	**80**
81							0%		0.02	72.9%	0%	0.01	4.0%	0.01	596.01	0.00%	0.01	81
82	80 - 84	1	737.7	0.01	150%	100%	0%	0.02	0.02	72.2%	0%	0.01	4.0%	0.01	667.55	0.00%	0.01	82
83							0%		0.01	71.4%	0%	0.00	4.0%	0.00	749.61	0.00%	0.00	83
84							0%		0.01	70.7%	0%	0.00	4.0%	0.00	843.98	0.00%	0.00	84
85							**0%**		**0.01**	**70.0%**	**0%**	**0.00**	**4.0%**	**0.00**	**952.46**	**0.00%**	**0.00**	**85**

10.1.15 CIBT02 Calculations Detail - Total and Permanent Disability - Males

Age	Age Group	Claim Inceptions in CMI Expce D26	CMIR12 Inception Rates D26 per 10,000	A / E % Observed in CMI Expce D26	Conversion Factor to Model TPD	Crude TPD Incidence Rate from D26 per 10,000	Claim Inceptions in CMI Expce D13	CMIR12 Inception Rates D13 per 10,000	A / E % Observed in CMI Expce D13	Conversion Factor to Model TPD	Crude TPD Incidence Rate from D26 per 10,000	Weighted Average Crude TPD Rate per 10,000	Adjustment for Mix of TPD Definitions	Adjustment for Effective Age	Smoothed, Interpolated Full TPD Rate per 10,000	Adjustment for Overlap with other CIs	Stand-Alone CI Rate I'_x per 10,000	Reduction for Accelerated	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18													80%	79%	0.30	8%	0.28	4.9%	0.26	18
19													80%	79%	0.34	8%	0.31	5.1%	0.30	19
20													**80%**	**79%**	**0.38**	**9%**	**0.35**	**5.3%**	**0.33**	**20**
21													80%	79%	0.43	9%	0.39	5.6%	0.37	21
22	18 - 24	0	2.2	0%	28%	0.00	4	9.9	80%	13%	1.02	0.71	80%	79%	0.49	9%	0.44	5.8%	0.42	22
23													80%	79%	0.55	10%	0.49	6.1%	0.46	23
24													80%	79%	0.62	10%	0.56	6.4%	0.52	24
25													**80%**	**79%**	**0.70**	**11%**	**0.62**	**6.7%**	**0.58**	**25**
26													80%	79%	0.78	11%	0.70	7.0%	0.65	26
27	25 - 29	11	3.1	169%	33%	1.70	24	14.2	52%	16%	1.20	1.40	80%	79%	0.88	12%	0.78	7.3%	0.73	27
28													80%	79%	1.00	12%	0.88	7.7%	0.81	28
29													80%	79%	1.12	12%	0.98	8.0%	0.90	29
30													**80%**	**79%**	**1.26**	**13%**	**1.10**	**8.4%**	**1.01**	**30**
31													80%	79%	1.42	14%	1.23	8.9%	1.12	31
32	30 - 34	47	4.5	193%	38%	3.27	84	19.4	72%	20%	2.84	3.04	80%	79%	1.60	14%	1.38	9.3%	1.25	32
33													80%	79%	1.81	15%	1.54	9.8%	1.39	33
34													80%	79%	2.04	15%	1.73	10.3%	1.55	34
35													**80%**	**79%**	**2.30**	**16%**	**1.93**	**10.8%**	**1.72**	**35**
36													80%	79%	2.59	16%	2.16	11.4%	1.92	36
37	35 - 39	59	6.8	120%	44%	3.58	148	26.0	83%	25%	5.49	4.51	80%	79%	2.92	17%	2.42	12.0%	2.13	37
38													80%	78%	3.29	18%	2.70	12.6%	2.36	38
39													80%	78%	3.71	19%	3.03	13.2%	2.63	39
40													**80%**	**78%**	**4.20**	**19%**	**3.39**	**13.9%**	**2.92**	**40**
41													80%	78%	4.75	20%	3.79	14.6%	3.24	41
42	40 - 44	126	11.0	152%	50%	8.41	171	34.9	75%	32%	8.21	8.32	80%	78%	5.37	21%	4.25	15.4%	3.60	42
43													80%	78%	6.08	22%	4.76	16.2%	3.99	43
44													80%	78%	6.89	22%	5.34	17.0%	4.43	44
45													**80%**	**78%**	**7.81**	**23%**	**5.99**	**17.9%**	**4.92**	**45**
46													80%	78%	8.87	24%	6.72	18.8%	5.46	46
47	45 - 49	194	18.5	149%	58%	15.85	242	48.4	83%	39%	15.76	15.81	80%	77%	10.07	25%	7.54	19.7%	6.05	47
48													80%	78%	11.44	26%	8.45	20.7%	6.70	48
49													80%	78%	13.00	27%	9.47	21.7%	7.41	49
50													**80%**	**78%**	**14.76**	**28%**	**10.59**	**22.8%**	**8.18**	**50**
51													80%	78%	16.75	29%	11.84	23.9%	9.01	51
52	50 - 54	320	32.5	140%	66%	30.13	383	71.5	91%	49%	31.50	30.76	80%	78%	19.00	30%	13.21	25.0%	9.90	52
53													80%	79%	21.51	32%	14.70	26.2%	10.84	53
54													80%	79%	24.30	33%	16.30	27.5%	11.82	54
55													**80%**	**80%**	**27.35**	**34%**	**18.00**	**28.7%**	**12.82**	**55**
56													80%	80%	30.69	36%	19.77	30.1%	13.83	56
57	55 - 59	337	59.5	133%	75%	59.35	347	115.4	84%	59%	57.68	58.58	80%	81%	34.29	37%	21.61	31.4%	14.81	57
58													80%	82%	38.17	38%	23.48	32.8%	15.77	58
59													80%	82%	42.32	40%	25.39	34.3%	16.68	59
60													**80%**	**83%**	**46.74**	**42%**	**27.29**	**35.8%**	**17.53**	**60**
61													80%	83%	51.43	43%	29.17	37.3%	18.29	61
62	60 - 64	132	113.3	80%	83%	75.54	111	207.7	51%	70%	74.09	74.93	80%	84%	56.40	45%	31.01	38.9%	18.96	62
63													80%	84%	61.65	47%	32.79	40.5%	19.52	63
64													80%	84%	67.23	49%	34.49	42.1%	19.98	64
65													**80%**	**85%**	**73.20**	**51%**	**36.12**	**43.7%**	**20.32**	**65**
66																				66
67																				67
68																				68
69																				69
70																				**70**
71																				71
72																				72
73																				73
74																				74
75																				**75**
76																				76
77																				77
78																				78
79																				79
80																				**80**
81																				81
82																				82
83																				83
84																				84
85																				**85**

10.1.16 CIBT02 Calculations Detail - Total and Permanent Disability - Females

Age	Age Group	Claim Inceptions in CMI Expce D26	CMIR12 Inception Rates D26 per 10,000	A / E % Observed in CMI Expce D26	Conversion Factor to Model TPD	Crude TPD Incidence Rate from D26 per 10,000	Claim Inceptions in CMI Expce D13	CMIR12 Inception Rates D13 per 10,000	A / E % Observed in CMI Expce D13	Conversion Factor to Model TPD	Crude TPD Incidence Rate from D26 per 10,000	Weighted Average Crude TPD Rate per 10,000	Adjustment for Mix of TPD Definitions	Adjustment for Effective Age	Smoothed, Interpolated Full TPD Rate per 10,000	Adjustment for Overlap with other CIs	Stand-Alone CI Rate I'_x per 10,000	Reduction for Accelerated	Addition for Accelerated Rate $I_x - k_x q_x$ per 10,000	Age
18													80%	79%	0.75	9%	0.68	3.6%	0.65	18
19													80%	79%	0.84	10%	0.76	3.8%	0.73	19
20													**80%**	**79%**	**0.95**	**10%**	**0.86**	**4.0%**	**0.82**	**20**
21													80%	79%	1.07	10%	0.96	4.2%	0.92	21
22	18 - 24	2	2.2	400%	28%	2.42	4	9.9	74%	17%	1.23	1.58	80%	79%	1.20	10%	1.08	4.4%	1.03	22
23													80%	79%	1.35	11%	1.21	4.7%	1.15	23
24													80%	79%	1.52	11%	1.36	4.9%	1.29	24
25													**80%**	**79%**	**1.71**	**11%**	**1.52**	**5.2%**	**1.44**	**25**
26													80%	79%	1.93	11%	1.71	5.4%	1.62	26
27	25 - 29	19	3.1	358%	32%	3.52	43	14.2	149%	21%	4.35	3.97	80%	79%	2.17	12%	1.92	5.7%	1.81	27
28													80%	79%	2.44	12%	2.15	6.0%	2.02	28
29													80%	79%	2.74	12%	2.41	6.3%	2.26	29
30													**80%**	**79%**	**3.08**	**12%**	**2.70**	**6.7%**	**2.52**	**30**
31													80%	79%	3.47	13%	3.03	7.0%	2.82	31
32	30 - 34	36	4.5	245%	37%	4.07	60	19.4	126%	25%	6.12	4.95	80%	79%	3.91	13%	3.40	7.4%	3.15	32
33													80%	79%	4.40	13%	3.82	7.8%	3.52	33
34													80%	79%	4.94	13%	4.28	8.2%	3.93	34
35													**80%**	**79%**	**5.56**	**14%**	**4.80**	**8.6%**	**4.39**	**35**
36													80%	79%	6.25	14%	5.38	9.0%	4.89	36
37	35 - 39	93	6.8	451%	43%	13.27	71	26.0	135%	30%	10.66	12.22	80%	79%	7.02	14%	6.03	9.5%	5.45	37
38													80%	80%	7.89	14%	6.74	10.0%	6.07	38
39													80%	80%	8.85	15%	7.54	10.5%	6.75	39
40													**80%**	**80%**	**9.91**	**15%**	**8.42**	**11.0%**	**7.49**	**40**
41													80%	80%	11.08	15%	9.38	11.6%	8.29	41
42	40 - 44	98	11.0	366%	50%	19.92	92	34.9	165%	37%	21.17	20.41	80%	81%	12.37	16%	10.44	12.2%	9.17	42
43													80%	81%	13.78	16%	11.59	12.8%	10.11	43
44													80%	81%	15.32	16%	12.84	13.4%	11.12	44
45													**80%**	**82%**	**17.00**	**16%**	**14.20**	**14.1%**	**12.19**	**45**
46													80%	82%	18.82	17%	15.66	14.8%	13.33	46
47	45 - 49	106	18.5	295%	57%	31.16	85	48.4	133%	45%	28.69	30.16	80%	83%	20.78	17%	17.23	15.6%	14.54	47
48													80%	83%	22.90	17%	18.90	16.4%	15.81	48
49													80%	83%	25.16	18%	20.69	17.2%	17.14	49
50													**80%**	**84%**	**27.58**	**18%**	**22.58**	**18.0%**	**18.51**	**50**
51													80%	84%	30.15	18%	24.58	18.9%	19.94	51
52	50 - 54	104	32.5	235%	66%	50.35	91	71.5	127%	54%	49.25	49.88	80%	85%	32.88	19%	26.67	19.8%	21.39	52
53													80%	85%	35.76	19%	28.87	20.8%	22.88	53
54													80%	86%	38.77	20%	31.15	21.7%	24.38	54
55													**80%**	**86%**	**41.92**	**20%**	**33.51**	**22.8%**	**25.87**	**55**
56													80%	87%	45.17	20%	35.92	23.8%	27.36	56
57	55 - 59	78	59.5	243%	75%	108.39	46	115.4	91%	65%	67.68	90.14	80%	87%	48.53	21%	38.39	25.0%	28.81	57
58													80%	88%	51.98	21%	40.89	26.1%	30.22	58
59													80%	88%	55.53	22%	43.43	27.3%	31.58	59
60													**80%**	**89%**	**59.17**	**22%**	**46.02**	**28.5%**	**32.89**	**60**
61													80%	89%	62.92	23%	48.64	29.8%	34.15	61
62	60 - 64	1	113.3	17%	83%	15.99	3	207.7	39%	75%	60.40	34.46	80%	89%	66.78	23%	51.31	31.1%	35.35	62
63													80%	89%	70.76	24%	54.03	32.5%	36.49	63
64													80%	89%	74.88	24%	56.81	33.8%	37.58	64
65													**80%**	**90%**	**79.18**	**25%**	**59.67**	**35.3%**	**38.62**	**65**
66																				66
67																				67
68																				68
69																				69
70																				**70**
71																				71
72																				72
73																				73
74																				74
75																				**75**
76																				76
77																				77
78																				78
79																				79
80																				**80**
81																				81
82																				82
83																				83
84																				84
85																				**85**

10.2 CIBT02 Illustrative Individual-Age Incidence Rates for Other Common CIs

The following tables show the illustrative Stand-Alone incidence rates for each of the other common CIs considered in Section 4.10. The offsets against TPD (for overlap) and non-CI deaths (for additional acceleration of death benefits) are also shown in separate tables.

10.2.1 Illustrative Stand-Alone Incidence rates for Other Common CIs - Males

Age	Alzheimer's Disease per 10,000	Angioplasty per 10,000	Aorta Graft Surgery per 10,000	Benign Brain Tumour per 10,000	Blindness per 10,000	Coma per 10,000	Deafness per 10,000	Heart Valve Repair or Replacement per 10,000	HIV Infection per 10,000	Loss of Speech per 10,000	Loss of Hands or Feet per 10,000	Motor Neurone Disease per 10,000	Paralysis of Limbs per 10,000	Parkinson's Disease per 10,000	Third Degree Burns per 10,000	Traumatic Head Injury per 10,000	Sub-Total for Other Common CIs per 10,000	As % Core CIs %	Age
18	0.00	0.00	0.04	0.06	0.07	0.00	0.04	0.24	0.00	0.00	0.03	0.00	0.35	0.00	0.29	0.00	1.14	33%	18
19	0.00	0.00	0.04	0.06	0.08	0.00	0.04	0.25	0.00	0.00	0.03	0.00	0.35	0.00	0.29	0.00	1.16	30%	19
20	**0.00**	**0.00**	**0.04**	**0.07**	**0.08**	**0.00**	**0.04**	**0.26**	**0.00**	**0.00**	**0.04**	**0.01**	**0.34**	**0.00**	**0.30**	**0.00**	**1.17**	**28%**	**20**
21	0.00	0.00	0.04	0.07	0.08	0.00	0.04	0.26	0.00	0.00	0.04	0.01	0.33	0.00	0.30	0.00	1.18	27%	21
22	0.00	0.00	0.04	0.07	0.08	0.00	0.04	0.27	0.00	0.00	0.04	0.01	0.33	0.00	0.30	0.00	1.19	26%	22
23	0.00	0.01	0.04	0.08	0.08	0.00	0.04	0.28	0.00	0.00	0.04	0.01	0.32	0.00	0.30	0.00	1.20	24%	23
24	0.00	0.01	0.04	0.08	0.08	0.00	0.04	0.28	0.00	0.00	0.04	0.01	0.31	0.00	0.30	0.00	1.21	22%	24
25	**0.00**	**0.01**	**0.04**	**0.08**	**0.09**	**0.00**	**0.04**	**0.29**	**0.00**	**0.00**	**0.05**	**0.01**	**0.30**	**0.01**	**0.30**	**0.00**	**1.22**	**21%**	**25**
26	0.00	0.01	0.04	0.09	0.09	0.00	0.04	0.30	0.00	0.00	0.05	0.01	0.29	0.01	0.30	0.00	1.23	20%	26
27	0.00	0.02	0.04	0.09	0.09	0.00	0.05	0.30	0.00	0.00	0.05	0.02	0.27	0.01	0.30	0.00	1.24	18%	27
28	0.00	0.02	0.04	0.10	0.09	0.00	0.05	0.31	0.00	0.00	0.05	0.02	0.26	0.01	0.30	0.00	1.26	17%	28
29	0.00	0.03	0.04	0.10	0.09	0.00	0.05	0.32	0.00	0.00	0.06	0.02	0.25	0.01	0.30	0.00	1.27	16%	29
30	**0.00**	**0.04**	**0.04**	**0.11**	**0.10**	**0.00**	**0.05**	**0.33**	**0.00**	**0.00**	**0.06**	**0.02**	**0.23**	**0.02**	**0.30**	**0.00**	**1.30**	**15%**	**30**
31	0.00	0.05	0.04	0.12	0.10	0.00	0.05	0.34	0.00	0.00	0.06	0.03	0.22	0.02	0.30	0.00	1.32	14%	31
32	0.00	0.06	0.04	0.12	0.10	0.00	0.05	0.35	0.00	0.00	0.07	0.03	0.20	0.03	0.30	0.00	1.36	13%	32
33	0.00	0.08	0.04	0.13	0.10	0.00	0.05	0.36	0.00	0.00	0.07	0.04	0.19	0.03	0.29	0.00	1.40	12%	33
34	0.00	0.10	0.05	0.13	0.11	0.00	0.05	0.38	0.00	0.00	0.08	0.04	0.18	0.04	0.29	0.00	1.45	11%	34
35	**0.01**	**0.13**	**0.05**	**0.14**	**0.11**	**0.00**	**0.05**	**0.39**	**0.00**	**0.00**	**0.08**	**0.05**	**0.17**	**0.05**	**0.29**	**0.00**	**1.52**	**10%**	**35**
36	0.01	0.17	0.05	0.15	0.11	0.00	0.05	0.41	0.00	0.00	0.09	0.06	0.16	0.06	0.28	0.00	1.60	10%	36
37	0.01	0.22	0.05	0.16	0.11	0.00	0.05	0.43	0.00	0.00	0.09	0.06	0.15	0.08	0.28	0.00	1.69	9%	37
38	0.01	0.27	0.06	0.16	0.12	0.00	0.05	0.46	0.00	0.00	0.10	0.07	0.14	0.09	0.27	0.00	1.81	9%	38
39	0.02	0.34	0.06	0.17	0.12	0.00	0.06	0.49	0.00	0.00	0.11	0.08	0.13	0.11	0.27	0.00	1.95	8%	39
40	**0.02**	**0.42**	**0.07**	**0.18**	**0.13**	**0.00**	**0.06**	**0.52**	**0.00**	**0.00**	**0.12**	**0.10**	**0.12**	**0.14**	**0.27**	**0.00**	**2.12**	**8%**	**40**
41	0.03	0.51	0.07	0.19	0.13	0.00	0.06	0.56	0.00	0.00	0.13	0.11	0.11	0.16	0.27	0.00	2.32	8%	41
42	0.03	0.62	0.08	0.19	0.13	0.00	0.06	0.60	0.00	0.00	0.14	0.12	0.11	0.20	0.26	0.00	2.54	7%	42
43	0.04	0.73	0.09	0.20	0.14	0.00	0.06	0.65	0.00	0.00	0.15	0.14	0.10	0.23	0.26	0.00	2.80	7%	43
44	0.06	0.86	0.10	0.21	0.14	0.00	0.06	0.70	0.00	0.00	0.16	0.16	0.10	0.27	0.26	0.00	3.09	7%	44
45	**0.07**	**1.00**	**0.11**	**0.22**	**0.15**	**0.00**	**0.07**	**0.77**	**0.00**	**0.00**	**0.18**	**0.18**	**0.09**	**0.31**	**0.26**	**0.00**	**3.41**	**7%**	**45**
46	0.09	1.15	0.13	0.22	0.15	0.00	0.07	0.84	0.00	0.00	0.19	0.20	0.09	0.36	0.26	0.00	3.76	7%	46
47	0.12	1.31	0.14	0.23	0.16	0.00	0.07	0.92	0.00	0.00	0.21	0.22	0.09	0.41	0.26	0.00	4.15	7%	47
48	0.15	1.47	0.17	0.24	0.17	0.00	0.08	1.01	0.00	0.00	0.23	0.25	0.09	0.47	0.26	0.00	4.57	7%	48
49	0.19	1.63	0.20	0.24	0.17	0.00	0.08	1.11	0.00	0.00	0.25	0.28	0.08	0.54	0.26	0.00	5.05	7%	49
50	**0.25**	**1.80**	**0.23**	**0.25**	**0.18**	**0.00**	**0.08**	**1.23**	**0.00**	**0.00**	**0.28**	**0.31**	**0.08**	**0.61**	**0.26**	**0.00**	**5.57**	**7%**	**50**
51	0.32	1.98	0.27	0.25	0.19	0.00	0.09	1.36	0.00	0.00	0.30	0.35	0.08	0.69	0.26	0.00	6.14	7%	51
52	0.41	2.15	0.33	0.26	0.20	0.00	0.09	1.51	0.00	0.00	0.33	0.39	0.08	0.78	0.25	0.00	6.79	7%	52
53	0.54	2.33	0.39	0.27	0.21	0.00	0.10	1.68	0.00	0.00	0.37	0.43	0.08	0.89	0.25	0.00	7.53	7%	53
54	0.70	2.52	0.48	0.27	0.22	0.00	0.10	1.87	0.00	0.00	0.40	0.48	0.08	1.01	0.25	0.00	8.38	7%	54
55	**0.91**	**2.71**	**0.58**	**0.28**	**0.23**	**0.00**	**0.11**	**2.08**	**0.00**	**0.00**	**0.44**	**0.53**	**0.08**	**1.15**	**0.24**	**0.00**	**9.35**	**7%**	**55**
56	1.18	2.91	0.72	0.28	0.24	0.00	0.12	2.31	0.00	0.00	0.49	0.59	0.08	1.32	0.24	0.00	10.48	7%	56
57	1.53	3.11	0.88	0.29	0.25	0.00	0.13	2.57	0.00	0.00	0.54	0.65	0.09	1.52	0.24	0.00	11.80	7%	57
58	2.02	3.31	1.09	0.29	0.27	0.00	0.13	2.86	0.00	0.00	0.60	0.71	0.09	1.75	0.23	0.00	13.36	7%	58
59	2.65	3.50	1.35	0.30	0.29	0.00	0.15	3.17	0.00	0.00	0.67	0.78	0.09	2.03	0.23	0.00	15.22	8%	59
60	**3.48**	**3.69**	**1.66**	**0.30**	**0.31**	**0.00**	**0.16**	**3.51**	**0.00**	**0.00**	**0.74**	**0.86**	**0.09**	**2.37**	**0.23**	**0.00**	**17.40**	**8%**	**60**
61	4.56	3.87	2.05	0.31	0.33	0.00	0.17	3.87	0.00	0.00	0.82	0.93	0.10	2.76	0.23	0.00	19.99	8%	61
62	5.98	4.03	2.50	0.32	0.36	0.00	0.19	4.25	0.00	0.00	0.91	1.01	0.10	3.21	0.23	0.00	23.09	9%	62
63	7.89	4.18	3.03	0.32	0.39	0.00	0.20	4.65	0.00	0.00	1.00	1.09	0.11	3.75	0.23	0.00	26.83	10%	63
64	10.41	4.30	3.62	0.33	0.43	0.00	0.22	5.06	0.00	0.00	1.09	1.17	0.11	4.36	0.23	0.00	31.35	10%	64
65	**13.67**	**4.40**	**4.29**	**0.34**	**0.48**	**0.00**	**0.25**	**5.48**	**0.00**	**0.00**	**1.19**	**1.25**	**0.12**	**5.07**	**0.24**	**0.00**	**36.76**	**11%**	**65**
66	17.77	4.47	5.02	0.35	0.54	0.00	0.27	5.90	0.00	0.00	1.29	1.33	0.12	5.88	0.24	0.00	43.17	14%	66
67	22.71	4.51	5.80	0.36	0.61	0.00	0.30	6.33	0.00	0.00	1.39	1.40	0.13	6.77	0.24	0.00	50.54	15%	67
68	28.47	4.51	6.61	0.37	0.69	0.00	0.33	6.74	0.00	0.00	1.49	1.48	0.13	7.74	0.25	0.00	58.82	17%	68
69	35.03	4.49	7.44	0.38	0.80	0.00	0.37	7.15	0.00	0.00	1.59	1.54	0.14	8.78	0.25	0.00	67.95	18%	69
70	**42.34**	**4.42**	**8.25**	**0.39**	**0.93**	**0.00**	**0.42**	**7.54**	**0.00**	**0.00**	**1.69**	**1.60**	**0.15**	**9.87**	**0.26**	**0.00**	**77.86**	**20%**	**70**
71	50.37	4.31	9.04	0.40	1.09	0.00	0.47	7.91	0.00	0.00	1.79	1.66	0.16	11.00	0.27	0.00	88.46	21%	71
72	58.99	4.17	9.76	0.42	1.28	0.00	0.53	8.22	0.00	0.00	1.89	1.71	0.17	12.13	0.28	0.00	99.54	22%	72
73	68.05	3.99	10.39	0.43	1.52	0.00	0.59	8.44	0.00	0.00	1.98	1.75	0.17	13.24	0.30	0.00	110.85	23%	73
74	77.41	3.78	10.88	0.45	1.82	0.00	0.67	8.51	0.00	0.00	2.06	1.78	0.18	14.30	0.31	0.00	122.15	24%	74
75	**86.91**	**3.54**	**11.19**	**0.47**	**2.19**	**0.00**	**0.75**	**8.40**	**0.00**	**0.00**	**2.14**	**1.81**	**0.19**	**15.26**	**0.33**	**0.00**	**133.20**	**25%**	**75**
76	96.46	3.28	11.32	0.49	2.62	0.00	0.85	8.09	0.00	0.00	2.21	1.83	0.20	16.11	0.35	0.00	143.81	26%	76
77	106.10	3.00	11.25	0.51	3.14	0.00	0.95	7.61	0.00	0.00	2.28	1.85	0.22	16.84	0.38	0.00	154.10	27%	77
78	115.93	2.72	11.02	0.53	3.71	0.00	1.06	7.01	0.00	0.00	2.33	1.86	0.23	17.46	0.40	0.00	164.26	27%	78
79	126.04	2.44	10.66	0.55	4.36	0.00	1.17	6.34	0.00	0.00	2.38	1.87	0.24	17.99	0.43	0.00	174.47	28%	79
80	**136.54**	**2.17**	**10.18**	**0.58**	**5.06**	**0.00**	**1.30**	**5.65**	**0.00**	**0.00**	**2.43**	**1.87**	**0.25**	**18.42**	**0.47**	**0.00**	**184.90**	**29%**	**80**
81	147.52	1.91	9.60	0.60	5.81	0.00	1.43	5.00	0.00	0.00	2.48	1.87	0.27	18.76	0.51	0.00	195.74	29%	81
82	159.08	1.68	8.95	0.63	6.60	0.00	1.56	4.38	0.00	0.00	2.52	1.87	0.28	19.03	0.55	0.00	207.13	30%	82
83	171.32	1.47	8.27	0.65	7.41	0.00	1.69	3.80	0.00	0.00	2.56	1.87	0.29	19.24	0.59	0.00	219.19	31%	83
84	184.35	1.28	7.58	0.68	8.21	0.00	1.83	3.28	0.00	0.00	2.61	1.87	0.31	19.41	0.64	0.00	232.05	31%	84
85	**198.26**	**1.11**	**6.90**	**0.71**	**8.99**	**0.00**	**1.98**	**2.82**	**0.00**	**0.00**	**2.66**	**1.86**	**0.33**	**19.55**	**0.70**	**0.00**	**245.85**	**32%**	**85**

10.2.2 Illustrative Stand-Alone Incidence rates for Other Common CIs - Females

Age	Alzheimer's Disease per 10,000	Angioplasty per 10,000	Aorta Graft Surgery per 10,000	Benign Brain Tumour per 10,000	Blindness per 10,000	Coma per 10,000	Deafness per 10,000	Heart Valve Repair or Replacement per 10,000	HIV Infection per 10,000	Loss of Speech per 10,000	Loss of Hands or Feet per 10,000	Motor Neurone Disease per 10,000	Paralysis of Limbs per 10,000	Parkinson's Disease per 10,000	Third Degree Burns per 10,000	Traumatic Head Injury per 10,000	Sub-Total for Other Common CIs per 10,000	As % Core CIs %	Age
18	0.00	0.00	0.00	0.04	0.07	0.00	0.04	0.16	0.00	0.00	0.01	0.00	0.13	0.00	0.13	0.00	0.60	20%	18
19	0.00	0.00	0.00	0.04	0.08	0.00	0.04	0.16	0.00	0.00	0.01	0.00	0.13	0.00	0.14	0.00	0.61	17%	19
20	**0.00**	**0.00**	**0.00**	**0.05**	**0.08**	**0.00**	**0.04**	**0.16**	**0.00**	**0.00**	**0.01**	**0.00**	**0.13**	**0.00**	**0.14**	**0.00**	**0.62**	**15%**	**20**
21	0.00	0.00	0.00	0.05	0.08	0.00	0.04	0.16	0.00	0.00	0.01	0.00	0.12	0.00	0.15	0.00	0.62	14%	21
22	0.00	0.00	0.00	0.05	0.08	0.00	0.04	0.16	0.00	0.00	0.01	0.00	0.12	0.00	0.15	0.00	0.63	12%	22
23	0.00	0.00	0.00	0.05	0.08	0.00	0.04	0.16	0.00	0.00	0.01	0.00	0.12	0.00	0.15	0.00	0.64	11%	23
24	0.00	0.00	0.00	0.05	0.08	0.00	0.04	0.16	0.00	0.00	0.01	0.00	0.12	0.00	0.16	0.00	0.65	10%	24
25	**0.00**	**0.00**	**0.01**	**0.06**	**0.09**	**0.00**	**0.04**	**0.16**	**0.00**	**0.00**	**0.01**	**0.00**	**0.11**	**0.01**	**0.16**	**0.00**	**0.65**	**9%**	**25**
26	0.00	0.00	0.01	0.06	0.09	0.00	0.04	0.16	0.00	0.00	0.02	0.00	0.11	0.01	0.16	0.00	0.66	8%	26
27	0.00	0.00	0.01	0.06	0.09	0.00	0.05	0.17	0.00	0.00	0.02	0.00	0.11	0.01	0.16	0.00	0.67	7%	27
28	0.00	0.01	0.01	0.06	0.09	0.00	0.05	0.17	0.00	0.00	0.02	0.01	0.10	0.01	0.16	0.00	0.68	7%	28
29	0.00	0.01	0.01	0.07	0.09	0.00	0.05	0.17	0.00	0.00	0.02	0.01	0.10	0.01	0.16	0.00	0.69	6%	29
30	**0.00**	**0.01**	**0.01**	**0.07**	**0.10**	**0.00**	**0.05**	**0.17**	**0.00**	**0.00**	**0.02**	**0.01**	**0.10**	**0.01**	**0.16**	**0.00**	**0.70**	**6%**	**30**
31	0.00	0.01	0.01	0.08	0.10	0.00	0.05	0.17	0.00	0.00	0.02	0.01	0.09	0.02	0.16	0.00	0.72	5%	31
32	0.01	0.01	0.01	0.08	0.10	0.00	0.05	0.18	0.00	0.00	0.02	0.01	0.09	0.02	0.16	0.00	0.74	5%	32
33	0.01	0.01	0.01	0.09	0.10	0.00	0.05	0.18	0.00	0.00	0.03	0.01	0.09	0.02	0.16	0.00	0.76	4%	33
34	0.01	0.02	0.01	0.09	0.11	0.00	0.05	0.19	0.00	0.00	0.03	0.01	0.09	0.03	0.16	0.00	0.78	4%	34
35	**0.01**	**0.02**	**0.01**	**0.10**	**0.11**	**0.00**	**0.05**	**0.19**	**0.00**	**0.00**	**0.03**	**0.02**	**0.08**	**0.03**	**0.16**	**0.00**	**0.81**	**4%**	**35**
36	0.01	0.03	0.01	0.10	0.11	0.00	0.05	0.20	0.00	0.00	0.03	0.02	0.08	0.04	0.16	0.00	0.85	4%	36
37	0.02	0.03	0.01	0.11	0.11	0.00	0.05	0.21	0.00	0.00	0.04	0.02	0.08	0.05	0.16	0.00	0.89	4%	37
38	0.02	0.04	0.01	0.12	0.12	0.00	0.05	0.22	0.00	0.00	0.04	0.03	0.08	0.06	0.15	0.00	0.94	3%	38
39	0.03	0.04	0.02	0.12	0.12	0.00	0.06	0.23	0.00	0.00	0.04	0.03	0.08	0.07	0.15	0.00	0.99	3%	39
40	**0.03**	**0.05**	**0.02**	**0.13**	**0.13**	**0.00**	**0.06**	**0.25**	**0.00**	**0.00**	**0.05**	**0.04**	**0.07**	**0.08**	**0.15**	**0.00**	**1.05**	**3%**	**40**
41	0.04	0.06	0.02	0.14	0.13	0.00	0.06	0.26	0.00	0.00	0.05	0.05	0.07	0.09	0.15	0.00	1.13	3%	41
42	0.05	0.08	0.02	0.15	0.13	0.00	0.06	0.28	0.00	0.00	0.05	0.05	0.07	0.11	0.15	0.00	1.21	3%	42
43	0.06	0.09	0.02	0.15	0.14	0.00	0.06	0.30	0.00	0.00	0.06	0.06	0.07	0.13	0.15	0.00	1.31	3%	43
44	0.08	0.10	0.03	0.16	0.14	0.00	0.06	0.33	0.00	0.00	0.06	0.07	0.07	0.15	0.15	0.00	1.42	3%	44
45	**0.10**	**0.12**	**0.03**	**0.17**	**0.15**	**0.00**	**0.07**	**0.36**	**0.00**	**0.00**	**0.07**	**0.09**	**0.07**	**0.18**	**0.15**	**0.00**	**1.55**	**3%**	**45**
46	0.12	0.14	0.03	0.18	0.15	0.00	0.07	0.39	0.00	0.00	0.07	0.10	0.07	0.21	0.15	0.00	1.70	3%	46
47	0.15	0.17	0.04	0.19	0.16	0.00	0.07	0.43	0.00	0.00	0.08	0.12	0.07	0.25	0.15	0.00	1.87	3%	47
48	0.19	0.20	0.04	0.20	0.17	0.00	0.08	0.47	0.00	0.00	0.09	0.14	0.07	0.29	0.15	0.00	2.07	3%	48
49	0.24	0.23	0.05	0.20	0.17	0.00	0.08	0.53	0.00	0.00	0.09	0.16	0.07	0.34	0.15	0.00	2.31	3%	49
50	**0.30**	**0.27**	**0.05**	**0.21**	**0.18**	**0.00**	**0.08**	**0.59**	**0.00**	**0.00**	**0.10**	**0.18**	**0.07**	**0.40**	**0.15**	**0.00**	**2.59**	**3%**	**50**
51	0.38	0.31	0.06	0.22	0.19	0.00	0.09	0.66	0.00	0.00	0.11	0.21	0.07	0.47	0.14	0.00	2.91	3%	51
52	0.48	0.35	0.07	0.22	0.20	0.00	0.09	0.74	0.00	0.00	0.12	0.24	0.07	0.54	0.14	0.00	3.28	3%	52
53	0.61	0.41	0.08	0.23	0.21	0.00	0.10	0.83	0.00	0.00	0.13	0.28	0.08	0.63	0.14	0.00	3.73	4%	53
54	0.77	0.47	0.10	0.24	0.22	0.00	0.10	0.95	0.00	0.00	0.14	0.32	0.08	0.73	0.14	0.00	4.25	4%	54
55	**0.97**	**0.54**	**0.12**	**0.24**	**0.23**	**0.00**	**0.11**	**1.08**	**0.00**	**0.00**	**0.15**	**0.36**	**0.08**	**0.84**	**0.14**	**0.00**	**4.86**	**4%**	**55**
56	1.21	0.61	0.14	0.25	0.24	0.00	0.12	1.23	0.00	0.00	0.17	0.41	0.08	0.97	0.14	0.00	5.56	4%	56
57	1.52	0.70	0.16	0.26	0.25	0.00	0.13	1.40	0.00	0.00	0.18	0.46	0.08	1.10	0.14	0.00	6.39	5%	57
58	1.92	0.79	0.19	0.26	0.27	0.00	0.13	1.60	0.00	0.00	0.20	0.52	0.09	1.26	0.14	0.00	7.36	5%	58
59	2.42	0.88	0.22	0.27	0.29	0.00	0.15	1.81	0.00	0.00	0.22	0.58	0.09	1.43	0.14	0.00	8.49	5%	59
60	**3.04**	**0.98**	**0.27**	**0.27**	**0.31**	**0.00**	**0.16**	**2.05**	**0.00**	**0.00**	**0.24**	**0.64**	**0.10**	**1.62**	**0.14**	**0.00**	**9.81**	**6%**	**60**
61	3.80	1.08	0.32	0.28	0.33	0.00	0.17	2.30	0.00	0.00	0.27	0.71	0.10	1.84	0.14	0.00	11.33	6%	61
62	4.75	1.18	0.38	0.28	0.36	0.00	0.19	2.58	0.00	0.00	0.29	0.77	0.10	2.08	0.15	0.00	13.11	7%	62
63	5.94	1.29	0.45	0.29	0.39	0.00	0.20	2.87	0.00	0.00	0.32	0.84	0.11	2.35	0.15	0.00	15.20	8%	63
64	7.41	1.38	0.53	0.29	0.43	0.00	0.22	3.17	0.00	0.00	0.36	0.91	0.11	2.66	0.15	0.00	17.64	8%	64
65	**9.20**	**1.48**	**0.62**	**0.30**	**0.48**	**0.00**	**0.25**	**3.48**	**0.00**	**0.00**	**0.39**	**0.98**	**0.12**	**3.02**	**0.15**	**0.00**	**20.48**	**9%**	**65**
66	11.38	1.57	0.74	0.31	0.54	0.00	0.27	3.80	0.00	0.00	0.43	1.04	0.13	3.42	0.16	0.00	23.78	14%	66
67	14.02	1.64	0.86	0.32	0.61	0.00	0.30	4.11	0.00	0.00	0.47	1.10	0.13	3.88	0.16	0.00	27.61	15%	67
68	17.22	1.70	1.00	0.33	0.69	0.00	0.33	4.42	0.00	0.00	0.52	1.15	0.14	4.39	0.17	0.00	32.08	16%	68
69	21.06	1.75	1.16	0.34	0.80	0.00	0.37	4.73	0.00	0.00	0.57	1.20	0.15	4.95	0.18	0.00	37.25	18%	69
70	**25.64**	**1.78**	**1.34**	**0.35**	**0.93**	**0.00**	**0.42**	**5.02**	**0.00**	**0.00**	**0.62**	**1.23**	**0.15**	**5.58**	**0.19**	**0.00**	**43.23**	**20%**	**70**
71	31.03	1.78	1.53	0.36	1.09	0.00	0.47	5.29	0.00	0.00	0.68	1.26	0.16	6.25	0.20	0.00	50.08	21%	71
72	37.33	1.76	1.72	0.37	1.28	0.00	0.53	5.51	0.00	0.00	0.73	1.27	0.17	6.93	0.21	0.00	57.82	23%	72
73	44.59	1.71	1.89	0.39	1.52	0.00	0.59	5.67	0.00	0.00	0.80	1.27	0.18	7.57	0.23	0.00	66.43	25%	73
74	52.90	1.65	2.05	0.41	1.82	0.00	0.67	5.73	0.00	0.00	0.86	1.27	0.19	8.13	0.24	0.00	75.91	27%	74
75	**62.33**	**1.56**	**2.15**	**0.43**	**2.19**	**0.00**	**0.75**	**5.66**	**0.00**	**0.00**	**0.93**	**1.25**	**0.20**	**8.54**	**0.26**	**0.00**	**86.26**	**29%**	**75**
76	72.95	1.45	2.21	0.45	2.62	0.00	0.85	5.46	0.00	0.00	0.99	1.23	0.21	8.78	0.29	0.00	97.50	31%	76
77	84.85	1.32	2.22	0.47	3.14	0.00	0.95	5.14	0.00	0.00	1.06	1.20	0.22	8.87	0.31	0.00	109.75	33%	77
78	98.10	1.19	2.18	0.49	3.71	0.00	1.06	4.73	0.00	0.00	1.13	1.17	0.23	8.81	0.34	0.00	123.16	35%	78
79	112.80	1.06	2.12	0.52	4.36	0.00	1.17	4.27	0.00	0.00	1.20	1.13	0.24	8.65	0.38	0.00	137.89	38%	79
80	**129.02**	**0.93**	**2.02**	**0.54**	**5.06**	**0.00**	**1.30**	**3.79**	**0.00**	**0.00**	**1.26**	**1.09**	**0.25**	**8.41**	**0.41**	**0.00**	**154.08**	**40%**	**80**
81	146.81	0.81	1.91	0.56	5.81	0.00	1.43	3.31	0.00	0.00	1.33	1.04	0.27	8.10	0.46	0.00	171.85	43%	81
82	166.08	0.70	1.79	0.58	6.60	0.00	1.56	2.86	0.00	0.00	1.39	1.00	0.28	7.76	0.51	0.00	191.11	45%	82
83	186.70	0.61	1.65	0.61	7.41	0.00	1.69	2.44	0.00	0.00	1.44	0.96	0.29	7.39	0.56	0.00	211.75	48%	83
84	208.54	0.52	1.52	0.63	8.21	0.00	1.83	2.05	0.00	0.00	1.50	0.91	0.31	7.00	0.63	0.00	233.65	51%	84
85	**231.48**	**0.45**	**1.39**	**0.65**	**8.99**	**0.00**	**1.98**	**1.71**	**0.00**	**0.00**	**1.55**	**0.87**	**0.32**	**6.61**	**0.70**	**0.00**	**256.69**	**53%**	**85**

10.2.3 Illustrative Offset for Overlap with TPD for Other Common CIs - Males

Age	Alzheimer's Disease per 10,000	Angioplasty per 10,000	Aorta Graft Surgery per 10,000	Benign Brain Tumour per 10,000	Blindness per 10,000	Coma per 10,000	Deafness per 10,000	Heart Valve Repair or Replacement per 10,000	HIV Infection per 10,000	Loss of Speech per 10,000	Loss of Hands or Feet per 10,000	Motor Neurone Disease per 10,000	Paralysis of Limbs per 10,000	Parkinson's Disease per 10,000	Third Degree Burns per 10,000	Traumatic Head Injury per 10,000	Sub-Total for Other Common CIs per 10,000	As % TPD in CIBT02 Core %	Age
18	0.00	0.00	0.00	0.00	0.07	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.04	0.00	0.21	75%	18
19	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.07	0.00	0.05	0.00	0.22	71%	19
20	**0.00**	**0.00**	**0.00**	**0.00**	**0.08**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.07**	**0.00**	**0.05**	**0.00**	**0.23**	**67%**	**20**
21	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.08	0.00	0.06	0.00	0.25	63%	21
22	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.08	0.00	0.06	0.00	0.26	59%	22
23	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.09	0.00	0.06	0.00	0.27	55%	23
24	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.09	0.00	0.07	0.00	0.29	52%	24
25	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.09**	**0.00**	**0.07**	**0.00**	**0.30**	**48%**	**25**
26	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.02	0.01	0.09	0.00	0.08	0.00	0.31	44%	26
27	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.02	0.01	0.10	0.00	0.08	0.00	0.32	41%	27
28	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.02	0.02	0.10	0.00	0.08	0.00	0.33	38%	28
29	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.02	0.02	0.10	0.00	0.09	0.00	0.34	35%	29
30	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.02**	**0.02**	**0.09**	**0.01**	**0.09**	**0.00**	**0.35**	**32%**	**30**
31	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00	0.00	0.03	0.02	0.09	0.01	0.09	0.00	0.37	30%	31
32	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00	0.00	0.03	0.03	0.09	0.01	0.09	0.00	0.38	27%	32
33	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00	0.00	0.03	0.03	0.09	0.01	0.10	0.00	0.39	25%	33
34	0.00	0.00	0.00	0.00	0.11	0.00	0.02	0.00	0.00	0.00	0.04	0.04	0.09	0.01	0.10	0.00	0.41	24%	34
35	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.04**	**0.04**	**0.08**	**0.02**	**0.10**	**0.00**	**0.42**	**22%**	**35**
36	0.00	0.00	0.00	0.00	0.11	0.00	0.03	0.00	0.00	0.00	0.05	0.05	0.08	0.02	0.10	0.00	0.44	21%	36
37	0.00	0.00	0.00	0.00	0.11	0.00	0.03	0.00	0.00	0.00	0.05	0.06	0.08	0.03	0.11	0.00	0.47	19%	37
38	0.01	0.00	0.00	0.00	0.12	0.00	0.03	0.00	0.00	0.00	0.06	0.06	0.08	0.03	0.11	0.00	0.49	18%	38
39	0.01	0.00	0.00	0.00	0.12	0.00	0.03	0.00	0.00	0.00	0.06	0.07	0.08	0.04	0.11	0.00	0.52	17%	39
40	**0.01**	**0.00**	**0.00**	**0.00**	**0.13**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.07**	**0.08**	**0.07**	**0.05**	**0.11**	**0.00**	**0.55**	**16%**	**40**
41	0.01	0.00	0.00	0.00	0.13	0.00	0.03	0.00	0.00	0.00	0.08	0.10	0.07	0.06	0.11	0.00	0.59	16%	41
42	0.02	0.00	0.00	0.00	0.13	0.00	0.03	0.00	0.00	0.00	0.09	0.11	0.07	0.08	0.12	0.00	0.64	15%	42
43	0.02	0.00	0.00	0.00	0.14	0.00	0.03	0.00	0.00	0.00	0.10	0.12	0.07	0.09	0.12	0.00	0.70	15%	43
44	0.03	0.00	0.00	0.00	0.14	0.00	0.03	0.00	0.00	0.00	0.11	0.14	0.07	0.11	0.12	0.00	0.76	14%	44
45	**0.03**	**0.00**	**0.00**	**0.00**	**0.15**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.13**	**0.16**	**0.07**	**0.14**	**0.13**	**0.00**	**0.83**	**14%**	**45**
46	0.04	0.00	0.00	0.00	0.15	0.00	0.03	0.00	0.00	0.00	0.14	0.18	0.07	0.16	0.13	0.00	0.91	14%	46
47	0.06	0.00	0.00	0.00	0.16	0.00	0.04	0.00	0.00	0.00	0.16	0.20	0.07	0.20	0.13	0.00	1.00	13%	47
48	0.07	0.00	0.00	0.00	0.17	0.00	0.04	0.00	0.00	0.00	0.17	0.22	0.06	0.23	0.13	0.00	1.10	13%	48
49	0.09	0.00	0.00	0.00	0.17	0.00	0.04	0.00	0.00	0.00	0.19	0.25	0.06	0.27	0.13	0.00	1.21	13%	49
50	**0.12**	**0.00**	**0.00**	**0.00**	**0.18**	**0.00**	**0.04**	**0.00**	**0.00**	**0.00**	**0.21**	**0.28**	**0.06**	**0.31**	**0.13**	**0.00**	**1.33**	**13%**	**50**
51	0.15	0.00	0.00	0.00	0.19	0.00	0.04	0.00	0.00	0.00	0.23	0.31	0.06	0.36	0.13	0.00	1.47	12%	51
52	0.19	0.00	0.00	0.00	0.20	0.00	0.05	0.00	0.00	0.00	0.25	0.35	0.06	0.41	0.13	0.00	1.64	12%	52
53	0.25	0.00	0.00	0.00	0.21	0.00	0.05	0.00	0.00	0.00	0.27	0.39	0.06	0.47	0.13	0.00	1.82	12%	53
54	0.32	0.00	0.00	0.00	0.22	0.00	0.05	0.00	0.00	0.00	0.30	0.43	0.06	0.54	0.12	0.00	2.04	13%	54
55	**0.41**	**0.00**	**0.00**	**0.00**	**0.23**	**0.00**	**0.05**	**0.00**	**0.00**	**0.00**	**0.33**	**0.48**	**0.06**	**0.61**	**0.12**	**0.00**	**2.30**	**13%**	**55**
56	0.54	0.00	0.00	0.00	0.24	0.00	0.06	0.00	0.00	0.00	0.37	0.53	0.06	0.69	0.12	0.00	2.61	13%	56
57	0.70	0.00	0.00	0.00	0.25	0.00	0.06	0.00	0.00	0.00	0.41	0.59	0.06	0.78	0.12	0.00	2.98	14%	57
58	0.91	0.00	0.00	0.00	0.27	0.00	0.07	0.00	0.00	0.00	0.45	0.65	0.07	0.89	0.12	0.00	3.42	15%	58
59	1.18	0.00	0.00	0.00	0.29	0.00	0.07	0.00	0.00	0.00	0.50	0.71	0.07	1.01	0.12	0.00	3.95	16%	59
60	**1.53**	**0.00**	**0.00**	**0.00**	**0.31**	**0.00**	**0.08**	**0.00**	**0.00**	**0.00**	**0.56**	**0.78**	**0.07**	**1.15**	**0.12**	**0.00**	**4.60**	**17%**	**60**
61	2.02	0.00	0.00	0.00	0.33	0.00	0.09	0.00	0.00	0.00	0.62	0.86	0.07	1.32	0.12	0.00	5.42	19%	61
62	2.65	0.00	0.00	0.00	0.36	0.00	0.09	0.00	0.00	0.00	0.68	0.93	0.08	1.52	0.12	0.00	6.43	21%	62
63	3.48	0.00	0.00	0.00	0.39	0.00	0.10	0.00	0.00	0.00	0.75	1.01	0.08	1.75	0.12	0.00	7.69	23%	63
64	4.56	0.00	0.00	0.00	0.43	0.00	0.11	0.00	0.00	0.00	0.82	1.09	0.08	2.03	0.12	0.00	9.25	27%	64
65	**5.98**	**0.00**	**0.00**	**0.00**	**0.48**	**0.00**	**0.12**	**0.00**	**0.00**	**0.00**	**0.89**	**1.17**	**0.09**	**2.37**	**0.12**	**0.00**	**11.22**	**31%**	**65**
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		66
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		67
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		68
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		69
70	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**70**
71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		71
72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		72
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		73
74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		74
75	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**75**
76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		76
77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		77
78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		78
79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		79
80	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**80**
81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		81
82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		82
83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		83
84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		84
85	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**85**

10.2.4 Illustrative Offset for Overlap with TPD for Other Common CIs - Females

Age	Alzheimer's Disease per 10,000	Angioplasty per 10,000	Aorta Graft Surgery per 10,000	Benign Brain Tumour per 10,000	Blindness per 10,000	Coma per 10,000	Deafness per 10,000	Heart Valve Repair or Replacement per 10,000	HIV Infection per 10,000	Loss of Speech per 10,000	Loss of Hands or Feet per 10,000	Motor Neurone Disease per 10,000	Paralysis of Limbs per 10,000	Parkinson's Disease per 10,000	Third Degree Burns per 10,000	Traumatic Head Injury per 10,000	Sub-Total for Other Common CIs per 10,000	As % Core CIs %	Age
18	0.00	0.00	0.00	0.00	0.07	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.14	21%	18
19	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.15	19%	19
20	**0.00**	**0.00**	**0.00**	**0.00**	**0.08**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.02**	**0.00**	**0.15**	**18%**	**20**
21	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.16	17%	21
22	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.17	16%	22
23	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.18	14%	23
24	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.18	13%	24
25	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.00**	**0.04**	**0.00**	**0.19**	**12%**	**25**
26	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.04	0.00	0.20	12%	26
27	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.04	0.00	0.20	11%	27
28	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.04	0.00	0.21	10%	28
29	0.00	0.00	0.00	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.04	0.00	0.05	0.00	0.22	9%	29
30	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.04**	**0.01**	**0.05**	**0.00**	**0.23**	**8%**	**30**
31	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.04	0.01	0.05	0.00	0.24	8%	31
32	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.04	0.01	0.05	0.00	0.25	7%	32
33	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.04	0.01	0.05	0.00	0.26	7%	33
34	0.00	0.00	0.00	0.00	0.11	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.04	0.01	0.05	0.00	0.27	6%	34
35	**0.01**	**0.00**	**0.00**	**0.00**	**0.11**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.02**	**0.01**	**0.04**	**0.01**	**0.06**	**0.00**	**0.28**	**6%**	**35**
36	0.01	0.00	0.00	0.00	0.11	0.00	0.03	0.00	0.00	0.00	0.02	0.02	0.04	0.02	0.06	0.00	0.30	5%	36
37	0.01	0.00	0.00	0.00	0.11	0.00	0.03	0.00	0.00	0.00	0.02	0.02	0.04	0.02	0.06	0.00	0.31	5%	37
38	0.01	0.00	0.00	0.00	0.12	0.00	0.03	0.00	0.00	0.00	0.02	0.02	0.04	0.02	0.06	0.00	0.33	5%	38
39	0.01	0.00	0.00	0.00	0.12	0.00	0.03	0.00	0.00	0.00	0.02	0.03	0.04	0.03	0.06	0.00	0.35	5%	39
40	**0.02**	**0.00**	**0.00**	**0.00**	**0.13**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.03**	**0.03**	**0.04**	**0.03**	**0.06**	**0.00**	**0.37**	**4%**	**40**
41	0.02	0.00	0.00	0.00	0.13	0.00	0.03	0.00	0.00	0.00	0.03	0.04	0.05	0.04	0.07	0.00	0.40	4%	41
42	0.03	0.00	0.00	0.00	0.13	0.00	0.03	0.00	0.00	0.00	0.03	0.05	0.05	0.05	0.07	0.00	0.43	4%	42
43	0.03	0.00	0.00	0.00	0.14	0.00	0.03	0.00	0.00	0.00	0.04	0.05	0.05	0.06	0.07	0.00	0.47	4%	43
44	0.04	0.00	0.00	0.00	0.14	0.00	0.03	0.00	0.00	0.00	0.04	0.06	0.05	0.07	0.07	0.00	0.51	4%	44
45	**0.05**	**0.00**	**0.00**	**0.00**	**0.15**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.05**	**0.07**	**0.05**	**0.08**	**0.07**	**0.00**	**0.55**	**4%**	**45**
46	0.06	0.00	0.00	0.00	0.15	0.00	0.03	0.00	0.00	0.00	0.05	0.09	0.05	0.09	0.07	0.00	0.61	4%	46
47	0.08	0.00	0.00	0.00	0.16	0.00	0.04	0.00	0.00	0.00	0.06	0.10	0.05	0.11	0.07	0.00	0.67	4%	47
48	0.10	0.00	0.00	0.00	0.17	0.00	0.04	0.00	0.00	0.00	0.06	0.12	0.05	0.13	0.07	0.00	0.74	4%	48
49	0.12	0.00	0.00	0.00	0.17	0.00	0.04	0.00	0.00	0.00	0.07	0.14	0.05	0.15	0.07	0.00	0.82	4%	49
50	**0.15**	**0.00**	**0.00**	**0.00**	**0.18**	**0.00**	**0.04**	**0.00**	**0.00**	**0.00**	**0.08**	**0.16**	**0.05**	**0.18**	**0.07**	**0.00**	**0.91**	**4%**	**50**
51	0.19	0.00	0.00	0.00	0.19	0.00	0.04	0.00	0.00	0.00	0.08	0.18	0.05	0.21	0.07	0.00	1.03	4%	51
52	0.24	0.00	0.00	0.00	0.20	0.00	0.05	0.00	0.00	0.00	0.09	0.21	0.06	0.25	0.07	0.00	1.16	4%	52
53	0.30	0.00	0.00	0.00	0.21	0.00	0.05	0.00	0.00	0.00	0.10	0.24	0.06	0.29	0.07	0.00	1.32	5%	53
54	0.38	0.00	0.00	0.00	0.22	0.00	0.05	0.00	0.00	0.00	0.11	0.28	0.06	0.34	0.07	0.00	1.51	5%	54
55	**0.48**	**0.00**	**0.00**	**0.00**	**0.23**	**0.00**	**0.05**	**0.00**	**0.00**	**0.00**	**0.12**	**0.32**	**0.06**	**0.40**	**0.07**	**0.00**	**1.73**	**5%**	**55**
56	0.61	0.00	0.00	0.00	0.24	0.00	0.06	0.00	0.00	0.00	0.13	0.36	0.06	0.47	0.07	0.00	1.99	6%	56
57	0.77	0.00	0.00	0.00	0.25	0.00	0.06	0.00	0.00	0.00	0.14	0.41	0.06	0.54	0.07	0.00	2.31	6%	57
58	0.97	0.00	0.00	0.00	0.27	0.00	0.07	0.00	0.00	0.00	0.15	0.46	0.07	0.63	0.07	0.00	2.68	7%	58
59	1.21	0.00	0.00	0.00	0.29	0.00	0.07	0.00	0.00	0.00	0.16	0.52	0.07	0.73	0.07	0.00	3.13	7%	59
60	**1.52**	**0.00**	**0.00**	**0.00**	**0.31**	**0.00**	**0.08**	**0.00**	**0.00**	**0.00**	**0.18**	**0.58**	**0.07**	**0.84**	**0.07**	**0.00**	**3.66**	**8%**	**60**
61	1.92	0.00	0.00	0.00	0.33	0.00	0.09	0.00	0.00	0.00	0.20	0.64	0.07	0.97	0.07	0.00	4.29	9%	61
62	2.42	0.00	0.00	0.00	0.36	0.00	0.09	0.00	0.00	0.00	0.22	0.71	0.08	1.10	0.07	0.00	5.05	10%	62
63	3.04	0.00	0.00	0.00	0.39	0.00	0.10	0.00	0.00	0.00	0.24	0.77	0.08	1.26	0.07	0.00	5.96	11%	63
64	3.80	0.00	0.00	0.00	0.43	0.00	0.11	0.00	0.00	0.00	0.27	0.84	0.09	1.43	0.08	0.00	7.05	12%	64
65	**4.75**	**0.00**	**0.00**	**0.00**	**0.48**	**0.00**	**0.12**	**0.00**	**0.00**	**0.00**	**0.29**	**0.91**	**0.09**	**1.62**	**0.08**	**0.00**	**8.35**	**14%**	**65**
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		66
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		67
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		68
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		69
70	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**70**
71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		71
72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		72
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		73
74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		74
75	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**75**
76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		76
77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		77
78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		78
79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		79
80	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**80**
81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		81
82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		82
83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		83
84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		84
85	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**85**

10.2.5 Illustrative Offset for Accelerated CI Rates for Other Common CIs - Males

Age	Alzheimer's Disease per 10,000	Angioplasty per 10,000	Aorta Graft Surgery per 10,000	Benign Brain Tumour per 10,000	Blindness per 10,000	Coma per 10,000	Deafness per 10,000	Heart Valve Repair or Replacement per 10,000	HIV Infection per 10,000	Loss of Speech per 10,000	Loss of Hands or Feet per 10,000	Motor Neurone Disease per 10,000	Paralysis of Limbs per 10,000	Parkinson's Disease per 10,000	Third Degree Burns per 10,000	Traumatic Head Injury per 10,000	Sub-Total for Other Common CIs per 10,000	As % Core CIs %	Age
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	18
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	19
20	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0%**	**20**
21	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	21
22	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	22
23	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	23
24	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0%	24
25	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0%**	**25**
26	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0%	26
27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0%	27
28	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0%	28
29	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0%	29
30	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0%**	**30**
31	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.03	0%	31
32	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.03	0%	32
33	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.04	0%	33
34	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.04	0%	34
35	**0.00**	**0.00**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.05**	**0%**	**35**
36	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.06	0%	36
37	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.06	0%	37
38	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.07	0%	38
39	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.08	0%	39
40	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0%**	**40**
41	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.11	0%	41
42	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.12	0%	42
43	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.13	0%	43
44	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.15	0%	44
45	**0.00**	**0.00**	**0.00**	**0.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.17**	**0%**	**45**
46	0.01	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.01	0.00	0.00	0.19	0%	46
47	0.01	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.01	0.00	0.00	0.21	0%	47
48	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.01	0.00	0.00	0.24	0%	48
49	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.01	0.00	0.00	0.27	0%	49
50	**0.01**	**0.00**	**0.00**	**0.08**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.20**	**0.00**	**0.01**	**0.00**	**0.00**	**0.30**	**0%**	**50**
51	0.02	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.01	0.00	0.00	0.34	0%	51
52	0.02	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.02	0.00	0.00	0.38	0%	52
53	0.03	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.02	0.00	0.00	0.42	0%	53
54	0.03	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.03	0.00	0.00	0.48	0%	54
55	**0.04**	**0.00**	**0.00**	**0.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.35**	**0.00**	**0.04**	**0.00**	**0.00**	**0.54**	**0%**	**55**
56	0.05	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.05	0.00	0.00	0.61	0%	56
57	0.06	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.06	0.00	0.00	0.68	0%	57
58	0.08	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.08	0.00	0.00	0.78	0%	58
59	0.10	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.10	0.00	0.00	0.88	0%	59
60	**0.12**	**0.00**	**0.00**	**0.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.59**	**0.00**	**0.13**	**0.00**	**0.00**	**1.01**	**0%**	**60**
61	0.15	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.17	0.00	0.00	1.15	0%	61
62	0.19	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.22	0.00	0.00	1.32	1%	62
63	0.23	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.29	0.00	0.00	1.52	1%	63
64	0.29	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.38	0.00	0.00	1.75	1%	64
65	**0.35**	**0.00**	**0.00**	**0.25**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.93**	**0.00**	**0.49**	**0.00**	**0.00**	**2.03**	**1%**	**65**
66	0.44	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.64	0.00	0.00	2.36	1%	66
67	0.54	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.83	0.00	0.00	2.76	1%	67
68	0.66	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	1.07	0.00	0.00	3.23	1%	68
69	0.81	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	1.37	0.00	0.00	3.80	1%	69
70	**0.99**	**0.00**	**0.00**	**0.40**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.33**	**0.00**	**1.75**	**0.00**	**0.00**	**4.47**	**1%**	**70**
71	1.21	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	0.00	2.22	0.00	0.00	5.27	1%	71
72	1.47	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.48	0.00	2.78	0.00	0.00	6.21	1%	72
73	1.79	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54	0.00	3.45	0.00	0.00	7.32	2%	73
74	2.16	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	4.25	0.00	0.00	8.60	2%	74
75	**2.61**	**0.00**	**0.00**	**0.65**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.66**	**0.00**	**5.17**	**0.00**	**0.00**	**10.09**	**2%**	**75**
76	3.14	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	0.00	6.24	0.00	0.00	11.79	2%	76
77	3.76	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	0.00	7.43	0.00	0.00	13.71	2%	77
78	4.48	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.78	0.00	8.73	0.00	0.00	15.84	3%	78
79	5.34	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	0.00	10.12	0.00	0.00	18.20	3%	79
80	**6.33**	**0.00**	**0.00**	**1.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.83**	**0.00**	**11.59**	**0.00**	**0.00**	**20.76**	**3%**	**80**
81	7.47	0.00	0.00	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	13.13	0.00	0.00	23.54	4%	81
82	8.78	0.00	0.00	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.86	0.00	14.73	0.00	0.00	26.55	4%	82
83	10.27	0.00	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.87	0.00	16.41	0.00	0.00	29.82	4%	83
84	11.95	0.00	0.00	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.87	0.00	18.18	0.00	0.00	33.37	5%	84
85	**13.82**	**0.00**	**0.00**	**1.47**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.87**	**0.00**	**20.03**	**0.00**	**0.00**	**37.20**	**5%**	**85**

10.2.6 Illustrative Offset for Accelerated CI Rates for Other Common CIs - Females

Age	Alzheimer's Disease per 10,000	Angioplasty per 10,000	Aorta Graft Surgery per 10,000	Benign Brain Tumour per 10,000	Blindness per 10,000	Coma per 10,000	Deafness per 10,000	Heart Valve Repair or Replacement per 10,000	HIV Infection per 10,000	Loss of Speech per 10,000	Loss of Hands or Feet per 10,000	Motor Neurone Disease per 10,000	Paralysis of Limbs per 10,000	Parkinson's Disease per 10,000	Third Degree Burns per 10,000	Traumatic Head Injury per 10,000	Sub-Total for Other Common CIs per 10,000	As % Core CIs %	Age
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%	18
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	19
20	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0%**	**20**
21	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	21
22	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	22
23	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	23
24	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	24
25	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0%**	**25**
26	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	26
27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	27
28	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	28
29	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0%	29
30	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.02**	**0%**	**30**
31	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0%	31
32	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0%	32
33	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0%	33
34	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0%	34
35	**0.00**	**0.00**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0%**	**35**
36	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0%	36
37	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0%	37
38	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0%	38
39	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0%	39
40	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.05**	**0%**	**40**
41	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.06	0%	41
42	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.07	0%	42
43	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.08	0%	43
44	0.01	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.01	0.00	0.00	0.09	0%	44
45	**0.01**	**0.00**	**0.00**	**0.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.05**	**0.00**	**0.01**	**0.00**	**0.00**	**0.10**	**0%**	**45**
46	0.01	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.11	0%	46
47	0.01	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.01	0.00	0.00	0.13	0%	47
48	0.02	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.01	0.00	0.00	0.15	0%	48
49	0.02	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.01	0.00	0.00	0.17	0%	49
50	**0.02**	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.00**	**0.01**	**0.00**	**0.00**	**0.20**	**0%**	**50**
51	0.03	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.01	0.00	0.00	0.22	0%	51
52	0.03	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.02	0.00	0.00	0.26	0%	52
53	0.04	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.02	0.00	0.00	0.29	0%	53
54	0.05	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.02	0.00	0.00	0.34	0%	54
55	**0.06**	**0.00**	**0.00**	**0.09**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.21**	**0.00**	**0.03**	**0.00**	**0.00**	**0.39**	**0%**	**55**
56	0.07	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.04	0.00	0.00	0.45	0%	56
57	0.09	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.04	0.00	0.00	0.51	0%	57
58	0.10	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.05	0.00	0.00	0.59	0%	58
59	0.13	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.07	0.00	0.00	0.68	0%	59
60	**0.15**	**0.00**	**0.00**	**0.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.41**	**0.00**	**0.08**	**0.00**	**0.00**	**0.78**	**0%**	**60**
61	0.19	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.10	0.00	0.00	0.90	1%	61
62	0.23	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.13	0.00	0.00	1.04	1%	62
63	0.28	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.16	0.00	0.00	1.19	1%	63
64	0.34	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.20	0.00	0.00	1.37	1%	64
65	**0.41**	**0.00**	**0.00**	**0.22**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.71**	**0.00**	**0.25**	**0.00**	**0.00**	**1.58**	**1%**	**65**
66	0.50	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.31	0.00	0.00	1.83	1%	66
67	0.61	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.39	0.00	0.00	2.11	1%	67
68	0.75	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.49	0.00	0.00	2.44	1%	68
69	0.92	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.61	0.00	0.00	2.83	1%	69
70	**1.12**	**0.00**	**0.00**	**0.36**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.04**	**0.00**	**0.77**	**0.00**	**0.00**	**3.29**	**1%**	**70**
71	1.37	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	0.00	0.96	0.00	0.00	3.82	2%	71
72	1.67	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	1.19	0.00	0.00	4.44	2%	72
73	2.02	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	1.47	0.00	0.00	5.16	2%	73
74	2.44	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	1.80	0.00	0.00	6.00	2%	74
75	**2.94**	**0.00**	**0.00**	**0.57**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.26**	**0.00**	**2.20**	**0.00**	**0.00**	**6.97**	**2%**	**75**
76	3.52	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	2.66	0.00	0.00	8.08	3%	76
77	4.20	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	3.18	0.00	0.00	9.34	3%	77
78	5.00	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	3.76	0.00	0.00	10.77	3%	78
79	5.94	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	4.37	0.00	0.00	12.37	3%	79
80	**7.04**	**0.00**	**0.00**	**0.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.23**	**0.00**	**5.02**	**0.00**	**0.00**	**14.16**	**4%**	**80**
81	8.32	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	5.70	0.00	0.00	16.15	4%	81
82	9.86	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	6.39	0.00	0.00	18.41	4%	82
83	11.73	0.00	0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.00	7.10	0.00	0.00	21.01	5%	83
84	14.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	7.81	0.00	0.00	24.01	5%	84
85	**16.74**	**0.00**	**0.00**	**1.18**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.04**	**0.00**	**8.51**	**0.00**	**0.00**	**27.48**	**6%**	**85**

10.3 CIBT02 Tables

The following tables set out the final individual-age incidence rates for each CI making up the full CIBT02 tables for Core CI Cover and Extended CI Cover.

Core Cover CIs:

- Cancer
- Heart Attack
- Stroke
- CABG
- MS
- KF
- MOT
- TPD

Extended Cover CIs:

- All 8 from Core Cover, plus
- Alzheimer's Disease
- Angioplasty to two or more coronary arteries
- Aorta Graft Surgery
- Benign Brain Tumour
- Blindness (based on more strict pre-2006 ABI model definition)
- Coma
- Deafness (based on more strict pre-2006 ABI model definition)
- Heart Value Repair or Replacement
- HIV Infection
- Loss of Speech
- Loss of Hands or Feet
- Motor Neurone Disease
- Paralysis of Limbs
- Parkinson's Disease
- Third Degree Burns
- Traumatic Head Injury
- Terminal Illness (but only on Accelerated CI cover)

10.3.1 CIBT02 - Core Cover - Males

Age	Cancer per 10,000	Heart Attack per 10,000	Stroke per 10,000	CABG per 10,000	Multiple Sclerosis per 10,000	Kidney Failure per 10,000	Major Organ Failure per 10,000	Total & Permanent Disability per 10,000	Total Stand-Alone CI Incidence Rate $\Sigma I'_x$ per 10,000	Additional Deaths per 10,000	Total Accelerated CI Incidence Rate $\Sigma I_x + (1 - \Sigma k_x).q_x$ per 10,000	Population Mortality Rate q_x per 10,000	Stand-Alone CI as % Population Mortality %	Accelerated CI as % Population Mortality %	Age
18	2.1	0.1	0.6	0.0	0.1	0.2	0.1	0.3	3.5	5.6	9.1	6.15	57%	148%	18
19	2.3	0.1	0.6	0.0	0.1	0.3	0.1	0.3	3.8	6.3	10.1	6.99	54%	145%	19
20	**2.4**	**0.2**	**0.6**	**0.0**	**0.1**	**0.3**	**0.1**	**0.4**	**4.1**	**6.9**	**11.0**	**7.54**	**54%**	**146%**	**20**
21	2.6	0.2	0.7	0.0	0.1	0.3	0.1	0.4	4.4	7.1	11.5	7.79	57%	148%	21
22	2.7	0.2	0.7	0.0	0.2	0.3	0.1	0.4	4.6	7.1	11.7	7.82	59%	150%	22
23	2.9	0.3	0.7	0.0	0.2	0.4	0.1	0.5	5.1	7.1	12.2	7.73	66%	158%	23
24	3.0	0.4	0.8	0.0	0.2	0.4	0.1	0.6	5.5	7.0	12.5	7.63	72%	164%	24
25	**3.2**	**0.4**	**0.8**	**0.0**	**0.3**	**0.4**	**0.1**	**0.6**	**5.8**	**6.9**	**12.7**	**7.62**	**76%**	**167%**	**25**
26	3.4	0.5	0.9	0.0	0.3	0.4	0.1	0.7	6.3	7.0	13.3	7.77	81%	171%	26
27	3.6	0.7	0.9	0.0	0.4	0.5	0.1	0.8	7.0	7.3	14.3	8.07	87%	177%	27
28	3.8	0.8	1.0	0.0	0.5	0.5	0.1	0.9	7.6	7.6	15.2	8.47	90%	180%	28
29	4.0	1.0	1.1	0.0	0.5	0.5	0.1	1.0	8.2	7.9	16.1	8.90	92%	181%	29
30	**4.2**	**1.2**	**1.1**	**0.0**	**0.6**	**0.5**	**0.1**	**1.1**	**8.8**	**8.2**	**17.0**	**9.33**	**94%**	**182%**	**30**
31	4.4	1.5	1.2	0.1	0.7	0.5	0.1	1.2	9.7	8.5	18.2	9.71	100%	187%	31
32	4.7	1.8	1.3	0.1	0.7	0.6	0.1	1.4	10.7	8.7	19.4	10.07	106%	193%	32
33	5.0	2.3	1.4	0.1	0.8	0.6	0.1	1.5	11.8	8.9	20.7	10.44	113%	198%	33
34	5.3	2.8	1.5	0.2	0.9	0.6	0.1	1.7	13.1	9.2	22.3	10.88	120%	205%	34
35	**5.7**	**3.4**	**1.7**	**0.2**	**0.9**	**0.6**	**0.2**	**1.9**	**14.6**	**9.5**	**24.1**	**11.40**	**128%**	**211%**	**35**
36	6.1	4.2	1.8	0.3	1.0	0.6	0.2	2.2	16.4	9.9	26.3	12.04	136%	218%	36
37	6.6	5.1	2.0	0.4	1.0	0.7	0.2	2.4	18.4	10.4	28.8	12.81	144%	225%	37
38	7.1	6.2	2.2	0.5	1.1	0.7	0.2	2.7	20.7	10.9	31.6	13.71	151%	230%	38
39	7.7	7.5	2.4	0.6	1.1	0.7	0.2	3.0	23.2	11.5	34.7	14.73	158%	236%	39
40	**8.4**	**9.1**	**2.7**	**0.8**	**1.1**	**0.7**	**0.2**	**3.4**	**26.4**	**12.1**	**38.5**	**15.86**	**166%**	**243%**	**40**
41	9.2	10.9	3.0	1.1	1.1	0.7	0.2	3.8	30.0	12.8	42.8	17.12	175%	250%	41
42	10.2	12.9	3.3	1.4	1.2	0.8	0.3	4.3	34.4	13.5	47.9	18.54	186%	258%	42
43	11.3	15.1	3.7	1.7	1.2	0.8	0.3	4.8	38.9	14.4	53.3	20.19	193%	264%	43
44	12.5	17.5	4.1	2.2	1.1	0.8	0.3	5.3	43.8	15.3	59.1	22.11	198%	267%	44
45	**13.9**	**20.0**	**4.5**	**2.7**	**1.1**	**0.9**	**0.3**	**6.0**	**49.4**	**16.4**	**65.8**	**24.36**	**203%**	**270%**	**45**
46	15.6	22.5	5.1	3.3	1.1	0.9	0.4	6.7	55.6	17.7	73.3	26.96	206%	272%	46
47	17.4	25.1	5.6	3.9	1.1	0.9	0.4	7.5	61.9	19.1	81.0	29.86	207%	271%	47
48	19.6	27.7	6.2	4.7	1.1	1.0	0.4	8.4	69.1	20.5	89.6	32.95	210%	272%	48
49	22.1	30.3	6.9	5.5	1.0	1.0	0.5	9.5	76.8	21.8	98.6	36.15	212%	273%	49
50	**24.9**	**33.0**	**7.7**	**6.3**	**1.0**	**1.0**	**0.5**	**10.6**	**85.0**	**23.0**	**108.0**	**39.37**	**216%**	**274%**	**50**
51	28.2	35.6	8.5	7.2	1.0	1.1	0.5	11.8	93.9	24.0	117.9	42.57	221%	277%	51
52	31.9	38.3	9.4	8.3	0.9	1.1	0.5	13.2	103.6	25.0	128.6	45.96	225%	280%	52
53	36.2	41.1	10.3	9.3	0.9	1.2	0.6	14.7	114.3	26.2	140.5	49.81	229%	282%	53
54	41.0	44.0	11.4	10.6	0.9	1.2	0.6	16.3	126.0	27.6	153.6	54.40	232%	282%	54
55	**46.5**	**47.1**	**12.6**	**11.9**	**0.8**	**1.2**	**0.6**	**18.0**	**138.7**	**29.4**	**168.1**	**59.99**	**231%**	**280%**	**55**
56	52.6	50.4	13.8	13.3	0.8	1.3	0.6	19.8	152.6	31.8	184.4	66.78	229%	276%	56
57	59.4	54.0	15.2	14.9	0.7	1.3	0.6	21.6	167.7	34.7	202.4	74.66	225%	271%	57
58	66.8	57.7	16.7	16.6	0.7	1.4	0.6	23.5	184.0	38.0	222.0	83.45	221%	266%	58
59	74.8	61.7	18.4	18.3	0.7	1.4	0.5	25.4	201.2	41.7	242.9	92.95	216%	261%	59
60	**83.5**	**65.8**	**20.2**	**20.1**	**0.6**	**1.5**	**0.5**	**27.3**	**219.5**	**45.6**	**265.1**	**102.99**	**213%**	**257%**	**60**
61	92.8	70.1	22.1	22.0	0.6	1.6	0.5	29.2	238.9	49.9	288.8	113.48	211%	254%	61
62	102.6	74.6	24.1	23.8	0.5	1.6	0.4	31.0	258.6	54.7	313.3	124.66	207%	251%	62
63	112.9	79.2	26.4	25.5	0.5	1.7	0.4	32.8	279.4	60.1	339.5	136.87	204%	248%	63
64	123.8	83.9	28.8	27.2	0.4	1.8	0.3	34.5	300.7	66.2	366.9	150.46	200%	244%	64
65	**135.1**	**88.6**	**31.5**	**28.7**	**0.4**	**1.9**	**0.3**	**36.1**	**322.6**	**73.3**	**395.9**	**165.76**	**195%**	**239%**	**65**
66	146.8	93.5	34.5	29.9	0.4	2.1	0.2		307.4	98.7	406.1	183.13	168%	222%	66
67	159.0	98.4	37.7	31.0	0.3	2.2	0.2		328.8	109.7	438.5	202.86	162%	216%	67
68	171.7	103.5	41.3	31.9	0.3	2.4	0.2		351.3	122.4	473.7	225.30	156%	210%	68
69	184.9	108.7	45.2	32.7	0.3	2.6	0.1		374.5	137.0	511.5	250.74	149%	204%	69
70	**198.6**	**114.1**	**49.7**	**33.3**	**0.2**	**2.9**	**0.1**		**398.9**	**154.0**	**552.9**	**279.52**	**143%**	**198%**	**70**
71	213.0	119.7	54.5	33.7	0.2	3.1	0.1		424.3	173.6	597.9	311.95	136%	192%	71
72	227.6	125.6	59.9	33.8	0.2	3.4	0.1		450.6	196.2	646.8	348.31	129%	186%	72
73	242.3	131.8	65.6	33.5	0.2	3.6	0.1		477.1	222.1	699.2	388.89	123%	180%	73
74	256.7	138.4	71.7	32.4	0.1	3.7	0.0		503.0	251.2	754.2	433.99	116%	174%	74
75	**270.7**	**145.3**	**78.1**	**30.5**	**0.1**	**3.8**	**0.0**		**528.5**	**283.4**	**811.9**	**483.89**	**109%**	**168%**	**75**
76	283.9	152.8	84.8	27.6	0.1	3.9	0.0		553.1	318.8	871.9	538.79	103%	162%	76
77	296.2	160.6	91.7	24.0	0.1	4.0	0.0		576.6	357.7	934.3	598.60	96%	156%	77
78	307.8	168.7	98.8	20.0	0.1	4.2	0.0		599.6	400.3	999.9	663.15	90%	151%	78
79	318.6	177.0	106.1	16.1	0.1	4.3	0.0		622.2	447.5	1069.7	732.26	85%	146%	79
80	**328.7**	**185.6**	**113.5**	**12.5**	**0.1**	**4.5**	**0.0**		**644.9**	**500.3**	**1145.2**	**805.77**	**80%**	**142%**	**80**
81	338.2	194.4	121.0	9.6	0.1	4.6	0.0		667.9	559.9	1227.8	884.16	76%	139%	81
82	347.3	203.3	128.6	7.3	0.1	4.6	0.0		691.2	628.8	1320.0	970.61	71%	136%	82
83	356.7	212.0	136.6	5.6	0.0	4.5	0.0		715.4	710.0	1425.4	1068.97	67%	133%	83
84	366.7	220.5	145.0	4.3	0.0	4.3	0.0		740.8	806.1	1546.9	1183.08	63%	131%	84
85	**377.9**	**228.9**	**153.9**	**3.3**	**0.0**	**3.9**	**0.0**		**767.9**	**920.3**	**1688.2**	**1316.78**	**58%**	**128%**	**85**

10.3.2 CIBT02 - Core Cover - Females

Age	Cancer per 10,000	Heart Attack per 10,000	Stroke per 10,000	CABG per 10,000	Multiple Sclerosis per 10,000	Kidney Failure per 10,000	Major Organ Failure per 10,000	Total & Permanent Disability per 10,000	Total Stand-Alone CI Incidence Rate $\Sigma I'_x$ per 10,000	Additional Deaths per 10,000	Total Accelerated CI Incidence Rate $\Sigma I_x + (1 - \Sigma k_x).q_x$ per 10,000	Population Mortality Rate q_x per 10,000	Stand-Alone CI as % Population Mortality %	Accelerated CI as % Population Mortality %	Age
18	1.6	0.0	0.4	0.0	0.1	0.1	0.1	0.7	3.0	2.3	5.3	2.73	110%	194%	18
19	1.8	0.0	0.5	0.0	0.2	0.1	0.1	0.8	3.5	2.3	5.8	2.79	125%	208%	19
20	**2.1**	**0.0**	**0.5**	**0.0**	**0.3**	**0.1**	**0.1**	**0.9**	**4.0**	**2.3**	**6.3**	**2.79**	**143%**	**226%**	**20**
21	2.3	0.1	0.5	0.0	0.3	0.2	0.1	1.0	4.5	2.3	6.8	2.79	161%	243%	21
22	2.6	0.1	0.6	0.0	0.4	0.2	0.1	1.1	5.1	2.3	7.4	2.81	181%	263%	22
23	3.0	0.1	0.6	0.0	0.5	0.2	0.1	1.2	5.7	2.3	8.0	2.85	200%	280%	23
24	3.3	0.1	0.7	0.0	0.6	0.2	0.1	1.4	6.4	2.3	8.7	2.93	219%	297%	24
25	**3.8**	**0.1**	**0.7**	**0.0**	**0.7**	**0.2**	**0.1**	**1.5**	**7.1**	**2.4**	**9.5**	**3.03**	**234%**	**313%**	**25**
26	4.2	0.1	0.8	0.0	0.9	0.2	0.1	1.7	8.0	2.4	10.4	3.19	251%	326%	26
27	4.8	0.2	0.8	0.0	1.0	0.3	0.1	1.9	9.1	2.5	11.6	3.38	269%	343%	27
28	5.3	0.2	0.9	0.0	1.2	0.3	0.1	2.1	10.1	2.6	12.7	3.61	280%	352%	28
29	6.0	0.2	0.9	0.0	1.3	0.3	0.1	2.4	11.2	2.7	13.9	3.89	288%	358%	29
30	**6.7**	**0.3**	**1.0**	**0.0**	**1.5**	**0.3**	**0.1**	**2.7**	**12.6**	**2.8**	**15.4**	**4.20**	**300%**	**367%**	**30**
31	7.4	0.4	1.1	0.0	1.6	0.3	0.1	3.0	13.9	3.0	16.9	4.55	305%	371%	31
32	8.3	0.4	1.2	0.0	1.8	0.3	0.1	3.4	15.5	3.1	18.6	4.94	314%	377%	32
33	9.1	0.5	1.3	0.0	1.9	0.4	0.1	3.8	17.1	3.2	20.3	5.35	319%	379%	33
34	10.1	0.6	1.4	0.0	2.0	0.4	0.1	4.3	18.9	3.3	22.2	5.79	326%	383%	34
35	**11.0**	**0.8**	**1.5**	**0.1**	**2.2**	**0.4**	**0.1**	**4.8**	**20.9**	**3.5**	**24.4**	**6.25**	**334%**	**390%**	**35**
36	12.1	0.9	1.6	0.1	2.3	0.4	0.1	5.4	22.9	3.6	26.5	6.73	340%	394%	36
37	13.2	1.1	1.8	0.1	2.4	0.4	0.2	6.0	25.2	3.7	28.9	7.25	347%	398%	37
38	14.4	1.4	1.9	0.1	2.4	0.4	0.2	6.7	27.5	3.9	31.4	7.86	350%	400%	38
39	15.7	1.6	2.1	0.1	2.5	0.5	0.2	7.5	30.2	4.0	34.2	8.57	352%	399%	39
40	**17.2**	**1.9**	**2.3**	**0.2**	**2.5**	**0.5**	**0.2**	**8.4**	**33.2**	**4.3**	**37.5**	**9.43**	**352%**	**398%**	**40**
41	18.8	2.3	2.6	0.2	2.6	0.5	0.2	9.4	36.6	4.5	41.1	10.46	350%	393%	41
42	20.7	2.7	2.8	0.2	2.6	0.5	0.2	10.4	40.1	4.9	45.0	11.65	344%	386%	42
43	22.7	3.1	3.1	0.3	2.6	0.5	0.2	11.6	44.1	5.2	49.3	12.99	339%	379%	43
44	25.0	3.5	3.4	0.3	2.5	0.5	0.2	12.8	48.2	5.5	53.7	14.48	333%	371%	44
45	**27.6**	**4.0**	**3.7**	**0.4**	**2.5**	**0.6**	**0.2**	**14.2**	**53.2**	**5.8**	**59.0**	**16.10**	**330%**	**366%**	**45**
46	30.6	4.5	4.0	0.5	2.4	0.6	0.2	15.7	58.5	6.1	64.6	17.84	328%	362%	46
47	33.8	5.1	4.3	0.6	2.4	0.6	0.2	17.2	64.2	6.4	70.6	19.69	326%	359%	47
48	37.2	5.6	4.7	0.7	2.3	0.6	0.3	18.9	70.3	6.7	77.0	21.64	325%	356%	48
49	40.8	6.2	5.0	0.8	2.2	0.6	0.3	20.7	76.6	6.9	83.5	23.68	323%	353%	49
50	**44.4**	**6.9**	**5.4**	**0.9**	**2.1**	**0.6**	**0.3**	**22.6**	**83.2**	**7.1**	**90.3**	**25.81**	**322%**	**350%**	**50**
51	48.2	7.6	5.8	1.0	2.0	0.7	0.3	24.6	90.2	7.4	97.6	28.02	322%	348%	51
52	52.0	8.4	6.3	1.2	1.9	0.7	0.3	26.7	97.5	7.6	105.1	30.38	321%	346%	52
53	55.8	9.3	6.8	1.3	1.9	0.7	0.3	28.9	105.0	8.0	113.0	32.97	318%	343%	53
54	59.7	10.4	7.3	1.5	1.8	0.7	0.3	31.2	112.9	8.4	121.3	35.88	315%	338%	54
55	**63.6**	**11.5**	**7.9**	**1.8**	**1.7**	**0.8**	**0.3**	**33.5**	**121.1**	**9.0**	**130.1**	**39.19**	**309%**	**332%**	**55**
56	67.6	12.8	8.5	2.0	1.6	0.8	0.3	35.9	129.5	9.6	139.1	42.95	301%	324%	56
57	71.5	14.3	9.2	2.3	1.5	0.8	0.3	38.4	138.3	10.5	148.8	47.20	293%	315%	57
58	75.4	16.0	10.1	2.7	1.4	0.8	0.3	40.9	147.6	11.6	159.2	51.94	284%	307%	58
59	79.3	17.8	11.0	3.0	1.3	0.9	0.3	43.4	157.0	12.9	169.9	57.16	275%	297%	59
60	**83.1**	**19.9**	**12.0**	**3.4**	**1.2**	**0.9**	**0.3**	**46.0**	**166.8**	**14.5**	**181.3**	**62.89**	**265%**	**288%**	**60**
61	86.8	22.1	13.2	3.9	1.1	0.9	0.3	48.6	176.9	16.5	193.4	69.14	256%	280%	61
62	90.5	24.5	14.6	4.4	1.0	1.0	0.2	51.3	187.5	18.9	206.4	75.98	247%	272%	62
63	94.2	27.1	16.2	4.9	0.9	1.0	0.2	54.0	198.5	21.7	220.2	83.51	238%	264%	63
64	97.9	29.8	17.9	5.5	0.8	1.0	0.2	56.8	209.9	25.0	234.9	91.81	229%	256%	64
65	**101.8**	**32.7**	**19.9**	**6.0**	**0.7**	**1.1**	**0.2**	**59.7**	**222.1**	**28.6**	**250.7**	**100.97**	**220%**	**248%**	**65**
66	105.9	35.7	22.2	6.6	0.7	1.1	0.1		172.3	55.6	227.9	111.14	155%	205%	66
67	110.3	39.0	24.8	7.2	0.6	1.2	0.1		183.2	62.2	245.4	122.71	149%	200%	67
68	115.0	42.4	27.6	7.7	0.5	1.3	0.1		194.6	69.8	264.4	136.10	143%	194%	68
69	120.2	46.0	30.8	8.2	0.5	1.4	0.1		207.2	78.9	286.1	151.77	137%	189%	69
70	**126.0**	**49.9**	**34.3**	**8.5**	**0.4**	**1.5**	**0.1**		**220.7**	**90.0**	**310.7**	**170.15**	**130%**	**183%**	**70**
71	132.4	54.1	38.2	8.8	0.4	1.6	0.1		235.6	103.5	339.1	191.59	123%	177%	71
72	139.3	58.5	42.4	8.9	0.3	1.7	0.0		251.1	119.7	370.8	216.11	116%	172%	72
73	146.2	63.2	47.0	8.8	0.3	1.7	0.0		267.2	138.5	405.7	243.64	110%	167%	73
74	153.0	68.2	52.0	8.5	0.2	1.7	0.0		283.6	159.8	443.4	274.10	103%	162%	74
75	**159.4**	**73.5**	**57.3**	**8.0**	**0.2**	**1.7**	**0.0**		**300.1**	**183.0**	**483.1**	**307.42**	**98%**	**157%**	**75**
76	165.2	79.3	62.9	7.2	0.2	1.7	0.0		316.5	207.9	524.4	343.68	92%	153%	76
77	170.3	85.3	69.0	6.3	0.2	1.6	0.0		332.7	235.0	567.7	383.56	87%	148%	77
78	175.0	91.7	75.4	5.3	0.1	1.6	0.0		349.1	265.2	614.3	427.88	82%	144%	78
79	179.2	98.3	82.5	4.3	0.1	1.6	0.0		366.0	299.8	665.8	477.49	77%	139%	79
80	**183.0**	**105.1**	**90.2**	**3.4**	**0.1**	**1.5**	**0.0**		**383.3**	**340.4**	**723.7**	**533.20**	**72%**	**136%**	**80**
81	186.7	112.1	98.7	2.6	0.1	1.4	0.0		401.6	388.8	790.4	596.01	67%	133%	81
82	190.2	119.1	107.9	2.0	0.1	1.3	0.0		420.6	446.7	867.3	667.55	63%	130%	82
83	193.6	126.2	117.7	1.5	0.1	1.2	0.0		440.3	515.9	956.2	749.61	59%	128%	83
84	197.0	133.3	128.3	1.2	0.1	1.1	0.0		461.0	598.0	1059.0	843.98	55%	125%	84
85	**200.6**	**140.3**	**139.5**	**0.9**	**0.1**	**1.0**	**0.0**		**482.4**	**694.8**	**1177.2**	**952.46**	**51%**	**124%**	**85**

10.3.3 CIBT02 - Extended Cover - Males

Age	Cancer per 10,000	Heart Attack per 10,000	Stroke per 10,000	CABG per 10,000	Multiple Sclerosis per 10,000	Kidney Failure per 10,000	Major Organ Failure per 10,000	Other Common CIs per 10,000	Total & Permanent Disability per 10,000	Total Stand-Alone CI Incidence Rate $\Sigma I'_x$ per 10,000	Terminal Illness per 10,000	Additional Deaths per 10,000	Total Accelerated CI Incidence Rate $\Sigma I_x + (1 - \Sigma k_x).q_x$ per 10,000	Stand-Alone CI as % Population Mortality %	Accelerated CI as % Population Mortality %	Age
18	2.1	0.1	0.6	0.0	0.1	0.2	0.1	1.1	0.1	4.4	0.1	5.6	10.1	71%	164%	18
19	2.3	0.1	0.6	0.0	0.1	0.3	0.1	1.2	0.1	4.8	0.1	6.3	11.2	69%	160%	19
20	**2.4**	**0.2**	**0.6**	**0.0**	**0.1**	**0.3**	**0.1**	**1.2**	**0.2**	**5.1**	**0.0**	**6.9**	**12.0**	**68%**	**159%**	**20**
21	2.6	0.2	0.7	0.0	0.1	0.3	0.1	1.2	0.2	5.4	0.0	7.1	12.5	69%	161%	21
22	2.7	0.2	0.7	0.0	0.2	0.3	0.1	1.2	0.1	5.5	0.0	7.1	12.6	70%	161%	22
23	2.9	0.3	0.7	0.0	0.2	0.4	0.1	1.2	0.2	6.0	0.0	7.1	13.1	78%	170%	23
24	3.0	0.4	0.8	0.0	0.2	0.4	0.1	1.2	0.3	6.4	0.0	7.0	13.4	84%	176%	24
25	**3.2**	**0.4**	**0.8**	**0.0**	**0.3**	**0.4**	**0.1**	**1.2**	**0.3**	**6.7**	**0.0**	**6.9**	**13.6**	**88%**	**179%**	**25**
26	3.4	0.5	0.9	0.0	0.3	0.4	0.1	1.2	0.4	7.2	0.0	7.0	14.2	93%	183%	26
27	3.6	0.7	0.9	0.0	0.4	0.5	0.1	1.2	0.5	7.9	0.0	7.3	15.2	98%	188%	27
28	3.8	0.8	1.0	0.0	0.5	0.5	0.1	1.3	0.6	8.6	0.0	7.6	16.2	102%	191%	28
29	4.0	1.0	1.1	0.0	0.5	0.5	0.1	1.3	0.7	9.2	0.0	7.9	17.1	103%	192%	29
30	**4.2**	**1.2**	**1.1**	**0.0**	**0.6**	**0.5**	**0.1**	**1.3**	**0.7**	**9.7**	**0.0**	**8.2**	**17.9**	**104%**	**192%**	**30**
31	4.4	1.5	1.2	0.1	0.7	0.5	0.1	1.3	0.8	10.6	0.0	8.5	19.1	109%	197%	31
32	4.7	1.8	1.3	0.1	0.7	0.6	0.1	1.4	1.0	11.7	0.0	8.7	20.4	116%	203%	32
33	5.0	2.3	1.4	0.1	0.8	0.6	0.1	1.4	1.1	12.8	0.0	8.9	21.7	123%	208%	33
34	5.3	2.8	1.5	0.2	0.9	0.6	0.1	1.5	1.3	14.2	0.0	9.2	23.4	131%	215%	34
35	**5.7**	**3.4**	**1.7**	**0.2**	**0.9**	**0.6**	**0.2**	**1.5**	**1.5**	**15.7**	**0.0**	**9.4**	**25.1**	**138%**	**220%**	**35**
36	6.1	4.2	1.8	0.3	1.0	0.6	0.2	1.6	1.8	17.6	0.1	9.8	27.5	146%	228%	36
37	6.6	5.1	2.0	0.4	1.0	0.7	0.2	1.7	1.9	19.6	0.1	10.3	30.0	153%	234%	37
38	7.1	6.2	2.2	0.5	1.1	0.7	0.2	1.8	2.2	22.0	0.1	10.8	32.9	160%	240%	38
39	7.7	7.5	2.4	0.6	1.1	0.7	0.2	2.0	2.5	24.7	0.1	11.4	36.2	168%	246%	39
40	**8.4**	**9.1**	**2.7**	**0.8**	**1.1**	**0.7**	**0.2**	**2.1**	**2.8**	**27.9**	**0.1**	**12.0**	**40.0**	**176%**	**252%**	**40**
41	9.2	10.9	3.0	1.1	1.1	0.7	0.2	2.3	3.2	31.7	0.1	12.7	44.5	185%	260%	41
42	10.2	12.9	3.3	1.4	1.2	0.8	0.3	2.5	3.7	36.3	0.1	13.4	49.8	196%	269%	42
43	11.3	15.1	3.7	1.7	1.2	0.8	0.3	2.8	4.1	41.0	0.1	14.3	55.4	203%	274%	43
44	12.5	17.5	4.1	2.2	1.1	0.8	0.3	3.1	4.5	46.1	0.1	15.1	61.3	209%	277%	44
45	**13.9**	**20.0**	**4.5**	**2.7**	**1.1**	**0.9**	**0.3**	**3.4**	**5.2**	**52.0**	**0.1**	**16.2**	**68.3**	**214%**	**280%**	**45**
46	15.6	22.5	5.1	3.3	1.1	0.9	0.4	3.8	5.8	58.5	0.2	17.5	76.2	217%	283%	46
47	17.4	25.1	5.6	3.9	1.1	0.9	0.4	4.1	6.5	65.0	0.2	18.9	84.1	218%	282%	47
48	19.6	27.7	6.2	4.7	1.1	1.0	0.4	4.6	7.3	72.6	0.2	20.3	93.1	220%	283%	48
49	22.1	30.3	6.9	5.5	1.0	1.0	0.5	5.0	8.3	80.6	0.1	21.5	102.2	223%	283%	49
50	**24.9**	**33.0**	**7.7**	**6.3**	**1.0**	**1.0**	**0.5**	**5.6**	**9.3**	**89.3**	**0.1**	**22.7**	**112.1**	**227%**	**285%**	**50**
51	28.2	35.6	8.5	7.2	1.0	1.1	0.5	6.1	10.3	98.5	0.1	23.7	122.3	231%	287%	51
52	31.9	38.3	9.4	8.3	0.9	1.1	0.5	6.8	11.6	108.8	0.1	24.6	133.5	237%	290%	52
53	36.2	41.1	10.3	9.3	0.9	1.2	0.6	7.5	12.9	120.0	0.2	25.8	146.0	241%	293%	53
54	41.0	44.0	11.4	10.6	0.9	1.2	0.6	8.4	14.3	132.4	0.2	27.1	159.7	243%	294%	54
55	**46.5**	**47.1**	**12.6**	**11.9**	**0.8**	**1.2**	**0.6**	**9.4**	**15.7**	**145.8**	**0.3**	**28.9**	**175.0**	**243%**	**292%**	**55**
56	52.6	50.4	13.8	13.3	0.8	1.3	0.6	10.5	17.2	160.5	0.4	31.2	192.1	240%	288%	56
57	59.4	54.0	15.2	14.9	0.7	1.3	0.6	11.8	18.6	176.5	0.4	34.0	210.9	236%	282%	57
58	66.8	57.7	16.7	16.6	0.7	1.4	0.6	13.4	20.1	194.0	0.4	37.2	231.6	232%	278%	58
59	74.8	61.7	18.4	18.3	0.7	1.4	0.5	15.2	21.4	212.4	0.5	40.8	253.7	229%	273%	59
60	**83.5**	**65.8**	**20.2**	**20.1**	**0.6**	**1.5**	**0.5**	**17.4**	**22.7**	**232.3**	**0.5**	**44.6**	**277.4**	**226%**	**269%**	**60**
61	92.8	70.1	22.1	22.0	0.6	1.6	0.5	20.0	23.8	253.5	0.5	48.8	302.8	223%	267%	61
62	102.6	74.6	24.1	23.8	0.5	1.6	0.4	23.1	24.6	275.3	0.6	53.4	329.3	221%	264%	62
63	112.9	79.2	26.4	25.5	0.5	1.7	0.4	26.8	25.1	298.5	0.7	58.6	357.8	218%	261%	63
64	123.8	83.9	28.8	27.2	0.4	1.8	0.3	31.3	25.3	322.8	0.8	64.4	388.0	215%	258%	64
65	**135.1**	**88.6**	**31.5**	**28.7**	**0.4**	**1.9**	**0.3**	**36.8**	**24.9**	**348.2**	**0.9**	**71.3**	**420.4**	**210%**	**254%**	**65**
66	146.8	93.5	34.5	29.9	0.4	2.1	0.2	43.2	0.0	350.6	1.0	96.3	447.9	191%	245%	66
67	159.0	98.4	37.7	31.0	0.3	2.2	0.2	50.5	0.0	379.3	1.2	106.9	487.4	187%	240%	67
68	171.7	103.5	41.3	31.9	0.3	2.4	0.2	58.8	0.0	410.1	1.4	119.2	530.7	182%	236%	68
69	184.9	108.7	45.2	32.7	0.3	2.6	0.1	68.0	0.0	442.5	1.7	133.2	577.4	176%	230%	69
70	**198.6**	**114.1**	**49.7**	**33.3**	**0.2**	**2.9**	**0.1**	**77.9**	**0.0**	**476.8**	**1.9**	**149.5**	**628.2**	**171%**	**225%**	**70**
71	213.0	119.7	54.5	33.7	0.2	3.1	0.1	88.5	0.0	512.8	2.2	168.3	683.3	164%	219%	71
72	227.6	125.6	59.9	33.8	0.2	3.4	0.1	99.5	0.0	550.1	2.5	190.0	742.6	158%	213%	72
73	242.3	131.8	65.6	33.5	0.2	3.6	0.1	110.9	0.0	588.0	2.9	214.8	805.7	151%	207%	73
74	256.7	138.4	71.7	32.4	0.1	3.7	0.0	122.2	0.0	625.2	3.2	242.6	871.0	144%	201%	74
75	**270.7**	**145.3**	**78.1**	**30.5**	**0.1**	**3.8**	**0.0**	**133.2**	**0.0**	**661.7**	**3.5**	**273.3**	**938.5**	**137%**	**194%**	**75**
76	283.9	152.8	84.8	27.6	0.1	3.9	0.0	143.8	0.0	696.9	3.8	307.0	1007.7	129%	187%	76
77	296.2	160.6	91.7	24.0	0.1	4.0	0.0	154.1	0.0	730.7	4.1	344.0	1078.8	122%	180%	77
78	307.8	168.7	98.8	20.0	0.1	4.2	0.0	164.3	0.0	763.9	4.6	384.5	1153.0	115%	174%	78
79	318.6	177.0	106.1	16.1	0.1	4.3	0.0	174.5	0.0	796.7	5.2	429.3	1231.2	109%	168%	79
80	**328.7**	**185.6**	**113.5**	**12.5**	**0.1**	**4.5**	**0.0**	**184.9**	**0.0**	**829.8**	**5.9**	**479.5**	**1315.2**	**103%**	**163%**	**80**
81	338.2	194.4	121.0	9.6	0.1	4.6	0.0	195.7	0.0	863.6	6.9	536.4	1406.9	98%	159%	81
82	347.3	203.3	128.6	7.3	0.1	4.6	0.0	207.1	0.0	898.3	8.2	602.2	1508.7	93%	155%	82
83	356.7	212.0	136.6	5.6	0.0	4.5	0.0	219.2	0.0	934.6	9.8	680.2	1624.6	87%	152%	83
84	366.7	220.5	145.0	4.3	0.0	4.3	0.0	232.0	0.0	972.8	11.8	772.7	1757.3	82%	149%	84
85	**377.9**	**228.9**	**153.9**	**3.3**	**0.0**	**3.9**	**0.0**	**245.8**	**0.0**	**1013.7**	**14.0**	**883.1**	**1910.8**	**77%**	**145%**	**85**

10.3.4 CIBT02 - Extended Cover - Females

Age	Cancer per 10,000	Heart Attack per 10,000	Stroke per 10,000	CABG per 10,000	Multiple Sclerosis per 10,000	Kidney Failure per 10,000	Major Organ Failure per 10,000	Other Common CIs per 10,000	Total & Permanent Disability per 10,000	Total Stand-Alone CI Incidence Rate $\Sigma I'_x$ per 10,000	Terminal Illness per 10,000	Additional Deaths per 10,000	Total Accelerated CI Incidence Rate $\Sigma I_x + (1 - \Sigma k_x).q_x$ per 10,000	Stand-Alone CI as % Population Mortality %	Accelerated CI as % Population Mortality %	Age
18	1.6	0.0	0.4	0.0	0.1	0.1	0.1	0.6	0.6	3.5	0.0	2.3	5.8	128%	213%	18
19	1.8	0.0	0.5	0.0	0.2	0.1	0.1	0.6	0.7	4.0	0.0	2.3	6.3	143%	226%	19
20	**2.1**	**0.0**	**0.5**	**0.0**	**0.3**	**0.1**	**0.1**	**0.6**	**0.7**	**4.4**	**0.0**	**2.3**	**6.7**	**158%**	**240%**	**20**
21	2.3	0.1	0.5	0.0	0.3	0.2	0.1	0.6	0.8	4.9	0.0	2.3	7.2	175%	258%	21
22	2.6	0.1	0.6	0.0	0.4	0.2	0.1	0.6	0.9	5.5	0.0	2.3	7.8	196%	277%	22
23	3.0	0.1	0.6	0.0	0.5	0.2	0.1	0.6	1.0	6.1	0.0	2.3	8.4	214%	294%	23
24	3.3	0.1	0.7	0.0	0.6	0.2	0.1	0.6	1.2	6.8	0.0	2.3	9.1	232%	311%	24
25	**3.8**	**0.1**	**0.7**	**0.0**	**0.7**	**0.2**	**0.1**	**0.7**	**1.3**	**7.6**	**0.0**	**2.4**	**10.0**	**250%**	**330%**	**25**
26	4.2	0.1	0.8	0.0	0.9	0.2	0.1	0.7	1.5	8.5	0.0	2.4	10.9	267%	342%	26
27	4.8	0.2	0.8	0.0	1.0	0.3	0.1	0.7	1.7	9.6	0.0	2.5	12.1	284%	358%	27
28	5.3	0.2	0.9	0.0	1.2	0.3	0.1	0.7	1.9	10.6	0.0	2.6	13.2	293%	365%	28
29	6.0	0.2	0.9	0.0	1.3	0.3	0.1	0.7	2.2	11.7	0.0	2.7	14.4	301%	371%	29
30	**6.7**	**0.3**	**1.0**	**0.0**	**1.5**	**0.3**	**0.1**	**0.7**	**2.5**	**13.1**	**0.0**	**2.8**	**15.9**	**312%**	**379%**	**30**
31	7.4	0.4	1.1	0.0	1.6	0.3	0.1	0.7	2.8	14.4	0.0	3.0	17.4	316%	382%	31
32	8.3	0.4	1.2	0.0	1.8	0.3	0.1	0.7	3.2	16.0	0.0	3.1	19.1	324%	387%	32
33	9.1	0.5	1.3	0.0	1.9	0.4	0.1	0.8	3.5	17.6	0.0	3.2	20.8	329%	388%	33
34	10.1	0.6	1.4	0.0	2.0	0.4	0.1	0.8	4.0	19.4	0.0	3.3	22.7	335%	392%	34
35	**11.0**	**0.8**	**1.5**	**0.1**	**2.2**	**0.4**	**0.1**	**0.8**	**4.5**	**21.4**	**0.0**	**3.5**	**24.9**	**342%**	**398%**	**35**
36	12.1	0.9	1.6	0.1	2.3	0.4	0.1	0.8	5.1	23.4	0.0	3.6	27.0	348%	401%	36
37	13.2	1.1	1.8	0.1	2.4	0.4	0.2	0.9	5.7	25.8	0.0	3.7	29.5	356%	407%	37
38	14.4	1.4	1.9	0.1	2.4	0.4	0.2	0.9	6.4	28.1	0.0	3.9	32.0	358%	407%	38
39	15.7	1.6	2.1	0.1	2.5	0.5	0.2	1.0	7.1	30.8	0.0	4.0	34.8	359%	406%	39
40	**17.2**	**1.9**	**2.3**	**0.2**	**2.5**	**0.5**	**0.2**	**1.1**	**8.0**	**33.9**	**0.0**	**4.2**	**38.1**	**360%**	**404%**	**40**
41	18.8	2.3	2.6	0.2	2.6	0.5	0.2	1.1	9.0	37.3	0.1	4.4	41.8	357%	400%	41
42	20.7	2.7	2.8	0.2	2.6	0.5	0.2	1.2	10.0	40.9	0.1	4.8	45.8	351%	393%	42
43	22.7	3.1	3.1	0.3	2.6	0.5	0.2	1.3	11.1	44.9	0.1	5.1	50.1	346%	386%	43
44	25.0	3.5	3.4	0.3	2.5	0.5	0.2	1.4	12.3	49.1	0.1	5.4	54.6	339%	377%	44
45	**27.6**	**4.0**	**3.7**	**0.4**	**2.5**	**0.6**	**0.2**	**1.5**	**13.6**	**54.1**	**0.1**	**5.7**	**59.9**	**336%**	**372%**	**45**
46	30.6	4.5	4.0	0.5	2.4	0.6	0.2	1.7	15.1	59.6	0.1	6.0	65.7	334%	368%	46
47	33.8	5.1	4.3	0.6	2.4	0.6	0.2	1.9	16.5	65.4	0.1	6.3	71.8	332%	365%	47
48	37.2	5.6	4.7	0.7	2.3	0.6	0.3	2.1	18.2	71.7	0.1	6.6	78.4	331%	362%	48
49	40.8	6.2	5.0	0.8	2.2	0.6	0.3	2.3	19.9	78.1	0.1	6.7	84.9	330%	358%	49
50	**44.4**	**6.9**	**5.4**	**0.9**	**2.1**	**0.6**	**0.3**	**2.6**	**21.7**	**84.9**	**0.1**	**6.9**	**91.9**	**329%**	**356%**	**50**
51	48.2	7.6	5.8	1.0	2.0	0.7	0.3	2.9	23.6	92.1	0.1	7.2	99.4	329%	355%	51
52	52.0	8.4	6.3	1.2	1.9	0.7	0.3	3.3	25.5	99.6	0.1	7.3	107.0	328%	352%	52
53	55.8	9.3	6.8	1.3	1.9	0.7	0.3	3.7	27.6	107.4	0.1	7.7	115.2	326%	349%	53
54	59.7	10.4	7.3	1.5	1.8	0.7	0.3	4.2	29.7	115.6	0.1	8.1	123.8	322%	345%	54
55	**63.6**	**11.5**	**7.9**	**1.8**	**1.7**	**0.8**	**0.3**	**4.9**	**31.8**	**124.3**	**0.2**	**8.6**	**133.1**	**317%**	**340%**	**55**
56	67.6	12.8	8.5	2.0	1.6	0.8	0.3	5.6	33.9	133.1	0.2	9.2	142.5	310%	332%	56
57	71.5	14.3	9.2	2.3	1.5	0.8	0.3	6.4	36.1	142.4	0.2	10.0	152.6	302%	323%	57
58	75.4	16.0	10.1	2.7	1.4	0.8	0.3	7.4	38.2	152.3	0.2	11.0	163.5	293%	315%	58
59	79.3	17.8	11.0	3.0	1.3	0.9	0.3	8.5	40.3	162.4	0.3	12.2	174.9	284%	306%	59
60	**83.1**	**19.9**	**12.0**	**3.4**	**1.2**	**0.9**	**0.3**	**9.8**	**42.3**	**172.9**	**0.3**	**13.7**	**186.9**	**275%**	**297%**	**60**
61	86.8	22.1	13.2	3.9	1.1	0.9	0.3	11.3	44.3	183.9	0.4	15.6	199.9	266%	289%	61
62	90.5	24.5	14.6	4.4	1.0	1.0	0.2	13.1	46.2	195.5	0.4	17.9	213.8	257%	281%	62
63	94.2	27.1	16.2	4.9	0.9	1.0	0.2	15.2	48.0	207.7	0.5	20.5	228.7	249%	274%	63
64	97.9	29.8	17.9	5.5	0.8	1.0	0.2	17.6	49.8	220.5	0.5	23.6	244.6	240%	266%	64
65	**101.8**	**32.7**	**19.9**	**6.0**	**0.7**	**1.1**	**0.2**	**20.5**	**51.3**	**234.2**	**0.5**	**27.0**	**261.7**	**232%**	**259%**	**65**
66	105.9	35.7	22.2	6.6	0.7	1.1	0.1	23.8	0.0	196.1	0.6	53.8	250.5	176%	225%	66
67	110.3	39.0	24.8	7.2	0.6	1.2	0.1	27.6	0.0	210.8	0.7	60.1	271.6	172%	221%	67
68	115.0	42.4	27.6	7.7	0.5	1.3	0.1	32.1	0.0	226.7	0.9	67.4	295.0	167%	217%	68
69	120.2	46.0	30.8	8.2	0.5	1.4	0.1	37.3	0.0	244.5	1.1	76.1	321.7	161%	212%	69
70	**126.0**	**49.9**	**34.3**	**8.5**	**0.4**	**1.5**	**0.1**	**43.2**	**0.0**	**263.9**	**1.3**	**86.7**	**351.9**	**155%**	**207%**	**70**
71	132.4	54.1	38.2	8.8	0.4	1.6	0.1	50.1	0.0	285.7	1.6	99.7	387.0	149%	202%	71
72	139.3	58.5	42.4	8.9	0.3	1.7	0.0	57.8	0.0	308.9	1.9	115.3	426.1	143%	197%	72
73	146.2	63.2	47.0	8.8	0.3	1.7	0.0	66.4	0.0	333.6	2.1	133.3	469.0	137%	192%	73
74	153.0	68.2	52.0	8.5	0.2	1.7	0.0	75.9	0.0	359.5	2.3	153.8	515.6	131%	188%	74
75	**159.4**	**73.5**	**57.3**	**8.0**	**0.2**	**1.7**	**0.0**	**86.3**	**0.0**	**386.4**	**2.4**	**176.0**	**564.8**	**126%**	**184%**	**75**
76	165.2	79.3	62.9	7.2	0.2	1.7	0.0	97.5	0.0	414.0	2.6	199.8	616.4	120%	179%	76
77	170.3	85.3	69.0	6.3	0.2	1.6	0.0	109.7	0.0	442.4	3.0	225.7	671.1	115%	175%	77
78	175.0	91.7	75.4	5.3	0.1	1.6	0.0	123.2	0.0	472.3	3.4	254.4	730.1	110%	171%	78
79	179.2	98.3	82.5	4.3	0.1	1.6	0.0	137.9	0.0	503.9	4.0	287.4	795.3	106%	167%	79
80	**183.0**	**105.1**	**90.2**	**3.4**	**0.1**	**1.5**	**0.0**	**154.1**	**0.0**	**537.4**	**4.9**	**326.2**	**868.5**	**101%**	**163%**	**80**
81	186.7	112.1	98.7	2.6	0.1	1.4	0.0	171.8	0.0	573.4	6.0	372.6	952.0	96%	160%	81
82	190.2	119.1	107.9	2.0	0.1	1.3	0.0	191.1	0.0	611.7	7.2	428.3	1047.2	92%	157%	82
83	193.6	126.2	117.7	1.5	0.1	1.2	0.0	211.8	0.0	652.1	8.7	494.9	1155.7	87%	154%	83
84	197.0	133.3	128.3	1.2	0.1	1.1	0.0	233.7	0.0	694.7	10.3	574.0	1279.0	82%	152%	84
85	**200.6**	**140.3**	**139.5**	**0.9**	**0.1**	**1.0**	**0.0**	**256.7**	**0.0**	**739.1**	**12.1**	**667.3**	**1418.5**	**78%**	**149%**	**85**