

A Critical Review

Report of the Critical Illness Healthcare Study Group

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EXECUTIVE SUMMARY

This paper covers three key aspects of UK Critical Illness business.

- a) Development of a Base Table from population data which can be used for benchmarking experience and determining appropriate pricing and valuation bases.
- b) Investigation of Critical Illness experience during the period 1991 - 1997.
- c) A survey of current reserving practices for Critical Illness business.

In Section 2 we have provided a market overview covering a brief history of the product, the development of the business over recent years and the various product developments in the market. This shows that Critical Illness business since its launch in the mid-1980's has been an extremely successful product and new business has grown substantially, in particular since the benefit was launched in conjunction with a mortgage product. The bulk of Critical Illness claims, (97% of the total) arise from 7 of the 'core conditions' together with TPD with the remaining conditions contributing only about 3% of the claims.

In Section 3 we have developed a Base Table (CIBT 93) from population data, largely for the years 1993/1994. This data allows us to build the Base Table from first principles and enables a better understanding of the underlying contribution to the Critical Illness pricing of individual Critical Illness conditions. Clearly, the Base Table can be updated with more recent data in the future, although many of the principles underlying the Base Table are unlikely to change.

The Base Table is not intended to be used unadjusted as there are many assumptions and approximations involved in the development of the Table. However, we hope it serves as a very useful basis for benchmarking experience both for Stand-Alone and Accelerated business.

Section 4 covers an extremely important area of the report as this is the first ever Critical Illness experience investigation in the UK. The experience analysis covers the years 1991 - 1997, with 32 participating offices who were very helpful in their contribution. The investigation covers over 60% of the estimated total claims arising during the investigation period.

In total the investigation covers over 5,000 claims under Accelerated business and over 450 under Stand-Alone business. Despite this, the business cannot yet be regarded as fully mature and changes to the experience can be expected as the business continues to mature.

Overall, the results of the Accelerated business are at 46% of CIBT93 for males and 43% of CIBT93 for females on a lives basis. This reflects the different mix of socio-economic groups covered by the insured from the general population and the effects of initial underwriting. These figures are broadly similar to the differences between insured and population mortality. The results for policies and amounts are very similar suggesting limited anti-selection in terms of amounts.

In addition, the results show:

- There is a trend of improving experience until 1996 although it appears to have worsened in 1997. The male Non-Smoker all durations experience has improved from 70% of CIBT93 in 1991 to 36% of CIBT93 in 1996, although the 1997 result is 43%.
- The effects of selection are quite marked, particularly at Duration 0 and the initial fear of major anti-selection in the early years does not appear to have materialised. Overall, the male Aggregate experience for durations 0, 1 and 2+ is at 31%, 45% and 53% of CIBT93 respectively.
- The results for duration 2+ experience suggest that the ultimate experience may still be in the development stage and it is too early to draw any firm conclusions about the level of the ultimate experience.
- Smoker/Non-Smoker differentials are currently lower than those experienced under mortality and it may be that it is too early in the development of the business for the full impact to emerge in the experience analysis.
- Stand-Alone experience is less credible than the Accelerated but appears broadly similar overall with the exception of female amounts experience which is markedly higher.
- There is considerable variation in experience between offices, and there appears to be some correlation with distribution channel.

In Section 5 the results of the survey with regards to the valuation basis are shown. The results suggest that the

average valuation margins adopted for linked business and reviewable conventional business are similar at around 23%, whereas the average margin for guaranteed business is 35%. In addition, offices make various adjustments to valuation bases for future trends with regard to their guaranteed business.

In Section 6, we highlight a number of current issues with regards to Critical Illness business and clearly these issues need to be addressed for the future success of this line of business.

The results of our investigations show not only that the ultimate experience may be in the development stage but also that the experience measured against CIBT93 varies significantly by disease and age. In Section 7, we have attempted to give one approximate method of estimating the ultimate shape of the Insured Lives table against CIBT93. This should be seen as an approximation for indicative purposes only. Each office can use their own method of approximation using the results from the investigation.

1 INTRODUCTION

The Critical Illness Healthcare Study Group was set up under the umbrella of the Health and Care Committee. We were not given any specific brief, however, we decided that we would focus on three particular areas.

- Development of a Base Table for UK Critical Illness business which would be useful to benchmark pricing and valuation bases.
- Investigation of the insured lives experience of Critical Illness business, as no previous industry-wide analysis has yet been published in the UK.
- Investigation of the current practices in reserving for Critical Illness business

This paper summarises the Group's work to date. As other Healthcare Study Groups are looking at the impact of guarantees and medical advances on healthcare business, we have not looked at these issues in detail in this report.

A Base Table is developed, in Section 3, from first principles, using available population data. The bulk of the underlying population data relates to 1993/1994 as this was the most recent data available in detail at the time when we started. Whilst the Base Table relates to 1993/1994, we have also given indications of the trends to Year 2000, which when combined with the experience analysis should give offices a reasonable starting point for pricing or valuation.

A Critical Illness experience investigation for the period 1991 - 1995 was carried out and a preliminary report was published in October 1997¹⁰. We have further extended the investigation into 1996 and 1997 and the full report is included in Section 4. The majority of data received to date has been processed but at the date of going to print, a small volume was still outstanding. We do not expect this to materially affect the overall results.

A survey of the main insurers and reinsurers writing Critical Illness business was undertaken during 1997 with regard to the valuation basis and the results of the survey were sent to all contributing offices in January 1998. A synopsis of this work is given in Section 5.

Preliminary findings of the above have been presented at the annual Healthcare Conferences at Warwick.

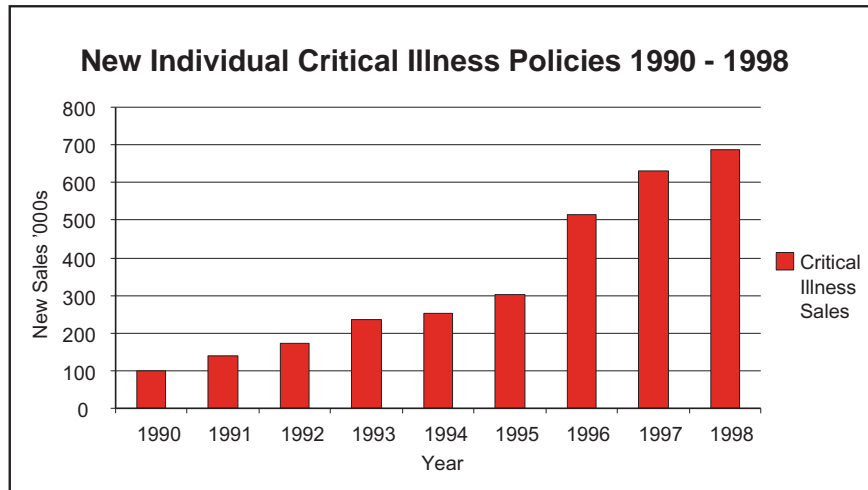
We would like to thank Pete Davis of Zurich Financial Services who was one of the founder members of the Group, Jackie Burton of Swiss Life who helped us tremendously with the printing and we are very much indebted to the participating companies without whose co-operation there would have been no experience investigation.

The views expressed in this paper are those of the authors and not necessarily of our employers.

2 MARKET OVERVIEW

2.1 A SUCCESS OF THE 1990'S

Critical Illness has been the jewel in the life assurance industry's crown since its launch in the mid-1980's. Although the product was initially slow in gaining momentum in the UK, the terrific success achieved by a number of Direct Sales Force (DSF) offices in the late 1980's confirmed the market appeal and huge potential for Critical Illness cover. This sparked a rush of other providers into the market in 1990/91 and sales have grown spectacularly :

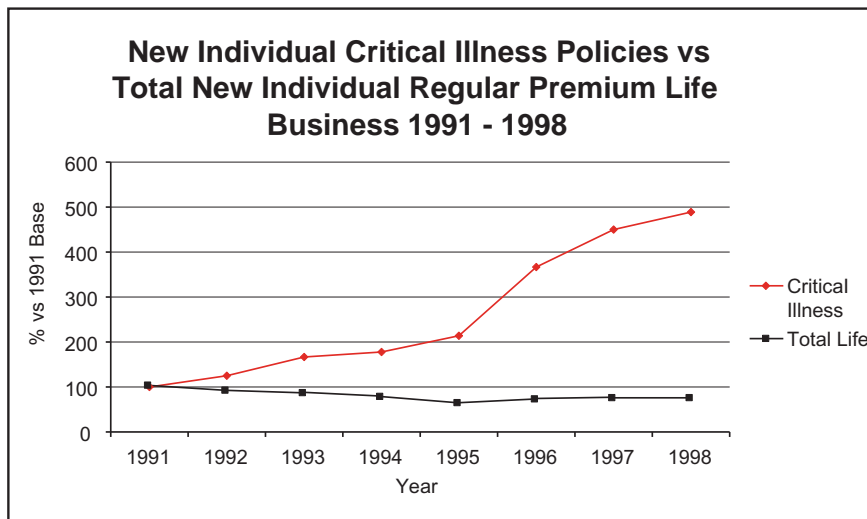


In 1998, there were almost 700,000 individual Critical Illness policies sold, representing almost 24% of overall new individual, regular premium life policy sales. Most life assurers now offer some form of Critical Illness cover within their range.

It is estimated that the total number of long-term individual Critical Illness policies in force had reached 2,400,000 by the end of 1998. In addition, around 50,000 lives were covered under group Critical Illness schemes. Overall, this represents only a 9% penetration of the working population. Whilst growth in sales has been spectacular, it seems there is still considerable scope for further expansion.

Despite being much the younger product in the UK market, Critical Illness sales have far outstripped sales of Income Protection policies. The certain nature of Critical Illness, such as listed illnesses, well defined claims criteria, and fixed benefits seems to be favourably viewed by consumers in comparison with the more subjective claims criteria and complex benefit limitations of Income Protection plans. Perhaps most of all in favour of Critical Illness is the simple appeal of a lump sum benefit over an income benefit.

The growth in Critical Illness sales looks even more impressive when shown in context with overall sales of individual, regular premium life business. The following graph illustrates the relative changes in sales level against a 1991 base of 100 :



Sales of new individual Critical Illness policies as a percentage of overall new individual, regular premium life policy sales have risen from 3.5% in 1991 to 23.6% in 1998.

It would, however, be misleading to claim all of the growth in Critical Illness as real new business. Around 85% of Critical Illness policies are written as "accelerated" life cover, attached to Whole Life, Endowment or Term Assurance policies. If we did not have the concept of Critical Illness cover, it is likely that a high proportion of these sales would still have been made, but simply as life cover policies. So, whilst the advent of Critical Illness cover has expanded the market to some degree, it's real success has been as a rider benefit, meeting a consumer need and enabling providers to get more value from each sale.

As for many products, the Critical Illness market shows a big difference in sales volumes between companies successfully marketing this product and those that have added Critical Illness simply to complete a product range. Although the market share of the top 10 providers by sales volume has fallen as the market has expanded, the top 10 still account for around 60% of the total market today. In addition, the make-up of the top 10 has changed considerably over the 1990's, alongside significant changes in distribution, marketing and product design.

An appreciation of such changes in Critical Illness business composition over the 1990's is very important as a foundation for interpreting the results of the UK industry experience analysis, as presented in Section 4. The primary aim of the remainder of this section is to paint a broad picture of the development of the Critical Illness market over the 1990's.

The main sources of data used for this section are series of market surveys undertaken by Swiss Re Life & Health¹ and ERC Frankona². Each of these surveys has good, but not 100%, market coverage, with estimates being made for the "missing" providers. Taken together they provide an excellent overall picture of the development of Critical Illness business in the UK.

Comparisons have been based on the number of policies sold rather than premium income. This at least allows sensible comparisons across product types, whereas, for example, it is not practical to identify premium income figures for just the Critical Illness part of Endowment policies.

2.2 CHANGING PATTERNS OF PRODUCTS

A Critical Illness product provides a benefit on the happening of one of the "listed" events. The "listed" events generally include defined illnesses, surgical procedures and disabilities. The product design aims at providing a "living benefit" which can be utilised while the policyholder is alive following the occurrence of one of the relevant events.

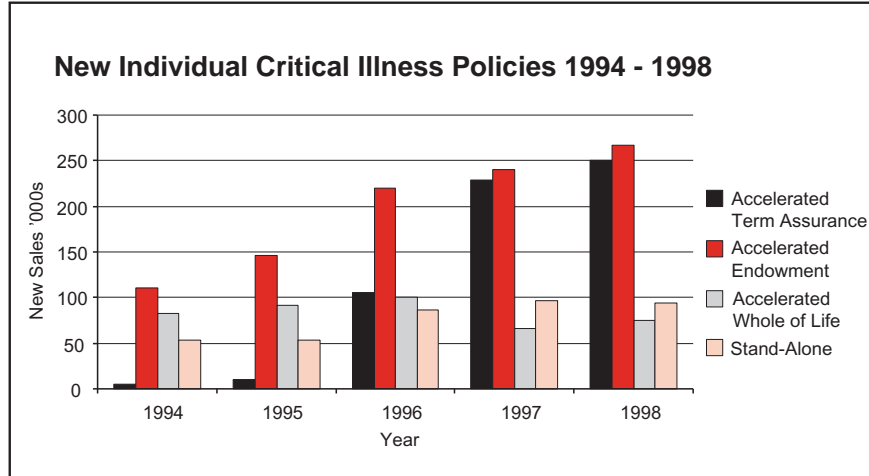
Critical Illness cover in the UK, has been offered in two main forms: Accelerated benefit or Stand-Alone benefit.

Accelerated benefit is a "package" of both death and Critical Illness covers. Effectively, death is just one of the "illnesses"/claim events covered. The Critical Illness benefit can be seen as an acceleration rider benefit which pays out the full Sum Insured on the earlier of death or one of the critical illness events happening, and not on both.

For Stand-Alone benefit, the Sum Insured is payable upon the happening of one of the listed "events" (excluding death), provided the life insured survives that Critical Illness event for a stated period, typically between 14 and 30 days.

Around 85% of Critical Illness business sold in the UK has been on an Accelerated basis.

The underlying product types used as vehicles for Critical Illness cover have been Whole Life, Endowment and Term Assurance policies. The breakdown of sales for 1994 to 1998 of Accelerated cover by product type is shown below, with total sales of Stand-Alone products:



The dominant Critical Illness products in the 1980's were Whole Life variants. Sales of Whole Life policies generally have declined over the 1990's in favour of simpler Term Assurance cover. However, Critical Illness variants have taken an increasing proportion of this shrinking market, so that Critical Illness Whole Life sales have been broadly level.

A major factor in the growth of Critical Illness business in the UK has been the sale of this cover alongside mortgages. Critical Illness proved an easy sale in the mortgage context. Establishing a need or desire to repay borrowings if serious illness struck was simple, and the relatively low cost of adding Critical Illness cover as an accelerated benefit to an Endowment policy made it relatively easy to clinch the sale.

New sales of Mortgage Endowments with Critical Illness cover represented 14% of total Mortgage Endowment sales in 1994. By 1998, the take-up rate for Critical Illness riders had risen to 42%, although this varies considerably between offices.

This concept applies equally well to Term Assurance in the mortgage context. Although Term Assurance Critical Illness plans had been offered since the late 1980's, it wasn't until 1996 that this variant reached the mass market with Bancassurers, in particular, using it as a key part of their mortgage protection range. Mortgage related Term Assurance with Critical Illness Acceleration now comprises 43% of the total mortgage related Term Assurance market.

For 1998, almost two-thirds of Critical Illness sales were mortgage related. It is also estimated that around 50% of inforce Critical Illness policies are mortgage related. An approximate split by product variant is shown below :

Approximate Split of Individual Critical Illness Policies

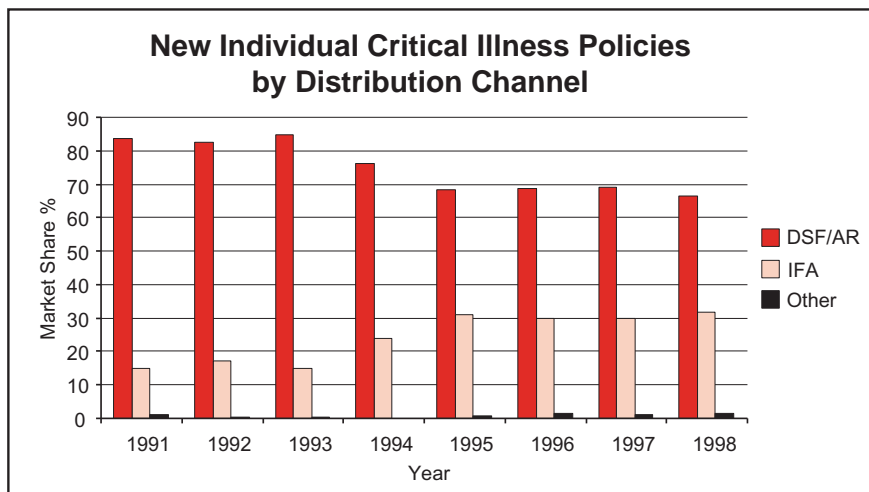
	1998 New Business			Inforce
	Mortgage Related	Non-Mortgage	Total New Business	End 1998 Total
Accelerated Term Assurance	25%	11%	36%	23%
Accelerated Endowment	38%	1%	39%	42%
Accelerated Whole Life	-	11%	11%	20%
Stand-Alone Term Assurance	2%	6%	8%	7%
Stand-Alone Whole Life	-	6%	6%	8%
Total	65%	35%	100%	100%

This again illustrates the rapid growth of Endowments, and particularly Term Assurance variants relative to Whole Life business.

The Mortgage Endowment market generally is now suffering from questions over the suitability of the product under current and expected economic conditions, low consumer confidence and strong pressure on margins. A number of providers have withdrawn their products. It is likely that the Mortgage Endowment market overall will shrink, with a switch of business to Term Assurance based cover. For Critical Illness variants, Accelerated Endowment sales may not increase at a similar rate in future, or may even decline, whereas Accelerated Term Assurance sales linked to mortgages seem likely to increase at a substantial rate.

2.3 CHANGING PATTERNS OF DISTRIBUTION

The first real success for Critical Illness cover in the UK came with Direct Sales Force (DSF) offices in the late 1980's. Despite many new entrants to the market, DSFs still held a market share of 85% in 1991, the remaining 15% of sales occurring in the Independent Financial Adviser (IFA) market. The graph below shows how the distribution split has changed over the 1990's :



The figures for "DSFs" include sales from Appointed Representatives (ARs).

"Other" covers Telemarketing, Direct Mail and Head Office sales. To date, attempts to market Critical Illness policies Direct, that is without any face-to-face selling, appear not to have been very successful.

Although there has been a general increase in IFA business relative to DSFs for new individual, regular premium life business, the pattern has been more marked for Critical Illness than other lines. This in part reflects the low base point for IFA business in 1991, but more importantly shows how confidence in the product has grown amongst IFAs.

A key trend, hidden in the data shown, is the switch of business within DSFs/ARs from traditional DSFs to

Bancassurers. From a low base in 1991, the total Critical Illness market share for Bancassurers has risen to 35% in 1998. The market, therefore, is currently split roughly one-third each to IFAs, Bancassurers and other DSFs/ARs. Over 1997/98 it was the Bancassurance sector which grew quickest:

New Individual Critical Illness Policies ('000's)

	1997	1998	% Growth
Bancassurers	176	238	+ 35%
Other DSFs/ARs	259	218	- 16%
IFAs	188	218	+ 16%

An approximate split of 1998 sales by product variant and distribution channel is shown below :

Approximate Split of 1998 New Individual Critical Illness Policies

	Bancassurer	Other DSF	IFAs	Direct	Total
Accelerated Term Assurance	21%	6%	8%	1%	36%
Accelerated Endowment	8%	15%	16%	-	39%
Accelerated Whole Life	1%	7%	3%	-	11%
Stand-Alone Business	5%	4%	5%	-	14%
Total	35%	32%	32%	1%	100%

For Bancassurers, the dominant variant is Term Assurance. Bancassurers account for around 60% of the total Accelerated Term Assurance Critical Illness market.

For other DSFs/ARs and IFAs, the dominant variant is Endowment. However, these DSFs/ARs remain the main supporters of Whole Life Critical Illness policies, accounting for around 60% of that market.

2.4 DEVELOPMENT OF PRODUCT FEATURES

2.4.1 The List of Critical Illnesses

The early products launched in the UK were, by today's comparisons, very simple. By 1990, the common "core" set of conditions had expanded to 6 illnesses; Cancer, Heart Attack, Stroke, CABG, Kidney Failure and Major Organ Transplant. Total and Permanent Disability (TPD) was generally also included as a sweep-up benefit intended to catch a range of illnesses, each with a severe impact on capabilities and lifestyle, but by measuring their effect rather than by including them on the list of specific Critical Illnesses.

The number of Critical Illnesses covered expanded rapidly through the early 1990's as providers tried to gain a competitive edge. In particular, as each company introduced its first Critical Illness policy there was pressure on them to find a new event to cover to gain publicity for their launch. However, the core 6 Critical Illnesses, plus TPD, still account for a very high proportion of expected claims. It could be argued that the some of the illnesses now covered in providers' lists - sometimes 30 or more - no longer meet a real need. Many of these additional conditions are uncommon and likely to be poorly understood by the policyholder. There is considerable overlap between conditions and the longer lists may serve only to confuse, ultimately diluting the impact of the real cover available. The race to add new conditions has slowed considerably over recent years.

Some providers offer a choice of levels of cover. Customers can select either a "basic" policy, covering perhaps 6 to 10 "core" illnesses, or a "comprehensive" policy with an extended list of, say, 30 illnesses.

A few providers have launched "budget" Stand-Alone Critical Illness products covering just a few, major and common, illnesses such as cancer, heart attack and stroke. To date, these types of policy have not made a significant impact in the market.

As the list of illnesses grew, more questions arose as to the relative severity of each listed illness. Whilst there is much attraction in the simplicity of a contract with a single benefit level, it could be argued that some of the less serious conditions / operations really only justify a reduced benefit. A structure of tiered benefit levels is common in South Africa, but has not yet been widely adopted in the UK.

2.4.2 ABI Statement of Best Practice for Critical Illness Cover

Variations between the definitions and range of Critical Illnesses offered by competing providers limited the confidence in, and enthusiasm for, this product in the IFA market. Acceptance of Critical Illness cover by IFAs was enhanced by the work carried out by NFIFA (a major IFA trade body) when in 1994 it achieved standardised definitions for the 6 "core" illnesses.

This work has now been taken forward by the ABI in its Statement of Best Practice for Critical Illness cover (issued April 1999)³:

- A common template for Key Features documents for Critical Illness plans is in place.
- Model wordings are now in place for an expanded set of "Core Conditions". These cover the six Critical Illnesses listed above plus Multiple Sclerosis. It is intended that any other Critical Illness which achieves inclusion on at least 95% of policies in the market, and accounts for at least 1% of male or female Critical Illness industry claims, will be added to this core list.
- Model wordings are also in place for a further list of "Additional Conditions". Currently these are : Aorta Graft Surgery; Benign Brain Tumour; Blindness; Coma; Deafness; Heart Valve Replacement or Repair; Loss of Limbs; Loss of Speech; Motor Neurone Disease; Paralysis/Paraplegia; Parkinson's Disease; Terminal Illness; and Third Degree Burns. It is intended that any other Critical Illness which achieves inclusion on at least 75% of policies on the market, will be added to this additional list.
- Model wordings for common policy exclusions have been set down.

All these measures are intended to make descriptions of cover clearer and will facilitate comparison between products. This is expected to significantly improve policyholders' understanding of, and confidence in, Critical Illness cover, with clearly anticipated benefits for providers.

Model definitions have not been developed at this stage for Total and Permanent Disability. The ABI Statement recognises a wide range of approaches are currently adopted in the UK market. These include occupation-based definitions (such as "own", "suited", or "any" occupation) and ability tests (such as "Activities of Daily Living" or "Functional Ability Tests"). The latter are felt to be less subjective than occupation-based definitions and are becoming more widely used.

2.4.3 Recent Developments

2.4.3.1 "Buy-Back"

With an Accelerated contract it is possible to provide an option to "buy back" or reinstate some or all of the original death benefit after payment of the Critical Illness benefit. For example, if the Sum Insured is paid out following a Heart Attack, a standard Accelerated policy would end. However, with "buy-back" the death benefit could be reinstated after, say, 12 months survival. A variant of this is to reinstate the death benefit in stages over, say, 4 years.

The price of a contract inclusive of this option, in line with the benefits offered, sits somewhere between the price for a standard Accelerated contract and the combined price of a Term Assurance (life cover only) and a Stand-Alone Critical Illness contract.

This option is common in some other territories, e.g. Australia, but has yet to gain prominence in the UK.

Along similar lines, a recent UK innovation is to offer "second event" Critical Illness cover. Instead of ending the policy on the first Critical Illness "event", cover could be reinstated for a limited list of Critical Illnesses after survival for, say, 12 months.

2.4.3.2 Packaging of Critical Illness Cover

To date, Critical Illness cover has normally just been packaged with life cover to form Accelerated cover. Over the last few years there has been a move towards marketing Critical Illness cover and Income Protection in a single package. This has generally been targeted at the mortgage market, with Accelerated Critical Illness cover providing a lump sum to meet the outstanding mortgage amount on suffering a Critical Illness. The Income Protection cover would meet the monthly mortgage payment whilst the insured is unable to work due to sickness or accident. The combination of these two benefits results in a cost saving through removing the overlap of the cover provided as, in this package, Income Protection benefits would cease following payment of the full Sum Insured on Critical Illness. Generally, these mortgage packages also include unemployment cover.

2.4.3.3 Premium Rates and Guarantees

Premium rates, and underlying risk rate assumptions, for Critical Illness cover have fallen considerably over the last decade in the UK market. This reflects both growing confidence in pricing, as insured experience has emerged, and particularly the intensification of competition.

Early contracts in the UK market were generally either unit-linked with reviewable risk charges, or conventional contracts with reviewable premiums. However, premium rate guarantees have become increasingly common over the last five years, especially in the IFA market and for Term Assurance Critical Illness plans. Considerable uncertainty over both the current level and the future trend of Critical Illness risk rates means that such guarantees cannot be granted lightly. Further work is ongoing in this area, via a Healthcare Study Group, and should assist practitioners in forming a view as to the appropriate price and reserving standards for these guarantees.

2.4.4 Group Critical Illness

Group Critical Illness business to date in the UK is small compared to individual business. It has been very slow to develop although there are now real signs of an emerging market.

It is estimated that, by the end of 1998, there were just under 50,000 lives covered under Group Critical Illness schemes, with inforce premium income of £4.1m

2.5 CRITICAL ILLNESS CLAIMS

There is no definitive source of claims data for the UK market. However, ERC Frankona have published annual surveys since 1992⁴ which, whilst not achieving 100% market coverage, provide an excellent overall picture of emerging claims.

From these reports it is estimated that, for the UK market as a whole, around 7,000 claims were admitted relating to the exposure period 1991 to 1997 (inclusive). This is the exposure period for the experience analysis in Section 4.

The table below, showing three separate strands of information, gives a brief overview of the mix of all Critical Illness claims in the UK market to date:

	(A) Approx. Proportion Total Admitted Claims	(B) Approx. Declinature Rate for Notified Claims	(C) Approx. Ratio of Male to Female Notified Claims
Cancer	54%	7%	45 : 55
Heart Attack	18%	16%	90 : 10
Stroke	8%	19%	65 : 35
CABG	4%	22%	95 : 5
MOT / KF	1%	33%	70 : 30
MS	5%	23%	35 : 65
TPD	7%	57%	55 : 45
Other	3%	N/A	N/A
Total	100%	21%	65:35

(a) Just 3 Critical Illnesses - Cancer, Heart Attack and Stroke - account for around 80% of total admitted claims.

The ABI's 7 "core conditions", together with TPD, account for around 97% of total admitted claims to date.

(b) Declinature of claims has been, and remains, a significant issue. Around 70% of declinatures are simply because the definition has not been met. Clearly much more still needs to be done to improve customer understanding of the cover and to ensure customer expectations match the providers' intentions. The declinature rates by illness give a good indication of which conditions/definitions are the most problematic.

A further 22% of declinatures are due to non-disclosure. This highlights the continuing need for a high level of vigilance by providers.

- (c) The ratio of claims between males and females gives a crude indication of the variation in mix of Critical Illness claims by sex. The overall UK business mix to date suggests we should expect an average ratio of around 65:35.

3 THE BASE TABLE (CIBT93)

3.1 CONSTRUCTION OF THE BASE TABLE

3.1.1 Introduction

There is currently no standard table which relates to Critical Illness experience in the UK. Our aim in this section of the paper is to develop a set of population incidence rates for Critical Illness which can be used as a Base Table for benchmarking the experience under UK policies and as a reference point for pricing and reserving. Because of delays in collecting and publishing population data, we opted to derive the Base Table in respect of 1993.

The Base Table is developed using population of England data, as this provides a large data source in order to derive a smooth set of rates. It is not expected that the experience under UK policies will follow the rates in the Base Table. In particular, no adjustment has been made in this table for the impact of selection arising from the underwriting process or from a different socio-economic mix. We hope the Base Table will nevertheless provide a useful standard against which the insured lives experience can be compared. Furthermore, the development of the Base Table from first principles should give a good understanding of the relative impact of the various risks covered.

The following sections describe the general approach to the calculation of the Base Table, including the principal data sources used, followed by a more detailed section on each of the various illnesses covered.

3.1.2 Scope

The Critical Illnesses covered in the Base Table are the core illnesses which virtually all offices include within the terms of their Critical Illness policies. These are Cancer, Heart Attack, Stroke, Coronary Artery Bypass Graft (CABG), Multiple Sclerosis (MS), Kidney Failure, Major Organ Transplant (MOT) and Total and Permanent Disability (TPD).

In deriving the incidence rates for each condition we have attempted to match the recently introduced ABI definitions. These model wordings were not in place in 1993, the year to which the Base Table is intended to apply, and providers at that time will have used a range of different definitions. However, any differences between offices in the definition of core conditions is likely to be small.

Although other illnesses such as Alzheimer's and Parkinson's disease are not covered in the Base Table, a consideration of the impact of these diseases is included in Section 3.11.

The Base Table has been developed on an aggregate basis with no attempt to differentiate between Smokers and Non-Smokers. An indication of these differentials can be obtained from the experience analysis in Section 4.

The Table covers ages 20 to 80 and is intended to relate to an "age exact" definition.

3.1.3 Data Sources

For each illness, the full list of data sources used in deriving the incidence rates is given in the section relating to that illness. The following provides some background information on the primary data sources used. These are all published by the Office of National Statistics (ONS) (previously the Office of Population Censuses and Surveys (OPCS)), except for Hospital Episodes Statistics which are published by the Department of Health.

a) Hospital Episodes Statistics (HES)

This data gives a measure of completed episodes for the population of England in NHS hospitals. As such, it provides a reservoir of credible data. The data is classified by International Classification of Disease (ICD) codes or Operation codes and is available by individual age and sex. HES data does not include any data from private hospitals or cases which are not hospitalised.

Where possible, data relating to the 1993/4 financial year was used. However, in some cases we only had access to the data in very broad age bands, in which case the more detailed 1994/5 data was used in preference.

b) Morbidity Statistics from General Practice (MSGP) 1991/1992

ONS publishes morbidity statistics from a representative sample of general practices on a decennial basis. The latest available data relates to 1991/1992. They publish incidence rates according to ICD code, sex and age band for "new and first ever episodes" as well as "first ever episodes".

The precise definition of the data is important. "Episodes" are defined as face to face contact between doctor and

patient including contact in hospital. "First ever episodes" are cases which are reported for the first time in the period concerned, whereas "New and First Ever" will also include recurrences from previous years.

c) Cancer Registrations

The ONS publishes Cancer registration statistics annually, the latest available data relating to 1992. The data takes the form of first time diagnosis rates in five-year age bands, separately for males and females and for each type of Cancer.

The data source is indicated in the relevant section for each event. In general, HES data has been used in preference to MSGP because it is more comprehensive.

3.1.4 General Approach

Incidence rates applicable to both Stand-Alone and Accelerated Critical Illness policies have been calculated for the Base Table. In doing this a standardised approach using the steps detailed below has been followed, wherever possible. For certain illnesses, it has been necessary to vary this approach, for example, due to the availability of data. The precise approach adopted for each illness is documented in Sections 3.2 to 3.9 with the detailed derivation of the rates shown in tables at the end of each section. The complete Base Table is shown in Section 3.10.

The general approach was as follows:-

3.1.4.1 Deriving First Ever Incidences

Where HES data was used as the starting point for the number of incidences for the Critical Illness concerned, this was on a "new and first ever" basis. The "new" cases reported in the period will include some re-admissions from previous years, and these need to be excluded to eliminate any double counting.

Incidence rates on both a "first ever" and "new and first ever" basis are available from MSGP. The general approach to convert the data onto a "first ever" basis has been to scale the HES incidences by the ratio of MSGP "first ever" to "new and first ever" incidence rates.

3.1.4.2 Adjustment for Unreported Cases

An appropriate adjustment needs to be made for unreported cases, which will depend on the Critical Illness concerned and the data sources used.

HES data covers all NHS hospitals in England. Unreported cases can arise from three sources:-

- where a patient dies suddenly following a Critical Illness, before being admitted to hospital;
- where the patient is admitted to a private hospital; and
- where the patient is not hospitalised at all.

Within the Base Table we have only adjusted for sudden deaths - we have no data to ascertain the significance of the other omissions.

3.1.4.3 Calculation of Crude Incidence Rates

Crude incidence rates can then be calculated by dividing the adjusted number of incidences by the relevant population.

3.1.4.4 Overlap with Other Illnesses

Where there is a strong correlation between two Critical Illness 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 an increased likelihood of CABG following a Heart Attack. As it is only possible to claim once under a Critical Illness policy, our approach has been to reduce the CABG incidence rates to allow for those which follow a Heart Attack.

3.1.4.5 Prevalence Adjustment

The crude population incidence rates have been calculated by using the total population as the denominator. For the

purpose of calculating a first time incidence rate the denominator needs to be reduced by the prevalence of lives who have already suffered from that particular Critical Illness.

The prevalence of the particular Critical Illness within the population can be estimated using the "patients consulting rates" reported in MSGP 1991/1992. If C_x is the consultation rate for a particular Critical Illness at age x , an approximation of the required adjustment to the incidence rates is to divide through by the factor $1 - C_x$.

3.1.4.6 Smoothing

The next step is to smooth the resulting incidence rates. Where individual age data is available, it has been smoothed by using 5 year moving averages. In other cases, the smoothing methods are covered under the individual sections for the specific illnesses.

3.1.4.7 Stand-Alone Rates

The Stand-Alone rates calculated for the Base Table assume that a survival period of 28 days applies. That is, the claimant needs to survive 28 days before any benefit is payable. The Stand-Alone rates are calculated by multiplying the smoothed incidence rates, calculated above, by the probability of survival during this 28 day period, which will depend on the Critical Illness concerned.

3.1.4.8 Accelerated Rates

To calculate Accelerated incidence rates, the Dash & Grimshaw model⁵ has been used, except for TPD. The additional risk, over and above the mortality risk, for products which have an Accelerated benefit is:-

$$i_x - k_x q_x$$

Where i_x is the smoothed incidence rate for the Critical Illness concerned (before adjustment for the survival period),

k_x is the proportion of deaths due to the Critical Illness concerned,

q_x is the population mortality rate.

The values of k_x are calculated using OPCS Mortality Statistics by Cause, England and Wales, for 1993. These are given in quinquennial age groups which have been used to derive individual age values.

The values of q_x are taken from ELT15 which relates to 1990-92. These were compared to crude population mortality rates derived from OPCS Mortality Statistics by Cause for 1993, the central year of the Base Table. However, no adjustment to the ELT15 rates was found to be necessary.

3.1.5 Trends to 2000

The Base Table was derived to relate to 1993. In deriving a set of incidence rates for current use it is necessary to consider how current experience might differ from the Base Table. For each condition, where discernable trends in experience have been identified from the historic data, this is commented on. This will assist in adjusting the Base Table to allow for current levels of population experience.

3.2 CANCER

3.2.1 Definition

The ABI model definition for Cancer is:

A malignant tumour characterised by the uncontrolled growth and spread of malignant cells and invasion of tissue. The term cancer includes leukaemia and Hodgkin's disease but the following are excluded:

- *All tumours which are histologically described as pre-malignant, as non-invasive or as cancer in situ.*
- *All forms of lymphoma in the presence of any Human Immunodeficiency Virus.*
- *Kaposi's sarcoma in the presence of any Human Immunodeficiency Virus.*
- *Any skin cancer other than malignant melanoma.*

For the purpose of determining risk rates, the main feature of this definition is the exclusion of most skin Cancers and HIV related Cancers.

3.2.2 Data Sources

- Cancer Registrations 1992 (and earlier years for deriving trends)
- HES Data 1993/1994
- OPCS - Mortality Statistics by Cause, England and Wales, for 1993

3.2.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.2.

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 Base Table. The report has been produced in a consistent way for several years and covers a large number of incidences each year. It is, therefore, reasonable to assume that it is a good reflection of the underlying experience and so no adjustments have been made to compensate for shortcomings in the data.

These statistics include data from death certificates in order to incorporate any sudden deaths, so it is not necessary to make any further adjustments to the base data in this respect.

The crude Critical Illness rates obtained from the Cancer Registration data (ICD codes 140-208, excluding 173) then need to be adjusted for any overlap with other illnesses. However, there is no firm evidence that the incidence of Cancer is affected by the existence of the other main Critical Illness events, and, as a result, no adjustments to the rates have been made for this.

As regards the adjustment for prevalence, HES 1993 data has been used to obtain the prevalence of Cancer sufferers in the population. These lives have been excluded from the denominator in order to obtain an incidence rate which is applicable to a population which is previously free from Cancer.

The data available covers approximately 280,000 Cancer incidences each year leading to a credible volume of data in each age group. As a result, it has not been necessary to smooth the result between age groups.

The Stand-Alone incidence rates have been calculated by multiplying the incidence rates, as calculated above, by the probability of survival for 28 days. In most circumstances, Cancer does not lead to death within this short survival period, hence the incidence rates have only been adjusted to reflect the mortality of normal lives. This has been done by applying 28 days mortality using the mortality rates from ELT15. It seems likely that there will be some additional mortality during the 28 days following the incidence of a Cancer, but this has not been quantified and the approach taken adds an element of caution.

The Accelerated Critical Illness rates have been determined using the Dash & Grimshaw model. The values of k_x have been obtained from OPCS - Mortality Statistics by Cause, England and Wales, for 1993. The ICD codes used were 140-208 excluding 173.

3.2.4 Trends

The reported incidence rates for each year from 1989 to 1992 have been analysed to investigate the trend in

experience. Previous years' data were disregarded because of known under-reporting. Because of the short period under consideration, it is difficult to conclude the appropriate level of adjustment.

The "all ages" incidence rates have increased by 5.1% (males) and by 5.2% (females) from 1989 to 1992, equivalent to between 1.5% and 2% p.a.

An analysis has also been made of the crude average rates for age ranges 20 - 59, 20 - 69 and 20 - 79, the objective being to concentrate on the age range that is most significant for the majority of Critical Illness business. These figures suggest that, for males, the increase in incidence rates for these ages is less severe than that for all ages combined. For females, the pattern is less clear, but would seem to suggest that these ages are following a similar trend to the "all ages" data.

As the Cancer Registration rates relate to the experience in 1992, these rates have been increased by 1% for males and 2% for females to obtain the rates in the Base Table, which are deemed to be applicable to 1993. A similar rate of adjustment could be used to adjust the experience to current levels.

It is worth noting that the data available does not distinguish between Smokers and Non-Smokers. It is known that the proportion of smokers, particularly among males, has fallen in recent years and if separate Smoker/Non-Smoker rates were available they may show a greater increase than the rates quoted above. In other words, part of the general deterioration in Cancer experience is being masked by the fall in the proportion of smokers.

3.3 HEART ATTACK

3.3.1 Definition

The ABI model definition for Heart Attack is:-

The death of a portion of the heart muscle as a result of inadequate blood supply as evidenced by an episode of typical chest pain, new electrocardiograph changes and by the elevation of cardiac enzymes. The evidence must be consistent with the diagnosis of heart attack.

3.3.2 Data Sources

- HES Data 1993/94
- Framingham Heart Study, USA
- British Medical Journal 1998; 316: 1065-1070 (4 April) RM Norris - Fatality outside hospital from acute coronary events in three British health districts, 1994/95
- Coronary Heart Disease Statistics, British Heart Foundation Database 1998.
- OPCS - Mortality Statistics by Cause, England, Wales, for 1993
- MSGP Data 1991/92

3.3.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.3.

HES data for 1993/94 was used to obtain the number of incidences for Heart Attack. The ICD code used was 410 (acute myocardial infarction). Note that other acute and sub-acute forms of ischaemic heart disease (ICD code 411) have been specifically excluded.

To adjust these incidences onto a "first ever" basis, the ratios of MSGP 1991/92 "first ever" to "new and first ever" incidence rates were examined. This showed the following results;

Age Band	Males	Females
25-44	100%	100%
45-64	68%	80%
65-74	67%	64%
75-84	70%	73%
85 & over	59%	63%

Based on this information, we have assumed that no adjustment is required up to age 45. For ages 45 to 84 an overall adjustment of 70% has been used, for both males and females. This approach recognises the relatively limited amount of data in the MSGP survey.

The data was then adjusted to allow for sudden deaths that go unreported. Data from Norris indicates that up to age 75, around 31% of Heart Attacks result in death prior to admission to hospital.

Data from the British Heart Foundation also indicated that 25-30% of Heart Attacks result in death prior to admission to hospital. This is similar to US data from the Framingham Heart Study which indicated sudden deaths (within one hour) of 26% for male Heart Attack sufferers.

Based on the above, an overall sudden death rate of 30% would seem to be appropriate. For males, age-banded data has been used (increasing from 18% up to age 45 to 35% for 70-74). As there is limited data for females, a flat rate of 30% has been used. These sudden death rates are based on all Heart Attacks, and it would seem reasonable that sudden deaths following a "first ever" Heart Attack will not be so great. As a result of this, only 50% of these proportions have been used.

The crude incidence rates were then calculated by dividing the adjusted HES incidences by the population of England.

In considering the overlap between Heart Attack and other Critical Illnesses, the correlation with Stroke and CABG

has been dealt with by appropriate adjustments to the Stroke and CABG incidence rates. It is not believed that the prevalence of prior Stroke and/or CABG will have a significant impact on the incidence of Heart Attacks and this has been ignored.

The resulting incidence rates were then further adjusted to allow for the prevalence of Heart Attack in the population of England, to derive a population free of Heart Attack. The prevalence of Heart Attack in the population was estimated using "patient consulting rates" from MSGP 1991/92 data. These rates showed a marked increase with age, and age specific rates have been obtained by fitting a least squares best fit line to the age banded data.

The individual age incidence rates were then smoothed by using a 5-year moving average.

To calculate the Stand-Alone incidence rates, an estimate of 28-day mortality following a Heart Attack is required. Sudden deaths following a first ever Heart Attack has been estimated above. Data from Framingham indicates a death rate of 12% on top of this for survival within the first month. The death rate among "first ever" Heart Attacks will not be as great as that for all Heart Attacks. In line with the derivation of the sudden death adjustment, 50% of the above rate has been used.

The Accelerated Critical Illness rates were determined using the Dash & Grimshaw model. The values of k_x have been determined from OPCS - Mortality Statistics by Cause, England and Wales, for 1993, again using ICD code 410.

It is interesting to note that at very old ages the additional cost for Accelerated Heart Attack cover ($i_x - k_x q_x$) becomes negative. This is due to the sub-set of the general population that has never suffered a Critical Illness having much lighter mortality than the general population.

3.3.4 Trends

Incidence rates from MSGP indicate an annual decrease of 3% pa (males) and 2.3% pa (females) from 1981/82 to 1991/92. The data also suggests a higher rate of decrease at lower ages.

Data from the British Heart Foundation suggests a rate of decrease of 3.6% pa, for males and females, in the incidence of Heart Attacks in the UK from 1982 to 1992. A higher rate of decrease at younger ages is also indicated.

The above indicates an overall rate of decrease in the incidence of Heart Attacks of around 3% pa for males and females over this 10 year period.

Part of this improvement is likely to be due to the reduction in the prevalence in smoking over the period and this is unlikely to continue at the same rate in the future. In 1982, 36% of males and 32% of females smoked, this reduced to 28% and 26% respectively in 1992. However, the rate of reduction has slowed and in 1996 the percentage smoking was 27% and 26% respectively.

An overall rate of decrease of 2% pa in the incidence of Heart Attacks, for males and females, might be appropriate for converting the Base Table to current levels of experience.

Critical Illness Incidence Rates - Heart Attack (males)
Incidence Rates per 10,000 Lives

Table 3.3 (m)

Age	Population of England (000's)	Number of Heart Attacks (ICD 410)	First Ever Adjustment	Sudden Death Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Smoothed Adjusted Crude Rate (ix)	28 Day Mortality Rate	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from Heart Attack (kx)	Extra Cost for Accelerated (ix - kx * qx)
20	334.96	0	100%	9%	0.00	0%	0.00%	0.09	15%	0.08	8.4267	0.0041	0.05
21	357.45	3	100%	9%	0.09	0%	0.00%	0.14	15%	0.12	8.6371	0.0055	0.10
22	375.82	7	100%	9%	0.20	0%	0.00%	0.16	15%	0.14	8.8479	0.0068	0.10
23	375.00	13	100%	9%	0.38	0%	0.00%	0.23	15%	0.20	8.8558	0.0081	0.16
24	387.17	5	100%	9%	0.14	0%	0.00%	0.31	15%	0.26	8.8636	0.0092	0.22
25	390.34	12	100%	9%	0.34	0%	0.00%	0.31	15%	0.27	8.5656	0.0104	0.22
26	402.53	17	100%	9%	0.46	0%	0.00%	0.37	15%	0.32	8.4709	0.0118	0.27
27	411.42	9	100%	9%	0.24	0%	0.01%	0.45	15%	0.38	8.4780	0.0135	0.33
28	419.52	26	100%	9%	0.68	0%	0.01%	0.58	15%	0.49	8.6897	0.0160	0.44
29	419.46	20	100%	9%	0.52	0%	0.01%	0.75	15%	0.64	8.9019	0.0188	0.58
30	409.81	37	100%	9%	0.99	0%	0.02%	1.09	15%	0.92	9.1147	0.0218	0.89
31	399.12	48	100%	9%	1.32	0%	0.03%	1.43	15%	1.22	9.3280	0.0254	1.20
32	389.39	68	100%	9%	1.92	0%	0.04%	1.87	15%	1.59	9.7471	0.0303	1.58
33	370.49	81	100%	9%	2.40	0%	0.05%	2.37	15%	2.01	9.9620	0.0378	1.99
34	358.25	89	100%	9%	2.73	0%	0.06%	3.11	15%	2.64	10.5888	0.0465	2.62
35	350.00	110	100%	9%	3.45	0%	0.08%	3.79	15%	3.22	11.6291	0.0558	3.14
36	338.26	155	100%	9%	5.04	0%	0.09%	4.85	15%	4.12	12.7760	0.0650	4.02
37	325.30	159	99%	9%	5.32	0%	0.11%	5.95	15%	5.06	13.7208	0.0740	4.94
38	315.45	225	98%	9%	7.68	0%	0.13%	7.32	15%	6.22	14.9793	0.0825	6.09
39	320.34	250	96%	9%	8.23	0%	0.15%	8.79	15%	7.47	16.0364	0.0908	7.33
40	318.62	314	94%	10%	10.29	0%	0.18%	10.48	16%	8.80	17.2021	0.0990	8.78
41	311.99	377	92%	10%	12.35	0%	0.21%	11.92	16%	10.01	18.5812	0.1072	9.93
42	318.96	438	90%	10%	13.73	0%	0.24%	14.12	16%	11.86	20.1758	0.1155	11.79
43	327.52	492	88%	11%	14.85	0%	0.27%	15.57	17%	12.92	21.8839	0.1240	12.86
44	339.37	675	86%	11%	19.22	0%	0.30%	17.04	17%	14.14	24.0206	0.1327	13.85
45	362.17	671	84%	11%	17.49	0%	0.34%	19.32	17%	16.04	26.6957	0.1413	15.55
46	397.14	846	82%	11%	19.63	0%	0.37%	21.40	17%	17.76	29.7063	0.1498	16.95
47	306.90	847	80%	12%	25.09	0%	0.41%	23.11	18%	18.95	33.1638	0.1578	17.88
48	302.27	858	78%	12%	25.16	0%	0.46%	25.60	18%	20.99	37.1826	0.1648	19.47
49	304.44	977	76%	12%	27.72	0%	0.50%	28.42	18%	23.31	41.4564	0.1714	21.32
50	288.22	1021	74%	12%	29.79	0%	0.55%	30.84	18%	25.29	46.4200	0.1777	22.59
51	263.16	1082	72%	12%	33.64	0%	0.59%	33.46	18%	27.44	51.8778	0.1839	23.92
52	241.88	1111	71%	12%	37.06	0%	0.64%	36.52	18%	29.94	57.7395	0.1896	25.57
53	256.27	1227	70%	12%	38.09	0%	0.69%	40.52	18%	33.22	64.2391	0.1945	28.02
54	257.84	1372	70%	13%	42.81	0%	0.75%	44.09	19%	35.71	71.4029	0.1990	29.88
55	255.84	1576	70%	13%	49.56	0%	0.80%	47.84	19%	38.75	79.7001	0.2033	31.63
56	250.26	1594	70%	13%	51.25	0%	0.85%	51.79	19%	41.95	89.0706	0.2071	33.34
57	244.78	1670	70%	14%	55.53	0%	0.91%	56.55	20%	45.24	99.4603	0.2098	35.68
58	239.71	1675	70%	15%	57.55	0%	0.97%	60.27	21%	47.61	111.1587	0.2106	36.86
59	230.49	1854	70%	15%	66.24	0%	1.02%	63.94	21%	50.51	124.2526	0.2104	37.80
60	228.25	1858	70%	16%	67.84	0%	1.08%	67.51	22%	52.65	139.1932	0.2096	38.33
61	233.43	1940	70%	16%	69.26	0%	1.14%	71.53	22%	55.80	156.0106	0.2088	38.96
62	234.01	2025	70%	17%	72.98	0%	1.19%	75.10	23%	57.83	174.8779	0.2078	38.76
63	228.02	2089	70%	17%	77.27	0%	1.25%	78.80	23%	60.67	196.4910	0.2064	38.23
64	220.83	2190	70%	17%	83.64	0%	1.31%	83.07	23%	63.96	219.9171	0.2049	38.01
65	215.61	2169	70%	18%	85.88	0%	1.36%	86.90	24%	66.05	244.6622	0.2032	37.18
66	214.24	2262	70%	18%	90.13	0%	1.42%	90.80	24%	69.01	271.0949	0.2017	36.13
67	213.63	2294	70%	18%	91.67	0%	1.47%	93.70	24%	71.21	299.6439	0.2002	33.72
68	204.58	2306	70%	18%	96.22	0%	1.52%	97.45	24%	74.06	329.1736	0.1989	31.97
69	199.28	2281	70%	18%	97.71	0%	1.57%	100.18	24%	76.14	360.2085	0.1978	28.92
70	193.52	2360	70%	18%	104.11	0%	1.62%	104.33	24%	79.29	392.9175	0.1968	27.02
71	196.09	2373	70%	18%	103.31	0%	1.66%	108.07	24%	82.13	431.1650	0.1954	23.81
72	195.56	2563	70%	18%	111.88	0%	1.70%	114.45	24%	86.98	474.5692	0.1935	22.61
73	195.24	2615	70%	18%	114.34	0%	1.74%	121.04	24%	91.99	521.7056	0.1905	21.65
74	123.55	1865	70%	18%	128.86	0%	1.78%	125.28	24%	95.21	569.7189	0.1870	18.76
75	111.80	1763	70%	19%	136.27	0%	1.81%	129.41	25%	97.06	619.7199	0.1831	15.93
76	118.28	1696	70%	19%	123.92	0%	1.83%	133.88	25%	100.41	677.6744	0.1793	12.41
77	118.36	1808	70%	19%	132.01	0%	1.85%	136.33	25%	102.25	741.7506	0.1753	6.29
78	114.97	1811	70%	19%	136.12	0%	1.87%	138.64	25%	103.98	810.2217	0.1713	-0.12
79	106.98	1742	70%	19%	140.72	0%	1.88%	146.25	25%	109.69	883.6740	0.1672	-1.46
80	96.16	1621	70%	20%	147.51	0%	1.88%	150.02	26%	111.01	961.5810	0.1630	-6.73

Critical Illness Incidence Rates - Heart Attack (females)

Incidence Rates per 10,000 Lives

Table 3.3 (f)

Age	Population of England (000s)	Number of Heart Attacks (ICD 410)	First Ever Adjustment	Sudden Death Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Smoothed Adjusted Crude Rate (i_x)	28 Day Mortality Rate	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from Heart Attack (k_x)	Extra Cost for Accelerated ($i_x - k_x \cdot q_x$)
20	316.68	0	100%	15%	0.00	0%	0.00%	0.02	21%	0.02	3.1327	0.0010	0.02
21	337.82	0	100%	15%	0.00	0%	0.01%	0.02	21%	0.02	3.2347	0.0015	0.02
22	358.72	2	100%	15%	0.07	0%	0.02%	0.03	21%	0.03	3.2358	0.0023	0.02
23	355.66	0	100%	15%	0.00	0%	0.03%	0.04	21%	0.03	3.3380	0.0036	0.03
24	371.38	3	100%	15%	0.10	0%	0.04%	0.05	21%	0.04	3.2379	0.0051	0.03
25	375.35	1	100%	15%	0.03	0%	0.05%	0.06	21%	0.05	3.4414	0.0068	0.04
26	387.10	2	100%	15%	0.06	0%	0.05%	0.08	21%	0.07	3.4426	0.0085	0.06
27	395.73	4	100%	15%	0.12	0%	0.05%	0.09	21%	0.07	3.5451	0.0102	0.06
28	402.86	4	100%	15%	0.12	0%	0.05%	0.13	21%	0.10	3.8503	0.0119	0.08
29	401.82	5	100%	15%	0.15	0%	0.05%	0.21	21%	0.17	3.9531	0.0136	0.16
30	394.34	7	100%	15%	0.21	0%	0.04%	0.26	21%	0.21	4.3603	0.0153	0.20
31	385.16	15	100%	15%	0.46	0%	0.04%	0.37	21%	0.29	4.6665	0.0168	0.29
32	374.28	12	100%	15%	0.38	0%	0.03%	0.46	21%	0.36	5.1762	0.0179	0.37
33	357.70	20	100%	15%	0.66	0%	0.03%	0.60	21%	0.48	5.7882	0.0183	0.50
34	351.75	18	100%	15%	0.60	0%	0.02%	0.70	21%	0.55	6.1979	0.0184	0.58
35	344.10	27	100%	15%	0.92	0%	0.02%	0.80	21%	0.63	6.9134	0.0182	0.67
36	333.81	26	100%	15%	0.92	0%	0.01%	0.88	21%	0.70	7.5287	0.0186	0.74
37	321.73	25	99%	15%	0.91	0%	0.01%	1.05	21%	0.83	8.2470	0.0199	0.89
38	312.23	29	98%	15%	1.07	0%	0.00%	1.21	21%	0.96	8.9671	0.0231	1.00
39	318.12	41	96%	15%	1.46	0%	0.00%	1.33	21%	1.05	9.7911	0.0272	1.07
40	316.65	49	94%	15%	1.71	0%	0.00%	1.58	21%	1.25	10.7195	0.0318	1.24
41	311.87	44	92%	15%	1.53	0%	0.00%	1.83	21%	1.45	11.6508	0.0360	1.42
42	316.82	64	90%	15%	2.14	0%	0.00%	2.20	21%	1.74	12.8923	0.0393	1.69
43	327.42	74	88%	15%	2.34	0%	0.01%	2.36	21%	1.86	14.1383	0.0410	1.78
44	338.39	110	86%	15%	3.29	0%	0.01%	2.75	21%	2.17	15.7999	0.0418	2.09
45	362.00	91	84%	15%	2.48	0%	0.02%	3.28	21%	2.59	17.7773	0.0422	2.53
46	393.71	143	82%	15%	3.50	0%	0.03%	3.64	21%	2.88	19.7649	0.0428	2.80
47	306.96	156	80%	15%	4.78	0%	0.04%	4.16	21%	3.28	21.8669	0.0440	3.19
48	303.03	137	78%	15%	4.15	0%	0.05%	4.96	21%	3.91	24.1890	0.0463	3.84
49	304.01	199	76%	15%	5.85	0%	0.07%	5.53	21%	4.37	26.6310	0.0491	4.22
50	287.83	214	74%	15%	6.47	0%	0.09%	6.01	21%	4.75	29.4035	0.0522	4.48
51	262.71	197	72%	15%	6.35	0%	0.10%	6.95	21%	5.49	32.5122	0.0557	5.15
52	242.40	209	71%	15%	7.20	0%	0.13%	7.93	21%	6.27	35.7546	0.0599	5.79
53	256.64	276	70%	15%	8.86	0%	0.15%	9.18	21%	7.25	39.0305	0.0657	6.62
54	259.76	338	70%	15%	10.72	0%	0.17%	10.30	21%	8.14	42.7648	0.0722	7.21
55	257.23	397	70%	15%	12.71	0%	0.20%	11.83	21%	9.34	47.6029	0.0792	8.06
56	251.32	364	70%	15%	11.93	0%	0.23%	13.41	21%	10.59	53.0388	0.0860	8.85
57	247.67	445	70%	15%	14.80	0%	0.26%	15.26	21%	12.06	59.1988	0.0925	9.79
58	241.58	491	70%	15%	16.74	0%	0.30%	16.84	21%	13.30	66.0009	0.0985	10.34
59	234.65	568	70%	15%	19.93	0%	0.33%	19.08	21%	15.07	73.9058	0.1042	11.38
60	235.06	586	70%	15%	20.53	0%	0.37%	21.41	21%	16.92	82.9591	0.1097	12.31
61	240.45	674	70%	15%	23.08	0%	0.41%	23.31	21%	18.41	92.2272	0.1152	12.68
62	247.05	791	70%	15%	26.37	0%	0.45%	25.17	21%	19.88	101.5178	0.1206	12.93
63	246.93	784	70%	15%	26.15	0%	0.49%	28.14	21%	22.23	112.8709	0.1256	13.95
64	240.99	853	70%	15%	29.15	0%	0.53%	30.77	21%	24.31	126.6296	0.1306	14.23
65	237.03	1014	70%	15%	35.23	0%	0.57%	33.20	21%	26.23	139.8505	0.1355	14.26
66	238.22	1045	70%	15%	36.13	0%	0.62%	36.01	21%	28.45	152.3144	0.1401	14.67
67	239.70	1117	70%	15%	38.38	0%	0.66%	38.87	21%	30.71	167.5594	0.1445	14.66
68	237.43	1155	70%	15%	40.06	0%	0.70%	41.34	21%	32.66	184.3656	0.1482	14.02
69	237.42	1248	70%	15%	43.29	0%	0.75%	44.20	21%	34.92	201.7962	0.1515	13.64
70	237.78	1368	70%	15%	47.38	0%	0.79%	47.23	21%	37.31	218.9571	0.1546	13.37
71	244.70	1493	70%	15%	50.25	0%	0.83%	50.87	21%	40.19	239.8394	0.1575	13.10
72	253.39	1640	70%	15%	53.30	0%	0.88%	55.69	21%	44.00	269.3109	0.1598	12.65
73	259.69	1829	70%	15%	58.00	0%	0.92%	59.50	21%	47.01	301.3986	0.1610	10.98
74	171.14	1394	70%	15%	67.08	0%	0.96%	63.89	21%	50.47	328.3922	0.1617	10.80
75	160.95	1293	70%	15%	66.16	0%	0.99%	67.22	21%	53.11	356.9071	0.1620	9.40
76	174.24	1520	70%	15%	71.84	0%	1.03%	70.67	21%	55.83	391.9935	0.1621	7.14
77	181.16	1533	70%	15%	69.69	0%	1.06%	74.38	21%	58.76	435.5571	0.1615	4.03
78	185.86	1692	70%	15%	74.97	0%	1.09%	78.35	21%	61.90	483.2467	0.1598	1.15
79	178.90	1853	70%	15%	85.30	0%	1.12%	82.58	21%	65.24	537.3947	0.1574	-1.99
80	165.73	1724	70%	15%	85.67	0%	1.14%	86.12	21%	68.04	595.9681	0.1547	-6.06

3.4 STROKE

3.4.1 Definition

The ABI model definition for Stroke is:

A cerebrovascular incident resulting in permanent neurological damage. Transient Ischaemic Attacks are specifically excluded.

3.4.2 Data Sources

- HES data 1993/1994
- Oxford Community Stroke Project: This gives details of incidence of Stroke in Oxfordshire - first ever incidence rates are shown by age/sex per 1000 population
- WHO Collaborative Study. A study into cerebrovascular disease in the community
- OPCS - Mortality Statistics by Cause, England and Wales, for 1993
- MSGP data 1991/1992.

3.4.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.4.

HES data for 1993/1994 was used to obtain the number of incidences for Stroke. The ICD codes used were 430 to 437 (Cerebrovascular Disease), excluding 435. ICD code 435 relates to Transient Ischaemic Attacks which are specifically excluded in the ABI definition of Stroke.

To adjust these incidences onto a "first ever" basis, the ratios of MSGP 1991/1992 "first ever" to "new and first ever" incidence rates were examined. This showed the following results:-

Age Band	Males	Females
25-44	100%	100%
45-64	79%	71%
65-74	56%	64%
75-84	57%	61%
85 & over	64%	61%

Based on this information, we have assumed no adjustment is required up to age 45. For 45-64 a factor of 80%, and above age 64 a factor of 60%, were used.

A further adjustment to these incidences was then made to allow for sudden deaths from Stroke which are not included within HES. The WHO study suggests that day 1 fatality from Stroke is about 10%. The reported cases have been grossed up by 5% to allow for this, which assumes that 50% of these deaths go unreported.

The crude incidence rates were then calculated by dividing the adjusted HES incidences by the population of England.

There is evidence to show that many Stroke victims have previously had a Heart Attack. The WHO study suggests that 7% of the Stroke victims have previously had a Heart Attack. The resulting crude incidence rates have therefore been reduced by 7% to avoid double counting.

The resulting incidence rates were then further adjusted to allow for the prevalence of Stroke in the population of England, to derive a population free from Stroke. The prevalence of Stroke in the population was estimated using MSGP 1991/1992 data. In theory, some allowance should also be made for the overlap with Heart Attack but this has been ignored.

The individual age incidence rates were then smoothed using a 5 year moving average.

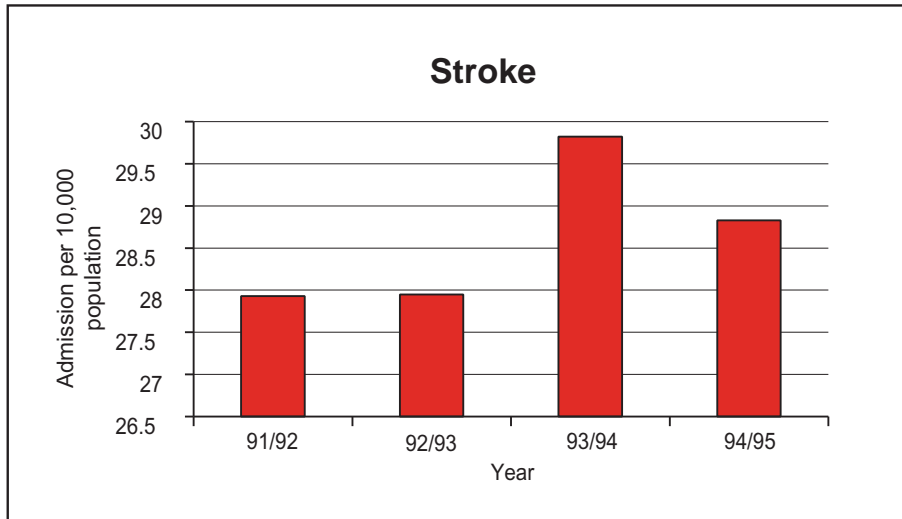
To derive the Stand-Alone incidence rates, a 28 day survival probability after Stroke is required. Survival rates are available from the Framingham Heart Study, but these are very much out of date. The Oxford Stroke project gives an estimated 28 day case fatality rate after a first ever Stroke of 19%. Data published by Fabrizio & Grattan⁶ suggest

survival prospects diminish with age. We have used 28 day fatality rates which increase linearly to 20% at age 90 from 0% at age zero.

The Accelerated Critical Illness rates were determined using the Dash & Grimshaw model. The values of k_x have been determined from OPCS - Mortality Statistics by Cause, England and Wales, for 1993 (ICD codes 430 to 437, excluding 435).

3.4.4 Trends

The graph below shows Stroke incidences recorded in HES data for 1991/92, 1992/93, 1993/94 and 1994/95. There is no clear evidence of a trend although the experience for 1993/94, which has been used for the Base Table, appears high relative to other years. Given the lack of any clear trend, it may be appropriate to assume no adjustment is necessary to re-base the table to current levels of experience.



Critical Illness Incidence Rates - Stroke (males)
Incidence Rates per 10000

Table 3.4 (m)

Age	Population of England (000's)	Number of Strokes	First Ever Adjustment	Sudden Death Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Adjusted Crude Rate	Smoothed Adjusted Crude Rate (i_x)	28 Day Mortality Rate	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from Stroke (k_x)	Extra Cost for Accelerated ($i_x \cdot k_x \cdot q_x$)
20	334.96	38	100%	5%	1.19	7%	0.02%	1.11	0.82	0.0444	0.78	8.4267	0.0102	0.73
21	357.45	32	100%	5%	0.94	7%	0.02%	0.88	0.95	0.0467	0.90	8.6371	0.0113	0.85
22	375.82	44	100%	5%	1.23	7%	0.02%	1.15	1.12	0.0489	1.07	8.8479	0.0125	1.01
23	375.00	43	100%	5%	1.21	7%	0.02%	1.12	1.03	0.0511	0.98	8.8558	0.0137	0.91
24	387.17	54	100%	5%	1.47	7%	0.02%	1.37	1.17	0.0533	1.11	8.8636	0.0149	1.04
25	390.34	25	100%	5%	0.67	7%	0.02%	0.63	1.19	0.0556	1.13	8.5656	0.0160	1.05
26	402.53	65	100%	5%	1.70	7%	0.02%	1.58	1.17	0.0578	1.10	8.4709	0.0172	1.03
27	411.42	53	100%	5%	1.36	7%	0.02%	1.26	1.20	0.0600	1.13	8.4780	0.0186	1.05
28	419.52	44	100%	5%	1.10	7%	0.02%	1.03	1.45	0.0622	1.36	8.6897	0.0202	1.28
29	419.46	65	100%	5%	1.63	7%	0.02%	1.52	1.45	0.0644	1.35	8.9019	0.0219	1.25
30	409.81	79	100%	5%	2.03	7%	0.02%	1.89	1.63	0.0667	1.52	9.1147	0.0237	1.42
31	399.12	63	100%	5%	1.66	7%	0.02%	1.55	1.89	0.0689	1.76	9.3280	0.0255	1.65
32	389.39	87	100%	5%	2.35	7%	0.02%	2.19	1.95	0.0711	1.81	9.7471	0.0273	1.68
33	370.49	87	100%	5%	2.47	7%	0.02%	2.30	2.22	0.0733	2.05	9.9620	0.0290	1.93
34	358.25	67	100%	5%	1.97	7%	0.02%	1.83	2.50	0.0756	2.31	10.5888	0.0307	2.17
35	350.00	115	100%	5%	3.46	7%	0.02%	3.22	2.72	0.0778	2.51	11.6291	0.0324	2.35
36	338.26	102	100%	5%	3.17	7%	0.02%	2.95	2.91	0.0800	2.68	12.7760	0.0339	2.47
37	325.30	110	100%	5%	3.56	7%	0.02%	3.31	3.27	0.0822	3.00	13.7208	0.0350	2.79
38	315.45	104	100%	5%	3.47	7%	0.02%	3.23	3.68	0.0844	3.37	14.9793	0.0354	3.15
39	320.34	119	100%	5%	3.91	7%	0.02%	3.64	4.29	0.0867	3.92	16.0364	0.0354	3.72
40	318.62	171	100%	5%	5.65	7%	0.02%	5.25	4.93	0.0889	4.49	17.2021	0.0353	4.33
41	311.99	192	100%	5%	6.48	7%	0.04%	6.03	5.56	0.0911	5.05	18.5812	0.0353	4.90
42	318.96	212	100%	5%	7.00	7%	0.07%	6.51	6.13	0.0933	5.56	20.1758	0.0357	5.41
43	327.52	212	100%	5%	6.81	7%	0.13%	6.35	6.22	0.0956	5.63	21.8839	0.0370	5.41
44	339.37	225	100%	5%	6.98	7%	0.25%	6.51	6.45	0.0978	5.82	24.0206	0.0387	5.52
45	362.17	263	80%	5%	6.12	7%	0.47%	5.71	6.63	0.1000	5.97	26.6957	0.0406	5.54
46	397.14	363	80%	5%	7.70	7%	0.47%	7.19	7.12	0.1022	6.40	29.7063	0.0424	5.87
47	306.90	288	80%	5%	7.90	7%	0.47%	7.38	8.09	0.1044	7.24	33.1638	0.0438	6.63
48	302.27	339	80%	5%	9.44	7%	0.47%	8.82	9.35	0.1067	8.35	37.1826	0.0446	7.69
49	304.44	438	80%	5%	12.12	7%	0.47%	11.32	10.67	0.1089	9.51	41.4564	0.0451	8.80
50	288.22	440	80%	5%	12.86	7%	0.47%	12.01	12.13	0.1111	10.78	46.4200	0.0454	10.02
51	263.16	462	80%	5%	14.78	7%	0.47%	13.81	13.18	0.1133	11.69	51.8778	0.0457	10.81
52	241.88	451	80%	5%	15.70	7%	0.47%	14.67	14.10	0.1156	12.47	57.7395	0.0460	11.45
53	256.27	459	80%	5%	15.08	7%	0.47%	14.09	15.72	0.1178	13.87	64.2391	0.0462	12.75
54	257.84	522	80%	5%	17.05	7%	0.47%	15.93	17.11	0.1200	15.06	71.4029	0.0464	13.80
55	255.84	654	80%	5%	21.53	7%	0.47%	20.11	18.77	0.1222	16.47	79.7001	0.0466	15.05
56	250.26	660	80%	5%	22.21	7%	0.47%	20.75	21.14	0.1244	18.51	89.0706	0.0469	16.96
57	244.78	714	80%	5%	24.56	7%	0.47%	22.95	23.51	0.1267	20.54	99.4603	0.0474	18.80
58	239.71	791	80%	5%	27.79	7%	0.47%	25.97	25.97	0.1289	22.62	111.1587	0.0482	20.61
59	230.49	814	80%	5%	29.74	7%	0.47%	27.79	28.50	0.1311	24.77	124.2526	0.0492	22.39
60	228.25	939	80%	5%	34.64	7%	0.47%	32.37	31.07	0.1333	26.93	139.1932	0.0504	24.06
61	233.43	991	80%	5%	35.75	7%	0.59%	33.45	34.17	0.1356	29.54	156.0106	0.0515	26.13
62	234.01	1061	80%	5%	38.18	7%	0.74%	35.77	37.64	0.1378	32.45	174.8779	0.0527	28.42
63	228.02	1196	80%	5%	44.17	7%	0.93%	41.46	38.97	0.1400	33.51	196.4910	0.0540	28.35
64	220.83	1258	80%	5%	47.97	7%	1.16%	45.14	39.86	0.1422	34.19	219.9171	0.0554	27.68
65	215.61	1411	60%	5%	41.33	7%	1.46%	39.01	41.43	0.1444	35.44	244.6622	0.0568	27.53
66	214.24	1363	60%	5%	40.18	7%	1.46%	37.92	43.03	0.1467	36.72	271.0949	0.0584	27.21
67	213.63	1563	60%	5%	46.21	7%	1.46%	43.61	44.60	0.1489	37.96	299.6439	0.0603	26.53
68	204.58	1698	60%	5%	52.42	7%	1.46%	49.47	47.90	0.1511	40.66	329.1736	0.0629	27.19
69	199.28	1771	60%	5%	56.13	7%	1.46%	52.97	51.90	0.1533	43.94	360.2085	0.0659	28.17
70	193.52	1802	60%	5%	58.81	7%	1.46%	55.51	56.62	0.1556	47.81	392.9175	0.0690	29.49
71	196.09	1903	60%	5%	61.29	7%	1.63%	57.95	61.32	0.1578	51.65	431.1650	0.0722	30.19
72	195.56	2196	60%	5%	70.92	7%	1.83%	67.19	68.27	0.1600	57.34	474.5692	0.0754	32.47
73	195.24	2377	60%	5%	76.90	7%	2.05%	73.01	76.89	0.1622	64.42	521.7056	0.0787	35.82
74	123.55	1802	60%	5%	92.11	7%	2.30%	87.68	83.94	0.1644	70.14	569.7189	0.0821	37.19
75	111.80	1829	60%	5%	103.32	7%	2.57%	98.62	89.68	0.1667	74.73	619.7199	0.0854	36.74
76	118.28	1829	60%	5%	97.67	7%	2.57%	93.22	95.91	0.1689	79.72	677.6744	0.0888	35.73
77	118.36	1882	60%	5%	100.42	7%	2.57%	95.86	101.26	0.1711	83.93	741.7506	0.0922	32.84
78	114.97	1987	60%	5%	109.15	7%	2.57%	104.19	105.75	0.1733	87.42	810.2217	0.0958	28.17
79	106.98	2030	60%	5%	119.85	7%	2.57%	114.40	112.71	0.1756	92.92	883.6740	0.0993	24.95
80	96.16	1931	60%	5%	126.83	7%	2.57%	121.07	121.53	0.1778	99.92	961.5810	0.1029	22.58

Critical Illness Incidence Rates - Stroke (Females)
Incidence Rates per 10000

Table 3.4 (f)

Age	Population of England (000's)	Number of Strokes	First Ever Adjustment	Sudden Death Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Adjusted Crude Rate	Smoothed Adjusted Crude Rate (i_x)	28 Day Mortality Rate	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from Stroke (k_x)	Extra Cost for Accelerated ($i_x \cdot k_x \cdot q_x$)
20	316.68	33	100%	5%	1.10	7%	0.02%	1.02	1.02	0.0444	0.97	3.1327	0.0228	0.95
21	337.82	46	100%	5%	1.43	7%	0.02%	1.33	1.14	0.0467	1.09	3.2347	0.0266	1.06
22	358.72	42	100%	5%	1.23	7%	0.02%	1.15	1.20	0.0489	1.14	3.2358	0.0295	1.10
23	355.66	53	100%	5%	1.57	7%	0.02%	1.46	1.26	0.0511	1.20	3.3380	0.0305	1.16
24	371.38	39	100%	5%	1.11	7%	0.02%	1.03	1.33	0.0533	1.26	3.2379	0.0306	1.23
25	375.35	52	100%	5%	1.46	7%	0.02%	1.36	1.49	0.0556	1.41	3.4414	0.0302	1.38
26	387.10	65	100%	5%	1.77	7%	0.02%	1.64	1.65	0.0578	1.55	3.4426	0.0303	1.54
27	395.73	79	100%	5%	2.10	7%	0.02%	1.95	1.69	0.0600	1.59	3.5451	0.0314	1.58
28	402.86	93	100%	5%	2.43	7%	0.02%	2.26	1.93	0.0622	1.81	3.8503	0.0344	1.80
29	401.82	51	100%	5%	1.34	7%	0.02%	1.24	1.97	0.0644	1.84	3.9531	0.0384	1.82
30	394.34	103	100%	5%	2.75	7%	0.02%	2.56	2.00	0.0667	1.87	4.3603	0.0429	1.81
31	385.16	72	100%	5%	1.97	7%	0.02%	1.83	1.98	0.0689	1.84	4.6665	0.0471	1.76
32	374.28	81	100%	5%	2.28	7%	0.02%	2.12	2.27	0.0711	2.11	5.1762	0.0508	2.01
33	357.70	78	100%	5%	2.30	7%	0.02%	2.14	2.29	0.0733	2.12	5.7882	0.0534	1.98
34	351.75	98	100%	5%	2.93	7%	0.02%	2.73	2.57	0.0756	2.38	6.1979	0.0554	2.23
35	344.10	93	100%	5%	2.84	7%	0.02%	2.65	2.88	0.0778	2.65	6.9134	0.0572	2.48
36	333.81	110	100%	5%	3.47	7%	0.02%	3.23	3.28	0.0800	3.02	7.5287	0.0586	2.84
37	321.73	120	100%	5%	3.93	7%	0.02%	3.65	3.57	0.0822	3.28	8.2470	0.0594	3.08
38	312.23	132	100%	5%	4.45	7%	0.02%	4.14	3.95	0.0844	3.62	8.9671	0.0589	3.42
39	318.12	136	100%	5%	4.50	7%	0.02%	4.19	4.32	0.0867	3.94	9.7911	0.0577	3.75
40	316.65	147	100%	5%	4.89	7%	0.02%	4.55	4.73	0.0889	4.31	10.7195	0.0562	4.13
41	311.87	161	100%	5%	5.43	7%	0.03%	5.06	5.18	0.0911	4.70	11.6508	0.0549	4.54
42	316.82	185	100%	5%	6.15	7%	0.05%	5.72	5.40	0.0933	4.90	12.8923	0.0539	4.70
43	327.42	213	100%	5%	6.85	7%	0.09%	6.37	5.39	0.0956	4.88	14.1383	0.0535	4.64
44	338.39	183	100%	5%	5.69	7%	0.15%	5.30	5.59	0.0978	5.05	15.7999	0.0535	4.75
45	362.00	208	80%	5%	4.84	7%	0.25%	4.51	5.90	0.1000	5.31	17.7773	0.0536	4.94
46	393.71	304	80%	5%	6.50	7%	0.25%	6.06	6.46	0.1022	5.80	19.7649	0.0537	5.40
47	306.96	283	80%	5%	7.76	7%	0.25%	7.24	6.89	0.1044	6.17	21.8669	0.0538	5.71
48	303.03	354	80%	5%	9.84	7%	0.25%	9.17	7.49	0.1067	6.69	24.1890	0.0538	6.19
49	304.01	289	80%	5%	8.01	7%	0.25%	7.46	8.28	0.1089	7.38	26.6310	0.0539	6.85
50	287.83	275	80%	5%	8.05	7%	0.25%	7.50	9.01	0.1111	8.01	29.4035	0.0539	7.42
51	262.71	336	80%	5%	10.77	7%	0.25%	10.04	8.93	0.1133	7.92	32.5122	0.0540	7.17
52	242.40	335	80%	5%	11.64	7%	0.25%	10.85	9.95	0.1156	8.80	35.7546	0.0544	8.01
53	256.64	287	80%	5%	9.42	7%	0.25%	8.78	11.10	0.1178	9.79	39.0305	0.0552	8.95
54	259.76	416	80%	5%	13.49	7%	0.25%	12.57	11.76	0.1200	10.35	42.7648	0.0562	9.36
55	257.23	434	80%	5%	14.21	7%	0.25%	13.25	12.42	0.1222	10.90	47.6029	0.0573	9.69
56	251.32	427	80%	5%	14.31	7%	0.25%	13.34	13.68	0.1244	11.98	53.0388	0.0585	10.58
57	247.67	447	80%	5%	15.20	7%	0.25%	14.17	14.77	0.1267	12.90	59.1988	0.0598	11.23
58	241.58	464	80%	5%	16.17	7%	0.25%	15.08	15.83	0.1289	13.79	66.0009	0.0613	11.78
59	234.65	539	80%	5%	19.34	7%	0.25%	18.03	17.68	0.1311	15.36	73.9058	0.0629	13.03
60	235.06	554	80%	5%	19.85	7%	0.25%	18.50	19.23	0.1333	16.66	82.9591	0.0645	13.88
61	240.45	692	80%	5%	24.24	7%	0.33%	22.61	21.19	0.1356	18.32	92.2272	0.0661	15.09
62	247.05	688	80%	5%	23.45	7%	0.42%	21.90	23.46	0.1378	20.23	101.5178	0.0678	16.57
63	246.93	781	80%	5%	26.63	7%	0.55%	24.91	24.50	0.1400	21.07	112.8709	0.0697	16.64
64	240.99	897	80%	5%	31.34	7%	0.72%	29.36	25.22	0.1422	21.64	126.6296	0.0716	16.16
65	237.03	949	60%	5%	25.29	7%	0.94%	23.74	26.44	0.1444	22.62	139.8505	0.0735	16.16
66	238.22	1053	60%	5%	27.92	7%	0.94%	26.21	27.47	0.1467	23.44	152.3144	0.0758	15.92
67	239.70	1132	60%	5%	29.83	7%	0.94%	28.00	28.16	0.1489	23.96	167.5594	0.0786	14.98
68	237.43	1202	60%	5%	31.97	7%	0.94%	30.02	30.93	0.1511	26.25	184.3656	0.0827	15.67
69	237.42	1314	60%	5%	34.95	7%	0.94%	32.82	33.96	0.1533	28.75	201.7962	0.0874	16.31
70	237.78	1507	60%	5%	40.03	7%	0.94%	37.58	37.28	0.1556	31.48	218.9571	0.0924	17.04
71	244.70	1704	60%	5%	43.98	7%	1.10%	41.36	41.53	0.1578	34.98	239.8394	0.0975	18.14
72	253.39	1900	60%	5%	47.36	7%	1.30%	44.62	47.38	0.1600	39.80	269.3109	0.1028	19.68
73	259.69	2232	60%	5%	54.28	7%	1.52%	51.26	52.37	0.1622	43.88	301.3986	0.1085	19.66
74	171.14	1776	60%	5%	65.54	7%	1.79%	62.06	56.54	0.1644	47.25	328.3922	0.1144	18.97
75	160.95	1678	60%	5%	65.84	7%	2.10%	62.55	62.29	0.1667	51.91	356.9071	0.1204	19.32
76	174.24	1807	60%	5%	65.50	7%	2.10%	62.22	67.27	0.1689	55.91	391.9935	0.1263	17.78
77	181.16	2215	60%	5%	77.22	7%	2.10%	73.36	71.86	0.1711	59.56	435.5571	0.1319	14.40
78	185.86	2360	60%	5%	80.20	7%	2.10%	76.18	78.82	0.1733	65.16	483.2467	0.1371	12.56
79	178.90	2534	60%	5%	89.46	7%	2.10%	84.98	87.61	0.1756	72.23	537.3947	0.1421	11.26
80	165.73	2689	60%	5%	102.47	7%	2.10%	97.35	95.67	0.1778	78.66	595.9681	0.1469	8.11

3.5 CORONARY ARTERY BYPASS GRAFT (CABG)

3.5.1 Definition

The ABI model definition for CABG is:-

The undergoing of open heart surgery on the advice of a Consultant Cardiologist to correct narrowing or blockage of one or more coronary arteries with by-pass grafts but excluding balloon angioplasty, laser relief or any other procedures.

3.5.2 Data Sources

- HES Data 1994/95
- STS National Cardiac Database, Society of Thoracic Surgeons
- SCTS United Kingdom Cardiac Surgical Register, Society of Cardiothoracic Surgeons of Great Britain and Ireland
- US National Center for Health Statistics, National Hospital Discharge Survey, 1996 (NCHS)

3.5.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.5.

HES data for 1994/95 was used to obtain the numbers of CABG operations. The operation codes used were K40 to K46.

Adjustments were first made to this data so that they related to first ever operations. US data from the STS database indicates that in 1997, 92% of operations involving a CABG were first ever operations. This percentage has been fairly stable throughout the 1990's. As no equivalent UK data has been found, this 92% adjustment factor has been applied to the base HES data to convert it to a "first ever" basis.

The crude population incidence rates were then calculated by dividing these incidences by the population of England. No adjustments were needed for sudden deaths, prior to admission into hospital, as it is the number of operations which is being analysed.

A further adjustment was then necessary to allow for overlaps with the other Critical Illnesses. There is clearly an increased risk for a CABG operation in patients who have previously had a Heart Attack. No specific UK data has been found that quantifies this link, but Fabrizio & Grattan⁶ suggest an overlap of 54% based on Australian data. The American Journal of Cardiology indicates a similar percentage, and it doesn't vary significantly with age. As a result, the crude CABG incidence rates have been reduced by 50% to allow for those cases which have previously had a Heart Attack.

As the incidence rates have been adjusted to exclude those cases which have previously had a Heart Attack, the population in the denominator of the incidence rates must also be reduced by the prevalence of Heart Attack sufferers in the population. No further adjustment has been made for the prevalence of CABG in the general population, beyond the adjustment for the prevalence of Heart Attacks, as it is believed to be insignificant.

The individual age incidence rates were then smoothed using a five year moving average.

To obtain the Stand-Alone incidence rates, an estimate of 28 day mortality following a CABG operation is needed. Data from the SCTS register indicated that UK operative mortality for operations involving a CABG was 3.5% in 1996/97. Similar data from the US STS database indicates operative mortality of 3.1% in 1997. Given the greater use of CABG in the US, it would seem reasonable that overall the US operative mortality rate is slightly lower.

The US STS database provides operative mortality separated by sex, age band and first operation. This data has been used to produce the following estimate of UK age banded first ever operative mortality. As anticipated, operative mortality increases with age and is lighter for first ever operations.

Estimated UK First Ever CABG Operative Mortality

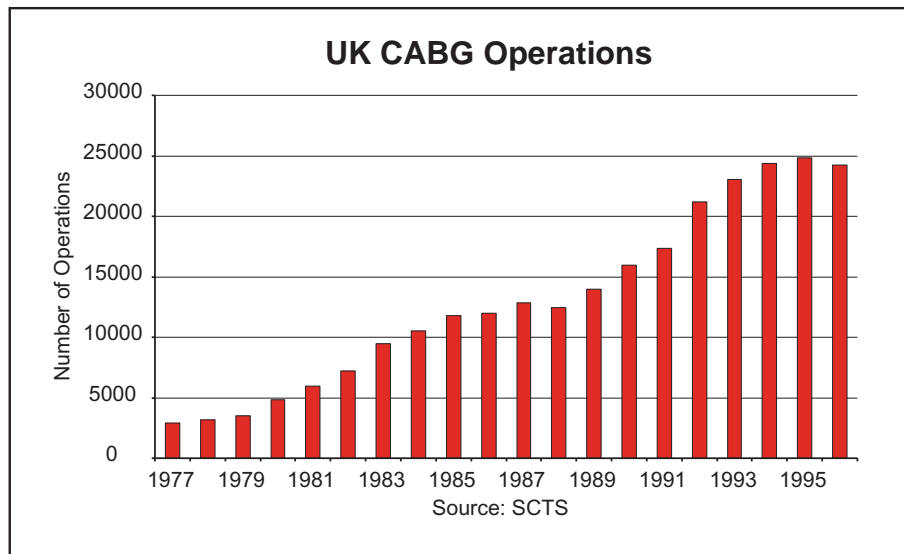
Age Band	Males	Females
20-50	1.2%	1.9%
51-60	1.1%	2.2%
61-65	1.9%	3.3%
66-70	2.3%	4.1%
71-80	3.7%	6.5%

For the remainder of the 28-day survival period, ELT15 mortality has been used. This is likely to be conservative.

The smoothed incidence rates (without further adjustment) have been used for the Accelerated Critical Illness rates in the Base Table. There is no data on ultimate mortality following CABG, it is therefore assumed that the recorded deaths due to Heart Attack will also include all cases where a CABG has been previously performed.

3.5.4 Trends

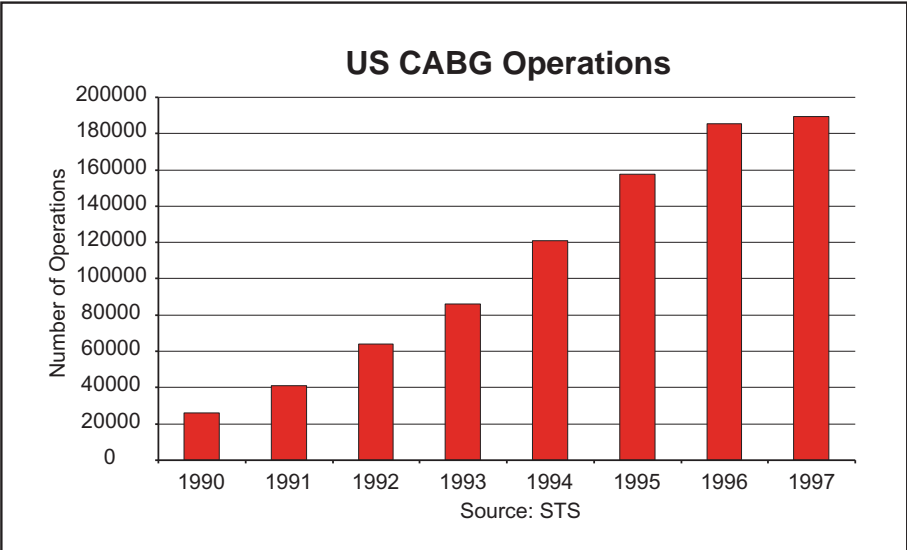
As illustrated in the following graph there has been a substantial increase in the number of operations in the UK involving CABG.



Over the period shown there has been an average rate of increase of 12% pa. The rate of increase has slowed in recent years. This may be partly explained by the increasing use of Angioplasty, as illustrated in Section 3.11.15.

The number of operations has actually reduced in 1996/97 though this may be a result of the most recent years data not being complete.

Data from a large number of hospitals in the US shows a small increase in the number of operations from 1996 to 1997. However, in earlier years the rate of increase in US CABG operations has been substantial and averages over 33% pa over the period shown.



There were 410 CABG operations per million population (pmp) in the UK in 1996/97 compared to 1,400 pmp in the USA in 1997 based on NCHS data. This illustrates that there may still be substantial scope for the number of UK CABG operations to increase further.

In light of the above, a rate of increase of 5% pa may be appropriate in projecting the base CABG population rates forward to current levels of experience. However, this figure is subject to considerable uncertainty.

Critical Illness Incidence Rates - CABG (males)
Incidence Rates per 10,000 Lives

Table 3.5 (m)

Age	Population of England (000's)	Number of CABG Operations (K40-K46)	First Ever Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Smoothed Adjusted Crude Rate (ix) (per 10,000)	Operative Mortality	28 Day Mortality Rate (ELT 15) (per 10,000)	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from CABG (k _x)	Extra Cost for Accelerated (i _x - k _x * q _x)
20	334.96	0	92%	0.00	50%	0.00%	0.00	1.2%	0.00006	0.00	8.4267	0	0.00
21	357.45	0	92%	0.00	50%	0.00%	0.00	1.2%	0.00007	0.00	8.6371	0	0.00
22	375.82	0	92%	0.00	50%	0.00%	0.00	1.2%	0.00007	0.00	8.8479	0	0.00
23	375.00	1	92%	0.02	50%	0.00%	0.00	1.2%	0.00007	0.00	8.8558	0	0.00
24	387.17	0	92%	0.00	50%	0.00%	0.00	1.2%	0.00007	0.00	8.8636	0	0.00
25	390.34	0	92%	0.00	50%	0.00%	0.01	1.2%	0.00007	0.01	8.5656	0	0.01
26	402.53	1	92%	0.02	50%	0.00%	0.01	1.2%	0.00006	0.01	8.4709	0	0.01
27	411.42	1	92%	0.02	50%	0.00%	0.01	1.2%	0.00007	0.01	8.4780	0	0.01
28	419.52	3	92%	0.07	50%	0.00%	0.02	1.2%	0.00007	0.02	8.6897	0	0.02
29	419.46	1	92%	0.02	50%	0.00%	0.01	1.2%	0.00007	0.01	8.9019	0	0.01
30	409.81	1	92%	0.02	50%	0.00%	0.02	1.2%	0.00007	0.02	9.1147	0	0.02
31	399.12	0	92%	0.00	50%	0.00%	0.03	1.2%	0.00007	0.03	9.3280	0	0.03
32	389.39	4	92%	0.09	50%	0.00%	0.05	1.2%	0.00007	0.05	9.7471	0	0.05
33	370.49	5	92%	0.12	50%	0.00%	0.11	1.2%	0.00008	0.11	9.9620	0	0.11
34	358.25	12	92%	0.31	50%	0.10%	0.16	1.2%	0.00008	0.16	10.5888	0	0.16
35	350.00	23	92%	0.60	50%	0.10%	0.22	1.2%	0.00009	0.22	11.6291	0	0.22
36	338.26	17	92%	0.46	50%	0.10%	0.31	1.2%	0.00010	0.31	12.7760	0	0.31
37	325.30	24	92%	0.68	50%	0.10%	0.42	1.1%	0.00011	0.42	13.7208	0	0.42
38	315.45	36	92%	1.05	50%	0.10%	0.56	1.1%	0.00011	0.55	14.9793	0	0.56
39	320.34	50	92%	1.44	50%	0.20%	0.79	1.1%	0.00012	0.78	16.0364	0	0.79
40	318.62	68	92%	1.96	50%	0.20%	0.97	1.1%	0.00013	0.96	17.2021	0	0.97
41	311.99	94	92%	2.77	50%	0.20%	1.18	1.1%	0.00014	1.17	18.5812	0	1.18
42	318.96	85	92%	2.45	50%	0.20%	1.48	1.1%	0.00015	1.46	20.1758	0	1.48
43	327.52	112	92%	3.15	50%	0.30%	1.78	1.1%	0.00017	1.76	21.8839	0	1.78
44	339.37	163	92%	4.42	50%	0.30%	2.04	1.1%	0.00018	2.01	24.0206	0	2.04
45	362.17	195	92%	4.95	50%	0.30%	2.61	1.1%	0.00020	2.58	26.6957	0	2.61
46	397.14	230	92%	5.33	50%	0.40%	3.14	1.1%	0.00023	3.10	29.7063	0	3.14
47	306.90	271	92%	8.12	50%	0.40%	3.65	1.1%	0.00025	3.60	33.1638	0	3.65
48	302.27	277	92%	8.43	50%	0.50%	4.38	1.1%	0.00029	4.33	37.1826	0	4.38
49	304.44	313	92%	9.46	50%	0.50%	5.07	1.1%	0.00032	5.02	41.4564	0	5.07
50	288.22	383	92%	12.23	50%	0.50%	5.93	1.1%	0.00036	5.86	46.4200	0	5.93
51	263.16	350	92%	12.24	50%	0.60%	6.57	1.1%	0.00040	6.49	51.8778	0	6.57
52	241.88	436	92%	16.58	50%	0.60%	7.37	1.1%	0.00044	7.29	57.7395	0	7.37
53	256.27	412	92%	14.79	50%	0.70%	8.24	1.1%	0.00049	8.15	64.2391	0	8.24
54	257.84	488	92%	17.41	50%	0.70%	9.32	1.1%	0.00055	9.22	71.4029	0	9.32
55	255.84	579	92%	20.82	50%	0.80%	10.14	1.1%	0.00061	10.02	79.7001	0	10.14
56	250.26	624	92%	22.94	50%	0.90%	11.52	1.2%	0.00068	11.38	89.0706	0	11.52
57	244.78	654	92%	24.58	50%	0.90%	12.70	1.3%	0.00076	12.52	99.4603	0	12.70
58	239.71	742	92%	28.48	50%	1.00%	13.59	1.4%	0.00085	13.39	111.1587	0	13.59
59	230.49	726	92%	28.98	50%	1.00%	14.14	1.5%	0.00095	13.92	124.2526	0	14.14
60	228.25	734	92%	29.59	50%	1.10%	15.05	1.6%	0.00107	14.79	139.1932	0	15.05
61	233.43	719	92%	28.34	50%	1.10%	15.42	1.7%	0.00120	15.14	156.0106	0	15.42
62	234.01	852	92%	33.50	50%	1.20%	15.94	1.8%	0.00134	15.63	174.8779	0	15.94
63	228.02	793	92%	32.00	50%	1.30%	16.12	1.9%	0.00151	15.79	196.4910	0	16.12
64	220.83	817	92%	34.04	50%	1.30%	16.46	2.0%	0.00169	16.10	219.9171	0	16.46
65	215.61	733	92%	31.28	50%	1.40%	16.05	2.1%	0.00188	15.68	244.6622	0	16.05
66	214.24	736	92%	31.61	50%	1.40%	15.68	2.2%	0.00208	15.30	271.0949	0	15.68
67	213.63	681	92%	29.33	50%	1.50%	15.20	2.3%	0.00230	14.82	299.6439	0	15.20
68	204.58	630	92%	28.33	50%	1.50%	14.47	2.4%	0.00253	14.09	329.1736	0	14.47
69	199.28	633	92%	29.22	50%	1.60%	13.46	2.5%	0.00276	13.09	360.2085	0	13.46
70	193.52	506	92%	24.06	50%	1.60%	12.67	2.7%	0.00301	12.29	392.9175	0	12.67
71	196.09	459	92%	21.54	50%	1.70%	11.62	2.9%	0.00331	11.25	431.1650	0	11.62
72	195.56	457	92%	21.50	50%	1.70%	11.44	3.1%	0.00364	11.04	474.5692	0	11.44
73	195.24	382	92%	18.00	50%	1.70%	10.77	3.3%	0.00400	10.37	521.7056	0	10.77
74	123.55	367	92%	27.33	50%	1.80%	9.86	3.5%	0.00437	9.47	569.7189	0	9.86
75	111.80	212	92%	17.44	50%	1.80%	8.65	3.7%	0.00475	8.29	619.7199	0	8.65
76	118.28	162	92%	12.60	50%	1.80%	7.61	3.9%	0.00520	7.27	677.6744	0	7.61
77	118.36	123	92%	9.56	50%	1.90%	5.47	4.2%	0.00569	5.21	741.7506	0	5.47
78	114.97	97	92%	7.76	50%	1.90%	4.02	4.4%	0.00622	3.82	810.2217	0	4.02
79	106.98	73	92%	6.28	50%	1.90%	3.07	4.7%	0.00678	2.91	883.6740	0	3.07
80	96.16	34	92%	3.25	50%	1.90%	2.39	4.9%	0.00738	2.26	961.5810	0	2.39

Critical Illness Incidence Rates - CABG (females)
Incidence Rates per 10,000 Lives

Table 3.5 (f)

Age	Population of England (000's)	Number of CABG Operations (K40-K46)	First Ever Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Smoothed Adjusted Crude Rate (ix) (per 10,000)	Operative Mortality	28 Day Mortality Rate (ELT 15) (per 10,000)	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from CABG (kx)	Extra Cost for Accelerated (ix - kx * qx)
20	316.68	0	92%	0.00	50%	0.00%	0.00	1.9%	0.00002	0.00	3.1327	0	0.00
21	337.82	0	92%	0.00	50%	0.00%	0.00	1.9%	0.00002	0.00	3.2347	0	0.00
22	358.72	0	92%	0.00	50%	0.00%	0.00	1.9%	0.00002	0.00	3.2358	0	0.00
23	355.66	0	92%	0.00	50%	0.00%	0.00	1.9%	0.00003	0.00	3.3380	0	0.00
24	371.38	0	92%	0.00	50%	0.00%	0.00	1.9%	0.00002	0.00	3.2379	0	0.00
25	375.35	2	92%	0.05	50%	0.00%	0.00	1.9%	0.00003	0.01	3.4414	0	0.00
26	387.10	0	92%	0.00	50%	0.00%	0.01	1.9%	0.00003	0.01	3.4426	0	0.01
27	395.73	0	92%	0.00	50%	0.00%	0.01	1.9%	0.00003	0.01	3.5451	0	0.01
28	402.86	1	92%	0.02	50%	0.00%	0.01	1.9%	0.00003	0.01	3.8503	0	0.01
29	401.82	1	92%	0.02	50%	0.00%	0.01	1.9%	0.00003	0.01	3.9531	0	0.01
30	394.34	1	92%	0.02	50%	0.00%	0.01	1.9%	0.00003	0.01	4.3603	0	0.01
31	385.16	2	92%	0.05	50%	0.00%	0.02	1.9%	0.00004	0.02	4.6665	0	0.02
32	374.28	1	92%	0.02	50%	0.00%	0.02	1.9%	0.00004	0.02	5.1762	0	0.02
33	357.70	2	92%	0.05	50%	0.00%	0.02	1.9%	0.00004	0.02	5.7882	0	0.02
34	351.75	2	92%	0.05	50%	0.00%	0.03	1.9%	0.00005	0.03	6.1979	0	0.03
35	344.10	0	92%	0.00	50%	0.00%	0.04	1.9%	0.00005	0.04	6.9134	0	0.04
36	333.81	5	92%	0.14	50%	0.00%	0.04	1.9%	0.00006	0.04	7.5287	0	0.04
37	321.73	5	92%	0.14	50%	0.00%	0.06	1.9%	0.00006	0.06	8.2470	0	0.06
38	312.23	2	92%	0.06	50%	0.00%	0.08	1.9%	0.00007	0.08	8.9671	0	0.08
39	318.12	10	92%	0.29	50%	0.00%	0.08	1.9%	0.00008	0.08	9.7911	0	0.08
40	316.65	7	92%	0.20	50%	0.00%	0.12	1.9%	0.00008	0.12	10.7195	0	0.12
41	311.87	4	92%	0.12	50%	0.00%	0.17	1.9%	0.00009	0.16	11.6508	0	0.17
42	316.82	18	92%	0.52	50%	0.00%	0.20	1.9%	0.00010	0.20	12.8923	0	0.20
43	327.42	19	92%	0.53	50%	0.00%	0.27	1.9%	0.00011	0.26	14.1383	0	0.27
44	338.39	23	92%	0.63	50%	0.00%	0.29	1.9%	0.00012	0.28	15.7999	0	0.29
45	362.00	35	92%	0.89	50%	0.00%	0.29	1.9%	0.00014	0.29	17.7773	0	0.29
46	393.71	13	92%	0.30	50%	0.00%	0.32	1.9%	0.00015	0.32	19.7649	0	0.32
47	306.96	19	92%	0.57	50%	0.00%	0.36	1.9%	0.00017	0.35	21.8669	0	0.36
48	303.03	28	92%	0.85	50%	0.10%	0.46	1.9%	0.00019	0.45	24.1890	0	0.46
49	304.01	31	92%	0.94	50%	0.10%	0.67	1.9%	0.00020	0.65	26.6310	0	0.67
50	287.83	59	92%	1.89	50%	0.10%	0.83	1.9%	0.00023	0.81	29.4035	0	0.83
51	262.71	69	92%	2.42	50%	0.10%	1.02	2.0%	0.00025	1.00	32.5122	0	1.02
52	242.40	58	92%	2.20	50%	0.10%	1.19	2.0%	0.00027	1.17	35.7546	0	1.19
53	256.64	76	92%	2.72	50%	0.10%	1.35	2.1%	0.00030	1.32	39.0305	0	1.35
54	259.76	76	92%	2.69	50%	0.20%	1.49	2.1%	0.00033	1.46	42.7648	0	1.49
55	257.23	96	92%	3.43	50%	0.20%	1.72	2.2%	0.00037	1.68	47.6029	0	1.72
56	251.32	104	92%	3.81	50%	0.20%	2.02	2.3%	0.00041	1.97	53.0388	0	2.02
57	247.67	122	92%	4.53	50%	0.30%	2.14	2.4%	0.00045	2.09	59.1988	0	2.14
58	241.58	148	92%	5.64	50%	0.30%	2.33	2.5%	0.00051	2.27	66.0009	0	2.33
59	234.65	101	92%	3.96	50%	0.30%	2.59	2.6%	0.00057	2.52	73.9058	0	2.59
60	235.06	135	92%	5.28	50%	0.40%	2.79	2.7%	0.00064	2.71	82.9591	0	2.79
61	240.45	168	92%	6.43	50%	0.40%	2.95	2.9%	0.00071	2.86	92.2272	0	2.95
62	247.05	174	92%	6.48	50%	0.40%	3.35	3.1%	0.00078	3.24	101.5178	0	3.35
63	246.93	193	92%	7.19	50%	0.50%	3.71	3.3%	0.00087	3.59	112.8709	0	3.71
64	240.99	209	92%	7.98	50%	0.50%	4.00	3.4%	0.00097	3.86	126.6296	0	4.00
65	237.03	228	92%	8.85	50%	0.60%	4.05	3.5%	0.00107	3.91	139.8505	0	4.05
66	238.22	241	92%	9.31	50%	0.60%	4.19	3.7%	0.00117	4.03	152.3144	0	4.19
67	239.70	182	92%	6.99	50%	0.70%	4.27	3.9%	0.00129	4.10	167.5594	0	4.27
68	237.43	221	92%	8.56	50%	0.70%	4.13	4.1%	0.00141	3.96	184.3656	0	4.13
69	237.42	226	92%	8.76	50%	0.70%	3.95	4.4%	0.00155	3.77	201.7962	0	3.95
70	237.78	192	92%	7.43	50%	0.80%	3.92	4.7%	0.00168	3.73	218.9571	0	3.92
71	244.70	200	92%	7.52	50%	0.80%	3.76	5.0%	0.00184	3.57	239.8394	0	3.76
72	253.39	183	92%	6.64	50%	0.90%	3.89	5.3%	0.00207	3.67	269.3109	0	3.89
73	259.69	197	92%	6.98	50%	0.90%	3.59	5.6%	0.00231	3.38	301.3986	0	3.59
74	171.14	185	92%	9.94	50%	1.00%	3.21	5.9%	0.00252	3.02	328.3922	0	3.21
75	160.95	78	92%	4.46	50%	1.00%	2.84	6.2%	0.00274	2.66	356.9071	0	2.84
76	174.24	72	92%	3.80	50%	1.00%	2.31	6.5%	0.00301	2.15	391.9935	0	2.31
77	181.16	58	92%	2.95	50%	1.10%	1.48	6.8%	0.00334	1.38	435.5571	0	1.48
78	185.86	34	92%	1.68	50%	1.10%	1.15	7.1%	0.00371	1.07	483.2467	0	1.15
79	178.90	35	92%	1.80	50%	1.10%	0.89	7.5%	0.00412	0.82	537.3947	0	0.89
80	165.73	21	92%	1.17	50%	1.10%	0.64	8.0%	0.00457	0.58	595.9681	0	0.64

3.6 MULTIPLE SCLEROSIS

3.6.1 Definition

The ABI model definition for Multiple Sclerosis is:

A definite diagnosis by a Consultant Neurologist of Multiple Sclerosis which satisfies all of the following criteria:

- *There must be current impairment of motor or sensory function, which must have persisted for a continuous period of at least six months.*
- *The diagnosis must be confirmed by diagnostic techniques current at the time of the claim.*

The important point to note here is that the claim is not paid until the disease reaches its so called "progressive stage" where there is a continued deterioration in the debilitating effect of the disease. It can be many years from onset before the disease reaches this stage.

3.6.2 Data Sources

- HES Data 1994/95
- "Multiple Sclerosis" by Bernie O'Brien, Office of Health Economics (1987).
- OPCS - Mortality Statistics by Cause, England and Wales, for 1993
- MSGP Data 1991/92

3.6.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.6.

The HES data (ICD Code 340) relates to "new and first ever" incidences and this first needs to be converted onto a "first ever" basis. This was done by examining the ratio of "first ever" and "new and first ever" incidence rates from MSGP 1991/92. However, the data here was very sparse, and so a broad approach has been necessary. A factor of 0.5 for all ages has been used; it is believed that this will incorporate a small margin of prudence.

No adjustments to the data for under reporting were considered necessary. In particular, the under-reporting arising from sudden death due to Multiple Sclerosis is unlikely to be significant.

The crude incidence rates were then calculated by dividing the adjusted HES incidences by the population of England. As these rates were only available for broad age groups, the incidence rates were then graduated to a quadratic curve using a least squares approach.

No adjustment to these incidence rates was considered necessary to allow for overlaps with other Critical Illnesses. However, a prevalence adjustment was necessary, so that the resulting incidence rates related to a population previously free from this Critical Illness. The prevalence of MS sufferers in the population has been estimated using "patient consulting rates" reported in MSGP 1991/92.

The incidence rates derived from the HES data relate to the "onset of illness" rather than the "onset of progressive form of illness". These rates, therefore, needed to be adjusted to bring them onto a progressive basis.

Data from O'Brien 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. However, 20% of the original sufferers 20 years from onset will still not have experienced the illness in its progressive form. Around 65% of sufferers will have entered the progressive stage within 10 years from onset.

In adjusting the rates to progressive form, 80% of all MS diagnoses are assumed to convert to progressive form at some point. Of these, 10% are assumed to occur immediately and the remaining 70% spread evenly over the following 14 years. It is important to note that this adjustment has a considerable impact at younger ages and the Base Table could significantly underestimate the true cost of MS if claims are paid closer to initial diagnosis.

To calculate the Stand-Alone incidence rates, an estimate of 28 day mortality is needed. ELT15 mortality was used for this purpose.

The Accelerated Critical Illness rates have been determined by using the Dash & Grimshaw model. The values of k_x have been obtained from OPCS - Mortality Statistics by Cause, England and Wales, for 1993 (ICD Code 340).

3.6.4 Trends

Over the period 1981/82 to 1991/92 the crude incidence rates reported in MSGP have increased from 0.1 per mille to 0.2 per mille. This increase is believed to be largely due to advancements in diagnosis. Given that we are considering the progressive form of the illness, trends in the underlying natural incidence of MS are more relevant than trends in detection. We could find no evidence that the underlying trend has changed over recent years, and so it would appear reasonable to assume no change in the incidence rates over the short term.

Critical Illness incidence Rates - MS (males)
MS Incidence Rates per 10,000 lives

Table 3.6 (m)

Age	Age Group	Population of England (1000's)	Number of MS Incidences	First Ever Adjustment	Crude Rate <i>(per 10,000)</i>	Graduated Crude Rate <i>(per 10,000)</i>	Adjustment for Overlap other with CT's	Consulation Rate	Grossed up Incidence Rate	Incidence Rate adjusted for progressive form	28 Day Mortality Rate <i>(ELT 15)</i>	Stand-Alone Rate <i>(per 10,000)</i>	ELT 15 Population qx <i>(per 10,000)</i>	Proportion of Deaths from MS <i>(k_x)</i>	Extra Cost for Accelerated <i>(i_x - k_x * q_x)</i>			
20	15 - 19	1448.7	14	50%	0.05	0.460566	0%	0.00010	0.46	0.10	0.00006	0.10	8.4267	0.0000	0.10			
21						0.533797	0%	0.00024	0.53	0.13	0.00007	0.13	0.13	0.00007	0.13	8.6371	0.0000	0.13
22						0.604498	0%	0.00037	0.60	0.17	0.00007	0.17	0.17	0.00007	0.17	8.8479	0.0000	0.17
23						0.672669	0%	0.00051	0.67	0.20	0.00007	0.20	0.20	0.00007	0.20	8.8558	0.0003	0.20
24						0.738310	0%	0.00064	0.74	0.24	0.00007	0.24	0.24	0.00007	0.24	8.8636	0.0007	0.24
25	20 - 44	9051.7	1632	50%	0.90	0.801421	0%	0.00078	0.80	0.29	0.00007	0.29	8.5656	0.0010	0.28			
26						0.862002	0%	0.00091	0.86	0.33	0.00006	0.33	0.33	0.00006	0.33	8.4709	0.0013	0.32
27						0.920053	0%	0.00105	0.92	0.38	0.00007	0.38	0.38	0.00007	0.38	8.4780	0.0017	0.37
28						0.975574	0%	0.00119	0.98	0.43	0.00007	0.43	0.43	0.00007	0.43	8.6897	0.0021	0.41
29						1.028565	0%	0.00132	1.03	0.49	0.00007	0.49	0.49	0.00007	0.49	8.9019	0.0026	0.46
30	20 - 44	9051.7	1632	50%	0.90	1.079026	0%	0.00146	1.08	0.54	0.00007	0.54	9.1147	0.0031	0.51			
31						1.126957	0%	0.00159	1.13	0.59	0.00007	0.59	0.59	0.00007	0.59	9.3280	0.0035	0.56
32						1.172359	0%	0.00173	1.17	0.64	0.00007	0.64	0.64	0.00007	0.64	9.7471	0.0040	0.60
33						1.215230	0%	0.00186	1.22	0.69	0.00008	0.69	0.69	0.00008	0.69	9.9620	0.0044	0.65
34						1.255571	0%	0.00200	1.26	0.74	0.00008	0.74	0.74	0.00008	0.74	10.5888	0.0049	0.68
35	20 - 44	9051.7	1632	50%	0.90	1.293382	0%	0.00213	1.30	0.78	0.00009	0.78	11.6291	0.0054	0.72			
36						1.328664	0%	0.00226	1.33	0.82	0.00010	0.82	0.82	0.00010	0.82	12.7760	0.0058	0.75
37						1.361415	0%	0.00239	1.36	0.86	0.00011	0.86	0.86	0.00011	0.86	13.7208	0.0063	0.77
38						1.391636	0%	0.00252	1.40	0.90	0.00011	0.90	0.90	0.00011	0.90	14.9793	0.0058	0.81
39						1.419328	0%	0.00265	1.42	0.93	0.00012	0.93	0.93	0.00012	0.93	16.0364	0.0052	0.85
40	20 - 44	9051.7	1632	50%	0.90	1.444489	0%	0.00278	1.45	0.97	0.00013	0.97	17.2021	0.0046	0.89			
41						1.467120	0%	0.00291	1.47	1.00	0.00014	1.00	1.00	0.00014	1.00	18.5812	0.0041	0.92
42						1.487222	0%	0.00304	1.49	1.03	0.00015	1.03	1.03	0.00015	1.03	20.1758	0.0035	0.96
43						1.504793	0%	0.00317	1.51	1.06	0.00017	1.06	1.06	0.00017	1.06	21.8839	0.0038	0.97
44						1.519835	0%	0.00330	1.52	1.08	0.00018	1.08	1.08	0.00018	1.08	24.0206	0.0040	0.99
45	45 - 54	3052.2	1144	50%	1.87	1.532346	0%	0.00343	1.54	1.11	0.00020	1.10	26.6957	0.0042	0.99			
46						1.542328	0%	0.00356	1.55	1.13	0.00023	1.13	1.13	0.00023	1.13	29.7063	0.0045	0.99
47						1.549779	0%	0.00369	1.56	1.15	0.00025	1.15	1.15	0.00025	1.15	33.1638	0.0047	0.99
48						1.554701	0%	0.00382	1.56	1.16	0.00029	1.16	1.16	0.00029	1.16	37.1826	0.0044	1.00
49						1.557093	0%	0.00395	1.56	1.18	0.00032	1.18	1.18	0.00032	1.18	41.4564	0.0041	1.01
50	45 - 54	3052.2	1144	50%	1.87	1.556954	0%	0.00408	1.56	1.19	0.00036	1.19	46.4200	0.0038	1.02			
51						1.554286	0%	0.00421	1.56	1.20	0.00040	1.20	1.20	0.00040	1.20	51.8778	0.0035	1.02
52						1.549088	0%	0.00434	1.56	1.21	0.00044	1.21	1.21	0.00044	1.21	57.7395	0.0032	1.03
53						1.541359	0%	0.00447	1.55	1.22	0.00049	1.22	1.22	0.00049	1.22	64.2391	0.0031	1.02
54						1.531101	0%	0.00460	1.54	1.22	0.00055	1.22	1.22	0.00055	1.22	71.4029	0.0030	1.01
55	55 - 64	2373.9	725	50%	1.53	1.518313	0%	0.00436	1.52	1.23	0.00061	1.23	79.7001	0.0028	1.00			
56						1.502995	0%	0.00412	1.51	1.23	0.00068	1.23	1.23	0.00068	1.23	89.0706	0.0027	0.99
57						1.485147	0%	0.00388	1.49	1.23	0.00076	1.23	1.23	0.00076	1.23	99.4603	0.0026	0.97
58						1.464769	0%	0.00364	1.47	1.23	0.00085	1.22	1.23	0.00085	1.22	111.1587	0.0025	0.95
59						1.441860	0%	0.00340	1.45	1.22	0.00095	1.22	1.22	0.00095	1.22	124.2526	0.0024	0.93
60	55 - 64	2373.9	725	50%	1.53	1.416422	0%	0.00316	1.42	1.21	0.00107	1.21	139.1932	0.0022	0.91			
61						1.388454	0%	0.00292	1.39	1.20	0.00120	1.20	1.20	0.00120	1.20	156.0106	0.0021	0.88
62						1.357956	0%	0.00268	1.36	1.19	0.00134	1.19	1.19	0.00134	1.19	174.8779	0.0019	0.86
63						1.324928	0%	0.00244	1.33	1.18	0.00151	1.18	1.18	0.00151	1.18	196.4910	0.0017	0.84
64						1.289370	0%	0.00220	1.29	1.16	0.00169	1.16	1.16	0.00169	1.16	219.9171	0.0015	0.83
65	65 - 74	1975.9	339	50%	0.86	1.251282	0%	0.00196	1.25	1.15	0.00188	1.14	244.6622	0.0013	0.82			
66						1.210665	0%	0.00172	1.21	1.13	0.00208	1.12	1.13	0.00208	1.12	271.0949	0.0011	0.82
67						1.167517	0%	0.00148	1.17	1.11	0.00230	1.10	1.11	0.00230	1.10	299.6439	0.0009	0.82
68						1.121839	0%	0.00124	1.12	1.08	0.00253	1.08	1.08	0.00253	1.08	329.1736	0.0009	0.79
69						1.073631	0%	0.00100	1.07	1.06	0.00276	1.05	1.06	0.00276	1.05	360.2085	0.0009	0.75
70	65 - 74	1975.9	339	50%	0.86	1.022893	0%	0.00101	1.02	1.03	0.00301	1.03	392.9175	0.0008	0.71			
71						0.969625	0%	0.00102	0.97	1.00	0.00331	1.00	1.00	0.00331	1.00	431.1650	0.0008	0.67
72						0.913828	0%	0.00103	0.91	0.97	0.00364	0.96	0.97	0.00364	0.96	474.5692	0.0007	0.63
73						0.855500	0%	0.00104	0.86	0.93	0.00400	0.93	0.93	0.00400	0.93	521.7056	0.0007	0.59
74						0.794642	0%	0.00105	0.80	0.90	0.00437	0.89	0.90	0.00437	0.89	569.7189	0.0006	0.57
75	75 - 84	927.2	66	50%	0.36	0.731255	0%	0.00106	0.73	0.86	0.00475	0.86	619.7199	0.0005	0.56			
76						0.665337	0%	0.00107	0.67	0.82	0.00520	0.82	0.82	0.00520	0.82	677.6744	0.0004	0.54
77						0.596889	0%	0.00108	0.60	0.78	0.00569	0.78	0.78	0.00569	0.78	741.7506	0.0003	0.53
78						0.525912	0%	0.00109	0.53	0.74	0.00622	0.73	0.74	0.00622	0.73	810.2217	0.0003	0.48
79						0.452404	0%	0.00110	0.45	0.69	0.00678	0.69	0.69	0.00678	0.69	883.6740	0.0003	0.44
80	75 - 84	927.2	66	50%	0.36	0.376367	0%	0.00092	0.38	0.64	0.00738	0.64	961.5810	0.0003	0.40			

Critical Illness Incidence Rates - MS (females)
MS Incidence Rates per 10,000 lives

Table 3.6 (f)

Age	Age Group	Population of England (1000's)	Number of MS Incidences	First Ever Adjustment	Crude Rate (per 10,000)	Graduated Crude Rate (per 10,000)	Adjustment for Overlap with CT's	Consulation Rate	Grossed up Incidence Rate	Rate adjusted for progressive form	28 Day Mortality Rate (ELT 15)	Stand-Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from MS (Kx)	Extra Cost for Accelerated ($i_x - k_x * q_x$)
20	15 - 19	1365.3	38	50%	0.14	0.95	0%	0.00030	0.95	0.22	0.00002	0.22	3.1327	0.0010	0.22
21						1.08	0%	0.00064	1.08	0.29	0.00002	0.29	3.2347	0.0014	0.28
22						1.21	0%	0.00097	1.21	0.35	0.00002	0.35	3.2358	0.0017	0.35
23						1.34	0%	0.00131	1.34	0.43	0.00003	0.43	3.3380	0.0024	0.42
24						1.46	0%	0.00164	1.46	0.50	0.00002	0.50	3.2379	0.0031	0.49
25						1.57	0%	0.00198	1.57	0.59	0.00003	0.59	3.4414	0.0038	0.58
26						1.68	0%	0.00231	1.69	0.68	0.00003	0.68	3.4426	0.0045	0.66
27						1.79	0%	0.00265	1.79	0.77	0.00003	0.77	3.5451	0.0051	0.76
28						1.89	0%	0.00299	1.89	0.87	0.00003	0.87	3.8503	0.0065	0.85
29						1.98	0%	0.00332	1.99	0.98	0.00003	0.98	3.9531	0.0078	0.94
30	20 - 44	8792.8	3541	50%	2.01	2.08	0%	0.00366	2.08	1.07	0.00003	1.07	4.3603	0.0091	1.03
31						2.16	0%	0.00399	2.17	1.17	0.00004	1.17	4.6665	0.0104	1.12
32						2.24	0%	0.00433	2.25	1.26	0.00004	1.26	5.1762	0.0118	1.20
33						2.32	0%	0.00466	2.33	1.35	0.00004	1.35	5.7882	0.0126	1.27
34						2.39	0%	0.00500	2.41	1.43	0.00005	1.43	6.1979	0.0134	1.35
35						2.46	0%	0.00503	2.47	1.51	0.00005	1.51	6.9134	0.0142	1.41
36						2.52	0%	0.00506	2.54	1.59	0.00006	1.59	7.5287	0.0149	1.47
37						2.58	0%	0.00509	2.60	1.66	0.00006	1.66	8.2470	0.0157	1.53
38						2.64	0%	0.00512	2.65	1.73	0.00007	1.73	8.9671	0.0154	1.59
39						2.68	0%	0.00515	2.70	1.79	0.00008	1.79	9.7911	0.0150	1.64
40	2.73	0%	0.00518	2.74	1.85	0.00008	1.85	10.7195	0.0147	1.69					
41	2.77	0%	0.00521	2.78	1.91	0.00009	1.91	11.6508	0.0143	1.74					
42	2.80	0%	0.00524	2.82	1.96	0.00010	1.96	12.8923	0.0140	1.78					
43	2.83	0%	0.00527	2.85	2.01	0.00011	2.01	14.1383	0.0130	1.83					
44	2.86	0%	0.00530	2.87	2.05	0.00012	2.05	15.7999	0.0120	1.87					
45	2.88	0%	0.00533	2.89	2.10	0.00014	2.10	17.7773	0.0110	1.90					
46	2.89	0%	0.00536	2.91	2.13	0.00015	2.13	19.7649	0.0100	1.94					
47	2.90	0%	0.00539	2.92	2.17	0.00017	2.17	21.8669	0.0090	1.97					
48	2.91	0%	0.00542	2.92	2.20	0.00019	2.20	24.1890	0.0088	1.98					
49	2.91	0%	0.00545	2.93	2.22	0.00020	2.22	26.6310	0.0087	1.99					
50	45 - 54	3053.2	2225	50%	3.64	2.91	0%	0.00548	2.92	2.24	0.00023	2.24	29.4035	0.0086	1.99
51						2.90	0%	0.00551	2.91	2.26	0.00025	2.26	32.5122	0.0084	1.99
52						2.88	0%	0.00554	2.90	2.28	0.00027	2.28	35.7546	0.0083	1.98
53						2.87	0%	0.00557	2.88	2.29	0.00030	2.29	39.0305	0.0083	1.97
54						2.84	0%	0.00560	2.86	2.29	0.00033	2.29	42.7648	0.0082	1.94
55						2.82	0%	0.00546	2.83	2.30	0.00037	2.30	47.6029	0.0082	1.91
56						2.78	0%	0.00532	2.80	2.30	0.00041	2.30	53.0388	0.0081	1.87
57						2.75	0%	0.00518	2.76	2.29	0.00045	2.29	59.1988	0.0081	1.81
58						2.71	0%	0.00504	2.72	2.28	0.00051	2.28	66.0009	0.0073	1.80
59						2.66	0%	0.00490	2.67	2.27	0.00057	2.27	73.9058	0.0064	1.80
60	55 - 64	2443.2	1259	50%	2.58	2.61	0%	0.00476	2.62	2.26	0.00064	2.25	82.9591	0.0056	1.79
61						2.55	0%	0.00462	2.56	2.24	0.00071	2.23	92.2272	0.0048	1.79
62						2.49	0%	0.00448	2.50	2.21	0.00078	2.21	101.5178	0.0040	1.81
63						2.43	0%	0.00434	2.44	2.18	0.00087	2.18	112.8709	0.0037	1.77
64						2.36	0%	0.00420	2.37	2.15	0.00097	2.15	126.6296	0.0034	1.72
65						2.28	0%	0.00406	2.29	2.12	0.00107	2.11	139.8505	0.0032	1.67
66						2.20	0%	0.00392	2.21	2.08	0.00117	2.08	152.3144	0.0029	1.64
67						2.12	0%	0.00378	2.13	2.03	0.00129	2.03	167.5594	0.0026	1.59
68						2.03	0%	0.00364	2.04	1.99	0.00141	1.98	184.3656	0.0025	1.53
69						1.93	0%	0.00350	1.94	1.94	0.00155	1.93	201.7962	0.0023	1.47
70	65 - 74	2375.8	642	50%	1.35	1.84	0%	0.00317	1.84	1.88	0.00168	1.88	218.9571	0.0022	1.41
71						1.73	0%	0.00284	1.74	1.82	0.00184	1.82	239.8394	0.0020	1.35
72						1.62	0%	0.00251	1.63	1.76	0.00207	1.76	269.3109	0.0018	1.27
73						1.51	0%	0.00218	1.51	1.70	0.00231	1.69	301.3986	0.0016	1.22
74						1.39	0%	0.00185	1.40	1.63	0.00252	1.62	328.3922	0.0013	1.19
75						1.27	0%	0.00152	1.27	1.55	0.00274	1.55	356.9071	0.0011	1.16
76						1.14	0%	0.00119	1.15	1.48	0.00301	1.47	391.9935	0.0009	1.14
77						1.01	0%	0.00086	1.01	1.40	0.00334	1.39	435.5571	0.0006	1.13
78						0.88	0%	0.00053	0.88	1.31	0.00371	1.31	483.2467	0.0006	1.04
79						0.73	0%	0.00020	0.73	1.22	0.00412	1.22	537.3947	0.0005	0.94
80	0.59	0%	0.00017	0.59	1.13	0.00457	1.12	595.9681	0.0005	0.84					

3.7 KIDNEY FAILURE (KF)

3.7.1 Definition

The ABI model definition for Kidney Failure is :-

End-stage renal failure presenting as chronic irreversible failure of both kidneys to function, as a result of which either regular renal dialysis or renal transplant is initiated.

3.7.2 Data Sources

- HES Data 1994/95
- The European Dialysis and Transplant Association (EDTA)
- UK Transplant Support Services Authority (UKTSSA) reports. UKTSSA is a special health authority of the NHS providing a 24-hour support service to all transplant units in the UK for the matching and allocation of organs for transplant.
- ONS "Britain 1998" and "Britain 2000" Official UK Yearbooks. These yearbooks include a section giving number of organ transplants performed.
- OPCS - Mortality Statistics by Cause, England and Wales, for 1993.

3.7.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.7.

Although this Critical Illness is headlined "Kidney Failure" the definition actually hinges on treatment. The claim trigger is compound : part operation; part dialysis treatment. Data on kidney transplant operations is relatively easy to obtain and validate. However, under the stated definition, a Kidney Failure claim would generally be triggered earlier through acceptance onto a program of regular renal dialysis. Data on dialysis, covering, in particular, the first incidence of treatment is really required but does not seem to be readily available.

However, it is clear from initial inspection of the data that the incidence rate for Kidney Failure is very small and of low significance within a Critical Illness contract. Accordingly, a more approximate approach to estimating incidence rates for Kidney Failure has been adopted.

Data from EDTA gives crude incidence rates per 100,000 (male/female combined), for the UK, based on acceptance for dialysis or transplant treatment.

Age Bands	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+
Rate	2.7	3.3	4.4	2.3	0.4	0.0

This is the form of information required, but this (sparse) data relates to the 1980's and has only been received second hand and without reference to the original report. As a necessary check, therefore, these incidence rates have been compared and combined with other data.

MSGP data shows the incidence of various kidney-related diseases but is inconclusive as a guide to the specific treatment-based definition in use here.

HES data for 1994/95 was used to obtain the incidence of kidney transplant. The operation code used was M01. Crude population incidence rates, for 10-year age bands, were calculated by dividing these incidences by the population of England.

Age Band	Under 20	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 +	All Ages
Number of Transplants 1994/95								
Males	72	141	156	163	176	112	19	839
Females	45	88	104	105	97	48	13	500
Incidence Rate per 100,000								
Males	1.2	4.0	4.3	5.2	7.0	5.4	0.9	3.7
Females	0.8	2.6	3.0	3.3	3.8	2.1	0.4	2.1
All Lives	1.0	3.4	3.7	4.2	5.4	3.7	0.6	2.9
Approximate Ratio of Incidence Rates for EDTA against HES								
Ratio	70%	75%	80%	90%	70%	50%	20%	80%

Data from UKTSSA and ONS suggest that the number of kidney transplants per year is fairly stable so that it is reasonable to use the EDTA data without adjustment for time trends.

The EDTA incidence rates show an earlier peak with respect to age. This is to be expected as many patients would spend a considerable period undergoing regular dialysis treatment before a donor organ became available for transplant.

The overall level of the EDTA rates may appear low compared to the reported incidence of transplants. However, the data is not necessarily inconsistent and any approximation error should be viewed in the context outlined above.

To make the most of the available data, separate incidence rates for males and females, derived from HES kidney transplant data, have been used as a base. Age banded adjustments were applied to bring the totals (male/female combined) in line with EDTA incidence rates by age. These age-banded rates have then been worked into a reasonably smooth, full, age-specific table by simplistic curve fitting, cross-checked against the 10-year crude average rates.

Given that the HES Data relates to transplants and excludes dialysis, it is likely that the resulting incidence rates will be understated. However, any understatement here can be crudely offset against deliberate overstatement in other parts of the rate derivation. In particular, no allowance has been made for post-operative or dialysis treatment mortality.

Note that the incidence of Kidney Failure, as defined, runs down to zero at ages 75 and above. This contrasts with the real incidence of kidney disease which certainly increases at older ages. However, the Kidney Failure definition relies upon certain forms of treatment which are unlikely to be initiated at advanced age.

Renal failure overall has a significant correlation with other Critical Illnesses. However, the definition rests on acceptance for dialysis or transplantation, and such treatment is unlikely to be given where renal failure is secondary to some other disease. It is felt, therefore, that the above derivation of incidence rates already makes a reasonable allowance for any overlap with other Critical Illnesses.

No further adjustment has been considered necessary to ensure the rates relate to "first events".

No adjustment was required for under-reporting, such as sudden deaths prior to the hospital episode in the HES data, as it is the number of acceptances for dialysis/operation which is being analysed.

No adjustment has been made for prevalence of Kidney Failure in the general population as the proportion of lives affected is clearly negligible.

To obtain Stand-Alone incidence rates, an estimate of 28 day mortality following Kidney Failure is needed. We are not aware of any relevant UK mortality data for this study. Fabrizio & Grattan quote an annual mortality rate of 11.5% for dialysis patients in Australia / NZ. This potential adjustment has, however, been ignored, as mentioned above.

The Accelerated Critical Illness rates were determined using the Dash & Grimshaw model. The values of k_x have been determined from OPCS - Mortality Statistics by Cause, England and Wales, for 1993, using ICD codes 584 to 586, for renal failure.

3.7.4 Trends

The incidences for kidney transplants in the UK over 1990 to 1998 were :

Data from UKTSSA	
1990	1,874
1991	1,767
1992	1,770
1993	1,684
1994	1,744
Data from ONS Britain Yearbooks	
1996	1,683
1998	1,616

The number of kidney transplants seems to have been relatively stable over the period shown. However, the waiting list for transplants increased from 3,850 in 1990 to 4,970 in 1994.

In the absence of any available data showing a clear trend on new incidences of dialysis or kidney disease generally, it may be appropriate to assume that no adjustment is necessary to re-base the table to current levels of experience.

Critical Illness Incidence Rates - Kidney Failure (males)
Incidence Rates per 10,000 Lives

Table 3.7 (m)

Age	Age Group	Population of England ('000's)	Number of Kidney Failures HES Data	Adjustment from Other Data Sources	First Ever Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Crude Rate (per 10,000)	Interpolated Smoothed Rate (ix) (per 10,000)	Operative Mortality Rate	28 Day Mortality Rate (ELT 15) (per 10,000)	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from Kidney Failure (k _x)	Extra Cost for Accelerated (i _x - k _x * q _x)
20										0.20	0.0%	0.00006	0.20	8.4267	0.0012	0.20
21										0.22	0.0%	0.00007	0.22	8.6371	0.0012	0.22
22										0.24	0.0%	0.00007	0.24	8.8479	0.0012	0.24
23										0.26	0.0%	0.00007	0.26	8.8558	0.0013	0.26
24										0.28	0.0%	0.00007	0.28	8.8636	0.0013	0.28
25	20 to 29	3,873.67	141	75%	100%	0.27	0%	0.00%	0.27	0.29	0.0%	0.00007	0.29	8.5656	0.0014	0.29
26										0.30	0.0%	0.00006	0.30	8.4709	0.0015	0.30
27										0.31	0.0%	0.00007	0.31	8.4780	0.0016	0.31
28										0.31	0.0%	0.00007	0.31	8.6897	0.0017	0.31
29										0.32	0.0%	0.00007	0.32	8.9019	0.0018	0.32
30										0.32	0.0%	0.00007	0.32	9.1147	0.0020	0.32
31										0.33	0.0%	0.00007	0.33	9.3280	0.0022	0.33
32										0.33	0.0%	0.00007	0.33	9.7471	0.0023	0.33
33										0.34	0.0%	0.00008	0.34	9.9620	0.0024	0.34
34										0.34	0.0%	0.00008	0.34	10.5888	0.0023	0.34
35	30 to 39	3,576.42	156	80%	100%	0.35	0%	0.00%	0.35	0.35	0.0%	0.00009	0.35	11.6291	0.0022	0.35
36										0.36	0.0%	0.00010	0.36	12.7760	0.0020	0.36
37										0.37	0.0%	0.00011	0.37	13.7208	0.0018	0.37
38										0.38	0.0%	0.00011	0.38	14.9793	0.0017	0.38
39										0.39	0.0%	0.00012	0.39	16.0364	0.0015	0.39
40										0.40	0.0%	0.00013	0.40	17.2021	0.0012	0.40
41										0.41	0.0%	0.00014	0.41	18.5812	0.0010	0.41
42										0.42	0.0%	0.00015	0.42	20.1758	0.0008	0.42
43										0.43	0.0%	0.00017	0.43	21.8839	0.0007	0.43
44										0.44	0.0%	0.00018	0.44	24.0206	0.0007	0.44
45	40 to 49	3,289.39	163	90%	100%	0.45	0%	0.00%	0.45	0.45	0.0%	0.00020	0.45	26.6957	0.0007	0.45
46										0.47	0.0%	0.00023	0.47	29.7063	0.0008	0.47
47										0.48	0.0%	0.00025	0.48	33.1638	0.0009	0.48
48										0.50	0.0%	0.00029	0.50	37.1826	0.0010	0.50
49										0.51	0.0%	0.00032	0.51	41.4564	0.0013	0.51
50										0.52	0.0%	0.00036	0.52	46.4200	0.0016	0.52
51										0.52	0.0%	0.00040	0.52	51.8778	0.0020	0.52
52										0.52	0.0%	0.00044	0.52	57.7395	0.0023	0.52
53										0.52	0.0%	0.00049	0.52	64.2391	0.0025	0.52
54										0.51	0.0%	0.00055	0.51	71.4029	0.0026	0.51
55	50 to 59	2,528.46	176	70%	100%	0.49	0%	0.00%	0.49	0.50	0.0%	0.00061	0.50	79.7001	0.0026	0.50
56										0.48	0.0%	0.00068	0.48	89.0706	0.0026	0.48
57										0.46	0.0%	0.00076	0.46	99.4603	0.0026	0.46
58										0.43	0.0%	0.00085	0.43	111.1587	0.0026	0.43
59										0.41	0.0%	0.00095	0.41	124.2526	0.0026	0.41
60										0.38	0.0%	0.00107	0.38	139.1932	0.0025	0.38
61										0.36	0.0%	0.00120	0.36	156.0106	0.0024	0.36
62										0.33	0.0%	0.00134	0.33	174.8779	0.0024	0.33
63										0.31	0.0%	0.00151	0.31	196.4910	0.0025	0.31
64										0.28	0.0%	0.00169	0.28	219.9171	0.0028	0.28
65	60 to 69	2,191.87	112	50%	100%	0.26	0%	0.00%	0.26	0.26	0.0%	0.00188	0.26	244.6622	0.0031	0.26
66										0.23	0.0%	0.00208	0.23	271.0949	0.0035	0.23
67										0.20	0.0%	0.00230	0.20	299.6439	0.0039	0.20
68										0.16	0.0%	0.00253	0.16	329.1736	0.0041	0.16
69										0.13	0.0%	0.00276	0.13	360.2085	0.0042	0.13
70										0.10	0.0%	0.00301	0.10	392.9175	0.0043	0.10
71										0.08	0.0%	0.00331	0.08	431.1650	0.0042	0.08
72										0.06	0.0%	0.00364	0.06	474.5692	0.0042	0.06
73										0.04	0.0%	0.00400	0.04	521.7056	0.0043	0.04
74										0.02	0.0%	0.00437	0.02	569.7189	0.0045	0.02
75	70 to 85	1,848.72	19	20%	100%	0.02	0%	0.00%	0.02	0.01	0.0%	0.00475	0.01	619.7199	0.0047	0.01
76										0.00	0.0%	0.00520	0.00	677.6744	0.0050	0.00
77										0.00	0.0%	0.00569	0.00	741.7506	0.0052	0.00
78										0.00	0.0%	0.00622	0.00	810.2217	0.0054	0.00
79										0.00	0.0%	0.00678	0.00	883.6740	0.0056	0.00
80										0.00	0.0%	0.00738	0.00	961.5810	0.0057	0.00

Critical Illness Incidence Rates - Kidney Failure (females)
Incidence Rates per 10,000 Lives

Table 3.7 (f)

Age	Age Group	Population of England (000's)	Number of Kidney Failures HES Data	Adjustment from Other Data Sources	First Ever Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Crude Rate (per 10,000)	Interpolated Smoothed Rate (ix) (per 10,000)	Operative Mortality Rate	28 Day Mortality Rate (EQT 15) (per 10,000)	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from Kidney Failure (k _x)	Extra Cost for Accelerated (l _x - k _x * q _x)
20										0.12	0.0%	0.00006	0.12	8.4267	0.0035	0.12
21										0.14	0.0%	0.00007	0.14	8.6371	0.0032	0.14
22										0.15	0.0%	0.00007	0.15	8.8479	0.0066	0.15
23										0.17	0.0%	0.00007	0.17	8.8558	0.0074	0.17
24										0.18	0.0%	0.00007	0.18	8.8636	0.0069	0.18
25	20 to 29	3,703.13	88	75%	100%	0.18	0%	0.00%	0.18	0.20	0.0%	0.00007	0.20	8.5656	0.0057	0.20
26										0.20	0.0%	0.00006	0.20	8.4709	0.0042	0.20
27										0.21	0.0%	0.00007	0.21	8.4780	0.0029	0.21
28										0.21	0.0%	0.00007	0.21	8.6897	0.0019	0.21
29										0.22	0.0%	0.00007	0.22	8.9019	0.0016	0.22
30										0.22	0.0%	0.00007	0.22	9.1147	0.0016	0.22
31										0.22	0.0%	0.00007	0.22	9.3280	0.0017	0.22
32										0.23	0.0%	0.00007	0.23	9.7471	0.0018	0.23
33										0.23	0.0%	0.00008	0.23	9.9620	0.0019	0.23
34										0.24	0.0%	0.00008	0.24	10.5888	0.0020	0.24
35	30 to 39	3,493.22	104	80%	100%	0.24	0%	0.00%	0.24	0.24	0.0%	0.00009	0.24	11.6291	0.0021	0.24
36										0.25	0.0%	0.00010	0.25	12.7760	0.0021	0.25
37										0.25	0.0%	0.00011	0.25	13.7208	0.0022	0.25
38										0.26	0.0%	0.00011	0.26	14.9793	0.0023	0.26
39										0.26	0.0%	0.00012	0.26	16.0364	0.0025	0.26
40										0.27	0.0%	0.00013	0.27	17.2021	0.0027	0.27
41										0.28	0.0%	0.00014	0.28	18.5812	0.0030	0.28
42										0.28	0.0%	0.00015	0.28	20.1758	0.0032	0.28
43										0.29	0.0%	0.00017	0.29	21.8839	0.0033	0.29
44										0.29	0.0%	0.00018	0.29	24.0206	0.0033	0.29
45	40 to 49	3,280.89	105	90%	100%	0.29	0%	0.00%	0.29	0.30	0.0%	0.00020	0.30	26.6957	0.0032	0.30
46										0.30	0.0%	0.00023	0.30	29.7063	0.0030	0.30
47										0.30	0.0%	0.00025	0.30	33.1638	0.0029	0.30
48										0.30	0.0%	0.00029	0.30	37.1826	0.0027	0.30
49										0.30	0.0%	0.00032	0.30	41.4564	0.0025	0.30
50										0.30	0.0%	0.00036	0.30	46.4200	0.0024	0.30
51										0.30	0.0%	0.00040	0.30	51.8778	0.0022	0.30
52										0.30	0.0%	0.00044	0.30	57.7395	0.0021	0.30
53										0.29	0.0%	0.00049	0.29	64.2391	0.0020	0.29
54										0.29	0.0%	0.00055	0.29	71.4029	0.0022	0.29
55	50 to 59	2,541.78	97	70%	100%	0.27	0%	0.00%	0.27	0.28	0.0%	0.00061	0.28	79.7001	0.0025	0.28
56										0.27	0.0%	0.00068	0.27	89.0706	0.0029	0.27
57										0.25	0.0%	0.00076	0.25	99.4603	0.0032	0.25
58										0.22	0.0%	0.00085	0.22	111.1587	0.0034	0.22
59										0.20	0.0%	0.00095	0.20	124.2526	0.0034	0.20
60										0.18	0.0%	0.00107	0.18	139.1932	0.0033	0.18
61										0.16	0.0%	0.00120	0.16	156.0106	0.0032	0.16
62										0.14	0.0%	0.00134	0.14	174.8779	0.0031	0.14
63										0.12	0.0%	0.00151	0.12	196.4910	0.0030	0.12
64										0.10	0.0%	0.00169	0.10	219.9171	0.0032	0.10
65	60 to 69	2,400.29	48	50%	100%	0.10	0%	0.00%	0.10	0.08	0.0%	0.00188	0.08	244.6622	0.0034	0.08
66										0.07	0.0%	0.00208	0.07	271.0949	0.0037	0.07
67										0.06	0.0%	0.00230	0.06	299.6439	0.0039	0.06
68										0.05	0.0%	0.00253	0.05	329.1736	0.0041	0.05
69										0.04	0.0%	0.00276	0.04	360.2085	0.0043	0.04
70										0.03	0.0%	0.00301	0.03	392.9175	0.0043	0.03
71										0.02	0.0%	0.00331	0.02	431.1650	0.0044	0.02
72										0.02	0.0%	0.00364	0.02	474.5692	0.0044	0.02
73										0.01	0.0%	0.00400	0.01	521.7056	0.0045	0.01
74										0.01	0.0%	0.00437	0.01	569.7189	0.0045	0.01
75	70 to 85	2,764.81	13	20%	100%	0.01	0%	0.00%	0.01	0.00	0.0%	0.00475	0.00	619.7199	0.0046	0.00
76										0.00	0.0%	0.00520	0.00	677.6744	0.0046	0.00
77										0.00	0.0%	0.00569	0.00	741.7506	0.0047	0.00
78										0.00	0.0%	0.00622	0.00	810.2217	0.0048	0.00
79										0.00	0.0%	0.00678	0.00	883.6740	0.0049	0.00
80										0.00	0.0%	0.00738	0.00	961.5810	0.0051	0.00

3.8 MAJOR ORGAN TRANSPLANT (MOT)

3.8.1 Definition

The ABI model definition for MOT is :-

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

Kidney is generally omitted from the list of organs in the MOT definition as kidney transplant is typically covered as a critical illness under "Kidney Failure".

3.8.2 Data Sources

- HES Data 1994/5
- UK Transplant Support Services Authority (UKTSSA) Reports. UKTSSA is a special health authority of the NHS providing a 24-hour support service to all transplant units in the UK for the matching and allocation of organs for transplant.

3.8.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.8.

Data on MOT operations is relatively easy to obtain and validate. However, under the stated definition, a MOT claim would often be triggered earlier through acceptance onto an appropriate waiting list. Data on waiting lists, covering, in particular, the incidence of new entrants to the list is really required but does not seem to be readily available.

However, it is clear from initial inspection of the data that the incidence rate for MOT is very small and of low significance within a normal Critical Illness contract. Accordingly, a more approximate approach to estimating incidence rates for MOT has been adopted.

Incidence rates have been based directly on data for MOT operations. A degree of underestimate, by ignoring any theoretical increase necessary to reflect acceptances onto the waiting list, has been crudely offset against deliberate overestimates in parts of the rate derivation. In particular, the overlap with other Critical Illnesses has been understated; operative mortality has been ignored; and a timing/trend adjustment has been ignored.

This approach, using operations data, should not significantly distort the age profile of the incidence rates. Given the implied severity of medical condition, individuals entering a waiting list for MOT would not generally expect to survive on the list for long.

HES data for 1994/95 was used to obtain the incidences of MOT. The operation codes used were : K01 for heart & lung; K02 for heart; E53 for lung; J01 for liver; J54 for pancreas; and W34 for bone marrow. The table overleaf shows the number of incidences:

Number of Major Organ Transplants (HES 1994/95)

Age Band	Under 20	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 +	All Ages
Males								
Heart	15	9	16	50	114	27	2	233
Hrt& Lung	5	9	3	4	4	0	0	25
Lung	2	7	4	13	18	4	0	48
Liver	36	14	24	52	63	39	1	229
Pancreas	0	0	1	1	0	0	0	2
Total	58	39	48	120	199	70	3	537
Females								
Heart	8	3	4	7	15	2	0	39
Hrt&Lung	4	4	6	4	3	0	0	21
Lung	3	4	7	16	16	1	0	47
Liver	57	17	29	50	60	36	1	250
Pancreas	0	0	1	1	0	0	0	2
Total	72	28	47	78	94	39	1	359
Additional Information : Bone Marrow Transplants								
Males	104	71	68	69	60	12	2	386
Females	81	37	58	49	45	5	9	284

Bone Marrow transplants have been excluded since they arise largely in the treatment of leukaemia and other cancers and so are already allowed for in the Cancer incidence rates. Also, kidney transplants have been excluded from consideration, as noted in Section 3.8.1. No further adjustment for overlap has been made, although there may be considerable overlap with other Critical Illnesses for heart transplants in particular.

No adjustment has been made to remove second and subsequent transplant events. It is assumed that a very high proportion of these operations are "first event" transplants for the recipient.

No adjustment was required for under-reporting, such as sudden deaths prior to the hospital episode in the HES data, as it is the number of operations which is being analysed.

Crude population incidence rates, for 10-year age bands, were calculated by dividing these incidences by the population of England. These age-banded rates have been worked into a reasonably smooth, full, age-specific table by simplistic curve fitting, cross-checked against the 10-year crude average rates.

No adjustment has been made for prevalence of MOT in the general population as the proportion of lives affected is clearly negligible.

To obtain Stand-Alone incidence rates, an estimate of 28 day mortality following MOT (or acceptance onto a waiting list) is needed. We are not aware of any relevant UK MOT operative mortality data for this study. Fabrizio & Grattan quote 5% to 15% for Australia / NZ. This potential adjustment has been ignored, as mentioned earlier.

The smoothed incidence rates (without further adjustment) have been used for the Accelerated Critical Illness rates in the Base Table. There is no data (k_x) on ultimate mortality following MOT, but any such deaths are very likely to be included in the k_x for other Critical Illnesses.

3.8.4 Trends

The number of Major Organ Transplants in the UK from 1990 to 1998 was :

Year	Heart	Heart&Lung	Lung	Liver	Total
Data from UKTSSA					
1990	348	52	94	360	854
1991	299	72	79	421	871
1992	340	90	53	580	1,063
1993	310	95	36	550	991
1994	328	117	52	635	1,132
Data from ONS Britain Yearbooks					
1996	291	53	117	600+	c. 1,100
1998	281	52	88	693	1,114

The total number of relevant MOTs seems to have risen by around 5% to 10% per annum over 1990 to 1994, but been relatively stable since then. Much of course depends on the availability of suitable donor organs and the priority given within health budgets to such high-cost operations.

The incidence rates calculated above strictly apply to 1994/95. For the Base Table we need rates for an effective date of 1993. A reduction of, say, 10% could be argued on the strength of the above data. However, this potential adjustment has been passed over as part of the broad offset of assumptions noted above.

As there is no clear trend from 1994 to date, it may be appropriate to assume that no adjustment is necessary to re-base the table to current levels of experience.

Critical Illness Incidence Rates - MOT (males)
Incidence Rates per 10,000 Lives

Table 3.8 (m)

Age	Age Group	Population of England (000's)	Number of Transplants	First Ever Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Crude Rate (per 10,000)	Interpolated Smoothed Rate (ix) (per 10,000)	Operative Mortality Rate	28 Day Mortality Rate (ELT 15)	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from MOT (kx)	Extra Cost for Accelerated ($i_x \cdot k_x \cdot q_x$)
20									0.09	0.0%	0.00006	0.09	8.4267	0.0000	0.09
21									0.09	0.0%	0.00007	0.09	8.6371	0.0000	0.09
22									0.09	0.0%	0.00007	0.09	8.8479	0.0000	0.09
23									0.10	0.0%	0.00007	0.10	8.8558	0.0000	0.10
24									0.10	0.0%	0.00007	0.10	8.8636	0.0000	0.10
25	20 to 29	3,873.67	39	100%	0.10	0%	0.00%	0.10	0.10	0.0%	0.00007	0.10	8.5656	0.0000	0.10
26									0.10	0.0%	0.00006	0.10	8.4709	0.0000	0.10
27									0.10	0.0%	0.00007	0.10	8.4780	0.0000	0.10
28									0.11	0.0%	0.00007	0.11	8.6897	0.0000	0.11
29									0.11	0.0%	0.00007	0.11	8.9019	0.0000	0.11
30									0.11	0.0%	0.00007	0.11	9.1147	0.0000	0.11
31									0.11	0.0%	0.00007	0.11	9.3280	0.0000	0.11
32									0.11	0.0%	0.00007	0.11	9.7471	0.0000	0.11
33									0.12	0.0%	0.00008	0.12	9.9620	0.0000	0.12
34									0.12	0.0%	0.00008	0.12	10.5888	0.0000	0.12
35	30 to 39	3,576.42	48	100%	0.13	0%	0.00%	0.13	0.13	0.0%	0.00009	0.13	11.6291	0.0000	0.13
36									0.14	0.0%	0.00010	0.14	12.7760	0.0000	0.14
37									0.15	0.0%	0.00011	0.15	13.7208	0.0000	0.15
38									0.17	0.0%	0.00011	0.17	14.9793	0.0000	0.17
39									0.19	0.0%	0.00012	0.19	16.0364	0.0000	0.19
40									0.21	0.0%	0.00013	0.21	17.2021	0.0000	0.21
41									0.23	0.0%	0.00014	0.23	18.5812	0.0000	0.23
42									0.26	0.0%	0.00015	0.26	20.1758	0.0000	0.26
43									0.30	0.0%	0.00017	0.30	21.8839	0.0000	0.30
44									0.33	0.0%	0.00018	0.33	24.0206	0.0000	0.33
45	40 to 49	3,289.39	120	100%	0.36	0%	0.00%	0.36	0.37	0.0%	0.00020	0.37	26.6957	0.0000	0.37
46									0.41	0.0%	0.00023	0.41	29.7063	0.0000	0.41
47									0.46	0.0%	0.00025	0.46	33.1638	0.0000	0.46
48									0.50	0.0%	0.00029	0.50	37.1826	0.0000	0.50
49									0.56	0.0%	0.00032	0.55	41.4564	0.0000	0.56
50									0.61	0.0%	0.00036	0.61	46.4200	0.0000	0.61
51									0.68	0.0%	0.00040	0.68	51.8778	0.0000	0.68
52									0.76	0.0%	0.00044	0.76	57.7395	0.0000	0.76
53									0.83	0.0%	0.00049	0.83	64.2391	0.0000	0.83
54									0.90	0.0%	0.00055	0.90	71.4029	0.0000	0.90
55	50 to 59	2,528.46	199	100%	0.79	0%	0.00%	0.79	0.93	0.0%	0.00061	0.93	79.7001	0.0000	0.93
56									0.89	0.0%	0.00068	0.89	89.0706	0.0000	0.89
57									0.83	0.0%	0.00076	0.83	99.4603	0.0000	0.83
58									0.75	0.0%	0.00085	0.75	111.1587	0.0000	0.75
59									0.67	0.0%	0.00095	0.67	124.2526	0.0000	0.67
60									0.59	0.0%	0.00107	0.59	139.1932	0.0000	0.59
61									0.52	0.0%	0.00120	0.52	156.0106	0.0000	0.52
62									0.45	0.0%	0.00134	0.45	174.8779	0.0000	0.45
63									0.39	0.0%	0.00151	0.39	196.4910	0.0000	0.39
64									0.32	0.0%	0.00169	0.32	219.9171	0.0000	0.32
65	60 to 69	2,191.87	70	100%	0.32	0%	0.00%	0.32	0.26	0.0%	0.00188	0.26	244.6622	0.0000	0.26
66									0.22	0.0%	0.00208	0.22	271.0949	0.0000	0.22
67									0.18	0.0%	0.00230	0.18	299.6439	0.0000	0.18
68									0.15	0.0%	0.00253	0.15	329.1736	0.0000	0.15
69									0.12	0.0%	0.00276	0.12	360.2085	0.0000	0.12
70									0.09	0.0%	0.00301	0.09	392.9175	0.0000	0.09
71									0.07	0.0%	0.00331	0.07	431.1650	0.0000	0.07
72									0.05	0.0%	0.00364	0.05	474.5692	0.0000	0.05
73									0.03	0.0%	0.00400	0.03	521.7056	0.0000	0.03
74									0.02	0.0%	0.00437	0.02	569.7189	0.0000	0.02
75	70 to 85	1,848.72	3	100%	0.02	0%	0.00%	0.02	0.01	0.0%	0.00475	0.01	619.7199	0.0000	0.01
76									0.00	0.0%	0.00520	0.00	677.6744	0.0000	0.00
77									0.00	0.0%	0.00569	0.00	741.7506	0.0000	0.00
78									0.00	0.0%	0.00622	0.00	810.2217	0.0000	0.00
79									0.00	0.0%	0.00678	0.00	883.6740	0.0000	0.00
80									0.00	0.0%	0.00738	0.00	961.5810	0.0000	0.00

Critical Illness Incidence Rates - MOT (females)
Incidence Rates per 10,000 Lives

Table 3.8 (f)

Age	Age Group	Population of England (000's)	Number of Transplants	First Ever Adjustment	Crude Rate (per 10,000)	Adjustment For Overlap with other CIs	Prevalence Rate Adjustment	Crude Rate (per 10,000)	Interpolated Smoothed Rate (ix) (per 10,000)	Operative Mortality Rate	28 Day Mortality Rate (ELT 15)	Stand Alone Rate (per 10,000)	ELT 15 Population qx (per 10,000)	Proportion of Deaths from MOT (k_x)	Extra Cost for Accelerated ($i_x - k_x * q_x$)
20									0.08	0.0%	0.00002	0.08	3.1327	0.0000	0.08
21									0.08	0.0%	0.00002	0.08	3.2347	0.0000	0.08
22									0.08	0.0%	0.00002	0.08	3.2358	0.0000	0.08
23									0.08	0.0%	0.00003	0.08	3.3380	0.0000	0.08
24									0.08	0.0%	0.00002	0.08	3.2379	0.0000	0.08
25	20 to 29	3,703.13	28	100%	0.08	0%	0.00%	0.08	0.08	0.0%	0.00003	0.08	3.4414	0.0000	0.08
26									0.08	0.0%	0.00003	0.08	3.4426	0.0000	0.08
27									0.09	0.0%	0.00003	0.09	3.5451	0.0000	0.09
28									0.09	0.0%	0.00003	0.09	3.8503	0.0000	0.09
29									0.10	0.0%	0.00003	0.10	3.9531	0.0000	0.10
30									0.10	0.0%	0.00003	0.10	4.3603	0.0000	0.10
31									0.11	0.0%	0.00004	0.11	4.6665	0.0000	0.11
32									0.11	0.0%	0.00004	0.11	5.1762	0.0000	0.11
33									0.12	0.0%	0.00004	0.12	5.7882	0.0000	0.12
34									0.12	0.0%	0.00005	0.12	6.1979	0.0000	0.12
35	30 to 39	3,493.22	47	100%	0.13	0%	0.00%	0.13	0.13	0.0%	0.00005	0.13	6.9134	0.0000	0.13
36									0.14	0.0%	0.00006	0.14	7.5287	0.0000	0.14
37									0.15	0.0%	0.00006	0.15	8.2470	0.0000	0.15
38									0.17	0.0%	0.00007	0.17	8.9671	0.0000	0.17
39									0.18	0.0%	0.00008	0.18	9.7911	0.0000	0.18
40									0.19	0.0%	0.00008	0.19	10.7195	0.0000	0.19
41									0.20	0.0%	0.00009	0.20	11.6508	0.0000	0.20
42									0.21	0.0%	0.00010	0.21	12.8923	0.0000	0.21
43									0.22	0.0%	0.00011	0.22	14.1383	0.0000	0.22
44									0.23	0.0%	0.00012	0.23	15.7999	0.0000	0.23
45	40 to 49	3,280.89	78	100%	0.24	0%	0.00%	0.24	0.24	0.0%	0.00014	0.24	17.7773	0.0000	0.24
46									0.26	0.0%	0.00015	0.26	19.7649	0.0000	0.26
47									0.27	0.0%	0.00017	0.27	21.8669	0.0000	0.27
48									0.29	0.0%	0.00019	0.29	24.1890	0.0000	0.29
49									0.31	0.0%	0.00020	0.30	26.6310	0.0000	0.31
50									0.32	0.0%	0.00023	0.32	29.4035	0.0000	0.32
51									0.35	0.0%	0.00025	0.35	32.5122	0.0000	0.35
52									0.37	0.0%	0.00027	0.37	35.7546	0.0000	0.37
53									0.40	0.0%	0.00030	0.40	39.0305	0.0000	0.40
54									0.42	0.0%	0.00033	0.42	42.7648	0.0000	0.42
55	50 to 59	2,541.78	94	100%	0.37	0%	0.00%	0.37	0.42	0.0%	0.00037	0.42	47.6029	0.0000	0.42
56									0.40	0.0%	0.00041	0.40	53.0388	0.0000	0.40
57									0.37	0.0%	0.00045	0.37	59.1988	0.0000	0.37
58									0.33	0.0%	0.00051	0.33	66.0009	0.0000	0.33
59									0.29	0.0%	0.00057	0.29	73.9058	0.0000	0.29
60									0.26	0.0%	0.00064	0.26	82.9591	0.0000	0.26
61									0.23	0.0%	0.00071	0.23	92.2272	0.0000	0.23
62									0.21	0.0%	0.00078	0.21	101.5178	0.0000	0.21
63									0.20	0.0%	0.00087	0.20	112.8709	0.0000	0.20
64									0.18	0.0%	0.00097	0.18	126.6296	0.0000	0.18
65	60 to 69	2,400.29	39	100%	0.16	0%	0.00%	0.16	0.16	0.0%	0.00107	0.16	139.8505	0.0000	0.16
66									0.13	0.0%	0.00117	0.13	152.3144	0.0000	0.13
67									0.10	0.0%	0.00129	0.10	167.5594	0.0000	0.10
68									0.08	0.0%	0.00141	0.08	184.3656	0.0000	0.08
69									0.05	0.0%	0.00155	0.05	201.7962	0.0000	0.05
70									0.03	0.0%	0.00168	0.03	218.9571	0.0000	0.03
71									0.02	0.0%	0.00184	0.02	239.8394	0.0000	0.02
72									0.01	0.0%	0.00207	0.01	269.3109	0.0000	0.01
73									0.01	0.0%	0.00231	0.01	301.3986	0.0000	0.01
74									0.00	0.0%	0.00252	0.00	328.3922	0.0000	0.00
75	70 to 85	2,764.81	1	100%	0.00	0%	0.00%	0.00	0.00	0.0%	0.00274	0.00	356.9071	0.0000	0.00
76									0.00	0.0%	0.00301	0.00	391.9935	0.0000	0.00
77									0.00	0.0%	0.00334	0.00	435.5571	0.0000	0.00
78									0.00	0.0%	0.00371	0.00	483.2467	0.0000	0.00
79									0.00	0.0%	0.00412	0.00	537.3947	0.0000	0.00
80									0.00	0.0%	0.00457	0.00	595.9681	0.0000	0.00

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3.9 TOTAL AND PERMANENT DISABILITY (TPD)

3.9.1 Definition

There is no ABI model definition for Total and Permanent Disability (TPD) and there are a number of variations used in the market. Within this section we have provided an indication of the cost for both the "any occupation whatsoever" definition and the "own occupation" definition. For the purposes of developing the Base Table we have opted for the "any occupation whatsoever" definition as this was the definition originally used and we believe remains the most prevalent definition today.

An example of a full definition is:-

The Life Assured, before his 65th birthday, having become totally and permanently unable, through accident or illness, to engage in any occupation or employment whatsoever.

3.9.2 Data Sources

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, 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 to look at experience under Individual Permanent Health Insurance (PHI) policies sold in the UK. Data sources are CMIR 7 and CMIR 15, together with Cause of Claim data published in CMIR 8.

3.9.3 Calculation of Incidence Rates

This Section describes the derivation of incidence rates. The detailed calculations are shown in Table 3.9.

CMI results indicate that the shorter the deferred period under a policy, the higher the ultimate claims level. 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 used D 26 experience.

Graduated inception rates for 1975-78 were published in CMIR 7. More recent data (up to 1990) was published in CMIR 15 and, for 26 week deferred business, showed significant increases over the earlier data. Adjusting the inception rates from Table H5 of CMIR7 by the 100xA/E figures from Table 2.4d of CMIR 15 gives inception rates for males of:

Age	10,000 x inception rate
32	13.4
37	10.0
42	13.5
47	23.0
52	38.2
57	80.3
62	108.4

One would not expect to pay out a TPD benefit in most of these cases, however, because the disability may not be considered permanent. One possible approach is to reduce these inception rates for recoveries in, say, the first 5 years of claim. 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.

Graduated recovery rates for 1975-78 were published in CMIR 12. More recent experience (1987-90) suggests all ages recovery rates of 56% of these, resulting in the following adjustments:

Age	Recoveries/inceptions %
20	85.4
40	68.3
60	29.1

Interpolating between these values gives estimated TPD incidence rates as set out below. It is clearly difficult to graduate so few rates; we have therefore decided to express them in terms of a mortality table, which might be expected to demonstrate a similar shape. The rates are shown as a percentage of AM92(2) ult:

Age	10,000 x Inception rate	Expressed as % of AM92 ult
32	3.3	54.1
37	2.9	38.5
42	4.8	43.6
47	10.5	58.1
52	21.1	67.0
57	52.3	92.5
62	81.1	80.2

These results have been smoothed to give us incidence rates for TPD as shown in the table below, with interpolation in between. Since these are based on PHI data they are implicitly based on an "Own Occupation" definition of disability. The impact of an "Any Occupation" definition can only be estimated, but could mean that rates around half of those for "Own Occupation" would be appropriate where the tighter definition applies.

Age	TPD rate as % of AM92	
	Own Occupation	Any Occupation
Up to 40	40	20
60	80	40

Adjustment is also required for the overlap with the Critical Illnesses. Since the benefit will be paid on diagnosis of Cancer, Heart Attack, etc such causes of claim should be excluded from the TPD rates. An analysis of PHI claims by cause for the period 1975-78 is contained in CMIR 8. There are a number of approximations inherent in using this data, for example:

- They relate to PHI inceptions and are not necessarily relevant for the "total and permanent" benefit we are considering.
- The categories of cause of claim are broad and may not match the definitions of the Critical Illnesses

Nevertheless we feel they are the most appropriate data available.

Figures from CMIR8 show the following percentage of claims within the categories "Neoplasms" and "Circulatory" for deferred 26 week business:-

Age	Neoplasm & Circulatory claims %
18-39	12.6
40-49	31.4
50-59	39.3
60-65	41.1
All ages	31.4

All the above analysis is for males. There is significantly less PHI data for females, so that similar analysis would be inappropriate. In the absence of any available data, the same rates have been used for females.

As the TPD rates have been derived from PHI experience they already incorporate a deferred period, so no further adjustment is required for the survival period under a Stand-Alone Critical Illness policy.

In the absence of data for the proportion of deaths due to TPD (k_x), we have adopted a different approach to deriving Accelerated rates from preceding sections. The cost of Accelerated cover can be expressed as:-

$$i_x \{ 1 - \sum q'_{x+t} * tP'_x * v^t \}$$

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 no data exists on the relevant mortality, and it is difficult to estimate as some claims may be in respect of mental and musculoskeletal conditions with minimal extra mortality, but others may have significantly impaired mortality. Further, there is likely to be high excess mortality initially, reducing with duration since diagnosis. For what follows we have assumed average mortality of 100% of A67/70(2) ult and interest of 8%. This gives the following percentage reductions to apply to the Stand-Alone rates to obtain Accelerated rates:

Age	Percentage reduction from Stand-Alone to Accelerated rates
30	5%
35	7.5%
40	10%
45	15%
50	20%
55	25%
60	32.5%
65	40%

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.

Since "own occupation" can be viewed as a less stringent definition, it may be considered that post-claim mortality is lighter and hence the cost of Accelerated cover higher relative to Stand-Alone cover.

3.9.4 Trends

Given the severity of an "Any Occupation" definition of TPD, it is unlikely that the underlying experience is subject to significant short-term variation. However, the interpretation of the definition is highly subjective and it appears it is being applied more liberally, in part in response to pressure from Ombudsmen, and care is therefore required. We expect that the differential between the cost of "any occupation" cover and "own occupation" cover has narrowed during the 1990s.

Critical Illness Incidence Rates - TPD (Males and Females)
 TPD Incidence Rates per 10,000

Table 3.9

Age	PHI Inception rate for 1975-78 (per 10,000)	Adjustment to experience for 1987-90	PHI Inception rate for 1987-90 (per 10,000)	Recoveries as % of Inceptions	Interpolated Recoveries as % of Inceptions	TPD Incidence rate (per 10,000)	Own Occ TPD Incidence rate as % of AM92	Any Occ TPD as % of AM92	% of inceptions due to Neoplasms & Circulatory	% of claims due to other CIs	Stand Alone Rate (per 10,000)	Reduction for Accelerated	Extra Cost for Accelerated (per 10,000)
20				85.4	85.4	0.0006		20%		0.0%	1.16	5.0%	1.11
21					84.5	0.0006		20%		1.2%	1.14	5.0%	1.08
22					83.7	0.0006		20%		2.4%	1.12	5.0%	1.06
23					82.8	0.0006		20%		3.6%	1.10	5.0%	1.04
24					81.9	0.0006		20%		4.8%	1.08	5.0%	1.03
25					81.1	0.0006		20%		6.0%	1.06	5.0%	1.01
26					80.2	0.0006		20%		7.2%	1.05	5.0%	1.00
27					79.3	0.0006		20%		8.4%	1.04	5.0%	0.99
28					78.5	0.0006		20%		9.6%	1.04	5.0%	0.99
29					77.6	0.0006		20%		10.8%	1.03	5.0%	0.98
30					76.8	0.0006		20%	12.6%	12.0%	1.04	5.0%	0.99
31					75.9	0.0006		20%		13.2%	1.05	5.5%	0.99
32	6	222.9%	13.4		75.0	0.0006	54.1%	20%		14.4%	1.06	6.0%	0.99
33					74.2	0.0006		20%		15.6%	1.07	6.5%	1.00
34					73.3	0.0007		20%		16.8%	1.10	7.0%	1.02
35					72.4	0.0007		20%		18.0%	1.13	7.5%	1.05
36					71.6	0.0007		20%		19.2%	1.17	8.0%	1.08
37	7	143.4%	10.0		70.7	0.0008	38.5%	20%		20.4%	1.22	8.5%	1.11
38					69.8	0.0008		20%		21.6%	1.27	9.0%	1.16
39					69.0	0.0009		20%		22.8%	1.34	9.5%	1.22
40				68.1	68.1	0.0009		20%		24.0%	1.42	10.0%	1.28
41					66.2	0.0010		21%		25.4%	1.59	11.0%	1.41
42	10	134.6%	13.5		64.2	0.0011	43.6%	22%		26.8%	1.78	12.0%	1.56
43					62.3	0.0012		23%		28.2%	1.99	13.0%	1.74
44					60.3	0.0013		24%		29.6%	2.24	14.0%	1.93
45					58.4	0.0015		25%	31.4%	31.0%	2.53	15.0%	2.15
46					56.4	0.0016		26%		32.4%	2.85	16.0%	2.39
47	16	143.7%	23.0		54.5	0.0018	58.1%	27%		33.8%	3.22	17.0%	2.67
48					52.5	0.0020		28%		35.2%	3.64	18.0%	2.99
49					50.6	0.0022		29%		36.6%	4.12	19.0%	3.34
50					48.6	0.0025		30%		38.0%	4.66	20.0%	3.73
51					46.7	0.0028		31%		38.2%	5.38	21.0%	4.25
52	28	136.3%	38.2		44.7	0.0032	67.0%	32%		38.4%	6.21	22.0%	4.85
53					42.8	0.0035		33%		38.6%	7.17	23.0%	5.52
54					40.8	0.0040		34%		38.8%	8.27	24.0%	6.29
55					38.9	0.0045		35%	39.3%	39.0%	9.54	25.0%	7.16
56					36.9	0.0050		36%		39.2%	11.00	26.5%	8.08
57	52	154.5%	80.3		35.0	0.0057	92.5%	37%		39.4%	12.67	28.0%	9.12
58					33.0	0.0064		38%		39.6%	14.58	29.5%	10.28
59					31.1	0.0071		39%		39.8%	16.76	31.0%	11.57
60				29.1	29.1	0.0080		40%		40.0%	19.25	32.5%	13.00
61					27.2	0.0090		40%		40.4%	21.48	34.0%	14.18
62	102	106.3%	108.4		25.2	0.0101	80.2%	40%	41.1%	40.8%	23.95	35.5%	15.44
63					23.3	0.0113		40%		41.2%	26.68	37.0%	16.81
64					21.3	0.0127		40%		41.6%	29.70	38.5%	18.27
65					19.4	0.0142		40%		42.0%	33.04	40.0%	19.83

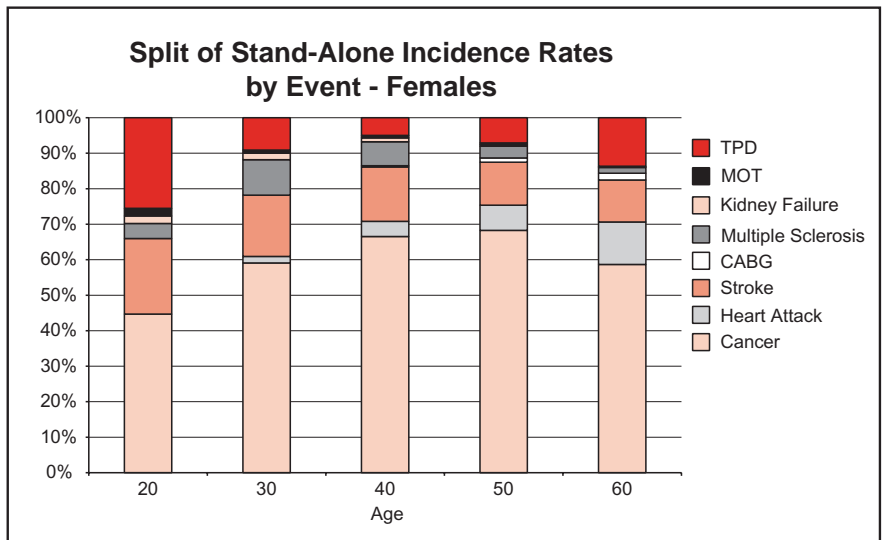
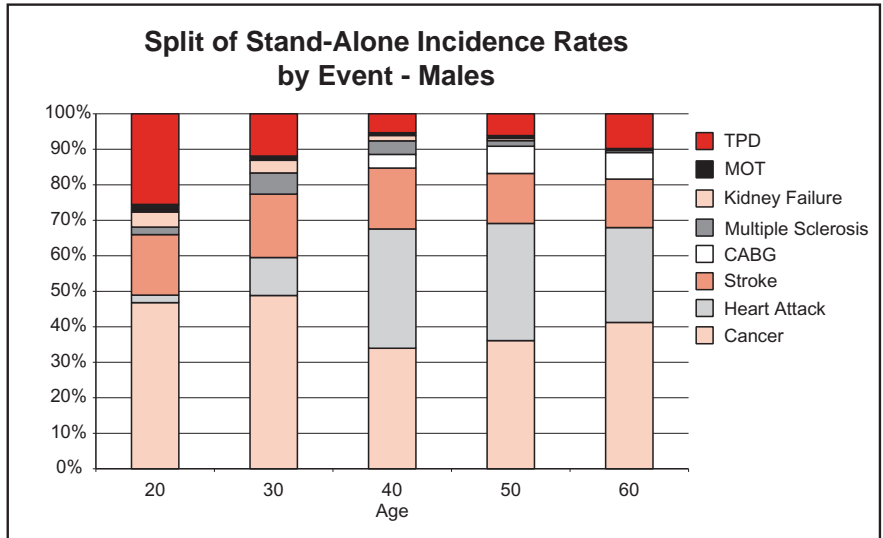
3.10 THE BASE TABLE (CIBT93)

The tables 3.10(m) and 3.10(f) at the end of this section show the build up of the Base Table from the incidence rates for the individual Critical Illness events. Rates per 10,000 are shown for both Stand-Alone and Accelerated cover, using an “age exact” definition.

3.10.1 Stand-Alone Incidence Rates

Stand-Alone rates (i'_x) are calculated by summing the equivalent rates for each of the eight Critical Illness events covered in Sections 3.2 to 3.9. No allowance has been made for any other illnesses that might be covered by a critical illness policy and this point is discussed further in Section 3.11.

The following graphs, for males and females, give an indication of the relative importance of the different events at specimen ages.



3.10.2 Accelerated Incidence Rates

Accelerated rates have been determined by adding the incidence rates for "additional deaths" to the Stand-Alone rates. The additional deaths have been calculated using the following formula:

$$q_x + \sum [(i_x - k_x q_x) - i'_x]$$

where the summation is over all events and

q_x = ELT15 population mortality,

$i_x - k_x q_x$ = Extra cost for Accelerated shown in the tables for each event,

i'_x = Stand-Alone incidence rates.

This approach has been adopted to ensure consistency with the causes of claim used in the Experience Investigation in Section 4.

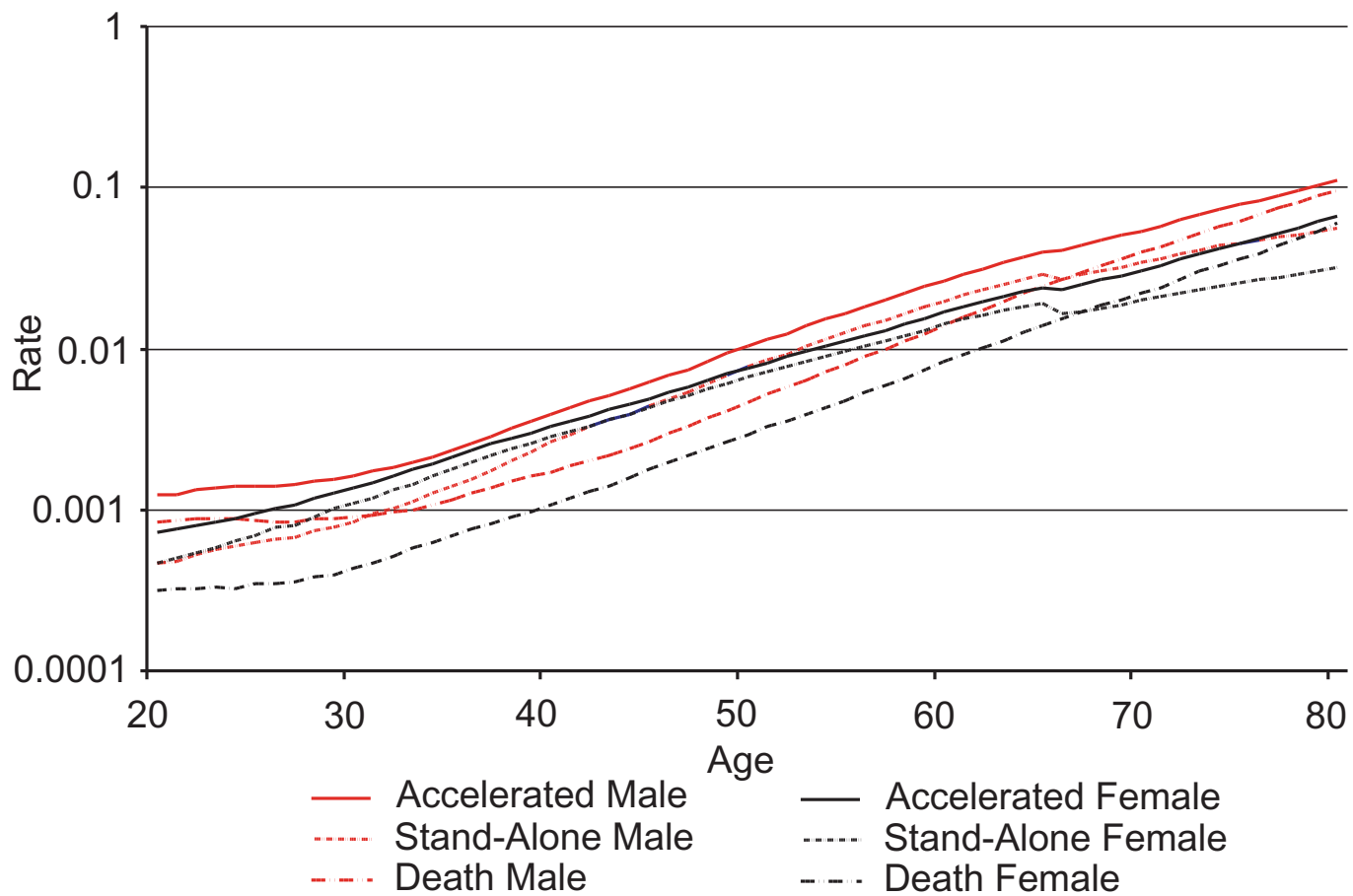
At many ages, the cost of Stand-Alone cover is very similar to the extra cost of Accelerated cover. As a result of the assumptions we have used there are a few cases where the extra cost of Accelerated exceeds that of Stand-Alone for a particular illness. This arises where we have made the simplifying assumption that $k_x = 0$ for CABG and MOT resulting in the extra cost for Accelerated cover being as taken i_x , which exceeds the Stand-Alone rate i'_x .

These deaths have been implicitly incorporated in the k_x 's for other illnesses (notably Heart Attack) so that the total rates shown in the Base Table are appropriate.

3.10.3 Comparison of CIBT93 with Population Mortality

The graph on the following page shows a comparison of Stand-Alone and Accelerated incidence rates from CIBT93 with population mortality rates from ELT 15. The graph plots both male and female rates using a logarithmic scale.

Comparison of CIBT93 with ELT 15



The Base Table (male) -CIBT93
Incidence Rates per 10,000

Table 3.10 (m)

Age	Cancer	Heart Attack	Stroke	CABG	Multiple Sclerosis	Kidney Failure	MOT	Total		Additional Deaths	Total	
								TPD	Stand-Alone Incidence Rates (i _v)		Accelerated Incidence Rates	
20	2.2	0.1	0.8	0.0	0.1	0.2	0.1	1.2	4.7	7.6	12.3	
21	2.3	0.1	0.9	0.0	0.1	0.2	0.1	1.1	4.8	7.7	12.5	
22	2.5	0.1	1.1	0.0	0.2	0.2	0.1	1.1	5.3	7.9	13.2	
23	2.7	0.2	1.0	0.0	0.2	0.3	0.1	1.1	5.6	7.9	13.5	
24	2.9	0.3	1.1	0.0	0.2	0.3	0.1	1.1	6.0	7.9	13.9	
25	3.1	0.3	1.1	0.0	0.3	0.3	0.1	1.1	6.3	7.6	13.9	
26	3.3	0.3	1.1	0.0	0.3	0.3	0.1	1.1	6.5	7.4	13.9	
27	3.5	0.4	1.1	0.0	0.4	0.3	0.1	1.0	6.8	7.4	14.2	
28	3.7	0.5	1.4	0.0	0.4	0.3	0.1	1.0	7.4	7.5	14.9	
29	3.9	0.6	1.4	0.0	0.5	0.3	0.1	1.0	7.8	7.6	15.4	
30	4.1	0.9	1.5	0.0	0.5	0.3	0.1	1.0	8.4	7.8	16.2	
31	4.4	1.2	1.8	0.0	0.6	0.3	0.1	1.0	9.4	7.9	17.3	
32	4.6	1.6	1.8	0.1	0.6	0.3	0.1	1.1	10.2	8.2	18.4	
33	4.9	2.0	2.1	0.1	0.7	0.3	0.1	1.1	11.3	8.3	19.6	
34	5.3	2.6	2.3	0.2	0.7	0.3	0.1	1.1	12.6	8.7	21.3	
35	5.7	3.2	2.5	0.2	0.8	0.4	0.1	1.1	14.0	9.4	23.4	
36	6.0	4.1	2.7	0.3	0.8	0.4	0.1	1.2	15.6	10.2	25.8	
37	6.4	5.1	3.0	0.4	0.9	0.4	0.2	1.2	17.6	10.8	28.4	
38	7.2	6.2	3.4	0.6	0.9	0.4	0.2	1.3	20.2	11.7	31.9	
39	8.0	7.5	3.9	0.8	0.9	0.4	0.2	1.3	23.0	12.3	35.3	
40	8.9	8.8	4.5	1.0	1.0	0.4	0.2	1.4	26.2	13.1	39.3	
41	9.7	10.0	5.0	1.2	1.0	0.4	0.2	1.6	29.1	13.8	42.9	
42	10.6	11.9	5.6	1.5	1.0	0.4	0.3	1.8	33.1	14.7	47.8	
43	12.0	12.9	5.6	1.8	1.1	0.4	0.3	2.0	36.1	15.6	51.7	
44	13.5	14.1	5.8	2.0	1.1	0.4	0.3	2.2	39.4	16.5	55.9	
45	15.0	16.0	6.0	2.6	1.1	0.5	0.4	2.5	44.1	17.7	61.8	
46	16.5	17.8	6.4	3.1	1.1	0.5	0.4	2.9	48.7	19.0	67.7	
47	18.0	19.0	7.2	3.6	1.1	0.5	0.5	3.2	53.1	20.6	73.7	
48	21.2	21.0	8.3	4.3	1.2	0.5	0.5	3.6	60.6	22.5	83.1	
49	24.4	23.3	9.5	5.0	1.2	0.5	0.6	4.1	68.6	24.5	93.1	
50	27.7	25.3	10.8	5.9	1.2	0.5	0.6	4.7	76.7	26.6	103.3	
51	30.9	27.4	11.7	6.5	1.2	0.5	0.7	5.4	84.3	28.9	113.2	
52	34.2	29.9	12.5	7.3	1.2	0.5	0.8	6.2	92.6	31.2	123.8	
53	38.7	33.2	13.9	8.1	1.2	0.5	0.8	7.2	103.6	34.1	137.7	
54	43.3	35.7	15.1	9.2	1.2	0.5	0.9	8.3	114.2	37.5	151.7	
55	47.8	38.7	16.5	10.0	1.2	0.5	0.9	9.5	125.1	40.9	166.0	
56	52.4	41.9	18.5	11.4	1.2	0.5	0.9	11.0	137.8	44.7	182.5	
57	57.1	45.2	20.5	12.5	1.2	0.5	0.8	12.7	150.5	49.5	200.0	
58	65.2	47.6	22.6	13.4	1.2	0.4	0.7	14.6	165.7	54.9	220.6	
59	73.2	50.5	24.8	13.9	1.2	0.4	0.7	16.8	181.5	60.1	241.6	
60	81.3	52.7	26.9	14.8	1.2	0.4	0.6	19.3	197.2	66.7	263.9	
61	89.7	55.8	29.5	15.1	1.2	0.4	0.5	21.5	213.7	73.5	287.2	
62	97.9	57.8	32.5	15.6	1.2	0.3	0.5	23.9	229.7	81.9	311.6	
63	110.3	60.7	33.5	15.8	1.2	0.3	0.4	26.7	248.9	90.4	339.3	
64	123.0	64.0	34.2	16.1	1.2	0.3	0.3	29.7	268.8	99.6	368.4	
65	135.7	66.0	35.4	15.7	1.1	0.3	0.3	33.0	287.5	110.3	397.8	
66	148.1	69.0	36.7	15.3	1.1	0.2	0.2		270.6	135.9	406.5	
67	161.0	71.2	38.0	14.8	1.1	0.2	0.2		286.5	149.3	435.8	
68	174.4	74.1	40.7	14.1	1.1	0.2	0.1		304.7	164.1	468.8	
69	187.9	76.1	43.9	13.1	1.1	0.1	0.1		322.3	179.7	502.0	
70	201.6	79.3	47.8	12.3	1.0	0.1	0.1		342.2	197.0	539.2	
71	214.7	82.1	51.6	11.2	1.0	0.1	0.1		360.8	217.0	577.8	
72	228.3	87.0	57.3	11.0	1.0	0.1	0.0		384.7	241.0	625.7	
73	242.6	92.0	64.4	10.4	0.9	0.0	0.0		410.3	268.2	678.5	
74	258.3	95.2	70.1	9.5	0.9	0.0	0.0		434.0	296.2	730.2	
75	270.9	97.1	74.7	8.3	0.9	0.0	0.0		451.9	327.1	779.0	
76	283.2	100.4	79.7	7.3	0.8	0.0	0.0		471.4	361.6	833.0	
77	298.6	102.2	83.9	5.2	0.8	0.0	0.0		490.7	399.6	890.3	
78	314.2	104.0	87.4	3.8	0.7	0.0	0.0		510.1	441.0	951.1	
79	328.7	109.7	92.9	2.9	0.7	0.0	0.0		534.9	488.1	1023.0	
80	343.0	111.0	99.9	2.3	0.6	0.0	0.0		556.8	539.9	1096.7	

The Base Table (female) -CIBT93
Incidence Rates per 10,000

Table 3.10 (f)

Age	Cancer	Heart Attack	Stroke	CABG	Multiple Sclerosis	Kidney Failure	MOT	TPD	Total	Additional Deaths	Total
									Stand-Alone Incidence Rates		Accelerated Incidence Rates
20	2.1	0.0	1.0	0.0	0.2	0.1	0.1	1.2	4.7	2.6	7.3
21	2.2	0.0	1.1	0.0	0.3	0.1	0.1	1.1	5.0	2.6	7.6
22	2.5	0.0	1.1	0.0	0.4	0.2	0.1	1.1	5.4	2.6	8.0
23	2.8	0.0	1.2	0.0	0.4	0.2	0.1	1.1	5.8	2.6	8.4
24	3.2	0.0	1.3	0.0	0.5	0.2	0.1	1.1	6.4	2.5	8.9
25	3.5	0.0	1.4	0.0	0.6	0.2	0.1	1.1	6.9	2.6	9.5
26	3.9	0.1	1.6	0.0	0.7	0.2	0.1	1.1	7.7	2.5	10.2
27	4.2	0.1	1.6	0.0	0.8	0.2	0.1	1.0	8.0	2.6	10.6
28	5.0	0.1	1.8	0.0	0.9	0.2	0.1	1.0	9.1	2.7	11.8
29	5.8	0.2	1.8	0.0	1.0	0.2	0.1	1.0	10.1	2.6	12.7
30	6.5	0.2	1.9	0.0	1.1	0.2	0.1	1.0	11.0	2.7	13.7
31	7.3	0.3	1.8	0.0	1.2	0.2	0.1	1.0	11.9	2.8	14.7
32	8.0	0.4	2.1	0.0	1.3	0.2	0.1	1.1	13.2	3.0	16.2
33	9.2	0.5	2.1	0.0	1.3	0.2	0.1	1.1	14.5	3.2	17.7
34	10.4	0.5	2.4	0.0	1.4	0.2	0.1	1.1	16.1	3.3	19.4
35	11.5	0.6	2.7	0.0	1.5	0.2	0.1	1.1	17.7	3.6	21.3
36	12.7	0.7	3.0	0.0	1.6	0.2	0.1	1.2	19.5	3.8	23.3
37	13.9	0.8	3.3	0.1	1.7	0.3	0.2	1.2	21.5	3.9	25.4
38	15.5	1.0	3.6	0.1	1.7	0.3	0.2	1.3	23.7	4.1	27.8
39	17.1	1.1	3.9	0.1	1.8	0.3	0.2	1.3	25.8	4.4	30.2
40	18.7	1.2	4.3	0.1	1.9	0.3	0.2	1.4	28.1	4.6	32.7
41	20.3	1.4	4.7	0.2	1.9	0.3	0.2	1.6	30.6	4.8	35.4
42	22.0	1.7	4.9	0.2	2.0	0.3	0.2	1.8	33.1	5.0	38.1
43	24.6	1.9	4.9	0.3	2.0	0.3	0.2	2.0	36.2	5.4	41.6
44	27.2	2.2	5.0	0.3	2.1	0.3	0.2	2.2	39.5	5.9	45.4
45	29.8	2.6	5.3	0.3	2.1	0.3	0.2	2.5	43.1	6.1	49.2
46	32.4	2.9	5.8	0.3	2.1	0.3	0.3	2.9	47.0	6.7	53.7
47	35.1	3.3	6.2	0.3	2.2	0.3	0.3	3.2	50.9	7.4	58.3
48	38.5	3.9	6.7	0.4	2.2	0.3	0.3	3.6	55.9	7.7	63.6
49	41.9	4.4	7.4	0.7	2.2	0.3	0.3	4.1	61.3	8.4	69.7
50	45.2	4.7	8.0	0.8	2.2	0.3	0.3	4.7	66.2	9.7	75.9
51	48.7	5.5	7.9	1.0	2.3	0.3	0.3	5.4	71.4	10.4	81.8
52	52.0	6.3	8.8	1.2	2.3	0.3	0.4	6.2	77.5	11.1	88.6
53	55.3	7.3	9.8	1.3	2.3	0.3	0.4	7.2	83.9	12.1	96.0
54	58.6	8.1	10.3	1.5	2.3	0.3	0.4	8.3	89.8	13.4	103.2
55	61.9	9.3	10.9	1.7	2.3	0.3	0.4	9.5	96.3	14.9	111.2
56	65.2	10.6	12.0	2.0	2.3	0.3	0.4	11.0	103.8	16.4	120.2
57	68.5	12.1	12.9	2.1	2.3	0.2	0.4	12.7	111.2	18.4	129.6
58	73.0	13.3	13.8	2.3	2.3	0.2	0.3	14.6	119.8	20.8	140.6
59	77.9	15.1	15.4	2.5	2.3	0.2	0.3	16.8	130.5	23.4	153.9
60	82.9	16.9	16.7	2.7	2.3	0.2	0.3	19.3	141.3	26.2	167.5
61	87.8	18.4	18.3	2.9	2.2	0.2	0.2	21.5	151.5	30.3	181.8
62	92.9	19.9	20.2	3.2	2.2	0.1	0.2	23.9	162.6	34.2	196.8
63	96.0	22.2	21.1	3.6	2.2	0.1	0.2	26.7	172.1	37.9	210.0
64	99.3	24.3	21.6	3.9	2.1	0.1	0.2	29.7	181.2	43.1	224.3
65	102.6	26.2	22.6	3.9	2.1	0.1	0.2	33.0	190.7	49.4	240.1
66	105.8	28.4	23.4	4.0	2.1	0.1	0.1		163.9	69.3	233.2
67	109.0	30.7	24.0	4.1	2.0	0.1	0.1		170.0	77.4	247.4
68	114.1	32.7	26.3	4.0	2.0	0.0	0.1		179.2	87.5	266.7
69	118.9	34.9	28.7	3.8	1.9	0.0	0.1		188.3	97.3	285.6
70	124.0	37.3	31.5	3.7	1.9	0.0	0.0		198.4	106.3	304.7
71	128.8	40.2	35.0	3.6	1.8	0.0	0.0		209.4	117.9	327.3
72	134.0	44.0	39.8	3.7	1.8	0.0	0.0		223.3	134.1	357.4
73	138.9	47.0	43.9	3.4	1.7	0.0	0.0		234.9	153.9	388.8
74	143.5	50.5	47.2	3.0	1.6	0.0	0.0		245.8	170.3	416.1
75	147.8	53.1	51.9	2.7	1.5	0.0	0.0		257.0	188.0	445.0
76	151.8	55.8	55.9	2.2	1.5	0.0	0.0		267.2	211.8	479.0
77	156.4	58.8	59.6	1.4	1.4	0.0	0.0		277.6	240.1	517.7
78	161.4	61.9	65.2	1.1	1.3	0.0	0.0		290.9	270.0	560.9
79	166.5	65.2	72.2	0.8	1.2	0.0	0.0		305.9	304.3	610.2
80	171.3	68.0	78.7	0.6	1.1	0.0	0.0		319.7	343.1	662.8

3.11 OTHER CRITICAL ILLNESSES

The Base Table that has been developed only covers the core illnesses (Cancer, Heart Attack, Stroke, CABG, MS, Kidney Failure, MOT and TPD). As the market has developed, a number of additional illnesses are now covered by a large number of offices.

To enable offices to adapt CIBT93 for the diseases they actually cover, indicative costs of other Critical Illnesses are outlined below. All the 'additional conditions' from the ABI Statement of Best Practice for Critical Illness Cover³ are considered below, as well as Alzheimer's disease and Angioplasty, which we feel are of particular interest.

Where applicable, the ABI model definition is given and [square brackets] have been used to indicate variable wording in the model definition. ABI model definitions do not exist for Alzheimer's disease and Angioplasty but a suggested definition has been given. Individual offices may need to make adjustments to the cost of these illnesses to reflect the definitions they actually use.

For each condition an indicative cost of the individual condition is given as a percentage of the Stand-Alone Base Table for the core illnesses. If significantly different, the percentage loading for Accelerated cover is given separately. For consistency, this is also expressed as a percentage of the Stand-Alone Base Table for the core illnesses (i.e. excluding the additional deaths for Accelerated cover). In a number of cases the additional cost of the individual disease is insignificant and/or overlaps with the core conditions and no additional cost is given.

3.11.1 Aorta Graft Surgery

The ABI model definition is:

Undergoing surgery for disease of the aorta needing excision and surgical replacement of a portion of the diseased aorta with a graft. For this definition, aorta means the thoracic and abdominal aorta but not its branches.

Basic incidence rates for Aorta Graft Surgery can be obtained from HES data. An appropriate adjustment then needs to be made for any overlap with Heart Attack and Coronary Artery Bypass Graft. An indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-39	0%	0%
40-44	0.5%	0%
45-54	0.5%	0%
55-64	1%	0.5%
65-74	2%	1%
75-80	1%	0.5%

3.11.2 Benign Brain Tumour

The ABI model definition is:

A non-malignant tumour in the brain resulting in permanent deficit to the neurological system. Tumours or lesions in the pituitary gland are not covered.

Incidence rates for Benign Brain Tumour have been obtained from Cancer Registration Statistics. The incidence rates are low and an indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-49	0%	0%
50-80	0.5%	0.5%

3.11.3 Blindness

The ABI model definition is:

Total permanent and irreversible loss of all sight in both eyes.

Incidence rates can be derived from Royal National Institute for the Blind figures. However, only a small proportion of the registered blind meet the above definition (c5% of registered blind are in 'total darkness'). There is also likely to be considerable overlap with TPD where included. An indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-59	0%	0%
60-80	0.5%	0.5%

3.11.4 Coma

The ABI model definition is:

A state of unconsciousness with no reaction to external stimuli or internal needs, persisting continuously with the use of life support systems for a period of at least 96 hours and resulting in permanent neurological deficit. Coma secondary to alcohol or drug misuse is not covered.

The above definition of coma is only likely to be satisfied as a result of a major accident, suffering another critical illness (e.g. Stroke) or AIDS. In the majority of cases, these will be covered by the core illnesses or TPD and therefore no additional loading is required for the cost of Coma.

3.11.5 Deafness

The ABI model definition is:

Total permanent and irreversible loss of all hearing in both ears.

MSGP provides incidence rates for Deafness but this will include loss of hearing in one ear. Incidence rates were derived from unpublished data producing the following indicative cost as a percentage of the Stand-Alone Base Table:

Age Band	Males	Females
20-54	0%	0%
55-64	0.5%	0.5%
65-74	1.5%	1.5%
75-80	2%	2%

3.11.6 Heart Valve Replacement or Repair

The ABI model definition is:

Undergoing open heart surgery from medical necessity to replace or repair one or more heart valves.

Basic incidence rates for Heart Valve Replacement or Repair can be obtained from HES data. An appropriate adjustment then needs to be made for any overlap with Heart Attack, Coronary Artery Bypass Graft and Aorta Surgery. An indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-44	3%	2%
45-54	2.5%	2%
55-64	2%	3%
65-74	1.5%	2%
75-80	1%	1.5%

3.11.7 Loss of Limbs

The ABI model definition is:

The permanent physical severance of two or more limbs from above the [elbow/wrist] or [knee/ankle] joint.

HES provides data for the amputation and other related operations on limbs. However, these statistics will overstate the incidence rates as the definition relates to the loss of two or more limbs. The rates will also vary according to the definition used (elbow/wrist or knee/ankle).

i) Above Elbow or knee

Loss of two or more limbs above the elbow or knee is particularly severe and will almost totally overlap with TPD and there is no need for an additional loading.

ii) Above Wrist or Ankle

If the definition is based on severance above the wrist or ankle then an indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-29	1%	0.5%
30-39	0.5%	0%
40-80	0%	0%

3.11.8 Loss of Speech

The ABI model definition is:

Total permanent and irreversible loss of the ability to speak as a result of physical injury or disease.

A large proportion of cases of loss of speech are due to Cancer or Stroke and are therefore already costed. Other causes could be accidents to the vocal chords or mental disorders. Mental disorders would be ruled out under the above definition. There should also be some overlap with TPD.

Overall, an indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-34	1%	1%
35-44	0.5%	0.5%
45-80	0%	0%

3.11.9 Motor Neurone Disease [before age x]

The ABI model definition is:

Confirmation by a Consultant Neurologist of a definite diagnosis of Motor Neurone Disease [before age x]

This is a steadily progressive disease that results in death within 3 to 4 years, on average. Only limited data is available from MSGP and an unpublished source and this indicates very low incidence rates. Therefore we believe no additional loading is necessary.

3.11.10 Paralysis/ Paraplegia

The ABI model definition is:

Total irreversible loss of muscle function or sensation to the whole of any two limbs as a result of injury or disease. The disability must be permanent and supported by appropriate neurological evidence.

Information from the Spinal Injuries Association suggests that nearly all cases are caused by accident and the vast majority of these cases are younger males. There is also a significant overlap with TPD and Loss of Limbs. The rates are minimal and an indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-29	1%	0.5%
30-39	0.5%	0%
40-80	0%	0%

3.11.11 Parkinson's Disease [before age x]

The ABI model definition is:

Confirmation by a Consultant Neurologist of a definite diagnosis of Parkinson's Disease [before age x]. Parkinson's Disease secondary to alcohol or drug misuse is not covered.

Basic incidence rates for Parkinson's Disease can be obtained from MSGP data. Incidence rates are insignificant at younger ages (up to 40) but increase rapidly above age 60. In addition, account needs to be taken of the overlap with TPD. An indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-39	0%	0%
40-44	0.5%	0.5%
45-54	1%	1%
55-64	1.5%	1.5%
65-74	4%	4%
75-80	5%	5%

3.11.12 Terminal Illness

The ABI model definition is:

Advanced or rapidly progressing incurable illness where, in the opinion of an attending Consultant and our Chief Medical Officer, the life expectancy is no greater than 12 months. [AIDS is specifically excluded and not covered under this definition.]

The costing of Terminal Illness will vary significantly between Accelerated and Stand-Alone cover. As a result they are considered separately below:

i) Accelerated Critical Illness Cover

Under Accelerated cover, Terminal Illness will represent a further small acceleration of the benefit. In deriving the Accelerated Base Table, we have already used OPCS Mortality Statistics by Cause to estimate the number of deaths from causes which are not due to Critical Illnesses (i.e. the additional deaths for Accelerated cover, $q_x - k_x q_x$).

The additional cost of Terminal Illness at age x is made up of an acceleration of a proportion of the additional deaths that would have occurred at age x+1 less those additional deaths at age x that have been accelerated to age x-1. It is assumed that 25% of the deaths from causes other than Critical Illnesses are diagnosed as a Terminal Illness. This allows for deaths that may not be diagnosed as a Terminal Illness (i.e. accidents and sudden deaths) and is highly speculative.

It is also assumed that Terminal Illness is diagnosed on average 6 months in advance of the date of death (i.e. 50% are brought forward to the earlier age band). This additional cost at age x can be represented as:

$$0.25 \times 0.5 [(1 - k_{x+1}) q_{x+1} - (1 - k_x) q_x]$$

An indicative cost as a percentage of the Stand-Alone Base Table (excluding the additional deaths for accelerated cover to be consistent with other diseases) is:

Age Band	Males	Females
20-29	0%	0%
30-39	0.5%	0.25%
40-59	0.4%	0.25%
60-64	0.5%	0.5%
65-69	0.75%	0.75%
70-74	1%	1%
75-80	1.25%	1.5%

ii) Stand-Alone Critical Illness Cover

The inclusion of Terminal Illness under Stand-Alone cover can lead to considerable difficulties at the claims stage and the benefit is far more expensive than under Accelerated cover.

There is a general question over whether Terminal Illness benefit fits well with Stand-Alone cover where the main purpose is to provide a benefit following survival of an event.

Under Stand-Alone cover a survival period of typically 28 days applies and problems may occur if death occurs during this period. Unless the cause of death is an accident it could be argued that the Terminal Illness diagnosis could have been made one month earlier resulting in a valid claim. This could lead to the introduction of death benefits to stand-alone cover by the back door. In most cases, someone who has died presumably must have been terminally ill at some point. For Stand-Alone cover it may also be appropriate to include an AIDS exclusion.

The payment of the benefit will depend on whether the symptoms are sufficiently apparent that the insured contacts their doctor, the doctor diagnoses a Terminal Illness and when this diagnosis is made. These can all be very subjective. If the existence of critical illness cover is known, this may alter the likelihood and timing of these events.

As a result of the above, this benefit is often not offered under Stand-Alone Critical Illness cover in the UK. However, an indicative costing is given below. This is developed in a similar way to Terminal Illness for accelerated cover with the inclusion of an allowance for the proportion of Terminal Illness claims that survive the 28 day waiting period. The additional cost at age x can be represented as:

$$0.25 \times 0.5 [(1 - k_{x+1}) q_{x+1} + (1 - k_x) q_x] \times \text{survival probability}$$

An indicative cost as a percentage of the Stand-Alone Base Table, using an assumed 28 day survival probability of 90%, is:

Age Band	Males	Females
20-29	25%	10%
30-39	16%	5%
40-59	9%	4%
60-64	9%	6%
65-69	13%	12%
70-74	15%	16%
75-80	20%	22%

3.11.13 Third Degree Burns

The ABI model definition is:

Third degree burns covering at least 20% of the body surface area.

Burns of this severity are about as severe as can be survived. HES includes figures for burns but the subdivisions relate to the site of the burn rather than the severity. It is possible to get an indication of the cost by considering all burns referred to plastic surgery but this is clearly an overstatement. As a result, the likely incidence rates are minimal and we believe no additional loading for the cost of Third Degree Burns is required.

3.11.14 Alzheimer's Disease

There is no ABI model definition for Alzheimer's disease but a possible wording is:

A definite diagnosis by a consultant neurologist of Alzheimer's Disease [before age x], resulting in the need for continuous supervision by another person.

Basic incidence rates have been derived from unpublished data. Adjustment needs to be made for cases with a prior history of Stroke, Heart Attack and Cancer. In addition, allowance needs to be made for the overlap with TPD up to age 65. The costing for Alzheimer's disease will also vary significantly between Accelerated and Stand-Alone cover and is given separately below. The rates are minimal at younger ages but increase significantly at older ages (in particular for Stand-Alone cover).

i) Accelerated Critical Illness Cover

An indicative cost as a percentage of the Stand-Alone Base Table (excluding the additional deaths for Accelerated cover to be consistent with other diseases) is:

Age Band	Males	Females
20-49	0%	0%
50-54	0.5%	0.5%
55-64	0.5%	0.5%
65-69	1%	1%
70-74	2%	3%
75-80	3%	5%

ii) Stand-Alone Critical Illness Cover

An indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-49	0%	0%
50-54	1%	1%
55-64	1%	1.5%
65-69	2%	3%
70-74	7%	12%
75-80	15%	25%

3.11.15 Angioplasty

There is no ABI model definition for Angioplasty but a possible wording is:

The undergoing of open heart surgery on the advice of a Consultant Cardiologist to correct narrowing or blockage of [two/one] 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 include Angioplasty as part of the Coronary Artery By-Pass Surgery definition or list this illness separately.

Basic incidence rates for Angioplasty can be obtained from HES data. An appropriate adjustment also needs to be made for any overlap with Heart Attack, Coronary Artery Bypass Graft and Heart Valve Replacement or Repair. The costing of Angioplasty will vary depending on the number of arteries, two or one, requiring surgery to meet the definition. As a result they are considered separately below:

i) Two or more arteries

Figures from the British Cardiovascular Intervention Society show that less than 20% of all angioplasty operations involve multiple arteries. Based on a definition involving 'two or more' arteries, an indicative cost as a percentage of the Stand-Alone Base Table is:

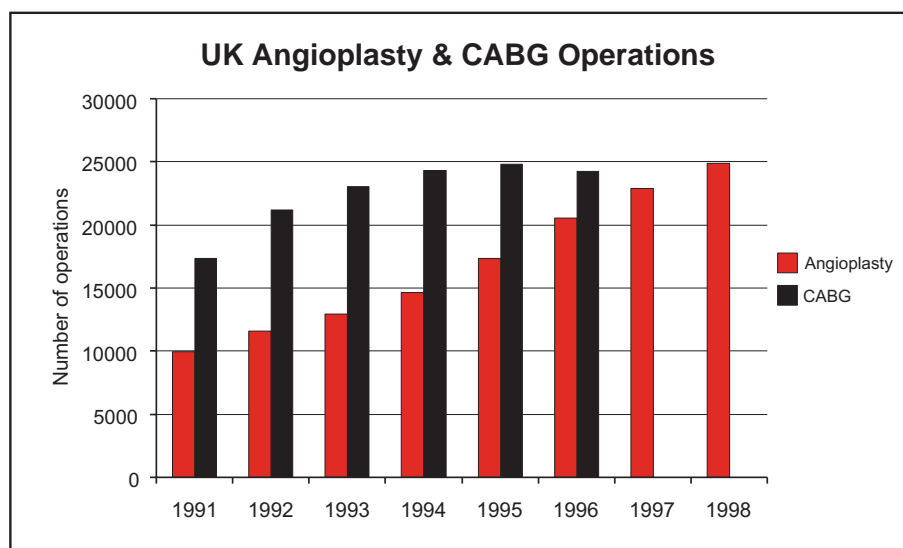
Age Band	Males	Females
20-34	0%	0%
35-44	2%	1%
45-54	1.5%	1%
55-64	1%	0.5%
65-74	1%	0.5%
75-80	0.5%	0%

ii) One or more arteries

Based on a definition involving 'one or more' arteries, an indicative cost as a percentage of the Stand-Alone Base Table is:

Age Band	Males	Females
20-34	0%	0%
35-44	10%	5%
45-54	7.5%	5%
55-64	5%	2.5%
65-74	5%	2.5%
75-80	2.5%	0%

As a result of the substantial increase in cost of covering 'one or more' arteries, some companies only pay a partial benefit for Angioplasty. There is also a general concern over the rate of increase in the number of angioplasty operations. Between 1991 and 1995 the number of angioplasty operations increased by 75% compared to a 43% increase in CABG operations over the same period. Increasingly Angioplasty is being used in place of CABG. These points are illustrated in the following graph:



Source: Society of Cardiothoracic Surgeons and British Cardiovascular Intervention Society.

3.11.16 Total Cost of Other Critical Illnesses

An indication of the cumulative cost of adding all the Critical Illness covered in Section 3.11 is given below as a percentage of the Stand-Alone Base Table. The rates have been smoothed to a limited extent and are shown separately for Accelerated and Stand-Alone cover.

Age Band	Accelerated		Stand-Alone	
	Males	Females	Males	Females
20-24	5%	3.5%	5%	3.5%
25-29	5%	3.5%	5%	3.5%
30-34	5%	3.5%	5%	3.5%
35-39	6.5%	4%	6%	3.5%
40-44	7%	4.5%	6.5%	4%
45-49	7%	4.5%	6.5%	4%
50-54	7%	5.5%	7%	5.5%
55-59	7.5%	7.5%	7.5%	8%
60-64	8%	8%	8%	8.5%
65-69	13%	12%	13%	13%
70-74	14%	14%	18%	22%
75-80	15%	16%	25%	35%

In producing a single set of factors the following assumptions have been made and individual offices may need to adjust the rates in light of this:

- the Loss of Limbs definition is based on the 'above the elbow or knee' wording
- no age limit has been applied in terms of the Parkinson's Disease definition
- Terminal Illness is only included under Accelerated cover and does not apply to Stand-Alone cover (this results in the Stand-Alone factors being lower than the Accelerated ones in certain age ranges)
- the Angioplasty definition is based on the 'two or more arteries' wording

4 EXPERIENCE INVESTIGATION 1991-1997

4.1 INTRODUCTION

Although there have been experience investigations covering Ireland⁷ and Australia and New Zealand^{8, 9} there has, to our knowledge, been no previous attempt to investigate the experience of Critical Illness policies in the UK. The CMI Bureau have commenced an investigation with effect from 1st January 1995 and whilst some data has been received, the rigorous nature of their investigations inevitably means some delays before results emerge. This investigation was intended to act as a stop-gap to ensure that lessons from the UK Critical Illness experience in the early 1990's are not lost entirely.

The analysis contained herein is based on data gathered in two distinct phases : the first covered 1991 to 1995 and the second 1996 and 1997. A preliminary report on the 1991-95 experience was published in October 1997¹⁰. Not all of the original contributors were able to supply data for the second investigation whereas a number of new offices joined at this stage, some of whom also contributed data in respect of part of the earlier period. The data for 1991-95 therefore differs from that in the preliminary report although we do not believe the differences are material.

The authors have attempted to verify the data received as far as possible but cannot be held responsible for any errors that may remain. Care should be exercised in using the results of this investigation.

4.2 SCOPE OF THE INVESTIGATION

All companies known to write long-term individual Critical Illness business were approached, via their Appointed Actuary, in January 1997 in respect of 1991-1995 data. This data formed the basis of the Preliminary Report referred to earlier. All companies were approached again in December 1998 in respect of 1996-1997 (regardless of their earlier participation). To date, data has been received and able to be used in respect of 32 companies (shown below). Each of these companies has been provided with an analysis of their own experience as well as this summary of the overall market experience.

Participating Offices

Abbey Life	Ecclesiastical Insurance	Royal Life
Abbey National Life	Equitable Life	Scottish Life
Albany Life	General Accident Life	Scottish Provident
Alliance & Leicester Life	Guardian Assurance	Scottish Widows
Allied Dunbar	Halifax Life	Skandia Life
AXA Sun Life	London & Manchester	Standard Life
Barclays Life	Midland Life	Sun Life of Canada
Black Horse Life	Nationwide Life	Swiss Life (UK)
Britannia Life	Nat West Life	Winterthur Life
BUPA Health	Norwich Union	Zurich Life
Cornhill Insurance	Reliance Mutual	

NB: A number of companies have changed their name since the investigation commenced. The old name is still used above where this is a better indicator of the business included within the analysis.

Many of the major companies were able to participate so that the authors estimate that this investigation covers over 60% of all claims arising during the investigation period.

It is important to note that whilst the investigation was intended to cover the period 1 January 1991 to 31 December 1997, many of the contributing offices launched Critical Illness policies during this period so are only included from launch. Others were unable to supply data for the entire period. Any conclusions drawn within this analysis are vulnerable to changes in the market profile or changes in contributing offices.

The investigations cover both Accelerated and Stand-Alone business. For the latter, the only comparison to be undertaken was between Critical Illness claims and expected incidences. For Accelerated business, two comparisons were intended - again between Critical Illness claims and expected incidences, but also between both Critical Illness and Death claims and the total expected claims. In a few cases companies were unable to identify death claims under Accelerated Critical Illness policies, so these companies were included in only the Critical Illness part of that investigation.

Data was requested either on an individual age basis on diskette, or in 5-year age bands in paper format. Without

exception, the companies with the largest portfolios submitted electronic data, so that there is minimal loss of accuracy in the overall report from the use of age-banded data. A copy of the paper forms for the In Force is shown below:

IN FORCE SUMMARY DATASHEET

Company :

Policy Type : **Stand-Alone / Acceleration** In force at : / /19

Sex : **Male / Female** Status : **Non-Smoker / Smoker**

Age definition : Standard Rates cases only : **Yes / No**

Age	Curtate Duration 0		Curtate Duration 1		Curtate Duration 2+	
	No. of lives	Sums assured	No. of lives	Sums assured	No. of lives	Sums assured
20-24						
25-29						
30-34						
35-39						
40-44						
45-49						
50-54						
55-59						
60-64						
65-69						
70-74						
75-79						
80 +						

For each claim the following data fields were requested : Policy Type (Accelerated or Stand-Alone), Date of Birth, Policy Commencement Date, Sex, Smoker Status, Critical Illness Sum Assured, Claim Amount Paid, Date of Diagnosis, Date Claim Paid and Cause of Claim.

As can be seen above the requested in force data was split by duration between duration 0, duration 1 and duration 2+. The authors had no prior view as to the length of the select period but it was agreed that to use any longer period would both complicate the investigation and could infringe on the confidentiality of those offices with the most mature portfolios.

In the following Sections results are referred to as being on a "Policies" basis. This is not strictly correct in that where Joint Life First Event policies are included in the investigation, both lives should have been included within the exposure. However neither would it have been correct to refer to results being on a "Lives" basis as no attempt has been made to eliminate multiple policies on a single life, even within an office. Perusal of the claims data revealed a number of such instances.

4.3 METHODOLOGY

4.3.1 Exposure

Very little exposure data lies outside the age-ranges 18 to 80, so the investigation was limited to these ages. There were no claims reported outside this range (A few claims for Childrens' benefit were advised. Since there was no corresponding measure of exposure, these were ignored).

The exposure was calculated using a Census method from the In Force data at each year-end and assuming that policies enter and lapse uniformly over the year. The formulae used are set out in Appendix 4A.

The following points should be noted :

- 1) No attempt was made to separately calculate the exposure for each of the Critical Illnesses, according to whether they are covered by particular offices. This was felt to be an unnecessary complication, particularly where offices have different generations of policies and in some cases have retrospectively extended cover. It was also anticipated that the vast majority of claims would be attributable to the "core" conditions, covered by all offices.

Furthermore, no allowance was made for any variation in the definitions of the various events. The authors feel that - with the possible exception of Total and Permanent Disability - variations between offices' definitions are minor and unlikely to significantly impact on their claims experience. In addition, the definitions used for some events would have changed during the investigation period.

By providing an indication of the relative significance of the various causes of claim within Section 4.5, the authors hope that offices will be able to assess the relative cost of their particular list of events and their definitions in interpreting their experience.

- 2) Although data was only requested for the period 1991-1997 some offices in fact supplied data for 1998 as well. This data has been included within this analysis.
- 3) In a few cases, the company year-end is not 31 December. Such differences have been ignored.
- 4) Some business was received on an Aggregate basis, rather than Smoker-differentiated. One company wrote business on an Aggregate basis whilst others were unable to differentiate some of their business between Smoker and Non-Smoker. This business has not been included in the Non-Smoker or Smoker category, but has been included within the Aggregate category.
- 5) For the convenience of contributing offices, data was accepted on either a "Standard Rates only" or an "All Policies" basis. Data was received in both categories. An approximate allowance is made for this within Section 4.4.1 below.

4.3.2 Actual Claims

The claims data requested is listed in 4.2 above.

Only paid claims were included in the analysis. In fact very few pending claims were reported but it was not clear whether all offices would have reported these. Since the majority of the investigation is limited to 31 December 1997, the authors expect the claims experience to be virtually complete.

Claims were incorporated within the analysis according to the Date of Diagnosis, where known. In some cases only the Date of Payment was supplied so this has been used instead.

The Cause of Claim was not always available so the analysis of experience by cause is for a (large) subset of the total claims experience.

Although both the Sum Assured and the Actual Payment were requested, only the Sum Assured has actually been used. There are various reasons why the two may differ, for example :

- If it is because the payment was delayed and hence interest was added it would be correct to use the Critical Illness Sum Assured.
- If, however, it is because a partial payout is made (either on an ex-gratia basis or because the policy stipulates a maximum payout, as for angioplasty say) then it would be more appropriate to use the actual claim payment.

4.3.3 Expected Claims

The bulk of the analysis has used the Base Table CIBT93, developed in Section 3. In Section 4.4.8 below some results are presented using the IC94 table (as developed in the paper "Reserving for Critical Illness Guarantees" which was presented to the Society of Actuaries in Ireland⁷ in November 1994) as this table was used in our preliminary report and has been commonly used in the UK.

Data was accepted from offices on any age definition. The rates used for calculating the expected claims were then adjusted according to the age definition underlying the data for the particular office. Since the Base Table is on an age exact basis, the following adjustments were applied :

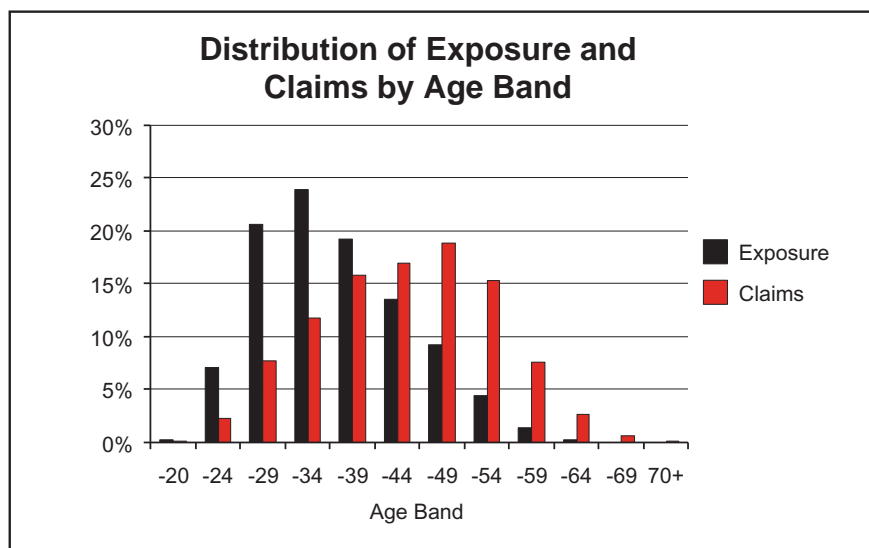
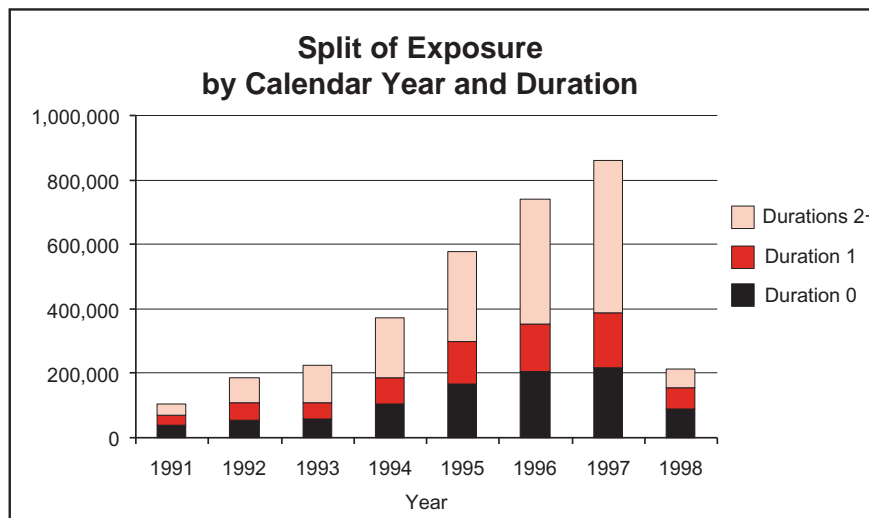
Age Nearest at 31 December	No adjustment
Age Last at 31 December	Use $(rate_x + rate_{x+1})/2$
Age Next at 31 December	Use $(rate_{x-1} + rate_x)/2$
Age Last at previous policy anniversary	Use $rate_{x+1}$
Age Next at previous policy anniversary	No adjustment

In the analyses of Accelerated business where Critical Illness claims only have been included, expected claims were calculated using the Stand-Alone rates from the Base Table. The assumption behind this is that cases where a policyholder dies soon after diagnosis of a Critical Illness are more likely to be notified as death claims than as Critical Illness claims, as the evidence requirements will generally be less.

4.4 OVERALL RESULTS

4.4.1 Introduction

In total the investigation contains over 5,000 claims under Accelerated business and over 400 under Stand-Alone business. The authors believe the results are therefore the best guide yet available to Critical Illness experience in the UK. It is however essential that the immaturity of the portfolio is recognised. In particular, as the graphs below demonstrate, the bulk of the exposure for Accelerated business relates to 1994-7 and is weighted towards shorter durations. Also there is relatively little exposure above age 50 :



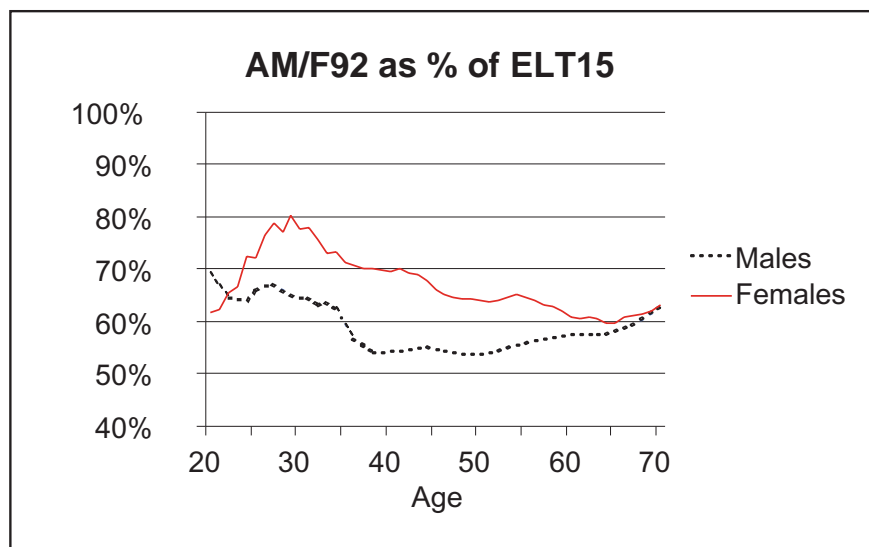
Overall results of the experience investigation are set out in Appendix 4B. These are set out as follows :

Table 1	Accelerated	All Claims	Policies
Table 2	Accelerated	All Claims	Amounts
Table 3	Accelerated	Critical Illness Claims only	Policies
Table 4	Accelerated	Critical Illness Claims only	Amounts
Table 5	Stand-Alone	Critical Illness Claims only	Policies
Table 6	Stand-Alone	Critical Illness Claims only	Amounts

In all cases these results are compared to the Base Table.

Some general comments are appropriate before the results are discussed :

- (1) As with any industry-wide analysis, care must be taken with the interpretation of results. In particular this analysis may contain heterogeneous types of business, such as mortgage-related and non-mortgage business. If these are not in constant proportions throughout the analysis unusual results may emerge.
- (2) Since the results are presented in comparison with the Base Table derived at a population level, it is not obvious what the "expected" result is. The authors hope that offices will find the results useful, perhaps by approximately adjusting the expected basis from the Base Table to their charging rates or their reassurance rates, for example. As an initial indication though, the following comparison of AM92 and AF92 ult with ELT15 may be helpful:



- (3) It has previously been noted that some offices contributed data including rated policies whilst others contributed "standard rates" data only. Overall it appears that around 50% of the exposure falls into each category. If one then hypothecates that around 10% of cases are rated and that an average loading might be +100% (or 2x ordinary rates) then the overall results will overstate standard rates results by around 5%. Offices need to take this into account in interpreting their own experience.
- (4) The results are based on an analysis of policies, rather than lives, which may mean that they could be distorted by lives with multiple policies. However, this would not impact the analysis of amounts. There may also be a distortion in the overall results as some companies may not have been able to exclude benefits that have been taken up under insurability options. These options would not have required the provision of medical evidence.

4.4.2 Overall Results - Accelerated Cover

The overall Accelerated results shown in Table I of Appendix 4B appear favourable at 46% for males and 43% for females on a aggregate policies basis. It is interesting to note that the duration 2+ result for males of 53% is remarkably similar to the relationship between AM92 and ELT15 shown above. In contrast, Accelerated experience for females is slightly better than for males whereas AF92 is generally higher in relation to ELT15.

The results for policies and amounts are similar, with amounts showing slightly better experience. This could be interpreted as demonstrating that there has been no anti-selection in terms of insured amounts, or at least that the

impact of, for example, stronger medical underwriting and higher average socio-economic class has been sufficient to outweigh any anti-selective effect.

Comparison of all claims experience with Critical Illness only claims experience, i.e. Table 1 of Appendix 4B with Table 3 (or Table 2 with Table 4) produces similar results which lends support to the Dash & Grimshaw model⁵, which is widely used in deriving Accelerated rates and was used for the Base Table.

Subsequent results are for the combined experience on a policies basis unless specifically stated otherwise.

4.4.3 Results by Calendar Year

The overall results hide a considerable variation over time. The following results are for male Non-Smokers only, to avoid any bias from changes in the portfolio mix. The number of claims for all durations is shown to give an indication of the relative significance of each year.

	Dn 0	Dn 1	Dns 2+	All Dns	Number of Claims
1991	52%	87%	71%	70%	115
1992	48%	55%	62%	57%	176
1993	33%	45%	54%	48%	189
1994	30%	53%	52%	47%	307
1995	25%	33%	48%	40%	403
1996	20%	35%	43%	36%	491
1997	24%	35%	51%	43%	676
1991-97	27%	42%	50%	43%	2,357

There is a clear downward trend in the earlier years. Our initial reaction to this trend was that it was probably a result of the changes in market composition over the period. For example, the greater proportion of mortgage-related business in more recent years was noted earlier. It should be noted that there is a slight increase in experience from 1996 to 1997.

We therefore repeated the analysis for a smaller group of offices, who had contributed data throughout the period :

	Dn 0	Dn 1	Dns 2+	All Dns	Number of Claims
1991	52%	87%	71%	70%	115
1992	58%	53%	58%	57%	119
1993	29%	38%	54%	46%	119
1994	38%	59%	53%	52%	162
1995	28%	47%	46%	44%	160
1996	26%	42%	52%	47%	200
1997	27%	35%	55%	50%	240
1991-97	37%	51%	54%	50%	1,115

These results seem to demonstrate that there has been a substantial improvement for these offices, although a smaller element of the overall market improvement has also been the result of structural changes.

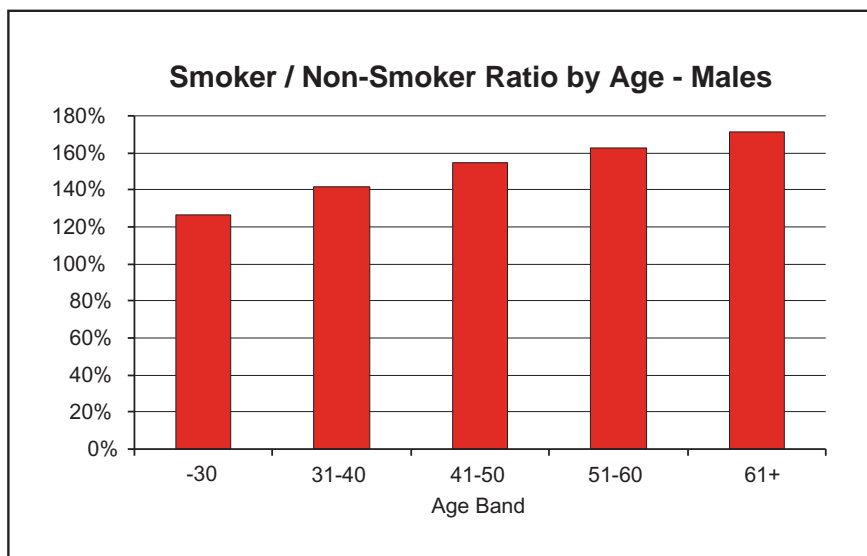
Similar results emerge for females and for Smokers.

It is noticeable that the reduction in experience is greater for duration 0 business than for durations 2+. Although this could reflect reduced anti-selection we feel that a stronger influence is the tendency to a higher average duration in the durations 2+ business. This may also explain the slight worsening of experience in the most recent years.

4.4.4 Smoker / Non-Smoker Differentials

Results emerging from the CMI investigations into Smoker-differentiated mortality¹¹ suggest a differential of around 170%, although this does vary significantly by age, duration and type of business. This is similar to differentials emerging in US mortality experience. Intuitively one might expect the differentials on Critical Illness business to be wider than mortality, since the main causes of claim are all potentially affected by smoking.

Our Preliminary Report into the 1991-95 experience showed much lower Smoker to Non-Smoker differentials than we expected, of around 135% for males and just 120% for females. These differentials have widened with the additional experience to 150% for males and 137% for females, suggesting that the low results may have been a reflection of the immaturity of the portfolio and the relatively low age profile. In particular, male results now increase steadily with age, supporting this view. We therefore expect these differentials to continue to increase as the portfolio continues to mature.



It is also important to note that, as a new line of business, Critical Illness may have been underwritten more strictly than existing lines of business such as pure life cover. One implication of this would be that the Smokers included in a Critical Illness portfolio would on average smoke less than those in a “life cover only” portfolio, and hence exhibit a narrower differential over Non-Smokers.

It should also be noted that the overall figures are reduced as a result of a low smoker/non smoker ratio for one particular office. Although extensive checking has failed to locate any inaccuracy in our analysis, we nevertheless thought readers would be interested in the ratios excluding this office:

Age Band	Males	Females
Up to 30	130%	109%
31-40	149%	131%
41-50	169%	184%
51-60	180%	141%
61+	193%	191%
All ages	162%	149%

The effects of smoking are considered further in Section 4.5 for each of the main causes of claim separately.

4.4.5 Results by Duration

There had been numerous concerns during the early development of Critical Illness business regarding anti-selection as early claims emerged. In some instances these appeared to indicate non-disclosure but such claims were paid if this remained unproven. An apocryphal story concerns a policy taken out in the morning and the policyholder

consulting their doctor regarding breast Cancer in the afternoon. This led to some calls for Critical Illness policies to contain a moratorium whereby no claims would be paid within the first 3 months (say) of the contract.

Whilst there have undoubtedly been claims which have rightly aroused the concerns of claims managers, the results for 1991-97 show that overall there has been very strong positive selection, especially at duration 0. Indeed this is noticeably stronger than on recent mortality tables. Using males, all claims on a policies basis as an illustration:

	Dn 0	Dn 1	Dns 2+	Dn 0/Dn 2+	Dn 1/Dn 2+
Male Non-Smoker	27%	41%	49%	54%	82%
Male Smokers	50%	63%	69%	73%	91%
Male Aggregate	31%	45%	53%	59%	85%
AM92(2) [age 45]				82%	96%

This may again reflect strict underwriting procedures. It may also partly reflect the heterogeneity of the business; suppose mortgage-related business has lower claims experience than protection business. Since the mortgage business is of more recent vintage, it will pull down the duration 0 result more than the duration 2+ result.

Analysis of Critical Illness only claims indicates a similar level of selection.

It is important to note that the length of the select period on Critical Illness policies is unknown and could be significantly different from the 2-year period that was adopted for this investigation. As a result, the 2+ experience may not be a good guide to the ultimate experience.

4.4.6 Results by Age

Results for males for the main age bands (31-40, 41-50 and 51-60) are remarkably similar. However experience for both younger and older lives is heavier. This is consistent with the relationship between mortality experience for the population and insured lives as illustrated in Section 4.4.1 above.

The female experience shows less of a clear pattern but overall experience appears to fall with age, again broadly consistent with the relationship between mortality experience for the population and insured lives illustrated earlier.

4.4.7 Results by Company and by Distribution Channel

Data received from participating offices was not subdivided by distribution channel or by product type (other than Accelerated/Stand-Alone). Nevertheless it appeared that the experience could differ markedly between companies and we were keen to gain any insights possible. With this in mind, we segregated the participating offices into three categories, according to our perception of their primary distribution channel. The 3 categories used were "Bancassurer", "Direct Sales Force (DSF)" and "Independent Financial Adviser (IFA)".

The results should be treated with caution for several reasons :

- Several offices sell via several channels
- The results are not necessarily caused by the distribution channel, but could be a function of the product type or the socio-economic mix of the portfolio
- There is still wide variation between the experience of offices within each category
- There is a limited amount of exposure under IFA business
- There is a different weighting between select and ultimate experience within each category.

The following results are combined for males and females, Non-Smokers and Smokers on a policies basis. It has already been noted that experience in 1991 and 1992 was particularly heavy and since these years were dominated by DSF companies they have been excluded to limit the distortion of the comparison.

Distribution Channel	Number of Claims	Actual/Expected %
Bancassurer	1,674	37
DSF	2,544	51
IFA	287	34
Total	4,505	44

We do not believe the difference between the results for IFA business and Bancassurers to be significant, however it appears that experience for companies selling business through Direct Sales Forces is of the order of 40% higher. This is likely to overstate the true picture, because of the greater weighting towards longer durations in the DSF business, but we believe that a genuine difference exists in the experience and is likely to lie in the range 25% to 35%.

In order to further demonstrate the variability in experience between companies, results are shown below for the top 8 contributing offices. Together these 8 companies account for 94% of the total exposure in this investigation. The following results are combined for males and females, Non-Smokers and Smokers on a Policies basis and again exclude 1991 and 1992 experience. In order to avoid infringing confidentiality no figures have been shown for actual or expected claims; only the ratio of actual to expected.

Company	Duration 0	Duration 1	Duration 2+	Standardised All Durations
A	19%	36%	21%	23%
B	18%	27%	37%	31%
C	35%	33%	40%	37%
D	35%	33%	52%	45%
E	29%	41%	56%	47%
F	34%	50%	54%	49%
G	29%	55%	57%	50%
H	34%	52%	62%	53%

It is noteworthy that some of the variation between companies is the result of differences in the maturity of portfolios.

If one applies constant weights to the experience of each office by duration then some of this effect is removed. Using the average weights of these 8 companies combined (23% duration 0, 19% duration 1 and 58% durations 2+) produces the results shown as "standardised" in the table above. Considerable variation in companies' results remains, but it should be noted that these values are not truly standardised as there are still considerable variations in weightings within the "2+" category.

4.4.8 Accelerated Results - Comparison with IC94

As noted earlier, it is not obvious what the "expected" result is and in view of the widespread use of IC94 as a comparison basis we felt it was appropriate to show some results against IC94.

The following features of the IC94 tables should be noted :

- The incidence rates and mortality rates underlying the table were largely derived from UK population data, but then adjusted as deemed appropriate for Irish experience
- The table covers the following events : Cancer, Heart Attack, Stroke, Coronary Artery Bypass Surgery, Open Heart Surgery, Angioplasty, Kidney Failure, Major Organ Transplant, Multiple Sclerosis, Paralysis, Blindness, Terminal Illness, Benign Brain Tumour, and Motor Neurone Disease.
- It should be noted that no form of Total and Permanent Disability cover has been incorporated.
- The table contains an adjustment from population experience to that expected from an insured portfolio
- It is an Aggregate table, i.e. there is no adjustment for Smoker/Non-Smoker

- Further, no adjustment was made in respect of initial selection
- IC94 contains tables for both Accelerated and Stand-Alone business. The rates for Accelerated business were derived using the "Dash & Grimshaw" model⁵

A summary of the results for all claims on a policies basis against IC94 is shown below :

Males Aggregate	Duration 0	Duration 1	Duration 2+	All Durations
Up to 30	45 %	105 %	114 %	86 %
31 - 40	59 %	76 %	94 %	81 %
41 - 50	50 %	69 %	85 %	74 %
51 - 60	54 %	78 %	90 %	82 %
61 +	91 %	66 %	102 %	95 %
All Ages	54 %	77 %	91 %	79 %

Females Aggregate	Duration 0	Duration 1	Duration 2+	All Durations
Up to 30	29 %	50 %	83 %	55 %
31 - 40	41 %	58 %	74 %	62 %
41 - 50	54 %	69 %	74 %	69 %
51 - 60	35 %	76 %	69 %	64 %
61 +	28 %	51 %	64 %	57 %
All Ages	41 %	63 %	74 %	63 %

For males, it appears that overall ultimate experience could reach IC94 as the portfolio matures. There are however considerable differences by age, greater than those exhibited when comparing experience to the Base Table. We feel these largely result from improvements in male Heart Attack experience in the UK during the 1980's. In particular, MSGP 1991/2 exhibited substantial improvement over the earlier 1981/2 survey, which was used in the construction of IC94.

For females, the results appear to have emerged lower than expected from IC94. In part this is a reflection of the loading implicit in IC94 for Cancer (the incidence of which was perceived to be higher in Ireland) which has a greater impact on females. However lighter experience was also noted earlier using the Base Table.

In deciding whether IC94 is an appropriate basis for valuation or pricing, offices need to consider the improvement in experience during our investigation period and the considerable variation in experience by office.

4.4.9 Stand-Alone Business

As noted above there are fewer claims within this investigation - only 462 in total - so less credibility can be attached to the results. Results are shown in Tables 5 and 6 of Appendix 4B.

Results on a policies basis are similar to those for Accelerated business - the male claim experience appears slightly lighter whereas the female experience appears slightly heavier.

The claims experience at young ages (up to 30) appears particularly high and may give cause for concern, but this is based on relatively few claims.

Smoker/Non-Smoker differentials are higher than on Accelerated business - at 179% for males and 174% for females overall.

Results by duration also exhibit a different feature from Accelerated business. The duration 0 result is slightly higher than for Accelerated business, but the duration 1 result is significantly so. The duration 2+ result is better, but it must be remembered that the Stand-Alone business tends to be less mature. Overall, therefore initial selection appears less pronounced than for Acceleration business.

Results on an amounts basis are higher than for policies for females. Some of this may be explained by greater variability in sums assured for Stand-Alone business - in contrast a large proportion of Accelerated business is mortgage-related and hence the sum assured less variable.

We are aware that one office incorrectly omitted some claims from this analysis. Excluding this Company, the overall aggregate results on a policies basis increase from 43% to 47% for males and from 49% to 59% for females.

4.5 RESULTS BY CAUSE OF CLAIM

As was noted earlier this analysis was performed on a subset of the overall data for Accelerated business only, where information on cause of claim was available. In total 3,582 claims were included within this analysis. It should be noted that the overall results differ slightly from those of the full data set.

A summary of results compared to the Base Table is given in Appendix 4C. The discussion below attempts to highlight some of the notable features.

Cancer

This is the largest cause of claim, and especially so for females. Experience in relation to the Base Table is higher than for most other causes.

The most striking feature of the experience is the apparent lack of any additional risk for Smokers. For males, Non-Smoker experience is markedly higher than Smoker experience whilst for females the two are similar. The "excess" male Non-Smoker experience is principally at ages up to 40. We expect that Smoker experience will deteriorate as smoking - related Cancers emerge with increasing duration. It may also be the case, as noted earlier in Section 4.4.4, that the experience currently covers only "moderate" Smokers.

There is a strong positive selection effect for duration 0 but duration 1 experience is then heavier than durations 2 and over.

Heart Attack

This is another major cause of claim for males but only 22 of the 527 claims were for females. Experience relative to the Base Table is similar to that of the overall investigation.

Smoker experience is approximately double that of Non-Smokers, whilst for males there appears to be an increasing A/E with age. There appears to be reasonably strong initial selection. If this lasts for longer than two years, then one would expect the duration 2+ results to increase further as portfolios mature.

Stroke

Experience is much lower relative to the Base Table than for either Cancer or Heart Attack but appears to increase with duration so this may merely be reflective of the immaturity of the portfolio. Again there appears to be a strong Smoker/ Non-Smoker effect.

Coronary Artery Bypass Graft (CABG)

Experience is higher than average relative to the Base Table and shows little evidence of positive selection. This is somewhat surprising as the underlying disease is essentially the same as that giving rise to a Heart Attack, and may therefore indicate a degree of anti-selection.

As with cancer, Non-Smoker experience exceeds that of Smokers. In this case this could be reflective of cardiologists' reluctance to perform surgery on those unwilling to help themselves by giving up smoking.

Results increase with age, as noted earlier for Heart Attack.

Multiple Sclerosis (MS)

Experience for both males and females is higher than average relative to the Base Table but not substantially so. Male experience appears to indicate a reasonable level of initial selection - as one would anticipate with a progressive disease - and a significant correlation with smoking. In contrast, the selection is less marked for females and there is virtually no smoking impact apparent. Whereas the bulk of claims are anticipated between ages 30 and 50, there are a high number of female claims at even younger ages.

Kidney Failure (KF) and Major Organ Transplant (MOT)

The number of expected claims for both these events is too small to allow any meaningful comment on experience to date.

Total and Permanent Disability (TPD)

This is a significant event, especially at the younger ages due to the accident risk. Overall experience appears light relative to the Base Table and with little smoking impact.

However the results increase markedly by duration and this may be caused by a tendency to defer claims until permanency can be definitely established. This may result in claims incurred at duration 0 being paid in duration 1 or even later. This suggests experience relative to the Base Table will increase as the business matures.

Results also appear to increase with age, suggesting that there may be an element of TPD being used as an early retirement vehicle above age 50.

The Base Table does not differentiate between males and females for TPD, but the experience indicates female experience is about 75% of that for males.

Death

It must be remembered that we are referring to residual death here, as in many cases death will normally follow behind one of the Critical Illnesses. Results are very similar to the overall results relative to the Base Table, but are subject to a marked Smoker/ Non-Smoker differential. Results by duration show a strong element of selection - indeed perhaps stronger than on conventional mortality business. This may reflect the tougher underwriting approach generally adopted for Critical Illness business.

Other Causes

The "All Causes" figures in Appendix 4C include claims from other causes, even though there is no expected for these within the Base Table. The cause of these claims is shown below, split by sex :

	Males	Females
Benign Brain Tumour	11	6
Blindness	1	0
Coma	5	3
Motor Neurone Disease	7	0
Paralysis	3	0
Parkinson's Disease	4	3
Severe Burns	1	0
Terminal Illness	7	7
Total	39	19

Many of these events have only been added to Critical Illness cover during the period of the investigation and indeed most of the claims in the above table relate to 1996 and after.

It should be noted that "Other Causes" figures may be under-stated:

- Some claims were recorded as "Brain Tumour". It was not clear whether these were benign (and should be included under "Benign Brain Tumour") or malignant (and should be included under "Cancer").
- Some claims were recorded as "Heart". It was not clear whether these were "Heart Attacks" or some other event, for example "Heart Valve Surgery". As a result, all Heart Surgery claims were included within "Heart Attack".

The number of such claims was not sufficient to materially impact the Cancer or Heart Attack results.

APPENDIX 4A - EXPOSURE FORMULAE

The following formulae have been used, where $IF_t(\text{year}, \text{age})$ is defined as the In Force at duration t at the end of the year for given age, $EXP_t(\text{year}, \text{age})$ is the exposure for duration t during that year for the given age, and $@if$ takes the form of the Lotus 1-2-3 function, i.e. $@if(x=y, A, B)$ takes the value A if $x=y$ and the value B if $x < y$.

Individual-age data :

Duration 0 : $EXP_0(\text{year}, \text{age}) = [2 * IF_0(\text{year}, \text{age}) + IF_1(\text{year}, \text{age}) + IF_0(\text{year}-1, \text{age}-1)] / 4$

Duration 1 : $EXP_1(\text{year}, \text{age}) = [IF_0(\text{year}-1, \text{age}-1) + 3 * IF_1(\text{year}, \text{age}) + 3 * IF_0(\text{year}-1, \text{age}-1) + @if\{IF_1(\text{year}-1, \text{age}-1) + IF_2(\text{year}-1, \text{age}-1) = 0, 0, IF_2(\text{year}, \text{age}) * IF_1(\text{year}-1, \text{age}-1) / (IF_1(\text{year}-1, \text{age}-1) + IF_2(\text{year}-1, \text{age}-1))\}] / 8$

Durations 2+ : $EXP_2(\text{year}, \text{age}) = [3 * IF_2(\text{year}, \text{age}) + @if\{IF_1(\text{year}-1, \text{age}-1) + IF_2(\text{year}-1, \text{age}-1) = 0, 0, IF_1(\text{year}-1, \text{age}-1) + 5 * IF_2(\text{year}-1, \text{age}-1) - IF_2(\text{year}-1, \text{age}-1) * (IF_1(\text{year}-1, \text{age}-1) + IF_2(\text{year}-1, \text{age}-1)) - IF_2(\text{year}, \text{age}) / (IF_1(\text{year}-1, \text{age}-1) + IF_2(\text{year}-1, \text{age}-1))\}] / 8$

Age-Banded data :

Duration 0 : $EXP_0(\text{year}, \text{age}) = [2 * IF_0(\text{year}, \text{age}) + IF_1(\text{year}, \text{age}) + IF_0(\text{year}-1, \text{age})] / 4$

Duration 1 : $EXP_1(\text{year}, \text{age}) = [IF_0(\text{year}-1, \text{age}) + 3 * IF_1(\text{year}, \text{age}) + 3 * IF_0(\text{year}-1, \text{age}) + @if\{IF_1(\text{year}-1, \text{age}) + IF_2(\text{year}-1, \text{age}) = 0, 0, IF_2(\text{year}, \text{age}) * IF_1(\text{year}-1, \text{age}) / (IF_1(\text{year}-1, \text{age}) + IF_2(\text{year}-1, \text{age}))\}] / 8$

Durations 2+ : $EXP_2(\text{year}, \text{age}) = [3 * IF_2(\text{year}, \text{age}) + @if\{IF_1(\text{year}-1, \text{age}) + IF_2(\text{year}-1, \text{age}) = 0, 0, IF_1(\text{year}-1, \text{age}) + 5 * IF_2(\text{year}-1, \text{age}) - IF_2(\text{year}-1, \text{age}) * (IF_1(\text{year}-1, \text{age}) + IF_2(\text{year}-1, \text{age})) - IF_2(\text{year}, \text{age}) / (IF_1(\text{year}-1, \text{age}) + IF_2(\text{year}-1, \text{age}))\}] / 8$

Notes :

- 1) The impact of ageing and people moving between age-bands has been ignored for banded data. Since all the major contributors have submitted individual-age data this represents little loss of accuracy in the overall results.
- 2) Care was required as to which years exposure was calculated for. If (say) the first in force data received was at 31/12/1993 then :
 - I If there is only duration 0 business at 31/12/1993 then we assumed the office commenced writing business during 1993. Hence there is a zero IF at 31/12/1992 and the exposure for 1993 was included.
 - II If there is NOT only duration 0 business at 31/12/1993 then we assumed the office commenced writing business prior to 1993. Hence there is a non-zero IF at 31/12/1992 that was not submitted and the first exposure included is for 1994

Under I above the exposure for the first year especially may be quite inaccurate according to when the office launched its contracts. This will not materially impact on the overall results but could distort the results for an individual office where this applies.

Table 1 Acceleration business All Claims (incl mortality) Policies

	Total Actual / Expected				Total Actual (£000)				Total Expected (£000)				Total Exposure (£000)			
	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns
Male Aggregate																
Age																
-30	26%	60%	64%	49%	61	99	152	312	237	165	236	638	166,867	115,359	162,840	445,066
31-40	33%	43%	53%	46%	162	173	502	837	487	405	946	1,839	211,751	174,666	397,905	784,322
41-50	30%	43%	52%	45%	173	216	784	1,173	569	508	1,509	2,586	97,395	86,593	253,041	437,029
51-60	31%	45%	52%	47%	108	143	621	872	343	316	1,195	1,854	24,892	22,845	83,658	131,395
61+	50%	36%	56%	52%	28	14	111	153	56	39	197	292	1,677	1,204	5,998	8,879
TOTAL	31%	45%	53%	46%	532	645	2,170	3,347	1,693	1,433	4,083	7,208	502,583	400,667	903,441	1,806,691
Female Aggregate																
Age																
-30	23%	40%	66%	43%	39	48	117	204	172	121	178	470	169,946	117,431	164,694	452,071
31-40	29%	41%	52%	43%	99	116	348	563	345	286	674	1,304	171,044	140,854	325,703	637,600
41-50	35%	45%	49%	45%	114	129	401	644	322	285	815	1,422	69,843	61,643	174,904	306,390
51-60	22%	48%	43%	40%	30	61	199	290	138	128	458	724	14,707	13,548	47,282	75,537
61+	18%	32%	41%	36%	2	3	21	26	11	9	51	72	567	473	2,546	3,586
TOTAL	29%	43%	50%	43%	284	357	1,086	1,727	988	829	2,176	3,992	426,106	333,949	715,129	1,475,184
Male Non-Smokers																
Age																
-30	26%	58%	58%	46%	46	73	106	225	180	126	183	489	126,504	87,840	126,551	340,895
31-40	30%	37%	50%	42%	113	117	371	601	381	317	742	1,440	165,072	136,058	311,383	612,514
41-50	26%	38%	48%	41%	117	156	578	851	458	408	1,213	2,078	78,156	69,327	203,122	350,605
51-60	22%	41%	49%	42%	62	107	484	653	285	261	991	1,537	20,619	18,823	69,308	108,750
61+	48%	32%	52%	49%	24	11	91	126	51	35	174	259	1,523	1,076	5,271	7,870
TOTAL	27%	41%	49%	42%	362	464	1,630	2,456	1,354	1,145	3,304	5,803	391,874	313,124	715,635	1,420,634
Male Smokers																
Age																
-30	26%	66%	87%	58%	15	26	46	87	57	39	53	149	40,363	27,519	36,289	104,171
31-40	46%	63%	64%	59%	49	56	131	236	106	89	205	400	46,679	38,608	86,522	171,808
41-50	50%	60%	70%	63%	56	60	206	322	111	100	295	507	19,239	17,266	49,919	86,424
51-60	79%	66%	67%	69%	46	36	137	219	58	55	203	316	4,273	4,022	14,350	22,645
61+	80%	74%	86%	83%	4	3	20	27	5	4	23	32	154	128	726	1,009
TOTAL	50%	63%	69%	63%	170	181	540	891	338	287	779	1,405	110,708	87,543	187,806	386,057
Female Non-Smokers																
Age																
-30	23%	41%	62%	42%	31	39	86	156	135	95	140	369	133,232	91,815	129,257	354,305
31-40	28%	37%	51%	42%	79	85	276	440	279	231	546	1,056	138,391	113,885	263,733	516,008
41-50	33%	42%	42%	40%	86	96	281	463	260	230	666	1,156	56,423	49,789	143,000	249,212
51-60	21%	48%	41%	39%	24	50	156	230	114	104	376	594	12,017	11,021	38,861	61,899
61+	20%	37%	36%	33%	2	3	16	21	10	8	45	63	490	412	2,216	3,118
TOTAL	28%	41%	46%	40%	222	273	815	1,310	797	668	1,773	3,238	340,553	266,921	577,067	1,184,541
Female Smokers																
Age																
-30	22%	34%	81%	47%	8	9	31	48	37	26	38	102	36,714	25,616	35,436	97,766
31-40	31%	57%	56%	50%	20	31	72	123	65	55	128	248	32,653	26,969	61,971	121,592
41-50	45%	60%	81%	68%	28	33	120	181	62	55	149	265	13,420	11,854	31,904	57,178
51-60	24%	47%	53%	46%	6	11	43	60	25	24	81	130	2,690	2,528	8,421	13,638
61+	0%	0%	76%	54%	0	0	5	5	2	1	7	9	77	61	330	468
TOTAL	33%	52%	67%	55%	62	84	271	417	191	160	403	754	85,553	67,028	138,062	290,643

Table 2 Acceleration business All Claims (incl mortality) Amounts

	Total Actual / Expected				Total Actual (£000)				Total Expected (£000)				Total Exposure (£000)			
	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns
Male Aggregate																
Age																
-30	27%	57%	63%	48%	2,840	3,990	6,129	12,960	10,330	7,009	9,786	27,124	7,292,717	4,907,963	6,750,371	18,951,052
31-40	35%	47%	53%	47%	7,946	8,742	22,671	39,359	22,887	18,450	42,683	84,020	10,126,030	8,093,288	18,177,139	36,396,457
41-50	32%	36%	49%	42%	7,658	7,016	27,873	42,547	23,881	19,713	57,204	100,797	4,199,240	3,467,388	9,937,155	17,603,783
51-60	22%	45%	50%	43%	2,918	4,664	18,062	25,644	13,085	10,335	36,340	59,761	967,781	766,681	2,634,629	4,369,091
61+	43%	29%	46%	43%	902	345	2,270	3,516	2,082	1,184	4,962	8,227	63,968	37,226	155,076	256,270
TOTAL	31%	44%	51%	44%	22,264	24,757	77,006	124,026	72,264	56,690	150,974	279,929	22,649,736	17,272,547	37,654,370	77,576,653
Female Aggregate																
Age																
-30	20%	42%	63%	42%	1,481	2,107	4,549	8,137	7,271	5,044	7,277	19,591	7,197,011	4,883,357	6,729,632	18,810,000
31-40	30%	42%	47%	41%	4,189	4,844	13,034	22,067	14,200	11,641	27,873	53,714	7,232,158	5,873,592	13,720,832	26,826,581
41-50	36%	46%	46%	44%	3,670	4,146	12,453	20,269	10,329	8,965	27,020	46,314	2,314,858	2,003,571	5,988,537	10,306,966
51-60	21%	41%	42%	38%	751	1,264	4,846	6,861	3,495	3,086	11,509	18,090	378,843	334,173	1,223,691	1,936,707
61+	78%	6%	28%	34%	223	11	307	542	288	195	1,110	1,592	13,465	10,132	56,476	80,072
TOTAL	29%	43%	47%	42%	10,314	12,373	35,189	57,876	35,583	28,930	74,789	139,302	17,136,335	13,104,824	27,719,168	57,960,327
Male Non-Smokers																
Age																
-30	27%	57%	54%	45%	2,212	3,117	4,215	9,544	8,059	5,496	7,843	21,398	5,688,557	3,849,460	5,412,100	14,950,117
31-40	32%	41%	48%	42%	6,052	6,125	16,789	28,965	18,665	15,023	35,016	68,704	8,225,356	6,568,137	14,873,423	29,666,916
41-50	28%	33%	46%	39%	5,622	5,481	22,140	33,243	20,403	16,666	48,508	85,577	3,575,869	2,924,151	8,412,072	14,912,092
51-60	17%	45%	49%	41%	2,030	4,104	15,644	21,779	11,632	9,065	31,897	52,594	857,704	670,714	2,308,221	3,836,639
61+	44%	29%	45%	42%	875	317	2,092	3,284	1,977	1,110	4,651	7,737	60,596	34,836	144,928	240,360
TOTAL	28%	40%	48%	41%	16,791	19,144	60,881	96,815	60,736	47,359	127,915	236,010	18,408,083	14,047,297	31,150,744	63,606,124
Male Smokers																
Age																
-30	28%	58%	99%	60%	628	873	1,915	3,416	2,271	1,513	1,943	5,726	1,604,160	1,058,504	1,338,271	4,000,935
31-40	45%	76%	77%	68%	1,894	2,617	5,882	10,393	4,222	3,427	7,667	15,316	1,900,673	1,525,152	3,303,716	6,729,541
41-50	59%	50%	66%	61%	2,036	1,535	5,733	9,304	3,478	3,047	8,696	15,220	623,371	543,237	1,525,082	2,691,691
51-60	61%	44%	54%	54%	887	560	2,418	3,866	1,453	1,271	4,443	7,166	110,077	95,967	326,408	532,452
61+	26%	37%	57%	47%	27	27	178	232	105	74	311	490	3,372	2,390	10,148	15,910
TOTAL	47%	60%	70%	62%	5,473	5,613	16,126	27,211	11,528	9,331	23,060	43,919	4,241,653	3,225,250	6,503,626	13,970,528
Female Non-Smokers																
Age																
-30	20%	40%	60%	40%	1,149	1,625	3,565	6,338	5,862	4,064	5,897	15,823	5,792,279	3,930,136	5,453,308	15,175,723
31-40	31%	40%	47%	41%	3,656	3,889	10,976	18,521	11,944	9,775	23,534	45,254	6,069,340	4,924,395	11,572,862	22,566,597
41-50	32%	43%	42%	40%	2,807	3,273	9,834	15,914	8,766	7,591	23,159	39,515	1,962,950	1,696,722	5,133,839	8,793,511
51-60	20%	43%	41%	37%	608	1,124	4,050	5,782	2,988	2,631	9,941	15,560	323,044	284,083	1,056,633	1,663,760
61+	83%	6%	27%	35%	223	11	274	508	270	178	1,021	1,469	12,509	9,285	51,830	73,624
TOTAL	28%	41%	45%	40%	8,443	9,922	28,699	47,064	29,830	24,240	63,552	117,621	14,160,122	10,844,622	23,268,471	48,273,215
Female Smokers																
Age																
-30	24%	49%	71%	48%	332	482	984	1,798	1,409	980	1,380	3,768	1,404,732	953,220	1,276,325	3,634,277
31-40	24%	51%	47%	42%	534	956	2,057	3,547	2,256	1,866	4,339	8,460	1,162,818	949,196	2,147,970	4,259,985
41-50	55%	64%	68%	64%	862	874	2,619	4,355	1,564	1,373	3,862	6,799	351,908	306,848	854,698	1,513,455
51-60	28%	31%	51%	43%	143	140	796	1,078	507	455	1,568	2,530	55,799	50,090	167,058	272,947
61+	0%	0%	38%	27%	0	0	34	34	18	16	89	123	956	846	4,647	6,449
TOTAL	33%	52%	58%	50%	1,871	2,451	6,489	10,811	5,753	4,690	11,237	21,681	2,976,213	2,260,201	4,450,697	9,687,112

Table 3 Acceleration business Critical Illness (& TPD) Claims only Policies

	Total Actual / Expected				Total Actual				Total Expected				Total Exposure			
	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns
Male Aggregate																
Age																
-30	32%	67%	63%	53%	34	51	71	156	105	76	112	293	159,164	112,792	162,338	434,294
31-40	37%	48%	59%	51%	101	112	333	546	276	236	566	1,078	201,317	170,189	396,797	768,303
41-50	27%	40%	53%	45%	103	141	570	814	385	351	1,068	1,804	92,882	84,534	252,514	429,929
51-60	28%	48%	54%	48%	70	110	479	659	246	231	894	1,371	23,742	22,300	83,522	129,564
61+	39%	48%	54%	51%	15	13	77	105	39	27	142	208	1,605	1,160	5,984	8,748
TOTAL	31%	46%	55%	48%	323	427	1,530	2,280	1,052	921	2,782	4,755	478,709	390,975	901,154	1,770,838
Female Aggregate																
Age																
-30	24%	41%	63%	43%	29	36	84	149	121	88	134	344	161,542	114,597	164,152	440,291
31-40	28%	41%	49%	42%	75	94	273	442	271	231	559	1,061	161,530	136,777	324,693	622,999
41-50	35%	43%	44%	42%	93	104	309	506	265	241	708	1,215	65,987	59,924	174,461	300,371
51-60	21%	43%	39%	37%	24	46	156	226	113	107	396	616	13,840	13,131	47,175	74,145
61+	24%	42%	34%	34%	2	3	14	19	8	7	41	56	513	450	2,540	3,502
TOTAL	29%	42%	45%	41%	223	283	836	1,342	779	675	1,838	3,292	403,410	324,879	713,020	1,441,308
Male Non-Smokers																
Age																
-30	36%	68%	62%	54%	29	39	54	122	80	58	87	225	120,637	85,868	126,159	332,664
31-40	33%	41%	58%	48%	72	76	257	405	216	184	444	844	156,974	132,552	310,509	600,034
41-50	23%	36%	50%	41%	70	101	427	598	311	282	859	1,451	74,664	67,717	202,708	345,089
51-60	22%	46%	53%	46%	46	87	391	524	205	191	742	1,138	19,717	18,385	69,195	107,297
61+	37%	41%	54%	49%	13	10	68	91	35	24	125	185	1,463	1,039	5,259	7,761
TOTAL	27%	42%	53%	45%	230	313	1,197	1,740	847	739	2,256	3,843	373,455	305,561	713,829	1,392,845
Male Smokers																
Age																
-30	20%	66%	68%	49%	5	12	17	34	26	18	25	69	38,527	26,924	36,179	101,630
31-40	48%	70%	62%	60%	29	36	76	141	60	51	122	234	44,343	37,637	86,288	168,269
41-50	44%	58%	68%	61%	33	40	143	216	75	69	209	353	18,218	16,817	49,806	84,841
51-60	59%	58%	58%	58%	24	23	88	135	41	40	152	233	4,024	3,915	14,327	22,267
61+	60%	108%	53%	61%	2	3	9	14	3	3	17	23	142	120	725	987
TOTAL	45%	63%	63%	59%	93	114	333	540	205	182	525	912	105,254	85,413	187,326	377,993
Female Non-Smokers																
Age																
-30	24%	42%	64%	44%	23	29	67	119	95	69	105	269	126,387	89,498	128,815	344,699
31-40	29%	39%	48%	41%	63	72	217	352	219	187	453	859	130,573	110,509	262,893	503,975
41-50	34%	43%	40%	39%	72	84	229	385	214	195	579	988	53,289	48,400	142,653	244,342
51-60	20%	42%	38%	36%	19	37	124	180	93	88	325	506	11,306	10,680	38,776	60,762
61+	28%	48%	34%	35%	2	3	12	17	7	6	36	49	443	392	2,211	3,046
TOTAL	28%	41%	43%	39%	179	225	649	1,053	629	545	1,498	2,671	321,997	259,479	575,348	1,156,824
Female Smokers																
Age																
-30	23%	36%	59%	40%	6	7	17	30	26	19	29	75	35,155	25,099	35,337	95,591
31-40	23%	50%	53%	45%	12	22	56	90	52	44	106	202	30,956	26,268	61,800	119,024
41-50	41%	43%	62%	53%	21	20	80	121	51	46	129	227	12,698	11,524	31,807	56,029
51-60	24%	45%	45%	42%	5	9	32	46	20	20	70	111	2,534	2,451	8,399	13,383
61+	0%	0%	38%	27%	0	0	2	2	1	1	5	7	70	58	329	456
TOTAL	29%	44%	55%	47%	44	58	187	289	150	131	340	621	81,412	65,400	137,672	284,484

Table 4 Acceleration business Critical Illness (TPD) Claims only Amounts

	Total Actual / Expected				Total Actual (£000)				Total Expected (£000)				Total Exposure (£000)			
	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns
Male Aggregate																
Age																
-30	36%	70%	65%	56%	1,748	2,310	3,057	7,116	4,790	3,287	4,680	12,757	7,207,066	4,870,712	6,742,640	18,820,417
31-40	37%	53%	62%	54%	5,031	5,762	15,882	26,675	13,461	10,898	25,490	49,850	9,999,604	8,027,447	18,159,260	36,186,311
41-50	30%	34%	51%	43%	4,985	4,777	20,748	30,511	16,757	13,855	40,384	70,996	4,161,686	3,446,632	9,931,032	17,539,349
51-60	22%	52%	54%	46%	2,136	4,003	14,638	20,778	9,762	7,718	27,218	44,698	961,335	762,954	2,633,500	4,357,789
61+	32%	39%	52%	45%	480	336	1,884	2,700	1,496	855	3,591	5,943	63,675	36,988	154,992	255,655
TOTAL	31%	47%	55%	48%	14,381	17,188	56,211	87,780	46,266	36,614	101,363	184,244	22,393,366	17,144,732	37,621,424	77,159,522
Female Aggregate																
Age																
-30	22%	44%	64%	44%	1,188	1,656	3,526	6,371	5,335	3,742	5,510	14,586	7,090,337	4,834,748	6,719,188	18,644,272
31-40	30%	42%	44%	40%	3,506	4,059	10,215	17,780	11,644	9,591	23,156	44,391	7,114,312	5,811,874	13,703,241	26,629,428
41-50	32%	43%	43%	40%	2,835	3,369	10,023	16,227	8,903	7,754	23,503	40,161	2,281,853	1,985,458	5,983,261	10,250,573
51-60	23%	37%	39%	36%	689	988	3,940	5,616	3,004	2,661	9,979	15,644	372,979	330,654	1,222,528	1,926,161
61+	102%	7%	24%	35%	223	11	211	446	220	157	892	1,268	13,234	10,024	56,455	79,712
TOTAL	29%	42%	44%	40%	8,442	10,084	27,915	46,440	29,106	23,905	63,039	116,051	16,872,716	12,972,758	27,684,673	57,530,147
Male Non-Smokers																
Age																
-30	40%	73%	61%	56%	1,506	1,869	2,276	5,650	3,739	2,577	3,749	10,065	5,623,805	3,820,994	5,406,034	14,850,834
31-40	34%	46%	58%	49%	3,744	4,073	12,040	19,857	10,991	8,882	20,925	40,798	8,125,043	6,515,500	14,858,962	29,499,506
41-50	26%	33%	49%	40%	3,736	3,817	16,660	24,213	14,327	11,719	34,252	60,299	3,546,171	2,907,815	8,407,134	14,861,119
51-60	18%	53%	54%	46%	1,576	3,583	12,875	18,035	8,682	6,771	23,891	39,344	852,502	667,693	2,307,307	3,827,502
61+	33%	38%	53%	46%	462	308	1,776	2,547	1,420	802	3,364	5,586	60,364	34,653	144,848	239,865
TOTAL	28%	44%	53%	45%	11,024	13,651	45,627	70,301	39,159	30,751	86,181	156,091	18,207,885	13,946,655	31,124,285	63,278,825
Male Smokers																
Age																
-30	23%	62%	84%	54%	242	442	782	1,466	1,052	710	931	2,693	1,583,261	1,049,717	1,336,605	3,969,584
31-40	52%	84%	84%	75%	1,287	1,689	3,843	6,819	2,470	2,016	4,565	9,052	1,874,561	1,511,947	3,300,297	6,686,805
41-50	51%	45%	67%	59%	1,250	960	4,088	6,298	2,430	2,136	6,132	10,698	615,515	538,817	1,523,898	2,678,230
51-60	52%	44%	53%	51%	560	419	1,763	2,743	1,080	947	3,327	5,354	108,833	95,261	326,193	530,287
61+	24%	51%	48%	43%	18	27	108	154	76	53	227	357	3,311	2,334	10,144	15,790
TOTAL	47%	60%	70%	62%	3,357	3,538	10,584	17,478	7,108	5,863	15,183	28,153	4,185,481	3,198,077	6,497,138	13,880,696
Female Non-Smokers																
Age																
-30	21%	41%	67%	43%	896	1,250	2,971	5,117	4,303	3,015	4,465	11,784	5,705,424	3,890,656	5,444,766	15,040,846
31-40	33%	41%	44%	40%	3,215	3,315	8,550	15,080	9,797	8,055	19,552	37,405	5,971,143	4,872,486	11,557,875	22,401,504
41-50	32%	44%	41%	39%	2,408	2,887	8,222	13,516	7,559	6,568	20,145	34,272	1,936,256	1,682,125	5,129,638	8,748,018
51-60	22%	39%	39%	36%	554	879	3,368	4,801	2,569	2,269	8,620	13,457	318,138	281,157	1,055,718	1,655,013
61+	109%	8%	24%	37%	223	11	200	435	205	144	819	1,168	12,291	9,188	51,813	73,292
TOTAL	30%	42%	43%	40%	7,296	8,343	23,311	38,949	24,433	20,051	53,601	98,085	13,943,252	10,735,612	23,239,809	47,918,672
Female Smokers																
Age																
-30	28%	56%	53%	45%	292	406	555	1,254	1,032	726	1,045	2,803	1,384,913	944,091	1,274,422	3,603,426
31-40	16%	48%	46%	39%	291	744	1,665	2,700	1,847	1,536	3,603	6,986	1,143,169	939,389	2,145,366	4,227,924
41-50	32%	41%	54%	46%	428	482	1,801	2,711	1,344	1,186	3,359	5,889	345,598	303,334	853,624	1,502,555
51-60	31%	28%	42%	37%	135	108	572	815	435	392	1,359	2,187	54,841	49,497	166,810	271,148
61+	0%	0%	15%	10%	0	0	11	11	15	13	72	100	943	835	4,642	6,421
TOTAL	25%	45%	49%	42%	1,146	1,741	4,604	7,490	4,673	3,854	9,438	17,966	2,929,464	2,237,146	4,444,864	9,611,474

Table 5 Stand-Alone business Policies

	Total Actual / Expected				Total Actual				Total Expected				Total Exposure			
	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns
Male Aggregate																
Age																
-30	38%	91%	99%	70%	5	8	8	21	13	9	8	30	20,285	13,289	12,259	45,833
31-40	52%	31%	44%	44%	25	11	21	57	48	36	47	131	34,776	26,005	33,499	94,281
41-50	31%	38%	40%	37%	27	26	43	96	86	68	108	263	21,193	16,748	26,633	64,574
51-60	35%	64%	43%	46%	24	37	46	107	68	58	108	234	6,661	5,644	10,453	22,758
61+	31%	54%	44%	43%	3	5	10	18	10	9	23	42	430	410	999	1,840
TOTAL	37%	48%	44%	43%	84	87	128	299	225	180	294	699	83,345	62,096	83,844	229,285
Female Aggregate																
Age																
-30	34%	68%	91%	58%	4	5	6	15	12	7	7	26	15,928	9,758	8,763	34,449
31-40	49%	49%	64%	54%	17	12	20	49	35	25	31	90	20,753	14,681	18,236	53,670
41-50	39%	49%	54%	47%	17	16	26	59	43	33	48	124	10,870	8,267	12,311	31,447
51-60	36%	70%	27%	41%	9	14	9	32	25	20	33	78	3,049	2,412	3,959	9,420
61+	63%	101%	41%	60%	2	3	3	8	3	3	7	13	197	184	456	837
TOTAL	42%	57%	51%	49%	49	50	64	163	118	88	126	332	50,796	35,302	43,725	129,823
Male Non-Smokers																
Age																
-30	48%	84%	89%	70%	5	6	6	17	11	7	7	24	16,095	10,804	10,217	37,116
31-40	49%	34%	33%	39%	19	10	13	42	39	30	40	108	28,314	21,344	28,044	77,702
41-50	30%	33%	35%	33%	22	19	33	74	72	58	94	224	17,804	14,180	23,113	55,097
51-60	29%	62%	39%	42%	17	32	38	87	60	51	96	207	5,835	4,974	9,321	20,129
61+	34%	46%	47%	44%	3	4	10	17	9	9	21	39	393	383	945	1,721
TOTAL	35%	46%	39%	39%	66	71	100	237	190	154	258	603	68,441	51,685	71,640	191,766
Male Smokers																
Age																
-30	0%	127%	151%	73%	0	2	2	4	3	2	1	6	4,004	2,400	2,019	8,423
31-40	78%	18%	109%	72%	6	1	8	15	8	6	7	21	5,777	4,265	5,309	15,351
41-50	43%	76%	73%	63%	5	7	10	22	12	9	14	35	2,891	2,266	3,395	8,553
51-60	87%	87%	74%	81%	6	5	8	19	7	6	11	23	683	571	1,089	2,343
61+	0%	188%	0%	43%	0	1	0	1	1	1	1	2	29	24	53	107
TOTAL	58%	70%	81%	70%	17	16	28	61	30	23	34	87	13,384	9,527	11,865	34,776
Female Non-Smokers																
Age																
-30	31%	49%	90%	52%	3	3	5	11	10	6	6	21	13,000	8,113	7,378	28,491
31-40	45%	53%	49%	48%	13	11	13	37	29	21	27	76	17,355	12,396	15,653	45,403
41-50	28%	58%	48%	44%	10	16	20	46	36	27	42	105	9,100	6,925	10,565	26,590
51-60	42%	70%	21%	40%	9	12	6	27	22	17	29	68	2,615	2,075	3,480	8,169
61+	35%	114%	16%	42%	1	3	1	5	3	3	6	12	176	163	397	735
TOTAL	36%	61%	41%	45%	36	45	45	126	99	74	109	282	42,245	29,671	37,472	109,388
Female Smokers																
Age																
-30	49%	169%	97%	94%	1	2	1	4	2	1	1	4	2,796	1,587	1,370	5,752
31-40	78%	28%	166%	93%	4	1	7	12	5	4	4	13	3,102	2,109	2,509	7,719
41-50	95%	0%	88%	67%	6	0	6	12	6	5	7	18	1,613	1,255	1,713	4,581
51-60	0%	79%	78%	52%	0	2	3	5	3	3	4	10	397	310	468	1,175
61+	307%	0%	213%	188%	1	0	2	3	0	0	1	2	21	21	59	102
TOTAL	70%	40%	113%	78%	12	5	19	36	17	12	17	46	7,929	5,282	6,118	19,328

Table 6 Stand-Alone business Amounts

	Total Actual / Expected				Total Actual (£000)				Total Expected (£000)				Total Exposure (£000)			
	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns	Dn 0	Dn 1	Dn 2+	All Dns
Male Aggregate																
Age																
-30	37%	108%	141%	85%	278	521	659	1,459	756	484	466	1,706	1,154,405	732,734	701,773	2,588,912
31-40	51%	45%	41%	45%	1,506	992	1,338	3,837	2,938	2,222	3,274	8,434	2,157,016	1,617,111	2,313,464	6,087,590
41-50	39%	31%	35%	35%	1,847	1,159	2,440	5,446	4,759	3,789	6,986	15,533	1,202,582	955,768	1,772,945	3,931,295
51-60	33%	59%	48%	47%	1,002	1,592	2,936	5,530	3,073	2,691	6,067	11,830	309,145	269,147	600,801	1,179,093
61+	112%	37%	46%	57%	387	134	468	990	347	361	1,020	1,728	15,624	16,195	45,876	77,696
TOTAL	42%	46%	44%	44%	5,021	4,399	7,842	17,262	11,873	9,547	17,812	39,232	4,838,772	3,590,956	5,434,859	13,864,587
Female Aggregate																
Age																
-30	79%	79%	93%	83%	459	281	302	1,042	582	355	325	1,262	779,916	469,733	427,536	1,677,185
31-40	63%	44%	100%	71%	1,077	544	1,661	3,282	1,710	1,231	1,663	4,604	1,041,927	743,976	982,577	2,768,480
41-50	59%	61%	39%	51%	1,000	787	817	2,604	1,688	1,295	2,088	5,071	440,090	336,907	544,456	1,321,453
51-60	80%	116%	23%	64%	607	706	243	1,555	763	610	1,068	2,441	94,766	75,021	131,676	301,464
61+	58%	148%	24%	60%	49	105	41	195	84	71	169	324	5,236	4,454	10,736	20,426
TOTAL	66%	68%	58%	63%	3,192	2,424	3,064	8,679	4,827	3,563	5,312	13,702	2,361,935	1,630,091	2,096,982	6,089,008
Male Non-Smokers																
Age																
-30	46%	95%	141%	87%	278	379	558	1,216	608	401	396	1,405	927,224	606,777	595,631	2,129,631
31-40	50%	51%	33%	44%	1,271	982	930	3,184	2,535	1,908	2,836	7,279	1,846,923	1,378,749	1,992,561	5,218,233
41-50	40%	27%	31%	33%	1,696	925	1,934	4,555	4,281	3,404	6,308	13,993	1,080,966	857,119	1,600,020	3,538,105
51-60	31%	58%	47%	45%	868	1,440	2,641	4,949	2,842	2,483	5,625	10,950	285,367	247,661	555,004	1,088,033
61+	116%	31%	48%	58%	387	108	468	963	334	350	983	1,667	15,021	15,666	44,157	74,843
TOTAL	42%	45%	40%	42%	4,502	3,834	6,532	14,868	10,600	8,546	16,148	35,294	4,155,501	3,105,971	4,787,373	12,048,845
Male Smokers																
Age																
-30	0%	171%	144%	84%	0	142	101	243	137	83	70	290	209,263	125,957	106,142	441,363
31-40	58%	3%	93%	57%	234	11	408	653	403	314	438	1,155	310,093	238,362	320,903	869,358
41-50	32%	61%	75%	58%	151	234	506	891	478	385	677	1,540	121,616	98,649	172,925	393,190
51-60	37%	73%	67%	60%	85	151	295	531	231	208	442	880	23,777	21,486	45,797	91,061
61+	0%	236%	0%	44%	0	27	0	27	13	11	37	61	603	529	1,720	2,852
TOTAL	37%	56%	79%	60%	470	565	1,310	2,345	1,261	1,001	1,664	3,926	665,353	484,984	647,486	1,797,823
Female Non-Smokers																
Age																
-30	90%	64%	94%	84%	437	192	262	891	483	302	278	1,063	645,116	399,218	365,710	1,410,045
31-40	63%	42%	82%	64%	941	449	1,193	2,583	1,488	1,074	1,462	4,024	904,676	647,843	861,687	2,414,206
41-50	43%	69%	39%	48%	648	787	717	2,152	1,493	1,143	1,842	4,478	388,921	297,186	481,513	1,167,620
51-60	90%	122%	16%	65%	607	646	154	1,407	678	531	956	2,165	84,063	65,080	117,805	266,948
61+	6%	157%	13%	44%	5	105	20	130	79	67	153	299	4,924	4,161	9,703	18,788
TOTAL	62%	70%	50%	60%	2,638	2,179	2,346	7,163	4,221	3,116	4,691	12,028	2,027,701	1,413,488	1,836,419	5,277,608
Female Smokers																
Age																
-30	24%	169%	86%	79%	22	89	40	151	91	53	47	190	123,670	70,515	61,825	256,010
31-40	61%	61%	233%	121%	136	96	468	699	222	157	201	580	137,251	96,132	120,890	354,274
41-50	129%	0%	41%	59%	252	0	100	352	195	152	246	593	51,168	39,721	62,943	153,833
51-60	0%	75%	79%	54%	0	60	88	148	85	80	112	277	10,704	9,941	13,871	34,516
61+	936%	0%	129%	257%	44	0	21	65	5	4	16	25	312	293	1,033	1,638
TOTAL	76%	55%	115%	85%	454	245	718	1,416	597	446	621	1,665	323,105	216,603	260,563	800,271

Table 1 Results by Duration and Cause of Claim

Actual/Expected										
	Cancer	H/Attack	Stroke	CABG	MS	KF	MOT	TPD	Death	All Causes
Males										
Non-Smokers										
Dn 0	44%	36%	13%	65%	27%	21%	55%	9%	26%	32%
Dn 1	77%	40%	26%	58%	33%	54%	0%	30%	40%	49%
Dns 2+	63%	51%	31%	77%	73%	37%	37%	57%	42%	51%
All Dns	61%	46%	26%	71%	54%	36%	34%	41%	37%	46%
Smokers										
Dn 0	32%	101%	31%	0%	67%	42%	0%	38%	55%	52%
Dn 1	38%	85%	73%	94%	134%	52%	0%	70%	74%	71%
Dns 2+	61%	92%	37%	59%	90%	21%	0%	44%	78%	70%
All Dns	50%	93%	42%	54%	93%	33%	0%	48%	72%	66%
Females										
Non-Smokers										
Dn 0	49%	10%	17%	89%	34%	36%	0%	9%	28%	37%
Dn 1	57%	24%	15%	0%	17%	0%	74%	40%	27%	42%
Dns 2+	52%	16%	19%	42%	67%	20%	0%	38%	57%	47%
All Dns	52%	16%	18%	44%	48%	20%	15%	31%	44%	43%
Smokers										
Dn 0	41%	50%	7%	0%	30%	76%	126%	25%	49%	39%
Dn 1	41%	29%	42%	0%	55%	0%	0%	0%	74%	44%
Dns 2+	59%	35%	32%	144%	58%	42%	0%	61%	126%	66%
All Dns	51%	37%	28%	91%	50%	43%	33%	39%	95%	55%
Expected Claims										
	Cancer	H/Attack	Stroke	CABG	MS	KF	MOT	TPD	Death	All Causes
Males										
Non-Smokers										
Dn 0	219	159	89	26	18	9	5	46	317	890
Dn 1	179	135	73	22	15	7	4	37	253	725
Dns 2+	590	480	238	87	41	19	14	115	741	2,325
All Dns	988	775	401	136	75	36	24	198	1,310	3,941
Smokers										
Dn 0	47	32	20	5	5	2	1	10	75	197
Dn 1	40	28	17	4	4	2	1	9	61	165
Dns 2+	126	101	52	17	10	5	3	25	168	506
All Dns	213	161	88	26	18	9	5	44	304	868
Females										
Non-Smokers										
Dn 0	271	20	65	2	30	6	3	35	89	521
Dn 1	220	17	52	2	23	4	3	27	70	418
Dns 2+	643	56	142	7	60	10	7	75	184	1,183
All Dns	1,134	93	259	11	113	20	13	137	342	2,122
Smokers										
Dn 0	58	4	15	0	7	1	1	8	20	115
Dn 1	49	3	12	0	5	1	1	6	16	94
Dns 2+	140	11	32	1	14	2	2	16	41	259
All Dns	247	19	58	2	26	5	3	31	78	468

Table 2 Results by Age Band and Cause of Claim

Actual / Expected		Cancer	H/Attack	Stroke	CABG	MS	KF	MOT	TPD	Death	All Causes
Males											
Non-Smokers											
-30		78%	26%	27%	n/a	48%	30%	0%	20%	37%	45%
31-40		79%	24%	25%	38%	59%	40%	31%	34%	36%	46%
41-50		51%	46%	20%	68%	63%	37%	43%	45%	40%	44%
51-60		54%	61%	35%	70%	12%	30%	37%	62%	32%	50%
61+		57%	45%	36%	120%	0%	0%	0%	0%	48%	51%
All Ages		61%	46%	26%	71%	54%	36%	34%	41%	37%	46%
Smokers											
-30		59%	0%	25%	n/a	0%	49%	0%	66%	71%	61%
31-40		51%	87%	48%	147%	151%	25%	0%	22%	61%	63%
41-50		47%	92%	27%	24%	53%	42%	0%	71%	71%	64%
51-60		47%	106%	55%	73%	74%	0%	0%	46%	87%	73%
61+		59%	86%	154%	0%	0%	0%	0%	0%	165%	97%
All Ages		50%	93%	42%	54%	93%	33%	0%	48%	72%	66%
Females											
Non-Smokers											
-30		50%	56%	22%	n/a	59%	20%	80%	16%	36%	40%
31-40		55%	5%	12%	0%	45%	23%	0%	17%	40%	42%
41-50		50%	16%	18%	103%	53%	20%	0%	42%	48%	44%
51-60		54%	19%	32%	20%	25%	0%	0%	52%	55%	48%
61+		45%	35%	0%	0%	0%	0%	0%	20%	44%	39%
All Ages		52%	16%	18%	44%	48%	20%	15%	31%	44%	43%
Smokers											
-30		34%	0%	10%	n/a	103%	0%	0%	41%	65%	43%
31-40		51%	41%	31%	0%	40%	0%	82%	20%	62%	48%
41-50		62%	26%	16%	124%	42%	195%	0%	51%	160%	69%
51-60		39%	40%	79%	110%	0%	0%	0%	60%	107%	53%
61+		29%	125%	0%	0%	0%	0%	0%	0%	191%	66%
All Ages		51%	37%	28%	91%	50%	43%	33%	39%	95%	55%
Expected Claims											
Males											
Non-Smokers											
-30		78	8	26	-	8	7	2	25	180	334
31-40		236	140	102	10	32	15	6	50	408	1,000
41-50		330	359	152	57	25	11	9	58	415	1,416
51-60		270	228	98	58	8	3	5	53	242	966
61+		74	40	22	10	1	0	0	13	64	224
All Ages		988	775	401	136	75	36	24	198	1,310	3,941
Smokers											
-30		24	2	8	-	3	2	1	8	55	102
31-40		63	37	27	3	9	4	2	13	110	268
41-50		73	79	34	12	6	2	2	13	92	312
51-60		45	38	16	10	1	1	1	9	40	160
61+		8	5	3	1	0	0	0	2	7	26
All Ages		213	161	88	26	18	9	5	44	304	868
Females											
Non-Smokers											
-30		92	2	36	-	17	5	2	26	65	245
31-40		384	21	95	2	54	9	5	42	125	736
41-50		438	37	88	4	34	5	4	38	96	743
51-60		195	27	34	5	8	1	1	27	45	344
61+		24	6	5	1	1	0	0	5	11	53
All Ages		1,134	93	259	11	113	20	13	137	342	2,122
Smokers											
-30		26	1	10	-	5	1	1	7	18	70
31-40		90	5	22	0	13	2	1	10	29	172
41-50		91	8	18	1	7	1	1	8	20	155
51-60		36	5	6	1	1	0	0	5	8	64
61+		4	1	1	0	0	0	0	1	2	8
All Ages		247	19	58	2	26	5	3	31	78	468

5 RESERVING

5.1 INTRODUCTION

One of the first tasks undertaken by the Critical Illness Healthcare Study Group was a review of reserving bases used for individual Critical Illness business in the UK. This was based around a survey of insurers and reinsurers writing Critical Illness business which was undertaken during 1997. The results of the survey were compiled into a report which was sent to all contributing offices in January 1998.

The purpose of this section of the paper is to review the main conclusions of the 1997 survey and to comment on changes that may have taken place since then.

The original report was based on responses received from 45 insurers and 4 reinsurers. The responses from reinsurers are discussed in Section 5.5 and the rest of this section concentrates on the responses from the 45 insurers only.

The survey identified whether companies write unit linked or conventional business, or both in many cases. Similarly, the split between Stand-Alone and Accelerated products was identified. These splits were sought because the approach to reserving is very dependent on the type of business. The number of responses received in each category was as follows:-

Unit Linked	22	Stand Alone	10
Conventional	8	Accelerated	8
Both	15	Both	27
Total	45	Total	45

A brief telephone survey was undertaken immediately before writing the current paper to ascertain if there had been any changes to practice since the 1997 survey. Approximately one quarter of the original respondents were contacted and all of these confirmed that they had not materially changed their approach to reserving since the earlier survey.

This is perhaps not surprising as the original survey indicated a reasonable degree of consistency between offices. In addition, we are not aware of any significant new information becoming available over the last two years that would have led offices to alter their valuation approach.

5.2 VALUATION METHODOLOGY

The basic methodology used for valuation was found to vary between companies as follows:

	Unit Linked	Conventional
Net Premium Approach	0	15
Discounted Cash Flow	27	2
Multiple of Premium	4	4
Other	6	2
Total	37	23

In most cases, as expected, companies are using a net premium valuation for conventional products and discounted cash flows for the sterling reserve on unit linked policies.

A multiple of premium is most commonly used by companies who have little in force business. Where stated, the multiple used varies from 1 month's risk premium to a full year's premium.

The "other" category generally applies to companies who use a combination of multiple of premium with either a net premium or discounted cash flow valuation.

5.3 VALUATION MORBIDITY ASSUMPTIONS

5.3.1 Source of Valuation Assumptions

Companies base the morbidity rates used for valuation on the following sources:

Reinsurers Rates	34
Office Experience	1
IC94	4
Other	5
No Response	1
Total	45

The majority of companies base their rates on those supplied by their reinsurers, highlighting the lack of an appropriate standard table for Critical Illness in the UK.

Few companies have sufficient experience to devise their own risk rates and only one actually chose to do so. A few companies use the IC94 table from the paper "Reserving for Critical Illness Guarantees⁷" which was presented to the Society of Actuaries in Ireland in November 1994. Some background to this table is given in Section 4.4.8.

5.3.2 Derivation of Valuation Risk Rates

The loadings applied by the 4 companies using IC94 were as follows:-

Company 1 +82% (Smoker); +15% (Non-Smoker) plus 1½% deterioration each year

Company 2 +60% (males); +40% (females)

Company 3 +5% (linked); +20% (conventional) plus additional loadings for TPD based on reinsurer's rates

Company 4 +85%

The loadings applied to reinsurers' rates were identified for 12 conventional and 20 linked products. The results can be summarised as follows:-

Loading	Conventional	Linked
0%	1	8
5-14%	2	4
15-24%	6	3
25-34%	1	3
35-44%	1	2
45%+	1	0
Total	12	20
Average Loading	21%	13%
Average (Excluding companies with 0%)	23%	22%

A number of companies use a range of loadings depending on either age, sex or product type. An appropriate average loading has been used in producing the above table.

When analysing these results it should be noted that the reinsurers rates will themselves include a range of margins for expenses and profit.

The questionnaire also asked for sample risk rates for males aged 30, 40 and 50. Rates were also given for Non-Smokers and Smokers or as Aggregate rates as appropriate. There are many reasons why it is not valid to directly compare rates: different product designs, illnesses covered, levels of guarantee etc. Despite this, the replies indicated a fair amount of consistency between offices and also, on average, a reasonable margin above IC94.

5.4 VALUATION MARGINS

5.4.1 The questionnaire asked Appointed Actuaries what margin over the best estimate of claims they believed to be inherent in their valuation assumptions. It also asked how this margin compared with that expected on mortality and long term disability products. The results were as follows:-

Margin in Valuation Critical Illness Assumption

Expected Margin	Number of Responses		
	Conventional		Linked
	Guaranteed	Reviewable	
0%	0	0	3
5-14%	1	4	8
15-24%	0	2	9
25-34%	1	5	7
35-44%	3	0	2
45%+	2	0	4
No response	0	5	4
Average	35%	22%	23%

Margin Compared to Other Products

	Mortality		Long Term Disability	
	Conventional	Linked	Conventional	Linked
Much more	3	4	2	1
More	11	12	6	7
Same	6	13	9	16
Less	1	3	2	3
Much less	1	3	0	2
No Response	1	2	4	8

These results point to the following features:-

1. There is a wide range of approaches taken, partly reflecting the different products sold by each company.
2. In many cases companies are using a greater margin than they use for their mortality basis. On average, the margin would seem to be slightly higher than that used for long-term disability although there is a wide variation between companies.
3. As a rule of thumb, the results of Sections 5.3.2 and 5.4.1 suggest that, on average for reviewable products, actuaries apply a 15% loading to reinsurers rates which are considered to have a 10% margin. This results in an overall margin of about 25%. For guaranteed products, the overall margin is around 35%.

5.4.2 Allowance for Future Trends

The questionnaire asked what allowance, if any, is made for possible future trends in the level of claims. 80% of companies make no allowance. A few companies consider future trends to be implicitly covered by the margin in their morbidity assumptions.

In most cases the ability to review premium rates and/or morbidity charges reduces the need to allow for future deterioration. This is particularly true for linked products and a few respondents explicitly made this point. Only one linked provider made a specific reserve for future deterioration; reserving 50% of the annualised premium to cover

the potential delay in implementing increased morbidity charges.

There is a more obvious need to allow for deterioration in conventional, non-linked products, particularly when the premium rates are guaranteed for a period. There are 2 distinct groups of policies and the approach taken to allowing for future trends was surprisingly consistent within each group.

The first group of companies either offer no guarantees or guarantee rates for a period of 5 years. None of these companies make any explicit allowance for future claim trends.

The remaining group contains 7 companies who guarantee premiums fully throughout the term of their Critical Illness policies. These companies showed a consistent approach of allowing for between 1% and 2% per annum deterioration in claims experience.

This compares with the Irish paper "Reserving for Critical Illness Guarantees⁷" which recommended a loading of between 1% and 3% per annum.

5.5 REINSURERS

Responses were received from 4 reinsurers, all of whom reinsure both Stand-Alone and Accelerated Critical Illness policies. All four write business predominantly on a risk premium basis, but also have smaller volumes of original terms business.

Only 2 of the responses specified the source of their valuation morbidity assumptions and in both cases rates were based on the Irish table IC94. The loadings applied to the standard table IC94 are quite small (+5% to +8%) but both reinsurers also allow for future deterioration in experience; one company increases their base rates by 1% per annum and the other by 3% per annum.

6 CURRENT ISSUES

Under this section we would like to highlight some of the current issues for discussion. It is not our intention to propose solutions.

6.1 CRITICAL ILLNESS DEFINITIONS

Critical Illness definitions are generally devised with the intention that they are clear and objective when a claim is assessed. The incidence rates and hence the price of Critical Illness products is based on data which relates as closely as possible to the definition. However, these are measured and stated with our current understanding of medical science and technology. The definitions are clearly stated in the policy document and these generally cannot be changed throughout the lifetime of the policy, which may be longer than 40 years in some cases. It is extremely difficult to forecast the impact of changes in medical science and technology on the relevance of these definitions in the future and whether current definitions would provide sufficient protection to the Life office.

Examples of potential problems include Multiple Sclerosis (MS) and Prostate Cancer.

6.1.1 Multiple Sclerosis (MS)

MS in many current policies is defined to include a definite diagnosis from a consultant neurologist and moderate neurological abnormalities for a continuous period of at least six months.

MS is complicated by the fact that its symptoms follow a course which is unpredictable and, as shown in Section 3.6.3, many show only mild effects with a large proportion going through remission and relapse and only some going into immediate progressive phase.

There is increasing pressure in the market to simplify the definition and pay on diagnosis. However this could have severe consequences on the pricing of the product as paying on diagnosis in many cases would mean paying a lot sooner than under current definition and when there are just mild effects or the disease may run a completely benign course. The analysis in Table 3.6 suggests the incidence rates would approximately double at age 30 and increase by 30% at age 50.

6.1.2 Prostate Cancer

In relation to Critical Illness insurance it has long been recognised that Prostate Cancer has the potential to upset our Critical Illness pricing calculations at advanced ages. The problem arises because Prostate Cancer lies dormant for many years and in the majority of the cases remains asymptomatic (that is there are no external signs of the Cancer). This means that Cancer registrations, on which our Cancer pricing is based, fail to reflect the true underlying incidence rates of the Cancer and therefore lead to an exposure to the risk of earlier detection and additional claims.

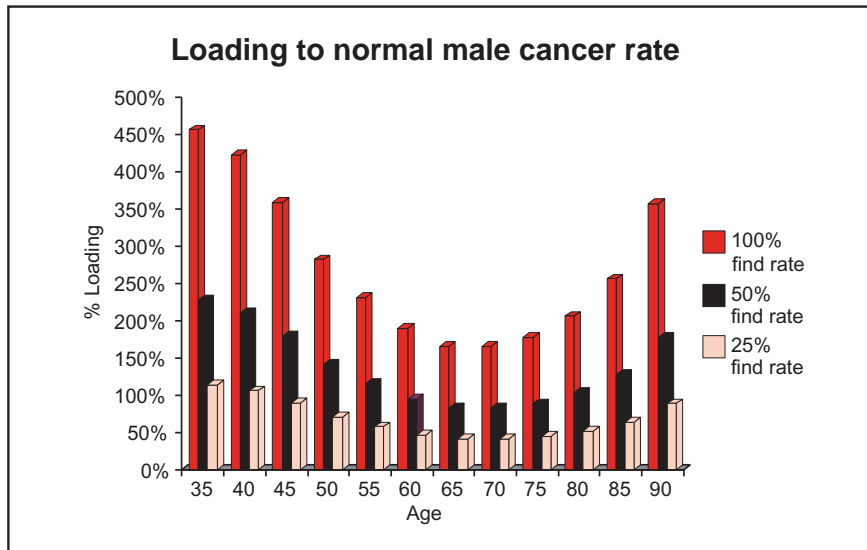
The possible widespread availability of relatively inexpensive tests for Prostate Cancer which can definitively detect the Cancer early would have a severe adverse impact on our pricing.

The table below shows the results of post mortem studies carried out in a Germany and Sweden into the prevalence of latent Prostate Cancer.

Prevalence of Latent Prostate Cancer %

Age	Breslow 199712 Sweden	Breslow 199712 Germany
50-59	21	22
60-69	28	25
70-79	43	33

The figures in the table show the prevalence of latent Prostate Cancer to indicate the potential impact of early detection on premium rates. A model¹⁵ can be constructed to assess the impact of the early detection and the sensitivity to various 'find rates' as illustrated in the following graph:



In Australia and the US offices tend to protect the profitability of Critical Illness contracts by adding an exclusion for minor Prostate Cancer. This has not yet been introduced in the UK. The introduction of ABI model definitions may slow down the process of introducing changes to the definitions, where offices are looking to tighten these.

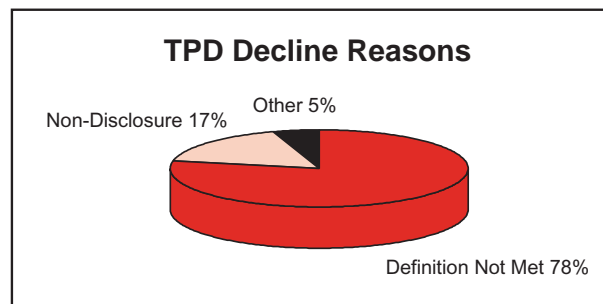
6.2 TOTAL AND PERMANENT DISABILITY (TPD)

The TPD benefit was historically included as a sweep up benefit, whereby if someone was sufficiently disabled, but not necessarily meeting the strict definitions for the 'core' illnesses, then a benefit would be paid out recognising the severity of the disability.

The TPD was based on an "any occupation" definition, whereby the individual would have to be unable to follow any occupation whatsoever and was totally and permanently disabled. This definition would seem to be fairly strict and the disability fairly severe to justify payment.

However, in practice it has been extremely difficult to implement this definition as the policyholders have not quite understood the definition and when actually applied in its strict fashion it has seemed to be unfair.

The extent of misunderstanding and difficulty with a TPD definition is demonstrated by the declination rates for TPD claims. In 1998, 57% of TPD claims were declined⁴. The reasons for declination are shown in the chart below:



The case of Sergeant -v- GRE demonstrates the problem with this definition. The case was related to a policyholder in the armed forces who had a personal accident policy incorporating an "any occupation" definition. The policyholder presented the argument that the definition implied that a benefit would be payable provided the individual was disabled and unable to do any one of the occupations of all the available occupations. The case went to court and the court, whilst not accepting the argument, recommended that the definition should imply that the policyholder is unable to follow any relevant occupation. Furthermore, recent rulings by the insurance ombudsman have reinforced this case.

This has led to a search for a more objective definition of disability. Whilst "own" or "own suited" definitions are clearer and can be used, these can only apply to limited occupations and clearly there is a need for a more objective definition of disability which can be applied to as many occupations as possible. More recently the TPD definitions relating to inability to carry out certain activities of daily work or failing certain objective functional assessment tests are gaining momentum. New definitions may not necessarily be any less severe than the any occupation TPD definition, however they are considered more objective and clearer for the policyholder to understand.

6.3 PRODUCT DESIGN

Since the advent of Critical Illness, there has been an ongoing debate about the suitability of the product's design. The main area of concern is the payment of the full sum assured on a "minor" event such as Balloon Angioplasty or a minor Heart Attack.

It is argued that this feature is potentially very anti-selective and does not necessarily meet the needs of the customer when the illness is not severe enough to justify huge payments. The potential problems have been highlighted in a paper by Mannion and Werth to the Society of Actuaries in Ireland¹³.

Scaled benefits are common in the South African market where benefits may be scaled as follows:

Heart Attack	100%
Coronary Artery Bypass Surgery	60%
Angioplasty	10%
Stroke (leading to severe disability)	100%
Stroke (other)	50%
Cancer (with metastases)	100%
Cancer (without metastases)	50%

There appears to be a case for gearing payments to the level of disability and in particular limiting payments in relation to some surgical procedures. However, the jury is still out on the extent of anti-selection being exercised in these cases.

It could be argued that the product is extremely successful and popular amongst customers and the added complexity may be detrimental to the future sales of the product. In addition, variable benefits may not meet customer needs in the mortgage market where the largest volumes of the product are sold in the UK.

6.4 CRITICAL ILLNESS PREMIUM RATE GUARANTEES

Premium rate guarantees for Critical Illness products is an important area for discussion.

Increasing trends in incidence rates for some of the major Critical Illnesses, for example Cancer, Coronary Artery Bypass and Angioplasty could also give cause for concern as to whether the industry is setting up sufficient reserves for these guarantees and whether the loadings in the premium rates are adequate.

Initial work on the reserving requirements for Critical Illness products with guarantees was done by the Irish Working Party in 1994⁷. This has now been followed up by an Institute of Actuaries Healthcare Study Group¹⁴ examining the reserving and pricing for guarantees. The main conclusion of their work is that capital (including reserves) required to support guaranteed healthcare insurance business is high. In addition, they demonstrate that similar conclusions can be drawn for reviewable business where in practice it can be difficult to implement such reviews. The report is not conclusive about the adequacy of current market pricing for guarantees, although it did suggest that the current market reserving practices are not unreasonable for Critical Illness policies.

6.5 CONSUMER UNDERSTANDING

There are a number of concerns that the severity of the claims definition are not appreciated by consumers.

Approximately 15% of Critical Illness claims (excluding TPD)⁴ are declined and of these 70% are declined because definitions are not met and 22% are declined due to non-disclosure. For TPD the declinature rates are even worse at 57% in 1998.

Clearly the declinature rates do provide a protection against anti-selection which would otherwise make the claims experience significantly worse. However, it cannot be denied that claimants are still failing to appreciate the need for a condition to be both total and permanent before a claim can be met on TPD. Some of the blame may lie on the industry for failing to get the message across to the policyholders, stating clearly what the product covers.

These concerns are also illustrated in the Ombudsmen's reports which show an increase in the number of referred cases from 6 in 1995 to 79 in 1999.

6.6 MEDICAL ADVANCES

Advances in medical science and technology will have a considerable impact on Critical Illness experience. For example, advances assist in making the detection of certain conditions easier, such as earlier detection of Prostate Cancer. Also, improvements in technology are likely to make certain surgical procedures easier and more frequent, such as Angioplasty and Coronary Artery Bypass Graft. Both of these examples are likely to adversely affect the experience on Critical Illness, whilst simultaneously improving mortality experience.

Research and development into genetics is also likely to have a significant impact on mortality and morbidity in the future. The Human Genome Project - a huge project to map and name every gene in the human DNA string - should be completed in the next 4 or 5 years. Understanding the function of each gene and how they interact will help the development of medicine to counteract genetic mutations. These developments could significantly impact incidence rates of Critical Illnesses, for example Cancer, Alzheimer's and Huntington's disease. It is extremely difficult to predict what the impact is likely to be in the future but it would not be unreasonable to assume that some of the developments in genetics are likely to be good news for Critical Illness products. However, the issue of disclosure of genetic test results is very important for Critical Illness business. The UK Forum For Genetics and Insurance and the ABI together are looking at the process to be followed by offices for genetic test results to be used in the underwriting process.

6.7 GOVERNMENT POLICY

Government policy in respect of health resources may have a significant impact on Critical Illness experience.

The recently published White Paper "Saving Lives: Our Healthier Nation" sets out a new approach to public health. The main aim is to achieve better health for everyone by combating the key killers in the UK. These include cancer, heart disease and stroke. One of the key aims is to reduce death rates by 2010. For example, reduce cancer in people under age 75 by at least 20% and heart disease in people under age 75 by at least 40%.

The Government objectives include improving screening and increased use of surgical procedures (e.g. bypass surgery and angioplasty to improve survival rates etc). Improvements in these areas may result in an increase in Stand-Alone Critical Illness claims.

7 THE BASE TABLE REVISITED

7.1 INTRODUCTION

Initially we were hoping to produce a Critical Illness insured lives "Standard Table" for use within the profession. However, our analysis of the experience for 1991-97 suggested this is still too immature to use as a basis for an insured lives table. In particular :

- the experience analysis shows clear initial selection, but there is relatively little data at longer durations to allow us to gauge what the ultimate level may be;
- restricting our data requirements to "durations 2+" means we have no evidence of how long the selection effect persists;
- there is very little data in the experience analysis to allow us to judge the shape of insured risk rates above age 60; and
- the analysis also revealed variations over time and wide variations by office.

However, considerable care is required when combining the experience analysis with the Base Table and it is unlikely that a uniform percentage adjustment will suffice in most cases. This is because a number of key factors are likely to vary in their impact by age, sex and illness. In particular :

- the insurance selection process does not act uniformly;
- the different mix of socio-economic groups within an insured portfolio alters the relative importance of each event;
- there is the possibility of anti-selection on some of the events; and
- the estimation error in our theoretical population rates is likely to vary.

Clearly, these factors could well result in the pattern of rates, by age and sex, for insured lives differing from that of the Base Table.

We therefore hope that the following example will be useful in illustrating how the experience analysis could be used to modify CIBT93. It should be stressed that this approach is intended to be illustrative and we recognise that another actuary could have arrived at different answers despite starting from the same data.

7.2 CIBT93 RE-ENGINEERED

A possible way forward is to use the CIBT93 rates as a smooth base and then calibrate each illness individually against the insured lives experience. Although the volume of insured lives data is quite small for some illnesses, this approach arguably strengthens the resulting "table" by augmenting the theoretical estimates with actual claims data.

In order to address the issue of not knowing how far our immature experience may deteriorate to become genuinely ultimate, we have compared the development patterns for the main events in our analysis to similar data for mortality by Cause of Death, as reported in CMIR13¹¹ for 1983 - 86. In addition, this study shows the ratio of insured lives mortality to population mortality, split by cause of death and by sex and age, so we have also compared development patterns by age, particularly to augment the very limited Critical Illness data we have at older ages.

We recognise that there are potential dangers in this approach :

- (a) The CMIR13 data relates to an earlier period (1983-86) than the Critical Illness experience (1991-97), has a different mix of contributing offices, and ignores any peculiar features of Critical Illness business (such as the dominance of mortgage-related cover and generally tighter underwriting).
- (b) The mortality data at durations 5+ is likely to relate to a substantially older average age than the earlier duration experience. For this reason we have focussed our attention on the "45-59" age band within the CMI results.
- (c) Mortality rates are recorded using duration and age at date of death, whereas the Critical Illness rates reflect duration and age at the date of the Critical Illness event. For a given group of lives, this difference is likely to shorten the period of any selection effects and to advance any pattern with respect to age.

However, CMIR13 is a valuable source of additional information provided it is used with care and with an appreciation of these shortcomings.

Appendix 7A summarises the results of the experience analysis by cause of claim and by age band or duration. These results are identical to those contained in Appendix 4C but for non-smoker and smoker combined. This confirms the wide variation in ratio of insured lives experience against CIBT93 by illness, age and sex.

Appendices 7B and 7C compare insured experience against population risk rates for both mortality and Accelerated Critical Illness.

Appendix 7B shows results by age band. There is a reasonable degree of similarity between the patterns shown for mortality and Critical Illness. This allows adjustments by age, derived from our experience analysis, to be applied to CIBT93 rates with increased confidence.

Appendix 7C shows results by duration. Again there is a reasonable degree of similarity between the pattern of results for mortality and Critical Illness. Since the mortality data is much more mature it may, therefore, give a reasonable indication as to the size and duration of the initial select period for each illness.

Using the information in these appendices, we have produced some illustrative adjustment factors to apply to CIBT93 to estimate "ultimate" insured lives rates for an Accelerated Critical Illness benefit.

In all cases, the results by cause in the Critical Illness experience analysis carry most weight, corroborated and extended by reference to the mortality data. These "ultimate" rates have an effective date of around end 1995, the weighted average date for exposure in the experience analysis.

The development patterns in the mortality data have been used to estimate the "grossing up" from Critical Illness "duration 2+" result to "ultimate" for Cancer, Heart Attack, Stroke and "Other Deaths". For CABG, we have assumed a pattern similar to Heart Attack. For MS and TPD, we have assumed that the initial selection effect is greater than for other illnesses as, given their definitions, valid claims for MS and TPD are most likely to arise well after the initial symptoms/event.

Similarly, the age patterns in the mortality data have been used to extend, and smooth, the age patterns shown by the Critical Illness experience results.

In estimating these factors, we have also taken account of an adjustment for rated cases (in line with (3) of Section 4.4.1), and the difference in overall result between the sub-set of data for which we could analyse experience by cause of claim, and the full data set.

Appendix 7D sets out these illustrative adjustment factors. We would again stress that these are based on one interpretation of the available information and should not be regarded as definitive.

The results of applying these factors to the CIBT93 rates for each event are illustrated in the graphs on the following page. These modified rates are labelled "Ult95" and are shown as a percentage of CIBT93.

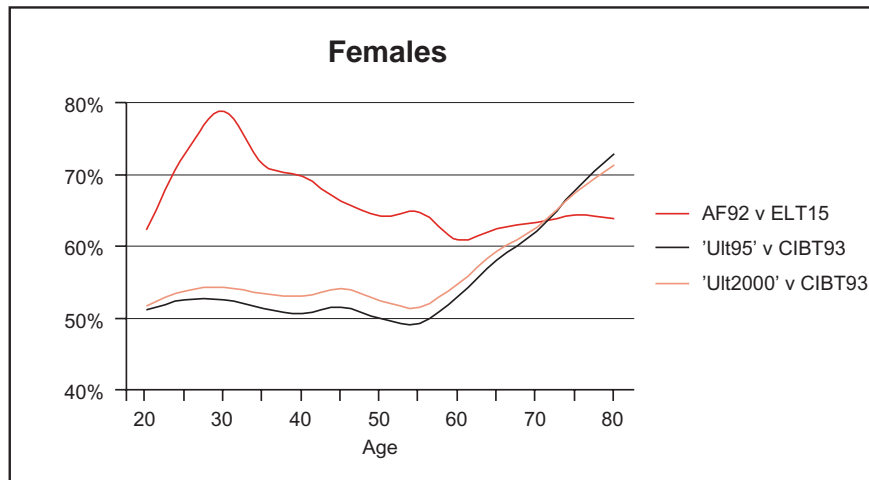
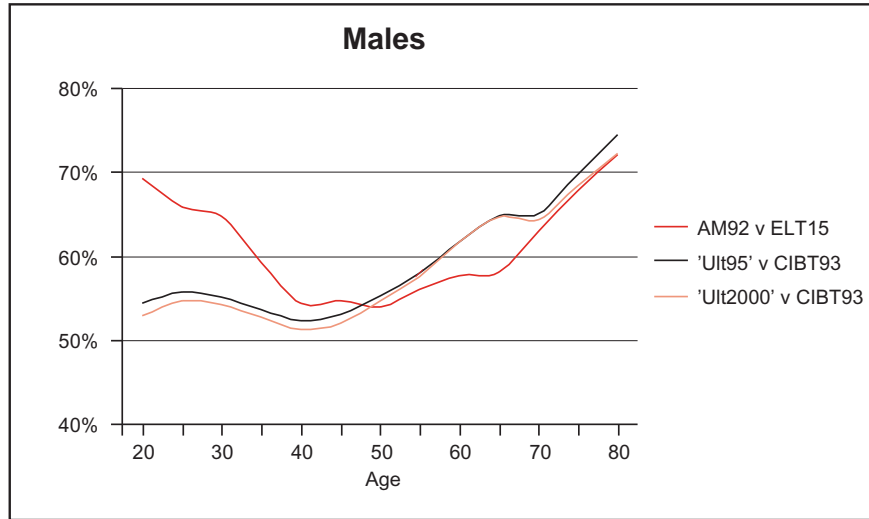
7.3 TRENDS TO 2000

It is important also to note that the illustrative trends, contained in Section 3, will have a different impact by age and sex and - again - a uniform adjustment to CIBT93 is inappropriate. We have therefore also illustrated the effect of factoring in the suggested trend adjustments and these are labelled "Ult2000" and shown in the graphs on the following page as a percentage of CIBT93.

These trend adjustments are, however, quite subjective. Furthermore, the trend factors used were derived with regard to population data, but there may be additional factors influencing the trends for insured lives. For example, the variations over time reported in the experience analysis may in part reflect changing mix of product and market, and reducing anti-selection as market penetration increased and as a higher proportion of business was written in conjunction with mortgages.

We have not allowed for any trend on TPD. Whilst we anticipate some increase in TPD claim rates, this arises primarily from movement in the practical interpretation of the claims definition, rather than from any real underlying shift in the incidence of disability, and would be very difficult to enumerate. Similar issues arise for MS, where, again, we have not allowed for any trend adjustment.

**Ultimate Insured versus Population Risk Rates
using illustrative adjustments to CIBT93**



7.4 PRELIMINARY CONCLUSIONS

(a) Pattern by Age

Whilst the experience analysis results (Section 4.4.6) were remarkably similar across the central age bands, covering ages 30 to 60, a different pattern emerges over a wider range of ages. Both the mortality ratio and the illustrative Critical Illness ratios for insured lives versus population rates are far from flat by age. Ratios rise significantly with age above age 55, particularly for males. Considerable care would be required if a flat multiple of CIBT93 was used for pricing or reserving, especially if much weight is placed on the rates at older ages.

(b) Initial Selection

If initial selection follows the pattern shown in mortality data for the main illnesses, then the current duration 2+ results may be 5% to 10% short of true ultimate levels. This is, of course, a significant "if"!

(c) Ratio of Insured to Population Risk Rates

The illustrated "ultimate" rates appear generally to conform, for males, to the widely accepted pricing rationale (as set out in Dash & Grimshaw) that the ratio of insured lives to population risk rates will be higher for Critical Illness than for mortality. However, this position is reversed for females. We have not drawn any conclusion from this as these results could simply reflect estimation error, tighter underwriting on Critical Illness business, different markets or socio-economic mix, etc.

The Critical Illness ratios shown increase at an earlier age than those for mortality. This feature appears to meet the expected difference noted in Section 7.2 (c) above.

(d) Trends to 2000

The combined effect of the trends, listed by Illness in Section 3, is to slightly reduce the Critical Illness rates for males, but to increase them for females. This marked difference by sex arises from the relative importance of each illness: for females, the expected increase in Cancer claims dominates; for males, the increase in Cancers is more than offset by an expected reduction in Heart Attacks and residual mortality.

(e) The Overall Approach

It is reiterated that these results are illustrative not definitive. The factors used are highly subjective. Considerable further work would be required to build confidence in such a basis if it were to be used to derive an alternative "standard table". Furthermore, as for any such table, practitioners need to have regard to significant, underlying variations over time and by office.

We would welcome comment on this approach and whether the Critical Illness Healthcare Study Group should attempt to refine it as part of our future work for the benefit of practitioners.

Appendix 7A

1991 - 97 Critical Illness Experience Analysis Results

Results for Sub-Set of Data with split by Cause of Claim and by Age Band or Duration

Aggregate (Smoker/Non-Smoker combined)

	Cancer	H/Attack	Stroke	Actual / Expected		KF	MOT	TPD	Death	Cause of Claim		All Claims Data All Causes
				CABG	MS					Data Sub-Set All Causes	Data All Causes	
Male												
by Age Band												
-30	74%	20%	26%	n/a	37%	35%	0%	31%	45%	49%	49%	
31-40	73%	37%	30%	61%	79%	37%	25%	32%	41%	49%	46%	
41-50	50%	54%	22%	60%	61%	38%	35%	50%	46%	48%	45%	
51-60	53%	67%	38%	71%	21%	26%	32%	60%	40%	53%	47%	
61+	57%	49%	48%	107%	0%	0%	0%	0%	60%	56%	52%	
by Duration												
Dn 0	42%	47%	17%	55%	35%	26%	45%	14%	31%	36%	31%	
Dn 1	70%	48%	34%	64%	54%	54%	0%	38%	47%	53%	45%	
Dns 2+	62%	58%	32%	74%	76%	33%	30%	55%	48%	54%	53%	
All	59%	54%	29%	69%	61%	36%	28%	42%	44%	50%	46%	
Female												
by Age Band												
-30	46%	44%	19%	n/a	69%	16%	62%	21%	42%	41%	43%	
31-40	54%	12%	15%	n/a	44%	18%	16%	18%	44%	43%	43%	
41-50	52%	18%	18%	107%	51%	51%	0%	44%	67%	49%	45%	
51-60	52%	22%	40%	34%	21%	0%	0%	53%	63%	49%	40%	
61+	43%	46%	0%	0%	0%	0%	0%	18%	62%	43%	36%	
by Duration												
Dn 0	47%	17%	15%	75%	33%	44%	24%	12%	32%	37%	29%	
Dn 1	54%	25%	20%	0%	24%	0%	60%	33%	36%	43%	43%	
Dns 2+	53%	19%	21%	59%	65%	24%	0%	42%	70%	50%	50%	
All	52%	20%	20%	52%	48%	25%	19%	32%	53%	46%	43%	
Expected Claims												
Male												
by Age Band												
-30	102	10	34	0	11	9	3	32	235	436	638	
31-40	299	177	130	13	41	19	8	63	518	1,268	1,839	
41-50	403	438	186	69	31	13	11	70	507	1,728	2,586	
51-60	315	266	114	68	9	4	6	62	282	1,126	1,854	
61+	82	45	25	11	1	0	0	14	72	250	292	
by Duration												
Dn 0	267	191	109	31	23	12	7	56	392	1,086	1,693	
Dn 1	219	163	90	26	19	9	6	45	313	890	1,433	
Dns 2+	716	581	290	104	51	24	17	140	909	2,831	4,083	
All	1,201	935	489	162	93	45	29	241	1,614	4,808	7,208	
Female												
by Age Band												
-30	119	2	47	0	22	6	3	33	83	315	470	
31-40	474	26	118	2	66	11	6	51	154	908	1,304	
41-50	529	45	106	5	41	6	5	46	116	898	1,422	
51-60	232	32	40	6	10	1	2	32	54	408	724	
61+	28	6	6	1	1	0	0	6	13	61	72	
by Duration												
Dn 0	329	24	80	3	36	7	4	43	110	635	988	
Dn 1	269	20	64	2	29	5	3	34	86	512	829	
Dns 2+	783	68	173	8	74	12	8	91	225	1,442	2,176	
All	1,381	111	317	13	139	24	16	168	420	2,590	3,992	

Appendix 7B

Comparison of Insured Experience against Population Risk Rates for Mortality and Accelerated Critical Illness by Cause of Claim and Age Band.

To assist comparison of patterns by age, an "Adjusted A/E" has been calculated by re-basing to give an overall A/E for insured lives of around 100.

Males

All Causes / Ages 45 - 59 A/E for CMIR 13 : 60%
 All Causes / All Ages A/E for CI Study : 50%

Females

All Causes / Ages 45 - 59 A/E for CMIR 13 : 66%
 All Causes / All Ages A/E for CI Study : 46%

Cancer

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	1889	83	138	0-30	75	74	148
				31-40	218	73	146
				41-50	203	50	101
45-59	9513	69	114	51-60	168	53	107
60-74	8578	68	114	60-	47	57	115
75-	2548	76	127				

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	307	88	133	0-30	55	46	102
				31-40	256	54	119
				41-50	275	52	114
45-59	976	85	128	51-60	120	52	114
60-74	430	69	104	60-	12	43	94
75-	112	86	130				

Heart Attack

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	882	58	97	0-30	2	20	39
				31-40	66	37	75
				41-50	237	54	108
45-59	8482	66	110	51-60	178	67	134
60-74	7426	72	121	60-	22	49	99
75-	2354	83	139				

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	10	42	64	0-30	1	44	96
				31-40	3	12	26
				41-50	8	18	39
45-59	107	48	73	51-60	7	22	48
60-74	172	61	92	60-	3	46	102
75-	99	79	119				

Stroke

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	276	61	102	0-30	9	26	53
				31-40	39	30	60
				41-50	40	22	43
45-59	1237	52	86	51-60	43	38	75
60-74	1520	55	92	60-	12	48	96
75-	1610	82	136				

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	24	52	78	0-30	9	19	42
				31-40	18	15	34
				41-50	19	18	39
45-59	84	56	85	51-60	16	40	87
60-74	71	44	67	60-	0	0	0
75-	107	74	112				

Other Deaths

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	3307	54	91	0-30	106	45	90
				31-40	215	41	83
				41-50	233	46	92
45-59	8375	51	84	51-60	112	40	80
60-74	7216	53	88	60-	43	60	120
75-	5233	66	110				

CMIR13				CI Study			
Age Band	A	A/E %	Adj A/E%	Age Band	A	A/E %	Adj A/E%
00-44	179	58	88	0-30	35	42	92
				31-40	68	44	97
				41-50	78	67	147
45-59	278	41	62	51-60	34	63	138
60-74	247	45	68	60-	8	62	136
75-	261	65	98				

Sources : "CMIR13" : Mortality in 1983-86 according to Cause of Death, CMIR13 pages 47 to 65, Medical and Non-Medical data combined.
 "CI Study" : Accelerated Critical Illness Experience in 1991-97 according to Cause of Claim, from Results shown in Appendices 4C and 7A.

Appendix 7C

Comparison of Insured Experience against Population Risk Rates for Mortality and Accelerated Critical Illness by Cause of Claim and Duration

To assist comparison of patterns by duration, an "Adjusted A/E" has been calculated by re-basing to give an overall A/E for insured lives of around 100%.

For CMIR13, two duration 5+ results are shown : (a) ages 45 - 59 only ; (b) all ages

Males

All Causes / Ages 45 - 59 A/E for CMIR 13 : 60%
All Causes / All Ages A/E for CI Study : 54%

Females

All Causes / Ages 45 - 59 A/E for CMIR 13 : 66%
All Causes / All Ages A/E for CI Study : 50%

Cancer

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	330	35	58	0	112	42	77
1-2	1164	60	100	1	153	70	129
3-4	1443	70	116	2+	446	62	115
5+(a)	9513	69	114				
5+(b)	22528	70	117				

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	98	26	40	0	156	47	94
1-2	365	54	81	1	145	54	107
3-4	418	69	104	2+	417	53	106
5+(a)	976	85	128				
5+(b)	1825	81	123				

Heart Attack

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	377	49	82	0	90	47	86
1-2	822	51	85	1	78	48	88
3-4	881	51	85	2+	337	58	107
5+(a)	8482	66	110				
5+(b)	19144	70	116				

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	43	49	74	0	4	17	33
1-2	77	46	70	1	5	25	50
3-4	65	42	63	2+	13	19	38
5+(a)	107	48	73				
5+(b)	388	59	89				

Stroke

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	73	39	65	0	18	17	30
1-2	182	46	77	1	31	34	63
3-4	184	44	74	2+	94	32	60
5+(a)	1237	52	86				
5+(b)	4643	61	102				

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	37	55	83	0	12	15	30
1-2	77	61	93	1	13	20	40
3-4	58	50	75	2+	37	21	42
5+(a)	84	56	85				
5+(b)	286	57	87				

Other Deaths

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	645	43	72	0	122	31	57
1-2	1404	46	77	1	147	47	86
3-4	1440	46	77	2+	440	48	89
5+(a)	8375	51	84				
5+(b)	24131	55	92				

CMIR13				CI Study			
Dur	A	A/E %	Adj A/E%	Dur	A	A/E %	Adj A/E%
0	103	34	52	0	35	32	63
1-2	257	46	70	1	31	36	72
3-4	229	45	68	2+	157	70	139
5+(a)	278	41	62				
5+(b)	965	51	77				

Sources :

"CMIR13" : Mortality in 1983-86 according to Cause of Death, CMIR13 pages 47 to 65, Medical and Non-Medical data combined.

"CI Study" : Accelerated Critical Illness Experience in 1991-97 according to Cause of Claim, from Results shown in Appendices 4C and 7A.

Appendix 7D
Illustrative Adjustment Factors Applied to CIBT93

Males

Approximate Ratio of "Ultimate" Insured to Base Table (Population)

Age	Cancer	HA	Stroke	CABG	MS	KF	MOT	TPD	Death
20	80%	25%	40%	65%	85%	35%	30%	50%	50%
25	80%	30%	40%	65%	85%	35%	30%	50%	50%
30	75%	35%	40%	65%	83%	35%	30%	50%	50%
35	70%	40%	40%	65%	80%	35%	30%	60%	50%
40	60%	50%	38%	65%	75%	35%	30%	70%	50%
45	50%	60%	35%	65%	70%	35%	30%	80%	50%
50	53%	65%	40%	70%	55%	35%	30%	85%	48%
55	55%	70%	45%	75%	40%	35%	30%	90%	45%
60	58%	75%	50%	85%	30%	35%	30%	95%	48%
65	60%	80%	55%	100%	30%	35%	30%	100%	50%
70	65%	80%	60%	115%	30%	35%	30%		58%
75	70%	85%	65%	120%	30%	35%	30%		65%
80	70%	90%	70%	120%	30%	35%	30%		75%

Approximate Adjustment for Trend from end 1995 to 2000 ("n/c" means no change)

Cancer	HA	Stroke	CABG	MS	KF	MOT	TPD	Death
5%	-9%	n/c	25%	n/c	n/c	n/c	n/c	-7%

Females

Approximate Ratio of "Ultimate" Insured to Base Table (Population)

Age	Cancer	HA	Stroke	CABG	MS	KF	MOT	TPD	Death
20	60%	20%	20%	65%	85%	35%	30%	40%	60%
25	60%	20%	20%	65%	85%	35%	30%	40%	60%
30	58%	20%	20%	65%	83%	35%	30%	40%	60%
35	55%	20%	20%	65%	80%	35%	30%	45%	60%
40	55%	20%	20%	65%	75%	35%	30%	53%	60%
45	55%	23%	25%	65%	70%	35%	30%	60%	60%
50	53%	25%	30%	70%	55%	35%	30%	65%	58%
55	50%	30%	35%	75%	40%	35%	30%	70%	55%
60	50%	40%	40%	85%	30%	35%	30%	75%	63%
65	50%	50%	43%	100%	30%	35%	30%	80%	70%
70	55%	60%	45%	115%	30%	35%	30%		75%
75	60%	65%	48%	120%	30%	35%	30%		80%
80	60%	70%	50%	120%	30%	35%	30%		85%

Approximate Adjustment for Trend from end 1995 to 2000 ("n/c" means no change)

Cancer	HA	Stroke	CABG	MS	KF	MOT	TPD	Death
9%	-9%	n/c	25%	n/c	n/c	n/c	n/c	-5%

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