

GISG 96 Working Party Chairman: Dr Geraldine Kaye

**WAYS TO IMPROVE THE LINK BETWEEN ACTUARIAL ANALYSIS AND
DECISION MAKING**

EXECUTIVE SUMMARY

"It will not do to dismiss as irrational this disparity between assessments of risk (of employment and many other things) and perceptions of those risks by people exposed to them. And it will not do to suppose that the disparity can be resolved by education. The challenge to the decision maker is to create an acceptable policy in the light of this disparity." (1987: Watson Memorial Lecture: Public and Professional Attitudes to Risk).

The long-term objective of this working party must be to find methods of expressing uncertainty to management in ways that enables them to make sensible decisions.

Ways must be found to:

- a. appreciate overall uncertainty by understanding the uncertainty of each element and the interactions and correlations between those elements
- b. identify courses of action which would reduce uncertainty of outcome or provide management with information to allow them to assess the additional return required to compensate for the uncertainty
- c. avoid giving a picture of false certainty or false uncertainty
- d. improve the understanding of uncertainty and the range of possible outcomes at the levels of management where final decisions are made
- e. engender relationships in such a way that questions can freely be asked.

We are not trying to stimulate only an intellectual debate. We are looking for practical solutions to the problem of how to communicate actuarial concepts in a simple, consistent and effective manner.

Recommendations by The Working Party

1. The introduction of group discussions for certain aspects of actuarial education.
2. That a booklet be developed which outlines examples of good communication in the context of the actuarial profession.
3. That a glossary of insurance and statistical terms be produced.
4. That closer links be initiated with the Royal Statistical Society as they have set up a working party with a similar brief.
5. That general insurance actuaries refresh their memory of the contents of GN12 regularly and one may hope that if 200 actuaries did this one or two suggestions for improvements to GN12 might be made! We would welcome views on whether GN12 should be amended to deal specifically with actuarial statements and opinions in the Annual Report and Accounts of General Insurers.

GISG WP REPORT

WAYS TO IMPROVE THE LINK BETWEEN ACTUARIAL ANALYSIS AND DECISION MAKING

Chairman: Dr Geraldine Kaye

Members: Jillian Evans, John Evans, Sheree Howard
David Loades, Bill McConnell, James Rakow

The purpose of this working party is not concerned with the actual technical calculations involved in calculating a specific risk, but much more on how to communicate results to people who have different levels of training in statistics and/or risk theory.

This paper will be presented at GISG on the second to the fifth of October 96 and the Association of the Society of South African Actuaries' conference on 24th & 25th October 96.

1. INTRODUCTION

Discussions of ways of presenting data and information in a helpful manner have featured in two papers presented at GISG in the last five years. (1994: Effective Management Information) & (1995: Designing Ad-hoc Management reporting systems). However, neither has specifically focused on ways of improving the link between actuarial analysis and decision making. This, our chosen topic, is not specific to general insurance. As the actuarial profession seeks to widen its field of activity, successful communication will become increasingly important.

Broadly there are four categories of actuaries, namely Academic, Consulting, Management and Technical. These categories are of course not mutually exclusive. If at GISG anyone can suggest a fifth type of actuary that the working party approves for inclusion in the version of this paper presented to South Africa then Geraldine will present a bottle of champagne.

One purpose of communication is interpreting the results of calculations so that the recipients can use them as a basis for decision taking, whether management, financial or otherwise. We need to find ways of improving the link between interpreting actuarial analysis and managerial decision making.

The textbook approach to presenting an answer is usually one numerical result. In the real world an outcome can be higher or lower. Presenting a result as one figure does not show just how wide of the mark a numerical answer can be and the possible financial impact of such a variation. It can also take a long time for the variation to emerge.

Also, how should an explanation of the risk involved be communicated so that those required to make a decision can do so with understanding and with confidence in the advice given. In particular, where a range is quoted, what are the events that have to occur to generate the top and bottom of that range? Alternatively, what would not have to happen so the range given could be narrowed down? Thus rather than a discussion about the answer, there is a discussion about the input.

Another problem can arise when actuaries insert caveats into the reports they present to management, but by the time these reports reach the board such warnings may have been removed. How does this leave the actuary placed? It is important to be aware of management objectives.

We need to work at our own Professional guidance and training. If one looks at GN12, in paragraph 3.6 "When applying statistical methods of estimation, the actuary should be aware that, in addition to the effect of random variations, there may be significant sources of error associated with the choice of model or its parameters. The actuary should consider how these uncertainties should be communicated to the recipients of the report". In order for us to achieve this objective when dealing with statistical models, we need to distinguish between the following:

- a) Uncertainties arising from the probability distributions embedded in the model
- b) Uncertainty about the values of the parameters used in the model
- c) Uncertainty about whether a satisfactory model has been used

All too often, there is a lack of confidence in the results. If a report gives due weight to each of the above then a lack of confidence in the results is engendered. How can one check how a model relates to reality so that confidence can be maintained?

The question we must ask ourselves is "How is the issue of uncertainty treated at different stages of the actuary's work, and how do we monitor this to ascertain if we are being effective in our own communication?" This must be dealt with early on. It is too late to tackle this issue only when the actuarial student starts studying for a communications paper. Should this be taught by the Institute or the employer?

2. EDUCATION

Each of our four categories of actuary needs different communication skills but it appears that there has not been a full analysis of what this means in terms of training. The profession's image would suffer if some groups of actuaries experienced their first difficulties with the examinations at the Fellowship stage because the Institute had aimed the communications paper only at potential senior consultants. The CPD handbook states "An actuary needs a full range of skills and knowledge to perform effectively and efficiently". If technical actuaries are to be screened out and deterred from attaining qualification, then the Institute/Faculty should not delay the elimination process to the Fellowship stage.

Clearly all actuaries need to be able to communicate to some extent as seen by the Institute and Faculty introducing the Fellowship Paper. Great emphasis is placed on the need for effective communication during the preparation for this exam, but little advice is given except at tutorials. With its current training and examination system, the Institute and Faculty must decide the kind or kinds of actuary that they are trying to breed for the future.

The Fellowship examination consists of two papers. The first is designed to test competency, to understand and use actuarial principles. Some questions are stated in a way that requires a candidate to, for example, write a letter, although most questions require the candidate to draft a report for a technical audience. If a student chose to answer all questions in the form of bullet points he would lose no more than 5% of the total marks. The student would not be further penalised for not addressing the question in the manner required.

The second paper is often referred to as the communications paper. In this case there is one compulsory question. Here candidates are asked to draft 500 words in a specific format, varying from a letter to a friend, through reports and memoranda to trustees and letters to disgruntled policyholders. A candidate who missed the style sought by the question and gave an otherwise technically correct answer could lose two thirds of the marks. There are tight marking schedules for clear English and style. From this session a candidate must obtain passes on both papers. Therefore if a candidate does not adapt to the style required, then that candidate will fail.

The Actuarial Education Company devotes considerable time to communication at tutorials, but not all students attend tutorials; attending tutorials is not mandatory for students. The Working Party would welcome views on the introduction of group

discussions¹ for certain aspects of actuarial education.

The CPD handbook, at present, only covers technical issues. The Working Party recommends that a booklet be developed which outlines examples of good communication in the context of the actuarial profession. There should also be examples of poor communication and their financial implications.

3. CONCERNS ABOUT COMMUNICATION

Uncertainty can be communicated both qualitatively and quantitatively. Communication of uncertainty, however, without any quantification can be quite unhelpful. It is normally of little use for an answer to include a huge unquantified range. By its nature General Insurance is invariably accompanied by uncertainty in some form or other. Examples of specific situations where action has been taken to illustrate the extent of that uncertainty to others can prove helpful as has been recommended above.

Actuarial ideas must be interpreted according to the audience, for example putting complex ideas across in pictures where necessary. Actuaries must interpret results and relay them to clients so that they can make informed decisions. The recipient of an answer must be able to use that answer usefully, rather than just wondering what to do with the piece of information that has been provided. An explanation of risk must be communicated in such a way that those required to make a decision can do so with understanding and with confidence in the advice given. For example, if a range is given, it could often be helpful to describe the events that would have to occur to generate the top and bottom of the range of answers. One approach suggested to help decision making was to outline what is necessary to "believe" in so as to be able to accept the answer.

The long-term² objective of this working party must be to find methods of expressing uncertainty to management in ways that enables them to make sensible decisions.

¹Alongside normal tuition, regular discussion groups with candidates from other companies chaired by a senior actuary.

²This objective is too large for this working party alone. If all we achieve with this working party is to generate the enthusiasm for spawning of many new more specific working parties then we will be satisfied.

Ways must be found to:

- a) appreciate overall uncertainty by understanding the uncertainty of each element and the interactions and correlations between those elements
- b) identify courses of action which would reduce uncertainty of outcome or provide management with information to allow them to assess the additional return required to compensate for the uncertainty
- c) avoid giving a picture of false certainty or false uncertainty
 - i) by giving a realistic idea of limits and the underlying scenarios which would produce those limits
 - ii) by giving an indication of the range of consequences if the out-turn differs from the estimate [or central forecast]
 - iii) by identifying the time frame of the uncertainty. Maybe action can be deferred until the position is more certain?
- d) improve the understanding of uncertainty and the range of possible outcomes at the levels of management where final decisions are made
- e) engender relationships in such a way that questions can freely be asked.

We are not trying to stimulate only an intellectual debate. We are looking for practical solutions to the problem of how to communicate actuarial concepts in a simple, consistent and effective manner. This points to standardising and codifying the language used. Actuaries should be concerned that what they think they are communicating might be very different from the message received. A standard statistical method such as confidence limits, if appropriate, could mean different things to different audiences, as could diagrams and/or figures. This Working Party recommends that a glossary of insurance and statistical terms be produced.

Other professions are also trying to get over complex ideas. In particular the Royal Statistical Society has set up a working party with a similar brief. As both professions are grappling with similar issues, it is recommended that closer links be initiated.

If we are concerned with how to communicate we must clarify with whom we are trying to communicate and why, before considering appropriate methods. We must also determine how to monitor whether, and the extent to which, we are succeeding in our communication and how to improve our written, verbal, numerical and graphical methods.

The actuary should look at what was estimated and calculate what it should have been with hindsight and consider why it has changed. This is analogous to analysis of surplus in life assurance or pensions. Predictions should be made when the original calculations are done. The actuary must then keep checking that the assumptions are being borne out in practice. An actuary should plan for the fact that he may be wrong and look at implications in the light of what is being predicted. The actuary must also consider whether he is more uncertain about the timescale of events than about the quantity of the results. It must be acknowledged that obtaining good data is difficult.

Often discussion about communicating uncertainty is concentrated on indemnifying a course of action rather than considering what information the recipient of the advice needs to take decisions. There must be a way for people to be able to state freely assumptions on paper without being afraid for others to criticise.

One should be able to say, "here is my result and this is my best estimate." GN12 section 2 states that it is normal practice to comment on methodology used and key assumptions. It is assumed that all general insurance actuaries have read GN12, but as it is only for guidance they may not have referred to it regularly. The working party recommends that general insurance actuaries refresh their memory of its contents regularly and one may hope that if 200 actuaries did this one or two suggestions for improvements to GN12 might be made!

4. WHAT NEEDS TO BE COMMUNICATED AND TO WHOM

It must always be remembered that communication is a two way process. As actuaries we need to be able to communicate to a vast range of individuals all with differing needs and understanding. For each particular report an actuary must determine whether it is technical analysis or professional judgement or both that is required.

Below we consider a number of the potential recipients of our communication in some detail, although this listing is not claimed to be exhaustive:- Actuaries, Accountants/Auditors, Board Members, Claims Departments, Government Departments, Intermediaries, Judiciary, Managers, Other Professionals, Press, Policyholders, Public, Regulators, Reinsurers, Shareholders, Students, Trustees, Underwriters and, last but not least, Universities.

Actuaries

All actuaries need to be able to communicate with other actuaries - this is, after all, one of the first skills we need to learn! However, as professionals, we have a duty to build on the foundation given to us during the examination process by always trying to increase our knowledge. As part of this commitment to continuing education, we

need to communicate with other actuaries both to monitor our own progress and understanding, and so that we can learn from others. Hence, it is essential that as a body of people, we all communicate in the same language and use the same terms. For example, at the GISG Conference 1995 in Bournemouth, there were several people talking about a '1 in a 100 year storm'. It would have been an interesting exercise to ascertain whether all 200 Conference attendees placed the same meaning on this seemingly simple phrase within the context in which it was given. GN12 in 2.5 lists several examples of words and phrases which, although commonly encountered are not accepted universally or are capable of different interpretations. Appendix A lists others. This adds weight to the recommendation in the previous section to produce a glossary of general insurance terminology.

Accountants/Auditors

Communication between accountants and actuaries can be on a wide range of topics. The foremost of these concerns the validity of the accounts and, in particular, the reserves. The accountant has a professional duty to sign the accounts only if they form a 'true and fair view' of the position of the company as at the accounting date.³ So, it is essential that both sides communicate fully and are equally aware of any relevant issues and the extent/degree of any uncertainty. It is interesting that there is a "GN" for the relationship between the appointed actuary and the auditor of a company transacting long-term insurance business, but no comparable guidance for short term business. Accountants require a single "estimate" to be included in published accounts. Refer to Appendix B for a discussion of the merits of point estimates and ranges. Many companies calculate claim reserves on two bases; 'best estimate' and 'published'. The difference between the two reserve amounts is then justified to the auditors in terms of reserve adequacy and uncertainty.

Board Members

Senior executives and the Board are the decision takers and the actuary must communicate in such a way that Board members understand the advice and its limitations. Presenting a range from which a single estimate, if required, can be selected is an essential part of the advice. Decision makers should be aware of the implications of choosing a single figure from that range - whether top, middle or bottom. Given a range, most people intuitively think it is symmetrical about a single "best estimate", which is not necessarily true.

An example of communication to management regarding product profitability follows:- The profitability of business written over time is projected and graphed as part of rate review process. A 'best estimate' profit figure is shown together with

³Refer to the first page of appendix A.

upper and lower bounds which reflect a range of possible outcomes - the more recent the time period, the wider the range. Reports are also produced which track the accuracy of these profitability estimates over time so that the Board members can gain more feel for the weighting which should be given to actuarial point estimates of profitability relative to other performance measures.

Claims Departments

Communication between actuaries and claims departments may concentrate on items connected with reserving issues/reports. However, accurate communication on a vast range of issues such as changes on claims handling procedures, changes in reserving strategy, identification of any trends in types of claims being reported etc is essential if the actuary is going to fulfil his duties under GN12.⁴

Government Departments

When a Government department is considering creating new legislation there is a requirement to estimate the costs which will be imposed on industry, the Compliance Cost Assessment (CCA). There is always uncertainty in such estimates. For example uncertainty in the CCA for imposing a minimum funding requirement on defined benefit pension schemes will arise from using a limited database, uncertainties in future economic and investment environments, even the perception of what constitutes cost, and differences in financial modelling and parameters selected. Changes in the behaviour of employers and trustees is an added cause of uncertainty. Ministers need to understand the need to balance the increased protection to members and the cost to employers against the uncertain background and the view that certainty in protecting benefits can be achieved only with unacceptable costs. Again the idea of risk needs to be put across. This illustrates a situation where the decision process requires compromise and different risks balanced. A different example is in considering policy decisions in the problems caused by BSE in cattle and CJD in humans.

Intermediaries

Intermediaries form an important link in the chain of communication between the actuary and the public. The PIA regulates life assurance, but not general insurance. Is yet more regulation required?

⁴Although only a best practice Guidance Note, it does comment in Section 2.3 that significant issues that need to be addressed in any report on the reserves or financial soundness of a general insurance company 'might be identified from discussions with ... claim personnel' etc.

Judiciary

There has been a marked growth in actuarial involvement in the area of 'expert witness' in recent years and, in recognition of this, the Institute has issued a Guidance Note, GN24, to advise its members acting in this role. In section 5.1, the need for the expert witness to consider the background of the audience is highlighted - "The experience of those involved and, in particular, the judge should be kept in mind when giving evidence as an actuarial expert. Actuarial concepts may be difficult to understand if their communication presupposes basic actuarial knowledge, or if they are presented using terms or acronyms with which others are unfamiliar. The actuary should explain technical terminology and concepts so that they can be understood by the court." However, Philip Carrington's comments arising from the Seminar 'The Actuary As an Expert Witness' held on the 8th December 1994 (B.A.J. 1, 1 (1995), page 133), show that, despite the fact that actuarial evidence has been received by Courts for a great many years, courts still seem unwilling to welcome evidence, something which probably arises, in part, from a failure to understand it properly. Some judicial comments which highlight this are: "Where compensation for future loss is involved the value of actuarial evidence is almost invariably diminished if not extinguished by uncertainties. (Per LJ Purchas in *Auty v National Coal Board* (1985))." "There is no reported case which says that a Judge cannot and should not look at actuarial evidence although there are strong indications that its value in a Court of Law is very limited." (Per LJ Stephenson in *Sullivan v West Yorkshire Passenger Transport Executive* (1985)). The inclusion, this year, of the Ogden Tables in the Civil Evidence Act is noteworthy.

Another area where the actuary could be involved in the judicial process is in the role of Assessor to the Court. The role of the Assessor is to assist the Judge (and hence the court) in the understanding of any technical issues involved. Assessors are frequently used in medical cases. One actuary has fulfilled this role, in the case of *Pinder v. Friends Provident*, a discrimination case involving differential premiums for male and female PHI policyholders. As the world becomes more litigious, this is an area which could grow in future.

Management

A movement in the answer of an actuarial general insurance calculation of 5% (for example changing the future inflation assumption for estimating the reserve of a liability class by 1% pa) can be viewed by the actuary as quite "small". Management, however, could view 5% as large, especially if it has the potential to remove 50% off their bottom line.

Many would say that there is a wide gap between a managers expectations of 'accuracy' or notion of 'uncertainty' and those held by his actuary. The first step towards successful communication in these circumstances must be the building of an understanding of each

others perspective and the constraints that each operates under. How best can we communicate to management? What words and pictures should we use?

For example actuaries regularly provide statistics and commentaries on claims frequencies to management. When considering occurrence frequency over time it is possible to illustrate it in histogram format but split the ultimate frequency between what has been notified to date and IBNR. The projected IBNR proportion then helps the 'customer' picture the greater potential for error in estimates of recent frequencies

Other Professionals

At the 1996 ICAEW General Insurance Conference, one of the speakers, Mark Hapgood QC, posed the following questions for actuaries. "What is wrong with plain English? And why not tell the client rather more about the decisions taken in the reserving process?" GN24, although aimed at expert witnesses is relevant: in particular section 5.

Press

One also has to be very careful communicating to the press, in view of the consequences of misquotation and misunderstanding. Many actuaries will have to abide by their organisation's rules as the organisation usually wishes to have strict control over any public statements. Common words with specific technical meanings are often misunderstood by the press: a generally accepted glossary would be useful. Refer to Section 4 and Appendix A.

Policyholders

Policyholders must understand what they are buying and what risks they are still taking. Major commercial insurers sell some commercial lines products with very large deductibles. As part of our duty to our customers, we need to ensure that the customer is fully aware of the level of risk they are retaining with such insurance. This is particularly important with regard to long-tail classes of business, such as Employers' Liability, where the customer may see very few claims at early durations for a particular policy year and, hence, without proper communication, may form a completely inappropriate view of the level of retained risk. In turn, this could cause them to budget unwisely for the cost both of this and future insurance years, creating the build-up of large deficits which will need to be met at some point in the future out of future years income/profits. Further, selling such insurance through intermediaries puts another party in the chain of communication. It is essential that the people at the start of this chain communicate all the issues clearly and fully and in a way such that nothing will be lost in its translation down the chain.

Public

"Even well-educated people find it difficult to reason about matters of probability and fall back on what has been recently published or can be expressed in images."
(FT 11 April 1996, Samuel Brittan).

Regulators

The DTI, when supervising general business, needs to understand the difference between the uncertainty in selecting premium rates and uncertainty in quantifying adequate provisions. When fulfilling their prime duty of protecting policyholders through supervising solvency there is a need to understand the range of possible outcomes and the situations which could give rise to them.

Reinsurers

Here the actuary can find himself providing advice to a ceding company or to a reinsurer and the issues will differ accordingly. Within a ceding company the actuary will be involved in deciding whether or not to reinsure, what method to use and how much. The decision will be based not least on the assessment of the risk transferred to the reinsurer and the cost. Other areas of uncertainty are choice of reinsurer, especially where long tail business is involved, the ability of a reinsurer to pay and the impact that this may have on a treaty commutation and the estimation of provisions for reinsurance bad debts. Uncertainty of risk can have a greater financial impact on reinsurers as their experience can be more 'highly geared' than a direct writer and hence more volatile (an example would be the potential impact of the Ogden Table multipliers on an XL layer relative to the whole account).

Shareholders

The Annual Report and Accounts produced for a (General) Insurance Company rarely give prominence, in words or pictures, to the levels of inherent uncertainty involved in such an operation. If one looks at the Revenue Account or Balance Sheet it appears that the company is able to put a single well-defined figure on the liabilities as any company may be able to when adding up invoices.

Increasingly in General Insurance Accounts one finds the Report of the Actuaries' nestling alongside the Auditors' Report. How many of these Actuaries' Reports point out that, whilst the Company's own estimates are above the Actuaries' best estimate (as they invariably are?), there is the possibility that the actual claims could exceed both estimates by a large amount?

A major American reinsurer in its latest Annual Report devoted three pages to a detailed discussion of an actuarial investigation into its latent liability exposures which concluded with the following paragraph:

'The reserves established as a result of the reevaluation represent IBNR amounts exclusively and are best estimates drawn from a range of possible outcomes based upon currently known facts projected forward for additional claimants using assumptions and methodologies considered reasonable. Notwithstanding this addition to reserves and the remaining protection under the (XYZ) Cover there can be no assurance that future losses resulting from these exposures will not materially adversely affect future earnings'.

We would welcome views on whether GN12 should be amended to deal specifically with actuarial statements and opinions in the Annual Report and Accounts of General Insurers.

Students

Looking at students' exams results, it seems that many of them are failing the communication papers. Before we tackle this problem, we need to clarify what it is we want them to achieve.

Practising actuaries fall into several categories as discussed in the Introduction and their needs must be looked at separately. For example some technical actuaries may only deal with other actuaries so that their opportunities to communicate with lay people are limited whereas consultants deal with a broad range of people.

Underwriters

There is a huge degree of pragmatism in what is done by underwriters compared with what is taught to actuaries. Often actuaries fail to take this into account. If actuaries want to be involved they must recognise and cope with competition, and live in that environment.

Universities

Communication with universities must be two way. If universities are to provide much of the research into actuarial matters then it follows that the profession must communicate its needs to universities. On the other hand if the work done in universities is to have application in commercial actuarial work then universities must present their results in such a way as to be accessible. This particularly applies to those academic actuaries working within universities.

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Despite the above categorisations it must be remembered that above all "people are people". Even in the same company, different managers expect different things. Some managers are simplistic in their outlook whilst others desire to understand the

background. Both sets of managers will be happy to receive the information in the form of graphs and charts. Whilst the simplistic manager may not want anything else, it could be argued that full commentary should be given in all cases so that the information presented would not be "misused or misunderstood".

The working party feels that people will migrate towards best practice, if they could see that it would be useful. If there is a booklet of best practice with practical examples then people will be inclined to use it. We reiterate our recommendation that a booklet of examples of good communication is produced.

(1994: Effective Management Information) suggested possible examples of suitable criteria for judging a particular piece of management information as effective as:

- presentation must aid interpretation;
- linked to the decision making process;
- can be interpreted in a short space of time;
- sufficiently accurate for its purpose;
- cost effective.

5. CONCLUSIONS

In the introduction we identified four categories of actuaries, namely Academic, Consulting, Management and Technical. Each of these groups have different communication needs and in particular not all of them will need to communicate with non-actuaries. Thus, as a profession, we need to ensure that we do not emphasise just one type of communication to the detriment of any other, and do not just concentrate on communication with the external world. After all, it would not be at all beneficial to the profession if some of the groups of actuaries identified had difficulties at the Fellowship stage because the communication paper was aimed only at potential senior consultants. Serious consideration needs to be given to what we are trying to achieve at the qualification level. Should we be concentrating on the actuary communicating with other actuaries as this ability comes first? This leaves the organisations for whom we work, together with the Institute to continue this training both before and after qualification.

We need to recognise that actuary to non actuary communication is becoming more frequent as the audience becomes wider. Additionally in the general insurance arena often we find that the actuary is the sole actuarial resource within a company. In the light of this, it is essential that there is scope for us to continue to develop our communication skills post qualification. This has been recognised by the CPD Committee who is including a section on 'Non Technical Skills' in the next issue of the CPD handbook.

This paper has considered that different methods of communications are needed for different audiences. In the context of General Insurance, where decisions must be made in conditions which are one off, is the language of statisticians reporting on the results of (repeatable) clinical trials applicable?

In addition, our investigations have revealed two problems with current terminology, namely that the same concept can be described in two or more ways and that two or more concepts can be described by the same words. Examples of this are provided in Appendix A. There is a need, therefore, to standardise terminology both within our profession, and among the most inter-related professions in the insurance "world".

It would be a worthwhile exercise to set out some worked examples of good communication based round specific examples such as the estimation of general insurance reserves. Such a report would include ways that people have found that worked for them. Appendix C provides four different examples of communication and press comment thereon.

6. RECOMMENDATIONS

The Actuarial Education Company devotes considerable time to communication at tutorials, but not all students attend tutorials: attending tutorials is not mandatory for students. The Working Party would welcome views on the introduction, of group discussions for certain aspects of actuarial education.

The CPD handbook, at present, only covers technical issues. The Working Party recommends that a booklet be developed which outlines examples of good communication in the context of the actuarial profession. There should also be examples of poor communication and their financial implications.

This Working Party recommends that a glossary of insurance and statistical terms be produced.

Other professions are also trying to get over complex ideas. In particular the Royal Statistical Society has set up a working party with a similar brief. As both professions are grappling with similar issues, it is recommended that closer links be initiated.

The working party recommends that general insurance actuaries refresh their memory of the contents of GN12 regularly and one may hope that if 200 actuaries did this one or two suggestions for improvements to GN12 might be made!

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The Working Party has recommended closer links between the Institute of Actuaries and the Royal Statistical Society. It is therefore fitting to conclude with a quotation from the inaugural address of the incoming President of RSS. "Communication only takes place if people are listening and the message is understandable" (Mad Cows and Ecstasy: Adrian Smith, 1996, RSS).

APPENDIX A

This appendix lists various terms together with the definitions applied for these terms by the Actuarial Education Company and either those given in the Statement of Recommended Practice, Accounting for Insurance Business, issued by the ABI in 1990, or those contained within the CII book entitled 'Accounting and Finance for Managers in Insurance'.

Definition of Insurance Terms

Provision:

Any amount written off or retained by way of providing for depreciation, renewals or diminution in value of assets or retained by way of providing for any known liability of which the amount cannot be determined with substantial accuracy.

Reserve:

Shall not, subject as aforesaid, include any amount written off or retained by way of providing for depreciation, renewals or diminution in value of assets or retained by way of providing for any known liability or any sum set aside for the purpose of its being used to prevent undue fluctuations in charges for taxation.

Where

- a. any amount written off or retained by way of providing for depreciation, renewals or diminution in value of assets; or
- b. any amount retained by way of providing for any known liability

is in excess of that which in the opinion of the directors is reasonably necessary for the purpose, the excess shall be treated for the purposes of this part of this schedule as a reserve and not as a provision.

Schedule 9, para. 32, Companies Act 1985

In paragraph 4 of the **Statement of Recommended Practice (SORP)**, Accounting for Insurance Business (ABI 1990), it states that:

"Although insurers are exempted from certain disclosure requirements by virtue of Section 255 and paragraph 28 of Schedule 9 of the Companies Act 1985 the principle effect of which is to permit them to establish and maintain undisclosed reserves, the recommendations in this Statement have been made without regard to the available exemptions except insofar as these relate to long-term insurance funds. Life insurers generally include in their balance sheet as a liability the long-term fund which may exceed the amount reasonably necessary to meet the liabilities of the long-term business: the long term fund in the balance sheet may therefore include undisclosed reserves".

Provision:

The accounting expression for funds set up to pay for future outgo, usually of unknown amount and/or timing. Commonly referred to in general insurance as reserves.

The Actuarial Education Company

Outstanding Claims (General Business):

The amount provided to cover the estimated ultimate cost of settling claims arising out of events which have occurred by the end of the accounting period, including claims incurred but not reported and claims handling expenses, less amounts already paid in respect of those claims.

Para. 56, SORP, Accounting for Insurance Business, ABI 1990

Annual basis of accounting

Provision should be made at the end of the accounting period for the estimated ultimate cost of all claims not settled at that date after the deduction of amounts already paid, whether arising from events occurring during the period or earlier periods and whether or not notified before the close of the accounting period.

The provision for claims outstanding should represent the best estimate in the light of information available having regard to prudent assumptions about the level at which claims are expected to be settled and should take into account anticipated levels of inflation and other factors which may be specific to certain categories of claim such as increases in court awards. The provision for claims outstanding will include a provision for claims incurred but not reported and an amount for the additional costs expected to arise on claims settled prior to the end of the accounting period but which it is anticipated will be reopened. Any amounts receivable as a direct result of salvage by, for example obtaining the legal ownership of insured property, or by subrogation by acquiring the rights of the policy holder against third parties following the settlement of a claim, should be taken into account in determining provisions for outstanding claims.

Para. 113-114, SORP, Accounting for Insurance Business, ABI 1990

(Note: Para 115 - 117 deal with Deferred Annual and Fund Bases of Accounting)

Outstanding Claims Reserve

A provision for the estimated amount of claims that have not been settled. It can be interpreted in two different ways so care is needed.

- (1) To include only claims which have been reported, which is often also called the Notified Outstanding Claims Reserve.
- (2) To include all claims not yet settled, i.e. including IBNR, INNER, reopened claims and fixture claims expenses.

The Actuarial Education Company

Claims handling expenses:

Expenses incurred by an insurance enterprise which are attributable to the handling of claims whether the expenses are incurred through the employment of the enterprises own staff or by using the services of third parties. Direct claims handling expenses are those which are readily attributable to a particular claim. Indirect claims handling expenses comprise the expenses of running a claims operation which are not readily attributable to specific claims.

Para. 53, SORP, Accounted for Insurance Business, ABI 1990

Provisions should be made at the end of an accounting period for claims handling expenses to cover the anticipated costs of negotiating and settling claims which have occurred - whether notified or not - by that date. The provisions should include the anticipated costs of the general claims administration relating to such claims.

Claims handling expenses should be charged against the revenue of the accounting period in which the claims occurred. The claims handling expense provision should be included with the claims outstanding provision.

Para. 110-111, SORP, Accounting for Insurance Business ABI 1990

Claims handling expenses:

A reserve to cover the estimated expenses of settling all claims, reported and unreported, outstanding at the accounting date.

It will normally include external expenses and those which can be directly attributed to the settlement of claims (such as legal expenses and claims assessors' fees). Providing it is not being used for tax account, it may also include expenses that are not directly attributable to specific claims. This would certainly be the case on a break-up basis.

The Actuarial Education Company

Deferred acquisition expenses:

Acquisition expenses relating to the unexpired period of risk which are carried forward from one accounting period to the next.

Para 58, SORP, Accounting for Insurance Business, ABI 1990

Under the annual and the deferred annual bases of accounting, a proportion of that element of underwriting expenses regarded as acquisition expenses should be deferred to a subsequent accounting period to match the deferral to a subsequent accounting period of a proportion of the written premiums to which the acquisition expenses relate. The deferral of acquisition expenses should be calculated separately for each class of business applying the ratio of unearned premiums to written premiums applicable to that class of business. When the funds basis of accounting is adopted there will not be a deferral of acquisition expenses but all expenses should be charged as incurred with an allocation to the appropriate underwriting year being made.

The basis adopted for determining deferred acquisition expenses should be disclosed.

The movement in deferred acquisition expenses between the beginning and the end of the accounting period should be disclosed as an addition to/deduction from expenses in the revenue account.

The amount of deferred acquisition expenses should be disclosed separately and not deducted from the unearned premium provision.

Para. 106-109, SORP, Accounting for Insurance Business, ABI 1990

Deferred acquisition expenses:

The amount of acquisition costs paid in a particular accounting period which are deemed to relate to unexpired period of cover.

In preparing realistic accounts on a going-concern basis, the fact that these costs will, in practice, have already been incurred means that this amount must be shown as an asset.

The Actuarial Education Company

(Note: In the Glossary provided by the Actuarial Education Company, it refers to two methods for calculating unearned premiums - both net and gross of DAC)

Claim:

The amount payable under a contract of insurance arising from the occurrence of an insured event, for example, the destruction of or damage to property; death or disability of the insured; the maturity of an endowment policy; the attainment of pensionable age; the amount payable on the surrender of a policy.

Para. 52, SORP, Accounting for Insurance Business, ABI 1990

A request by a policy holder for payment following the occurrence of an insured event. A claim does not necessarily lead to a payment.

The Actuarial Education Company

Co-insurance:

An arrangement whereby two or more insurance enterprises enter into a **single contract** with the insured to cover a risk in agreed proportions at an overall premium.

Para. 57, SORP, Accounting for Insurance Business, ABI 1990

Coinsurance Directive

The coinsurance directive (78/473/EEC)relates to risks within the community covered by a **single contract** at an overall premium where at least one of the coinsurers participates through an establishment in a member state other than that of the leading insurer; also criteria for risks to be covered, this being led for future discussion: in fact some states did establish their own thresholds.

**Page 8/4, B4, First Para., The Supervision of Insurance Companies (1),
Accounting & Finance for Members in Insurance**

Co-insurance:

A method of sharing a risk between a number of direct Insurers, each of whom have a **separate direct contractual relationship** with the insured and are, therefore, liable only for their own control share of the total risk.

The Actuarial Education Company

Non-proportional reinsurance:

Reinsurance whereby, in return for a premium, the reinsurer accepts liability for loss or claims incurred by the cedant in excess of an agreed amount which is normally subject to an upper limit.

Para. 71, SORP, Accounting for Insurance Business, ABI 1990

Reinsurance arrangements, where the risk is not shared proportionately between the cedant and reinsurer.

Excess of loss reinsurance:

A form of reinsurance whereby the reinsurer indemnifies the cedant for the amount of a loss above a stated excess point up to an upper limit. The excess point and upper limit may be fixed or indexed in line with a stability clause.

The Actuarial Education Company

Unexpired risks provisions:

The estimated amounts required over and above provisions for unearned premiums to meet future claims and related expenses on business in force at the end of the accounting period

Para.. 82, SORP, Accounting for Insurance Business, ABI 1990

Unexpired risks

Under the annual and deferred annual bases of accounting, where anticipated claims and related expenses under existing contracts exceed the amount of unearned premium provision carried forward, a provision for unexpired risks should be established to cover the losses expected to emerge in the subsequent accounting period. An insurance enterprise will usually consider the need for a provision for unexpired risks on the basis of the underwriting experience of the aggregate of all classes of business being written and not from the underwriting experience of each separate class.

The question of whether or not to set up an unexpired risks provision should be considered by all insurance enterprise on the basis of the underwriting experience of each aggregate of all classes of business being written and not from the underwriting experience of each separate class.

When an unexpired risks provision is established, the provision should be calculated on the basis that deferred acquisition expenses should not be amortised.

The accounting policy adopted in assessing the requirement for an unexpired risks provision, and whether investment income has been taken into account, should be disclosed together with the amount of the unexpired risks provision and changes in the amount of the provision from one accounting period to the next.

Para 128 - 131, SORP, Accounting for Insurance Business, ABI 1990

"Unexpired risks shall comprise the amount set aside in addition to unearned premiums in respect of risks to be borne by an insurance undertaking after the end of the financial year, in order to provide for all claims and expenses in connection with insurance contracts in force in excess of the related unearned premiums and any premiums receivable on those contracts".

The Insurance Fourth, Page 3/10 Accounting & Finance for Managers in Insurance, CII

Unexpired risks reserve:

This term is often used in two ways:

- (1) The reserve required to cover the claims and expenses which are expected to emerge from unexpired period of cover.
- (2) The reserve required to cover the excess of (1) over the Unearned premiums reserve. This is strictly, however, known as the additional reserve for unexpired risk.

The Actuarial Education Company

APPENDIX B

Advantages and Disadvantages of A Range of Values Versus a Point Estimate

A range of values for example for Ultimate losses would obviously better convey the risks associated with General Insurance as it would highlight the fact that there is not a true/certain answer (and, indeed, the only thing that is certain about any point (best) estimate is that it is NOT certain).

Any range of values would need to be accompanied by details of the relevant assumptions / actuarial basis and statements to reveal how confident we are in the range, (e.g. 95% confident that the actual Ultimate Loss will fall within the stated range given foreseeable circumstances and making no allowance for fixture changes in the law, interpretation of policy wordings; as yet unknown causes of liability etc. or, say, sufficient to allow for a catastrophe of a one in a 100-year level). This would ensure that the individuals using the range of values to make decisions can determine what they can / cannot believe in, (e.g. the board / management of a group using the range as a guide to setting the level of reserves etc).

However, obviously, interpretation of the accompanying wording is essential in order that the recipients of that information understand exactly what the given range covers (and, in particular, that it is NOT the range of all possible outcomes). This means that they would need to fully comprehend terms such as '95% confidence interval'; how the emergence of 'as yet unknown causes of liability' could affect the results; what a '1 in a 100-year event' is etc., some of which are subject to different interpretations by those (i.e. actuaries) giving the ranges.

If ranges were used throughout General Insurance, we would have stochastic accounts/balance sheets. This may be felt by some to go at least some way to convey the uncertainties involved with the business. However, it would mean that the accounts would become mini actuarial reports, outlining assumptions, the changes in the basis since the last accounting date and the implications of these changes.

It is highly unlikely that this would be well received and certainly would not be well understood by shareholders and policyholders, who, for example, are unlikely to appreciate the implications of the choice of the interest rate on the size of the reserves held, let alone how all the factors interact.

Further, if ranges were advocated for published accounts and DTI returns, would be necessary to establish some form of rules on how the ranges of reserves are to be determined or else it would be impossible for a company's financial strength to be assessed. (After all, currently, financial analysts can, from looking at a succession of

published accounts and DTI returns, fairly easily determine whether a company consistently under reserves in certain lines of business and by how much). Those using the accounts may be more interested in the downside risk rather than in margins.

There would also be the implications for tax assessment. Some form of a point estimate would still be needed for this purpose.

Hence, a point estimate is essential for the purposes of the published accounts. The fact that this does not adequately convey to the policyholder and shareholder the true nature of the risks associated with a General Insurance company means that it needs to be conveyed in some other way, e.g. within the Notes to the Accounts' although these are probably not well read amongst the investing general public.

For internal purposes, where the understanding of the business and risks involved are necessarily far greater, ranges (with the accompanying wording) are far more relevant / practical. However, even then it is likely that the users of this information (the management board etc) will, at some point, want the actuary to supply a point estimate - a "recommendation", (eg "What is the actuary's best estimate of the Ultimate Loss for a particular line of business and Accident year?")

Obviously, this point estimate may vary according to the situation/purpose- a point estimate to be used for pricing purposes may well be different from that to be used to book the reserves in the published accounts. Hence, even with point estimates, it is essential that the appropriate wording accompanies it. (Although words such as 'prudent' and 'caution' could be used rather than 'x% confidence intervals' etc., which may be slightly better understood.)

Again, as a number of commonly encountered words/terms used in general Insurance are not universally accepted, it is essential that the words or phrases accompanying the estimates are not subject to misinterpretation. (This is highlighted in GN12 (Section 2.5) and only serves to reiterate the need for an industry accepted / standard set of terms.)

APPENDIX C

Different versions of report on same topic

Press releases from different sources

Articles in Actuary

CMI Report

Press comment



PRESS RELEASE



Institute of Actuaries

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CONTINUOUS MORTALITY INVESTIGATION BUREAU

SMOKERS AND NON-SMOKERS - A MORTALITY STUDY

The first results from a major UK study, carried out by the actuarial profession, into the mortality of smokers and non-smokers confirm what has been reported in North America and in smaller studies in the UK - that people who smoke cigarettes suffer substantially heavier mortality than those who do not.

The study, a continuing one, was started on 1st January 1988. This report covers the results from the first two years, 1988 and 1989. The data have been collected from life assurance companies operating in the United Kingdom. The bulk of the data, nearly 80%, relates to people who have taken out whole of life or endowment policies. The remainder relates to temporary assurances. The two groups have been combined for this report. The data have been subdivided by sex, age and smoking category.

Many life assurance companies offer a discount from the standard premium rate quoted for certain products available in their range if the prospective policyholder is a non-smoker. Typically this is about 30%. The definition of a non-smoker does vary from office to office, but the most frequent criterion is that the prospective policyholder has not smoked cigarettes for at least 12 months prior to the date of the proposal for a policy. For the purposes of this study the categorisation "smoker" relates primarily to people who have taken out policies where a premium discount is available for non-smokers at the date of issue of the policy but have not availed themselves of the offer. "Non-smoker" relates to people who have taken out policies on a non-smoker basis. In this study there is no information as to whether the results are dependent upon the number of cigarettes smoked, or on the experience of smokers of pipes or cigars.

It is believed that this is the largest study carried out in the UK. For males it covered

111,642 smokers and 234,666 non-smokers. Thus about one third were smokers, virtually the same proportion as in the general population. There were 777 deaths among the smokers and 657 deaths among the non-smokers. For females, the numbers in the study were 47,482 smokers and 151,736 non-smokers giving rise to 177 deaths among smokers and 277 deaths among non-smokers. The proportion of female smoker policyholders, almost one quarter, is a bit lower than that found in the general population (roughly one third at the ages covered by this study). In all over half a million policyholders have been included. Over the two years there were 1,888 deaths.

Life offices need to know as much as possible about the risk factors likely to affect potential policyholders so that this can be taken into account when pricing policies. The object of this study was to determine whether there are indeed differences in the rates of mortality of smokers and non-smokers taking out life assurance policies and, if so, the extent of the difference. Non-smoker discounts have become more widely available over the 1980s and it is only, therefore, recently that sufficient numbers have built up to provide a large enough database for offices to investigate their combined experience.

The statistic used to measure the difference between the mortality rates of smokers and of non-smokers is the "excess mortality index". As first indications were that smokers suffered heavier rates of mortality than non-smokers, the excess mortality measured in this study relates to the observed excess mortality of smokers as compared with non-smokers. Technically, the index is calculated by looking at the mortality experience of both smokers and non-smokers by reference to a standard table of mortality, the standard used being a table based on UK assured lives and therefore directly applicable to the populations under study. Initially for each group, eg. male smokers, the actual deaths recorded in the group were compared with the number which would have been expected to have occurred had the mortality rates in the standard table applied to the population in the group. Dividing the actual deaths by the expected deaths produces the statistic known as the Standardised Mortality Ratio (SMR) which is widely used in demographic work. The SMRs for smokers and non-smokers give ratios compared to the standard; the "excess mortality index" gives a quick and convenient way of directly comparing the mortality experiences of the two groups. To move from the SMRs to the index, the SMR for smokers is first divided by the SMR for non-smokers. If the levels of mortality in the two groups are the same,

the figure resulting from this division will be unity, which is one. A result greater than unity means that the mortality of smokers is heavier than that of non-smokers; the index is defined as the amount by which the result exceeds unity, multiplied by 100 (to convert to a percentage).

The results of the study, subdivided by age group as well as for all ages combined, are given in the Appendix. The table shows, for men and women separately, the actual deaths and the SMR for both smokers and non-smokers, together with the excess mortality index of smokers compared to non-smokers. For all ages combined the excess mortality index for males was 78%; for females 92%. Put another way, the rates of mortality for male smokers are, on average, about $1\frac{3}{4}$ times those for non-smokers; mortality rates for female smokers are nearly twice those of female non-smokers.

The study was carried out by the Continuous Mortality Investigation Bureau of the Institute of Actuaries and the Faculty of Actuaries. Founded in 1920s the Bureau, which carries out a number of investigations, is a non-profit-making research body whose activities are directed by an Executive Committee, the members of which are appointed by the Councils of the Institute and the Faculty. It works with data supplied by life assurance companies writing business in the United Kingdom and the Republic of Ireland. All results published are based on pooled data: full confidentiality is maintained concerning the data and the experience of individual offices.

The results presented record the observed levels of mortality in the various subdivisions of the population under review. No attempt has been made to interpret the results by providing reasons for the differences found between the groups; in particular there has been no investigation as yet into the causes of death of smokers and non-smokers.

When setting premium rates for life assurance policies companies will naturally take into consideration the various risk factors perceived to be relevant to the life to be insured. However, other factors including expenses, the balance in the portfolio of policies offered and the office's desired position in the market as a whole, have a bearing on the calculations. In the case of non-smoker discounts, therefore, the differential between the premium rates offered to smokers and to non-smokers is not necessarily a direct reflection of the relationship between the basic underlying mortality risks of the two groups.

APPENDIX

The mortality experience of smokers and non-smokers 1988 and 1989. Database: UK assured lives - whole life, endowment and temporary. Actual deaths; expected deaths using the AM80 table for men and the AF80 table for women. Ratios of actual deaths to those expected (SMR) and excess mortality index for smokers compared with non-smokers.

Age group	Smokers			Non-Smokers		Excess Mortality Index $\frac{100 \text{ SMR Smokers} - 1}{\text{SMR Non-Smokers}}$
	Actual deaths	Expected deaths	SMR	Actual deaths	Expected deaths	
Males						
30 - 34	22	19	1.16	55	66	.83
35 - 39	116	100	1.16	121	204	.59
40 - 44	375	391	.98	289	572	.51
45 - 49	188	208	.90	157	303	.52
50 - 54	76	78	.97	35	58	.62
All ages	777	796	.98	657	1201	.55
Females						
30 - 34	5	6	.83	20	22	.91
35 - 39	28	29	.97	64	87	.74
40 - 44	84	63	1.33	114	180	.63
45 - 49	45	32	1.41	62	100	.62
50 - 54	15	12	1.25	17	39	.44
All ages	177	142	1.25	277	428	.65
						92



PRESS RELEASE



Institute of Actuaries

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Embargoed until 11am
Wednesday 14 October 1992

UP TO SIX YEARS OFF YOUR LIFE IF YOU ARE A SMOKER

The results of the largest independent investigation yet of smokers and non-smokers were presented today at a press briefing given jointly by the Continuous Mortality Investigation Bureau (CMI) and the Institute of Actuaries and the Faculty of Actuaries.

The investigation revealed some startling statistics: there were almost twice as many deaths among smokers as there would have been among comparable groups of non-smokers. If the smokers studied had been subject to the same mortality rates as those found among the non-smokers, the researchers would have expected 528 deaths to occur. In fact, the total was a staggering 954. Although the study cannot conclusively prove that smoking was the direct cause, it certainly appears to be a contributory factor.

The investigation also revealed that when studying the curve of deaths, the most frequent age of death for male non-smokers was 87 whereas for male smokers it was 81. Likewise, the most frequent age of death of female non-smokers was 91 whereas for female smokers it was 85.

Professor Wylie, Chairman of the CMI, commented: "Carrying out an investigation like this involves an immense effort and we are grateful to all those who have helped us in this research. I must stress that the CMI committee is completely independent and impartial. However, it is evident that there are almost twice as many deaths among smokers as among comparable groups of non-smokers and this is equivalent to an age difference of six years. Of course, we don't know whether, if all smokers gave up smoking, they would live longer. There may be other reasons why those who smoke also die sooner. But it certainly looks as if smoking has something to do with it."

It was not until the early 1980s that British life offices began charging different premium rates for smokers and non-smokers. A study into the medical profession, published in the 1980s, also showed increased mortality among smokers although this was a much smaller sample.

The CMI investigation is the largest in the UK to date and covers some 500,000 people. It is intended that the study will continue and be expanded to include causes of death.

— ENDS —

For further information, please contact:

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NOTES TO EDITOR:

THE INSTITUTE OF ACTUARIES AND THE FACULTY OF ACTUARIES

The Institute of Actuaries was formed in 1848 and the Scottish members formed the Faculty in 1856. The Faculty received the Royal Charter of Incorporation in 1868 and the Institute became a chartered Body in 1884.

The objectives of the Institute and the Faculty are identical, namely:

- to raise the status and promote the role of an actuary.
- to enhance and improve the ways in which an actuary is able to operate in applying the science of probability to the affairs of life, from which life assurance and other similar organisations derive their principles of operation.
- to consider all monetary questions related to the probability and principles of interest.

The Institute Secretariat is based at Staple Inn, London WC1 whilst the Faculty headquarters are in St Andrew Square, Edinburgh.

In recent years, there has been a rapid increase in the number of actuaries, working both at home and abroad within the insurance industry, investment, consultancy and in Government Service.

CONTINUOUS MORTALITY INVESTIGATION BUREAU (CMI)

The Continuous Mortality Investigation Bureau was set up in the 1920s by the Councils of the Institute of Actuaries and Faculty of Actuaries, to carry out research into mortality and morbidity rates of the population.

The data analysed in their research is supplied by life assurance offices using information from long term contracts with clients. Their research findings are published regularly at the rate of about one every 18 months.

The work of the Bureau is a continuing process and is carried out on annual and quadrennial cycles. Data is collected from life offices for a year. It is then distributed to contributing offices and the supervising sub-committee. Every four years, the experience is combined and a report prepared.

Its main areas of business include:

- Life insurance contracts issued at standard rates of premium
- Immediate annuities
- Individual pension arrangements
- Insured group pension arrangements

As from 1988, a smoking indicator has been included on the data records allowing this investigation into the effects of smoking habits on mortality.



PRESS RELEASE



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CONTINUOUS MORTALITY INVESTIGATION BUREAU
SMOKERS AND NON-SMOKERS MORTALITY

PRESS CONFERENCE

Wednesday 14 October 1992

Text of speech by Professor A D Wilkie, Chairman, CMI Bureau

Life insurance companies have always been interested in the mortality rates of their policyholders. Since I shall talk a lot about mortality rates I shall explain what I mean. Imagine that we have a large number of people - perhaps 100,000 - all of the same age and sex at the beginning of a year. We count how many of them die during the year and we calculate the proportion who have died. Mortality rates vary very much by age, from as low as 2 or 3 per 10,000 for healthy young females in their 20s, up to 1 in 3 or so for people who have reached age 100.

As early as the 1840s, 17 English life offices got together to produce the first mortality table based on the experience of those insured by life assurance companies. Investigations continued during the 19th century.

In the 1920s the Institute of Actuaries and the Faculty of Actuaries set up a permanent bureau to carry out a continuous mortality investigation of the experience of life office policyholders. I am now the Chairman of the Continuous Mortality Investigation or CMI Bureau.

The idea that smokers had worse mortality rates - that is, they died younger - than non-smokers was first suggested in the famous study by Richard Doll & Sir Austin Bradford Hill, which started in the 1950s, and for which the first results were published in 1964. Doll and Hill investigated the mortality experience of British doctors. They found that, among doctors, smokers had worse mortality rates than non-smokers.

It took some time, however, before people other than doctors were persuaded by these results and it was not until the early 1980s that British life offices generally began to charge smokers and non-smokers different premium rates. You might say that we had to wait until there were non-smoking chief executives or senior actuaries in life offices.

The CMI Bureau began collecting data from a number of life offices in 1988 and we now have available the results of the experience for the first two years of the investigation: 1988 and 1989. Over half a million people each year have been included in the investigation and 1,888 of them died during these two years. This is therefore a very large investigation compared with previous ones.

Carrying out an investigation like this takes a lot of work, both for the life insurance companies that gather the data from their own records and for the CMI Bureau that analyses it. Actuaries are grateful to the life offices for contributing their data and allowing it to be published. I must stress that the CMI Committee is completely independent and impartial. Members of the CMI Committee do not know the results for individual offices, but only the aggregate results for all offices combined.

I said that there were over 500,000 people insured for the two-year period. There were 386,402 non-smokers and 159,124 smokers. So over two-thirds of the lives insured (actually over 70% of them) were non-smokers.

There were rather more deaths among the smokers than the non-smokers: 934 non-smokers died and 954 smokers. To compare them accurately we make adjustments for the age and sex of the lives assured and for the type of policy and how long it has been in force.

After doing this calculation, we see that if smokers had had the same mortality rates as non-smokers there might have been 528 deaths. In fact there were 954 deaths, or an excess of 426 deaths. 426 is 81% of 528 so we say that there was excess mortality among smokers of 81%.

When we look at the two sexes separately we see that among male smokers there might have been 436 deaths if their mortality rates had been the same as those of male non-smokers. There were actually 777 deaths - an excess of 341 deaths, which is 78% of 436. Thus males had excess mortality of 78%.

Female smokers did worse. If their mortality rates had been the same as those of female non-smokers there might have been 92 deaths. Actually 177 of them died - an excess of 85 deaths, which is 92% of 92. Their excess mortality was therefore 92%.

This excess mortality is only a little bit lower than the comparable figure from investigations carried out by insurance companies in the United States. They show that there were just over twice as many deaths among smokers as there would have been among comparable groups of non-smokers.

I know that you might like to measure the effect of different mortality rates in terms of expectations of life. But really expectations of life are for those newly-born and we cannot yet make any distinction between smokers and non-smokers at that age. I think it is better to show you what we call the curve of deaths, which shows how the deaths among a typical population are spread across the ages.

Here you see the curve of deaths for males for smokers and non-smokers combined. The most frequent age at death is 84, where the curve of deaths reaches a peak. When I show the curve of deaths for smokers and non-smokers separately we see how the peak age at death for smokers goes down to 81 and the peak age at death for non-smokers goes up to 87, a difference of six years.

Here are the same figures for females. The peak age at death for female smokers and non-smokers combined is 89 and here we see how they separate to 85 for smokers and 91 for non-smokers, again a difference of six years.

In making these calculations, I have assumed that the excess mortality of smokers goes right on into old age. Strictly we do not know this from our current experience, because we have relatively few very old policyholders in our investigation. All the same, when we subdivide the experience by age groups and look at the excess mortality in each age group, we find the same sort of excess all the way up, at least above age 30 or so.

We have not so many deaths at young ages to be quite sure of what is happening, but if you assume that it is many years of smoking that causes the problem, it is not too surprising that the difference does not show up as strongly for people in their 20s as for people in their 60s.

The definition of smokers and non-smokers in our investigation depends on the definitions used by the life offices which contribute data. Those who have given up smoking for long enough probably go in with the non-smokers. Those who smoke pipes and cigars may go into either category depending on the office's practice. We have no separate investigation for those who have previously smoked but have given up, or for those who smoke heavily as opposed to those who smoke only a few cigarettes every day.

We also do not know whether people tell the truth to life offices. Smokers who tell lies are possibly included with the non-smokers. Even so, the mortality experience of honest smokers is much worse than that of non-smokers and dishonest smokers combined. However, I don't suggest that it is telling the truth that causes the greater number of deaths!

We have not yet got any figures about the causes of death of smokers as opposed to non-smokers. American investigations show much higher levels of lung cancer and of heart disease among smokers and also much higher numbers of accidents. When we do get figures in Britain to show the different causes of death among smokers and non-smokers we shall be interested to see whether the same differences show up.

Our studying is continuing and, in due course, we shall have more years' data to report on.

To summarise:

There are getting on for twice as many deaths among smokers as among comparable groups of non-smokers and this is equivalent to an age difference of six years. Of course, we don't know whether, if all smokers gave up smoking, they would live longer. There may be other reasons why those who smoke also die sooner. But it certainly looks as if smoking has something to do with it.

THE MORTALITY OF SMOKERS AND NON-SMOKERS, 1988-89

As from 1st January 1988 the Bureau has been collecting data differentiated according to the smoking habits of the policyholder. In the investigations the designation 'smoker' relates primarily to lives who have taken out policies where a non-smoker discount was available at the date of issue of the policy but who have not availed themselves of the offer. The term 'non-smoker discount' includes not only cases where a monetary or percentage reduction is allowed against the standard premium but all cases where non-smokers are offered preferential terms eg. the use of an age deduction when determining the premium rate. 'Non-smoker' relates to lives who have been granted policies on a non-smoker basis. This may vary from office to office but the most frequent requirement appears to be that the proposer has not smoked cigarettes for at least twelve months prior to the date of the proposal. There is additionally a small amount of data where, although the terms of the policy do not differentiate, the smoking status is known to the issuing company. There is no information available on the number of cigarettes smoked or on the experience of smokers of pipes or cigars.

A circular to offices in 1987 indicated widespread support for such an investigation and arrangements were duly made. In the event only a small number of offices have so far actually submitted returns containing split data. It is not unusual for new investigations to take a year or two to get established; the necessary changes to systems providing the data take time to organise and the task has to take its place in the queue for resources. Now that the investigation is fully established the Bureau would welcome additional contributions of data; the larger the data base the greater the credibility and the predictive value of the results.

Notwithstanding the above the Bureau now has differentiated data for the years 1988 and 1989 in sufficient quantity, for permanent (ie whole life and endowment) assurances and for temporary assurances, to make a worthwhile analysis. It is customary when an investigation begins part of the way through a quadrennium to delay publication of the first results until the normal quadrennial reports are produced. However, the Executive Committee considered that the preliminary results for this investigation were sufficiently interesting to warrant publication at the earliest opportunity.

The bulk of the data received has been for permanent assurances. Six offices submitted data giving a combined exposed to risk for male lives for the two years of 184,177 policy-years in the smoker category and 368,107 policy-years in the non-smoker category. The corresponding figures for policies on female lives were 74,288 and 236,409 respectively. In the case of temporary assurances, although the number of offices submitting data was greater, nine as against six,

Table 1. Permanent assurances, males, medical and non-medical combined, 1988 and 1989: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Smokers		Non-Smokers		All policies*		Mortality Index** (per cent)
	Actual deaths	100(A/E) by AM80	Actual deaths	100(A/E) by AM80	Actual deaths	100(A/E) by AM80	
Duration 0							
-30	4	215	18	118	28	121	115
31-45	20	127	34	89	62	135	95
46-60	3	135	9	45	22	77	200
61-75	3		1		2		
76-	0						
All ages	51	160	77	73	115	99	119
Duration 1							
-30	5	207	8	63	16	83	180
31-45	17	164	38	80	61	816	165
46-60	33	83	21	62	28	82	
61-75	5		3	33	4	78	
76-	1						
All ages	61	360	80	70	108	88	129
Duration 2 and over							
-30	9	118	24	84	56	80	40
31-45	57	86	57	52	870	74	65
46-60	286	90	182	50	3450	69	80
61-75	167	91	116	53	2597	75	72
76-	73	98	39	64	1054	85	61
All ages	594	91	409	53	7977	74	72

* Includes cases where smoking habits are not known.

** 100[(100(A/E) Smokers - 100(A/E) Non-Smokers) - 1]

the number of policies covered was much smaller. The combined exposed to risk for male lives in the smoker category was 39,108 with 101,226 in the non-smoker category. The corresponding figures for females were 20,675 and 67,063 respectively. For cases where the smoking category is known therefore, the grand total of policy-years of exposure in the experience was 1,091,053.

Some of the offices contributing data were unable to provide a split by smoking category for policies issued before the start of the investigation. For completeness, these policies have been included in the 'All policies' category in Tables 1

Table 2. Permanent assurances, females, medical and non-medical combined, 1988 and 1989: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Smokers		Non-Smokers		All policies*		Mortality Index** (per cent)
	Actual deaths	100(A/E by AF80)	Actual deaths	100(A/E by AF80)	Actual deaths	100(A/E by AF80)	
Duration 0							
-40	9	85	13	34	24	46	136
41-	12	462	13	129	29	206	258
All ages	21	158	26	56	53	88	182
Duration 1							
-40	15	122	34	78	55	88	56
41-	30	181	12	68	22	80	202
All ages	25	148	46	73	77	85	92
Duration 2 and over:							
-45	18	182	48	95	179	86	7
46-60	62	143	74	66	514	94	117
61-75	25	164	35	50	243	75	168
76-	19	97	13	40	128	82	142
All ages	115	120	170	54	1064	86	88

* Includes cases where smoking habits are not known.

** 100[(100(A/E) Smokers - 100(A/E) Non-Smokers) - 1]

to 5 and the 'combined' category in Table 6, which thus represent the full data for those offices contributing to this particular investigation.

In the original returns to the Bureau the policies included were categorised by medical type according to whether a full medical examination had been required at the date of issue (medical cases), or whether completion of a full medical questionnaire was deemed sufficient (non-medical cases). For most groups analysed the amount of medical data was too small to warrant separate analysis; in the only group where the data were sufficient, males, permanent assurances at durations 2+ (i.e. 2 and over), the results for the medical and non-medical cases were remarkably similar. All results are, therefore, shown on a combined medical basis.

COMPARISON BASES AND RESULTS

The experience of male lives has been investigated using as a comparison basis

Table 3. Temporary assurances, males, medical and non-medical combined, 1988 and 1989: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Smokers		Non-Smokers		All policies*		Excess Mortality Index** (per cent)
	Actual deaths	100A/E by AM80	Actual deaths	100A/E by AM80	Actual deaths	100A/E by AM80	
Duration 0							
-45	11	165	9	48	21	79	244
46-	14	173	13	48	32	87	260
All ages	25	169	22	48	53	84	252
Duration 1							
-45	5	110	7	56	13	68	96
46-	3	42	8	34	13	38	24
All ages	8	69	15	42	26	49	64
Duration 2 and over							
-45	10	78	17	57	216	77	37
46-60	21	82	22	37	489	65	122
61-	7	70	7	25	186	70	180
All ages	38	79	46	39	891	69	103

* Includes cases where smoking habits are not known.

** $100 \times (100A/E \text{ Smokers} - 100A/E \text{ Non-Smokers} - 1)$

the AM80 table for assured lives. The comparison basis for female lives is the AF80 table. The results for permanent assurances are shown in Table 1 for males and Table 2 for females. For temporary assurances the results for males are shown in Table 3 and for females in Table 4. In order to give the largest possible database the data for permanent assurances and temporary assurances, for all durations, were combined. The results are shown in Table 5.

Permanent assurances

For both males and females, in almost every group and at each duration, the mortality of smokers is heavier than that of non-smokers, in most cases substantially so. This can be measured by defining the excess mortality index (per cent) of smokers as compared with non-smokers as $100 \times (100A/E \text{ for smokers} - 100A/E \text{ for non-smokers} - 1)$. For all ages combined, the excess is even greater at durations 0 and 1 than at durations 2+. At durations 2+ the excess was 72% for males and 88% for females. In the case of males (durations 2+) the excess rose to a peak at the middle ages, 46 to 60, and fell away again. For females

Table 4. Temporary assurances, females, medical and non-medical combined, 1988 and 1989: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Smokers		Non-Smokers		All policies*		Excess Mortality Index** (per cent)
	Actual deaths	100A/E by AM80	Actual deaths	100A/E by AM80	Actual deaths	100A/E by AM80	
Duration 0							
All ages	5	155	4	38	13	90	208
Duration 1							
All ages	2	69	7	69	10	68	
Duration 2 and over							
-45	5		10	62	68	82	28
46-	4	90	14	90	90	101	
All ages	9	90	24	76	158	92	18

* Includes cases where smoking habits are not known.

** $100 \times (100A/E \text{ Smokers} - 100A/E \text{ Non-Smokers} - 1)$

(durations 2+), except at ages below 45, the level of mortality of smokers was more than twice that of non-smokers.

Temporary assurances

As mentioned above, the number of policies included in the temporary assurance investigation is smaller than the number in the permanent assurance investigation. There is a reasonable number of deaths in total in the male experience, the numbers in the individual age groups are too small for reliable conclusions to be drawn for individual cells. Overall, however, the results do not conflict with those found for permanent assurances; if anything, the additional mortality of smokers in the temporary assurance experience appears to be greater than that found in the permanent experience.

The number of deaths in the female experience is insufficient to provide useful results. Apart from duration 0, this is the one section of the investigations where the observed differential between mortality of smokers and non-smokers is smaller. However, the numbers of deaths are such that the statistics 100A/E for smokers and for non-smokers have wide confidence intervals about their observed values.

The combined experience

As would be expected the effect of combining all the available data for

Table 5. Permanent and temporary assurances combined, medical and non-medical combined, all durations combined, 1988 and 1989: actual deaths and ratios of actual deaths to those expected using the AM80 table for males and the AF780 table for females.

Age group (nearest ages)	Smokers Actual deaths	Non-Smokers Actual deaths	All policies* Actual deaths	100A/E by AM80	100A/E by AF780	Ratio Actual/Expected (per cent)
Males						
-30	22	55	83	81	87	40
31-45	116	121	237	110	77	97
46-60	375	289	664	311	60	88
61-75	128	137	265	127	76	72
76+	76	35	111	62	85	96
All ages	777	637	1414	55	74	78
Females						
-30	5	20	25	91	94	-
31-45	28	64	92	74	81	33
46-60	84	114	198	63	92	113
61-75	45	92	137	62	202	127
76+	15	17	32	44	138	184
All ages	177	277	454	65	166	92

* Includes cases where smoking habits are not known.

** 100A (100A/E Smokers ÷ 100A/E Non-Smokers - 1)

smokers and non-smokers (although still segregated by sex) is to mask some of the features revealed by the more detailed analysis. However, the main conclusions must remain the same; that whatever the level of analysis smokers suffer substantially heavier mortality than non-smokers.

It is well known that, age for age, the mortality of standard male lives is heavier than that of standard female lives. However, when the data are categorised by smoking habits some interesting features emerge, as can be seen in Table 6 where, for both males and females, the experience for each smoking category has been compared using the AM80 table. The rows in the table have been ranked, the category showing the lightest level of mortality being at the top of the table and that showing the heaviest level of mortality at the bottom. As would be expected these are male smokers and female non-smokers respectively. What is perhaps surprising is that the level of mortality of female smokers is considerably heavier than that of male non-smokers. In fact, the levels of mortality experienced by female smokers are not significantly different from those in

Table 6. Permanent and temporary assurances combined, medical and non-medical combined, 1988-1989: ratios of actual deaths to those expected using the AM80 table for both males and females for smokers, non-smokers and all smoking categories combined.

All ages	Duration 0 100A/E by AM80	Duration 1 100A/E by AM80	Duration 2+ 100A/E by AM80	All durations 100A/E by AM80
Males, Smokers	163	179	90	98
Males, Combined*	94	79	71	74
Females, Smokers	83	85	70	74
Males, Non-Smokers	66	64	51	55
Females, Combined*	43	54	54	51
Females, Non-Smokers	28	47	39	38

* Includes cases where smoking habits are not known.

the male combined experience. Similarly, but at a lower level, the mortality ratios for the male non-smoker group and the female combined groups, at durations 2+, are not significantly different.

Comparisons with other studies

The results so far from the CMI investigations support the conclusions of other studies in the same area. In particular the inter-company experience for 1983-85 compiled by the Committee on Individual Life Experience Studies of the Society of Actuaries, reviewed by James D Brock in 'The Actuary's September 1988', mirrors very closely the results of the CMI investigations. Similarly, a study of the Canadian Institute of Actuaries Committee on Expected Experience*, reporting on the experience for 1988 and 1989 showed, in general, very similar results. Their experience overall showed an even heavier mortality addition for smokers than the CMI experience, but the duration effect did not seem quite so marked. An earlier study by Rhodes and Savill¹ presented to the Institute of Actuaries Students' Society in December 1982, in a survey of evidence to that date, again reported very similar findings. The Bureau has yet to find any report on this topic, whatever the geographical location or status of its subjects, which does not tell the same story.

CONCLUSION

For the first time life offices in the UK have hard evidence, based directly on the experience of their own policyholders, of the differential in mortality between smokers and non-smokers. In the paper by Rhodes and Savill it was stated that the non-smoker discounts, where available in the term assurance

marked at the time, ranged from 30% to 40%. Current discounts, although more widely available, appear to be more generally in the 20% to 30% range, with only a handful of offices offering more than 30%. However, the wide range of term assurance premium rates available from different offices indicates that factors other than the pure mortality risk alone have an influence on the rates offered by an individual office. It is possible for a non-smoking prospective policyholder, by 'shopping around', to obtain a lower standard rate premium through an aggressively priced policy from Office X, than he or she could obtain on a discounted basis from Office Y which is pricing according to different criteria. That being said, the evidence is there that, measured on risk alone, larger non-smoker discounts than those currently available could be justified.

References

1. The Actuary (Society of Actuaries) Vol 22, No 6, September 1988.
2. Canadian Standard Ordinary Life Experience 1988 and 1989. Canadian Institute of Actuaries, April 1991.
3. 'Smoker and Non-Smoker', presented to the Institute of Actuaries Students' Society, December 1982.

INTER-OFFICE COMPARISONS

From time to time enquiries have been received in the Bureau as to whether there is any significant difference between the mortality experiences of the individual offices contributing data to the investigations. An office which submits data for a given year will have an analysis of its own experience prepared in the Bureau. It will also be sent a copy of the all offices experience for that year. An office can therefore tell how far its own experience differs from that of all offices combined. What it cannot tell is where its own experience falls in the spectrum. For example, an office which has very light experience does not know whether this light experience is balanced by several offices with experience just a bit heavier than the combined or whether there are perhaps several equally light offices being balanced by several correspondingly heavy offices; i.e. nothing is known about the dispersion of the individual experiences. It therefore seemed worthwhile to make some preliminary enquiries and the results are appended. It must be stressed that at all times in this exercise full confidentiality has been maintained as to the origin of any individual experience; all company names, together with the corresponding office numbers used for processing in the Bureau, have been suppressed in all material presented to the Executive Committee.

In the history of the Bureau there have been two previous investigations on this topic. The first, by Elderton, Oakley and Smither (JIA 68, 54 and TFA 15, 315) studied the statistics underlying the A1924-29 Table, the first standard table for assured lives prepared by the Joint Mortality Committee. When the A1924-29 Table was published the Committee thought it would be helpful to let each of the contributing offices have a statement showing how the mortality of the particular office compared with that of the A1924-29 Table. It was only when these calculations were completed that it was realised how wide were the variations in the experience of the individual offices. The authors considered whether, with such a heterogeneous group of potential users, one standard table was sufficient. They therefore devised supplementary tables from the experience of the seven lightest and five heaviest offices respectively, which were published in 1937.

The second investigation into the topic was made at the time of the publication of the A1949-51 Table. The individual calculations were carried out and it was again found that wide divergences existed among the mortality experiences of different offices. Offices were allocated to a light or heavy group and the experience of the two groups published in JIA 85, 57 and TFA 26, 122. It was considered that very little use had in fact been made of the A1924-29 (Heavy) Table and that there was therefore little justification for deriving a new one. However, it was thought useful to derive a set of rates of mortality from the experience of the light offices. No mortality functions were produced for these

Smoker and Non-Smoker Mortality

The excess mortality of smokers is a social issue as well as one which affects the insurance industry. Jillian Evans, Secretary of the Continuous Mortality Investigation Bureau (CMIB), outlines the results of the CMIB's recent investigation.

"There are getting on for twice as many deaths among smokers as among comparable groups of non-smokers and this is equivalent to an age difference of six years. Of course, we don't know whether, if all smokers gave up smoking, they would live longer. There may be other reasons why those who smoke also die sooner. But it certainly looks as if smoking has something to do with it". This was the conclusion of a presentation by Professor David Wilkie given at a press conference called to publicise the first results from the investigation by the Continuous Mortality Investigation Bureau (CMIB) into the mortality experience of smokers and non-smokers.

Why all the fuss? After all, there have been

large, covering, in the two years under review, more than one million policy years of experience, including 1888 deaths. It is also completely independent of either side of the tobacco debate. The Bureau has no



Figure 2:
Curve of deaths - Male Smokers
and Non-Smokers

any to grind and can publish its results without fear of, or favour to, either side. Similarly, the interest of the life assurance companies, who provide the data, lies in knowing as much as possible about the risks they are covering - hence the wide range of the CMIB's list of investigations, which

The second factor which led the CMIB Executive Committee to feed the results from the investigations would be of general interest lay in the extent of the differential observed between the mortality of smokers and non-smokers. It had been expected that some differential would be found, but the fact that the observed mortality rates of smokers were almost twice those of non-smokers was considered surprising enough to be worthy of wider publication.

So, what are the details of the investigation? It was based on 1 January 1988 and is

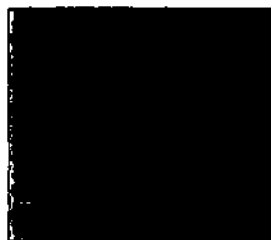


Figure 4:
Curve of deaths - Female Smokers
and Non-Smokers

continuing. The results presented here cover the two years 1988 and 1989. As is normal in CMIB investigations, the data were provided by life assurance companies, on this occasion restricted to those operating in the United Kingdom. The bulk of the data (about 80%) related to permanent (whole life and endowment) assurances. For males there was an exposed to risk of 223,285 policy years in the smoking category and 459,333 in the non-smoking category. Thus, about one third were smokers, virtually the same proportion as in the general population. There were 777 deaths among the smokers and 657 deaths among the non-smokers. For females there were 94,963 policy years of exposure among smokers and 303,672 among non-smokers. These gave rise to 177 deaths among smokers and 277 deaths among non-smokers. The proportion of female smoker policyholders, almost one quarter, is a bit lower than that found in the



Figure 1:
Curve of deaths - Males Combined

plenty of items in the media detailing the apparently harmful effects of smoking. Everyone knows smoking is bad for you - what's new?

First, in an area where there has been sustained media interest over the years, actual hard statistical evidence is remarkably thin on the ground. The study by Dr (now Sir) Richard Doll and the late Sir Austin Bradford Hill, published in 1964, investigated the mortality experience of British doctors. They found smokers had higher mortality rates than non-smokers. Subsequent studies have corroborated those findings but, in the UK at least, there has been no really large-scale independent inquiry.

The CMIB investigation is just that. It is

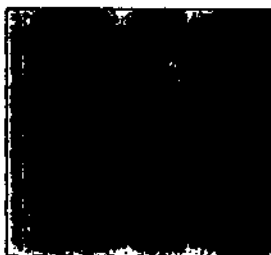


Figure 3:
Curve of deaths - Females Combined
includes impaired lives and permanent health insurance. This helps life assurance companies to price products keenly and with fairness between different groups of policyholders.

general population (roughly one third at the ages covered in this study).

The designation "smoker" in this study related primarily to people who had taken out life insurance policies where a non-smoker discount was available at the date of issue of the policy but who did not avail themselves of the offer. "Non-smoker" related to lives who have been granted policies on a non-smoker basis. The designation "non-smoker" may vary from office to office

groups in the experience, using as a comparison basis the AMRO table throughout, i.e., using the same comparison basis for both sexes. The categories in the experience have been ranked, that showing the highest level of mortality at the top of the table and that showing the highest mortality level at the bottom. As might be expected, these are male smokers and female non-smokers respectively. What is perhaps not so expected is that the level of mortality of female

table appropriate to the experience of smokers and non-smokers combined is constructed. Using the information from the study, sets of mortality rates for smokers and non-smokers separately are derived and life tables appropriate to the two groups are constructed. The curve of deaths (dx) is plotted for each table and the modal (most frequent) age at death can be clearly seen. The advantage of the statistic rather than an expectation of life calculated by reference to the same table is that, while the expectation of life varies with age, for any given table the modal age at death (for anybody below that age) remains the same.

In making these calculations it has been assumed that the excess mortality of smokers goes right on into old age. Strictly, we do not know this from our current experience, because there are relatively few very old policyholders in the investigation. All the same, when the experience is subdivided by age groups there is the same sort of excess mortality all the way up, at least above age 30 or so. There are not enough deaths at young ages to be quite sure of what is happening, but if you assume that it is many years of smoking that causes the problem, it is not too surprising that the difference does not show up as strongly for people in their twenties as for people in their thirties.

Figures 1 to 4 (page opposite) give the curves of deaths for males and for females, showing for each sex the curve for the combined data and the curves for smokers and non-smokers separately. It will be noted that both for males and for females the peak age at death occurs six years earlier for smokers than it does for non-smokers. Hence the headlines of the type "up to six years off your life if you are a smoker" following the press conference.

The results presented record the observed levels of mortality in the various sub-groups of the population under review. No attempt has been made to interpret the results by providing reasons for the differences between the groups. In particular, there has been no investigation, as yet, into the causes of death of smokers and non-smokers, although this is being actively considered.

There was, not surprisingly, a certain amount of interest at the press conference in the possible effect of the results on life assurance premium rates. Where offered, non-smoking discounts tend to be up to 30% of the standard premium. It is not for the Bureau to speculate about how these might change; the life assurance companies will, no doubt, in time, make their own response; many other factors apart from the pure mortality risk - in particular expenses - are taken into account when pricing products in a highly competitive commercial market. What can be said is that, for the first time, officers have hard evidence, based directly on the experience of their own policyholders, of the risks they are covering; this shows that, measured on risk alone, larger non-smoker discounts than those currently on offer could be justified.

Jillian Evans

TABLE 1

CMIB smoker/non-smoker experiences 1988 and 1989. Data base: UK assured lives, - whole life, endowment and temporary. Actual deaths, expected deaths using the AMRO table for men and the AFRO table for women, SMR and excess mortality index for smokers compared to non-smokers.

Smokers				Non-Smokers			Excess Mortality Index*
Age group	Actual deaths	Expected deaths	SMR	Actual deaths	Expected deaths	SMR	
Males							
- 30	22	19	1.16	55	66	.83	40
31 - 45	116	100	1.16	121	204	.59	97
46 - 60	375	391	.96	289	572	.51	88
61 - 75	188	208	.90	157	303	.52	73
76 -	76	78	.97	35	56	.62	56
All ages	777	796	.98	657	1201	.55	78
Females							
- 30	5	6	.83	20	22	.91	-
31 - 45	28	29	.97	64	87	.74	31
46 - 60	84	63	1.33	114	180	.63	111
61 - 75	45	32	1.41	52	100	.52	127
76 -	15	12	1.25	17	39	.44	184
All ages	177	142	1.25	277	428	.65	92

* $100 (SMR \text{ smokers} - SMR \text{ non-smokers} - 1)$

but the most frequent requirement appears to have been that the proposer had not smoked cigarettes for at least 12 months prior to the date of the proposal. There is no information available on the number of cigarettes smoked or on the experience of smokers of pipes or cigars.

The results of the investigation are shown in tabular form. In Table 1 (above) the actual deaths in each subsection of the experience have been compared with those expected by reference to a standard table in the usual way, to produce the Standardized Mortality Ratio (SMR). The standard tables used were the AMRO table for the male experience and the AFRO table for the female experience. Also shown is the "excess mortality index" of smokers vis-à-vis non-smokers, which gives a quick way of directly comparing the levels of mortality in the two groups. The index is defined as $100 (SMR \text{ Smokers} - SMR \text{ non-smokers} - 1)$. As can be seen, for all ages combined the excess mortality index for males was 78%; for females it was 92%.

Table 2 (right) shows the SMRs for all sub-

groups. It is considerably heavier than that of male non-smokers. In fact, the mortality of female smokers is very similar to that of all males, smokers and non-smokers combined, while that of male non-smokers is closer to that of all females, smokers and non-smokers combined.

The results can also be presented in terms of the effect on the curve of deaths. A life

TABLE 2

CMIB experience 1988-89, SMRs by reference to the AMRO table, all ages combined.

Category	SMR using AMRO
Male smokers	98
Female smokers	74
Male combined	72
Male non-smokers	55
Female combined	67
Female non-smokers	58

SAMPLE OF RESULTANT PRESS RELEASES

MONEY WEEK - 14 October 1992

UK - TERM ASSURANCE MARKET WILL BE SHAKEN UP BY MORTALITY

REUTERS NEWS SERVICE - 14 October 1992

SMOKING DOUBLES DEATH RATES, INSURANCE STUDY FINDS

"Actuaries' reports are compiled to help insurance companies assess their risks."

THE INDEPENDENT - 15 October 1992

SMOKERS COULD FACE HIGHER PREMIUMS

"Cigarette smokers can expect to be increasingly penalised when they buy life insurance policies..."

"Surprisingly, and for reasons not yet understood, there were more deaths among the female smokers than the male smokers. Men had an 'excess mortality' of 78 per cent and women 92 per cent.

FINANCIAL TIMES - 15 October 1992

SMOKING 'CUTS LIVES BY 6 YEARS'

"The Continuous Mortality Investigation Bureau and the Institute of Actuaries and Faculty of Actuaries, in a review of 500,000 people, found that the most frequent age of death for male smokers was 81, while male non-smokers most frequently died at 87."

GUARDIAN - 15 October 1992

RISK OF PREMATURE DEATH 'TWICE AS HIGH FOR SMOKERS'

"Smokers are twice as likely to die prematurely as non-smokers, with people sacrificing at least six years of life to tobacco, insurance companies warned yesterday."

"(John Martin, president of the Institute of Actuaries) added 'The message in that those who smoke have death rates which are almost twice as high as those of non-smokers. That is a hell of a message.'"

THE TIMES - 17 October 1992
SMOKERS FACE PREMIUMS RISE

“Smokers could face a 10% rise in term assurance premiums after new research this week showed almost twice as many smokers died in a two-year period as comparable non-smokers, and that smokers die on average six years earlier than non-smokers.”

MONEY MARKETING - 22 October 1992
SMOKING STATISTICS COULD SPARK PREMIUM REVIEW

“Premium rates for smokers could rise following figures from the Institute and Faculty of Actuaries which show that the impact of smoking on mortality is higher than previously thought.”

POST MAGAZINE - 22 October 1992
SMOKING COSTS SIX YEARS OF LIFE

“Smokers die six years earlier than non-smokers, according to the latest findings of the CMIB. Also at any given time, according to its survey, smokers are twice as likely to die as people who do not smoke.”