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THE MORTALITY OF MEMBERS OF GROUP SCHEMES IN SOUTH AFRICA

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ABSTRACT
In this paper, the mortality of members of group schemes underwritten by South African life insurance companies is investigated. The research provides some indication of the level or mortality of this population as a whole, which apart from being useful for costing group schemes in future could be used, to the extent that these data represent the mortality of those in formal employment, in the costing of a national retirement scheme. Rates of mortality are investigated by several demographic factors such as age, sex, salary and industry of employment.

KEYWORDS
Mortality; group life insurance; formally employed; group schemes

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1. INTRODUCTION

1.1 The idea for this research arose from discussions around how the Actuarial Society of South Africa (ASSA) could assist the South African government in estimating the expected cost of its reform of the social-security retirement system.

1.2 Although significant work has been, and continues to be, done on the estimation of mortality rates in South Africa by ASSA and other organisations such as the United Nations Population Division and the US Census Bureau, it is of limited use for costing social-security retirement benefits because the rates are applicable to either the insured population or the population of the country as a whole. This research focuses on pre-retirement mortality, and specifically the mortality of people who have compulsory group life insurance and hence are formally employed and in good enough health to be actively at work. By implication, it therefore excludes lives that would potentially form part of a social-security scheme but are not covered by group life insurance because they are retired, unemployed, informally employed or formally employed but not currently covered. In this paper, the expression 'group life insurance' refers to risk benefits that are provided to employees on a compulsory basis, mainly through the employer or, less frequently, through a union, bargaining council or professional association.

1.3 South Africa has a strong group-life-insurance sector with high market penetration. The vast majority of employees are covered without any medical underwriting. This is to keep the costs down but also the fact that employees are actively at work ensures that they are relatively healthy. In addition, because the benefits are linked to salary and insurance is not at the discretion of the individual, there is almost no anti-selection, that is, few people actively choosing to insure themselves because they know they are in poor health.

1.4 Although the original purpose of the study was to estimate mortality rates for social-security benefits, there are two other uses for the results of this research. Firstly, they will enable insurers selling group life business to compare their experience to that of the industry, and adjust their rates if necessary. Secondly, the results can be used by companies selling individual life insurance, from funeral cover to fully underwritten insurance, to calibrate more accurately some of their assumptions, for example, female mortality expressed as a percentage of male mortality ('female-to-male mortality ratio'), or the reductions in mortality as salary increases.

1.5 The investigation covers the five-year period from 1 January 2005 until 31 December 2009.

1.6 Although a number of insurance companies underwrote group life business for the period of this study, the six largest insurers were approached and agreed to provide data. Their market share, calculated as the total group-life-insurance claims paid by large insurance companies, was conservatively estimated at approximately 90%.[1] Given that the contributing insurers represented all the large insurers in the industry data as well as possibly one or two medium-sized insurers, this estimated market share is possibly understated.

1 ASISA, Life Industry Trade Figures for 2005 to 2009, 2011. www.asisa.co.za/index.php/industry-statistics/long-term-insurance.html, 21/08/2011

1.7 The investigation covered those employed, and hence economically active, in the formal sector and hence aged from 20 to 69. The relative volume of data submitted by contributing offices remained reasonably stable over this period. The data allowed mortality to be investigated by sex, age, salary, industry grouping and to some extent, province.

1.8 The purpose of this paper is to consider the crude results that are obtainable from such a dataset. Very little is offered in terms of rigorous statistical analysis, which is in line with similar papers. It is however intended to be read in conjunction with Clur et al. (2013) which details the graduation of the mortality rates of this group of lives.

1.9 Although there is research on how mortality relates to socio-economic class or income (Preston & Taubman,1994; Ridsdale & Gallop, unpublished), occupation (Pedoe, 1947; Pedoe, 1960) or socio-economic status more generally (White et al., unpublished; Pappas et al., 1993) and difference in mortality for the sexes (Kalben, 2000; Kruger & Nesse, 2004; Abdulraheem, Jimoh & Oladipo, 2011), little research appears to have been published on the mortality of employees and even less on the mortality of members of group schemes. Much of the research by actuaries has tended to focus on post-retirement longevity—such as Madrigal et al. (2010) who conclude that salary at retirement is a better predictor of longevity than amount of pension. Where, as in Richards & Jones (unpublished), the focus is broader, limited attention is devoted to factors associated with longevity.

1.10 The only previous study in South Africa was that by Dorrington, Martens & Slawski (1993), which compared the mortality of African members of group schemes to those of assured lives and the African population as a whole. The only relatively recent studies from other countries that the authors were able to identify were those of the Group Life Insurance Experience Committee (unpublished) in the US and the Committee on Expected Experience (unpublished) in Canada.

2. DATA

2.1 DESCRIPTION OF THE DATA

2.1.1 Data for this investigation were contributed by six South African life-insurance companies: Sanlam; Old Mutual; Momentum and Metropolitan (subsequently merged); and Liberty and Capital Alliance (subsequently merged). The largest of these contributions makes up 24% of the data, the smallest more than 9%.

2.1.2 The data consist of information on employees covered by compulsory group life insurance at various points in time and of deaths recorded by these companies over the period of the investigation.

2.1.3 The following types of insurance were specifically excluded from the investigation:

– family funeral policies;
– spouse group-life-insurance policies;

– accidental-death policies;
– voluntary life-insurance policies; and
– schemes based outside of the Republic of South Africa.

2.1.4 Exposure data were submitted as census data at discrete points in time. These originated primarily from employers' payroll data and included the following fields:
– date of birth;
– sex;
– annual salary;
– scheme identifier (name or unique number);
– industry of scheme, as distinct from the occupation of the individual;
– geographic region (province);
– scheme commencement date with current insurer;
– scheme termination date (if applicable);
– census date; and
– data extraction date.

2.1.5 Deaths data were submitted as separate datasets and included the following fields:
– date of birth;
– sex;
– annual salary at date of death;
– scheme identifier;
– industry;
– geographic region;
– date of death;
– date of submission of claim;
– date of payment of claim; and
– data extraction date.

2.2 DATA QUALITY

2.2.1 Table 1 shows the percentage of exposure and deaths for which information on specific demographic factors was provided in the dataset after basic data checks and fixes, but before redistribution of data with unknown fields. The redistribution is discussed in section 2.3.

2.2.2 The overall level of completeness of the data is very good, which makes detailed and in-depth analyses possible.

2.2.3 Data on province were the least complete. The incomplete 20% comprised mostly schemes that were classified as 'nationwide', where the company operates in more than one province, but also included some schemes where the information on province was truly unknown. Thus all schemes that did not identify a province were classified as nationwide.

Table 1. Completeness of data by demographic factor

	Exposure	Deaths
Age	100%	100%
Sex	99%	100%
Salary	99%	98%
Industry	96%	96%
Province	80%	82%
Calendar year	100%	100%
Scheme size	100%	100%
Scheme growth	100%	100%

2.3 REASONABILITY CHECKS AND CORRECTIONS FOR MISSING FIELDS

2.3.1 Reasonability checks were performed to identify schemes with obvious problems. Some manual adjustments were made to the industry classification of large schemes that were not accurately allocated. Schemes where the claims files were clearly missing were identified and excluded from the investigation.

2.3.2 Unrealistically high or low salaries were identified and treated as missing information. Similarly, schemes with very high or very low average salaries were individually investigated to determine whether the salary definition was correct (for example monthly instead of annual, or cents instead of rands). In general very few problems with salaries were found. This is perhaps not unexpected as it would be in insurers' best interest to ensure that salary information is always accurate, since both the sum at risk and the premium payable are usually a function of the salary.

2.3.3 Since census data were available only at discrete points in time—and no unique identifiers for individual lives are present in the data—claims could not be linked to the exposure on individual lives. It was therefore not possible simply to exclude those with missing information, and some small adjustments had to be made to the data to allow for missing age, sex and salary fields.

2.3.4 For a scheme where the age, sex or salary information was of a particularly low level of completeness the entire scheme with all of its deaths and exposure was excluded from the analysis.

2.3.5 For the remaining data, the entries with missing information were redistributed in proportion to the known data. This redistribution allowed for some of the known information to influence the proportion in which missing information was redistributed. For example, the distribution of missing salaries depended on the distribution of age, sex, industry of employment and calendar year. This minimises the risk that the missing data are not actually distributed at random.

2.3.6 In the case of industry, adjustment was not possible. All records linked to schemes with unknown industries have been excluded from analyses discussed in this paper.

2.4 INDUSTRIES

2.4.1 Grouping industries into those expected to involve light physical effort and those expected to involve heavy effort is a subjective exercise. Contributing companies classify industries differently. Some use a handful of groupings on a sliding scale from 'light' to 'heavy'. Others have many more groupings and use more detailed industry descriptions such as 'financial services' and 'heavy manufacturing'.

2.4.2 Whatever the groupings, they are typically loosely defined and serve only as guidelines for the decision-maker, who must use his or her judgement to allocate the scheme to an appropriate industry.

2.4.3 In an effort to allow contributing offices to be able to compare the results to the experience of the schemes they insure, the various industries have been categorised into five groupings (A to E), these industries being further grouped into 'light', 'mid' or 'heavy' industries. The industries are loosely categorised in terms of the grouping outlined in Table 2.

Table 2. Grouping of industries

Industry group	Overall description	Description of component industries
A	light	financial services, business administration
B	light	other services such as retail, education, health and IT
C	mid	manual labour such as light manufacturing and other blue-collar work that does not involve heavy machinery
D	heavy	heavy manufacturing and other heavy industry
E	heavy	mining, transport, agriculture, municipalities

2.4.4 It was impossible to ensure that all schemes were correctly categorised. This is especially the case for industry group C which, the authors suspect, includes schemes that were allocated to it simply because they did not fit clearly into any of the other categories.

2.4.5 In the absence of sufficient information to do otherwise, an entire scheme had to be allocated to a single industry grouping. This does not necessarily reflect the occupations of all individuals within the scheme. For example, for the purposes of this investigation a financial officer at a mining company would be grouped into industry grouping E, although one would expect the mortality of such an individual to correlate more closely with employees performing the core business practices at a financial services company. That same mining company might also have security staff, IT technicians, cleaners and call-centre operators. The industry grouping is therefore not a good proxy for occupation. In most cases it would, however, be representative of the majority of employees.

2.5 PROVINCES

2.5.1 As with industries, there is no ideal method of allocating schemes to specific geographic regions. Typical practice would be for contributing offices to use

the province where the greatest proportion of employees operate. If the province were unknown or if employees operate in more than one region, the scheme was classified as nationwide. Otherwise any one of the following criteria may have been applied:

– the province in which the company's head office is located;
– the province of the company's postal code, which would in most cases refer to the province in which the head office is located; and
– the province in which the sales office that administers the scheme is located (a criterion used for only a small proportion of the information).

2.5.2 There are very few data on provinces outside of Gauteng, the Western Cape and KwaZulu-Natal and hence data from other provinces were classified as 'other'.

2.6 SALARY BANDS

2.6.1 In order to ensure comparability of salary information across calendar years, salaries were adjusted to a base of 1 January 2010 using the consumer price index.[2] Data points were then grouped into salary bands based on inflation-adjusted annual salaries.

Table 3. Annual salary bands

Salary band	Range (R)
1	[0;40 000)
2	[40 000;70 000)
3	[70 000;125 000)
4	[125 000;250 000)
5	[250 000;∞)

2.6.2 These annual salary bands were chosen to be practical to apply, to produce sufficient volumes of data, and to produce clear differences between the mortality rates observed within each band. Bands were initially identified by considering the male experience, which suggested that the first salary band be defined with reference to an upper limit of R70 000. Female mortality, however, shows much more variation at very low salaries, and so the first two income bands were defined using upper limits of R40 000 and R70 000 respectively. Depending on which industry is under consideration, it was found that the salary bands capture differing proportions of the overall exposure. For males in light industries the exposure is evenly distributed, with roughly 20% of the exposure in each of the bands. In mid industries roughly 30% fall in the lowest salary band, the proportion decreasing in each subsequent band and reaching 9% in the highest salary band. For heavy industries this number goes down to 5%, which is the lowest proportion that is used in the study.

2 Constructed from the two series of Statistics South Africa publications: P0141.1 Consumer Price Index (CPI), 2005, 2006 and 2007 and P0141 Consumer Price Index (CPI) 2008, 2009 and 2010

2.6.3 More significant results could potentially have been obtained by using different salary bands depending on the industry or sex, but this would have hampered direct comparison of the results and would have caused difficulties in any attempt to apply the results in practice.

2.6.4 What constitutes 'salary' was not necessarily consistent throughout the data. Employee benefits would typically be based on pensionable salary, but it is possible that other salary measures such as total cost to company could have been captured. In addition to this, pensionable salary could vary greatly and, in the authors' opinion, could be anything from 60% to 100% of total cost to company. However, in the authors' opinion, this number seldom falls outside the range of 80% to 90% of total cost to company, and it is the authors' opinion that it is unlikely that inconsistencies have led to any distortion of the results.

2.7 ALLOWANCE FOR DEATHS THAT HAVE OCCURRED BUT HAVE NOT YET BEEN REPORTED

2.7.1 Most data on deaths submitted by life offices were extracted around the middle of 2010. To allow for deaths that would have occurred during the exposure period of 1/1/2005 to 31/12/2009 but which had not yet been reported by the time the data were collected, the data were corrected for claims incurred but not yet reported (IBNR).

2.7.2 Since reporting efficiency can vary greatly between life offices, separate IBNR corrections were made for each contributing company. In each case a simple numbers-based runoff triangle, using the basic chain-ladder method (Schmidt, unpublished) was used to estimate the level of under-reporting in each month, and a series of development factors was produced that was used to gross up the number of reported deaths. Table 4 summarises the total level of under-reporting estimated for each period of the investigation.

2.7.3 For one office the deaths from 2005 to 2007 were extracted in 2008, which results in a relatively high IBNR requirement for 2007.

Table 4. Completeness of reporting

Year	Reported deaths	IBNR	Deaths with IBNR	Completeness of reporting
2005	8 657	11	8 668	100%
2006	11 376	43	11 419	100%
2007	13 002	529	13 531	96%
2008	13 270	90	13 360	99%
2009	9 775	1 309	11 084	88%
Total	56 080	1 982	58 062	97%

2.8 SOURCES OF BIAS

2.8.1 The major potential bias in this study is whether the results are representative of the formally employed population in South Africa, given that the data are drawn from only a subsection of the workforce.

2.8.2 Since the data are for compulsory group-life-insurance benefits the problem of anti-selection is largely removed. Anti-selection could potentially still occur in situations where influential senior staff members obtain higher levels of cover, or more lenient free cover limits, but this would affect only the size of the claim amount and not the number of deaths in this investigation.

2.8.3 It is also possible, especially in a small company, that a senior staff member might hire a sick friend or family member to allow them to receive a non-underwritten life-insurance benefit as part of the company's employee benefits. These cases are not expected to have a substantial impact on the overall results.

2.8.4 Most group-life schemes would have a standard actively-at-work requirement, which means that employees that leave employment because of prolonged ill health or disability are removed from the experience. The data therefore represent the experience only for employees that are in good enough health to be working.

2.8.5 Critical-illness or lump-sum disability claims that accelerate the life-insurance benefit fully would also lead to the removal of employees from the exposure prior to death. This is in line with ¶2.8.4 and does not contradict the assumption that the employees being investigated are healthy enough to be working.

2.8.6 Unhealthy employees are potentially included in the investigation where a scheme has an optional continuation of cover during disability benefit—an arrangement under which employees would continue to receive group-life-insurance cover, even when they become disabled and hence economically inactive. Few insurers were able to specify whether such an option was applicable to specific schemes, or for that matter which schemes definitely had an income disability benefit. Income disability benefits have become more popular in recent years and the authors expect that a large portion of the schemes in the exposure would have an income disability benefit. Moreover, most schemes with income disability benefits would have opted for continuation of cover. Thus the mortality can be expected to be a little heavier than that of healthy workers.

2.8.7 Whether or not disabled employees are included in the investigation is an important consideration, since (at least in theory) one would expect disabled people to experience heavier mortality. This would not necessarily hold for all forms of disability; nevertheless, it would probably contribute to the overstatement of the mortality relative to those healthy enough to work.

2.8.8 Apart from the above, further work is required before one can decide how representative the sample of schemes and the employers is of the formal sector as a whole.

3. CRUDE MORTALITY RATES

3.1 In this section, crude mortality rates aggregated across the ages 20 to 69 are presented. These are initially presented only by sex. Salary, industry and province are added incrementally as rating factors until finally rates by sex, salary, industry and province are provided.

3.2 Let $D_{x,r}$ represent the number of deaths aged x last birthday in demographic grouping r, where a 'demographic grouping' is defined as a segment of the population grouped by demographic factors such as sex, industry and salary band. The crude rates were calculated assuming that $D_{x,r}$ has a Poisson distribution with parameter $\mu_{x+0.5,r}E^c_{x,r}$ In other words:

$$P\left(D_{x,r}=d\right)=\frac{e^{-\mu_{x+0.5,r}E^c_{x,r}}\left(\mu_{x+0.5,r}E^c_{x,r}\right)^d}{d!}; \quad (1)$$

where $\mu_{x+0.5,r}$ is the force of mortality—which for the purposes of this paper has been termed the 'mortality rate'—and $E^c_{x,r}$ is the central exposure to risk (i.e. person-years of exposure) in demographic grouping r aged x last birthday. Then the crude mortality rate and the approximate 95 per cent confidence intervals are respectively:

$$\hat{\mu}_{x+0.5,r}=\frac{d_{x,r}}{E^c_{x,r}}; \quad (2)$$

and

$$\hat{\mu}_{x+0.5,r}\pm 1.96\frac{\sqrt{d_{x,r}}}{E^c_{x,r}}; \quad (3)$$

where $d_{x,r}$ is the observed number of deaths in demographic grouping r aged x last birthday.

3.3 The age profile of the different demographic groups varies greatly and the results in subsequent sections have been standardised by reweighting them in proportion to the age distribution of all male employees aggregated across all other demographic factors within the investigation. This yields appropriate aggregated results that are directly comparable with one another. The resulting rate is equal to the crude rate, calculated as if the distribution, by age, of the exposure to risk of male employees within each salary band, each industry and each province were the same as the corresponding distribution for all salary bands, industries and provinces combined.

3.4 The average age of males using this distribution is 41. In order to be able to compare the rates for males and females, the rates for females below have also been standardised using the distribution of exposure by age of the males. The observed distribution for female employees by age is younger, with an average age of 39. A table of rates standardised using the female age distribution is provided in Table B.2 in Appendix B.

3.5 BY SEX

3.5.1 In this section the age-standardised mortality rates observed for males and females are provided. From Table 5 it is apparent that the age-standardised mortality of female employees is on average about half of that of male employees. This is a very

crude measure of the differential in mortality, and one would need to control for the effects of other demographic factors before being able to understand the relationship properly.

3.5.2 The average age and salary measures are also provided in Table 5. Note that in order to be consistent with results in subsequent sections the total exposure given in Table 5 excludes unknown industries. These numbers therefore differ from those in Table A.1 and the totals in other tables in Appendix A.

Table 5. Crude and standardised mortality rates, exposure, average age and average salary by sex

	Male	Female	Total
Exposure	4 623 620	2 539 078	7 162 698
Crude rate per 1 000	9,5	4,7	7,8
Age-standardised rate per 1 000	9,8	5,0	8,0
Average age	40,6	38,7	39,8
Average salary	131 756	108 877	123 646

3.6 BY SALARY

3.6.1 In Table 6 the age-standardised crude mortality rates by sex and salary band are provided.

Table 6. Aggregated standardised mortality rate per mille, by salary: males and females

	Salary band					
Sex	1	2	3	4	5	Total
Male	14,2	12,8	8,8	4,9	2,8	9,7
Female	9,6	5,8	2,8	2,0	1,4	4,9
Total	12,5	10,8	6,5	3,8	2,4	8,1

3.6.2 Mortality rates differ significantly by salary band, high earners experiencing only between 20% and 50% of the mortality of low earners. Possible reasons for this include easier living conditions, better access to medical care, higher levels of education and hence greater awareness of health issues and the ability to fund a more nutritional diet. In addition, in South Africa, a person's risk of exposure to HIV is also associated with socio-economic factors, with a higher prevalence amongst the unemployed and lower paid workers.

3.7 BY INDUSTRY

3.7.1 In this section, industry of employment is considered. In order to aid readability, light, mid and heavy industry groupings are used. Industries A and B (light),

exhibit very similar mortality experience and could be grouped together without losing too much information. So too with industries D and E (heavy). Grouping industries in this manner also increases the volume of data within each group, making the results statistically more credible.

3.7.2 Readers who are interested in the more detailed scale of five industries from A to E will find additional tables in Appendix B. In that appendix, combined tables for the results for males and females are also presented.

3.7.3 Table 7 sets out standardised mortality rates together with approximate 95% confidence intervals in parenthesis.

Table 7. Aggregated standardised mortality rate per mille and 95% confidence intervals, by salary band and industry: males

	Salary band					
Industry	1	2	3	4	5	Total
light	12,5	10,8	6,8	4,0	2,5	7,1
	(12,1;12,9)	(10,4;11,1)	(6,6;7,1)	(3,8;4,2)	(2,3;2,6)	(7,0;7,3)
mid	13,0	11,8	8,4	5,2	2,6	9,7
	(12,7;13,4)	(11,4;12,1)	(8,1;8,8)	(4,8;5,6)	(2,3;2,9)	(9,6;9,9)
heavy	16,7	14,9	11,5	6,2	4,3	12,7
	(16,3;17,1)	(14,6;15,2)	(11,1;11,8)	(5,9;6,6)	(3,8;4,7)	(12,6;12,9)
Total	14,2	12,8	8,8	4,9	2,8	9,7
	(14,0;14,5)	(12,6;13,0)	(8,6;9,0)	(4,8;5,1)	(2,6;2,9)	(9,6;9,8)

3.7.4 For males, the standardised mortality rates in Table 7 follow a very convincing pattern: within each salary band, the heavier the industry the higher the mortality rate, throughout. Possible reasons for this include physically more demanding work, dangerous working conditions, exposure to hazardous materials, and a difference in lifestyle.

3.7.5 Improved mortality at higher salaries also holds within each individual industry.

3.7.6 The difference between the upper right and lower left cells is striking. After standardising for age the average mortality of employees in a light industry earning more than R250 000 a year (salary band 5) is only 15% of that of employees in a heavy industry earning less than R40 000 a year (salary band 1).

3.7.7 As shown in Table 8, the same mortality pattern is evident for females except for one or two small discrepancies. The results in salary band 5, for instance, show mortality decreasing as the industry becomes heavier, which is contrary to the male experience. This could be due to higher earning females in heavy industries in fact working in office environments, rather than at the 'coal face'. However, given the small number of deaths in salary band 5 (with only 28 and 17 deaths recorded in the mid and heavy industry groups respectively) this trend is not statistically significant, and the wide confidence intervals suggest that the result may well be attributable to random variation.

Table 8. Aggregated standardised mortality rate per mille and 95% confidence interval, by salary band and industry: females

	Salary band					
Industry	1	2	3	4	5	Total
light	8,7	5,0	2,6	2,0	1,5	4,1
	(8,4;9,0)	(4,8;5,3)	(2,5;2,8)	(1,8;2,1)	(1,3;1,7)	(4,0;4,2)
mid	9,9	6,2	3,0	2,0	1,3	6,6
	(9,4;10,3)	(5,7;6,7)	(2,6;3,4)	(1,7;2,4)	(0,9;1,8)	(6,4;6,8)
heavy	12,0	8,5	3,6	2,5	1,2	6,7
	(11,4;12,6)	(7,8;9,2)	(3,2;4,0)	(2,1;2,9)	(0,6;1,7)	(6,5;7,0)
Total	9,6	5,8	2,8	2,0	1,4	4,9
	(9,4;9,8)	(5,6;6,0)	(2,7;2,9)	(1,9;2,2)	(1,3;1,6)	(4,9;5,0)

3.8 COMPARISON OF MALE AND FEMALE MORTALITY RATES

3.8.1 Male and female mortality is compared in Table 9. The difference between male and female mortality is the smallest where mortality rates are heaviest, i.e. in the lowest salary bands. The gap widens quickly between salary band 1 and 3, indicating that female mortality initially improves at a greater pace than male mortality as salaries increase. Between salary bands 3 and 5 the gap appears to narrow, although the small volume of data on female employees in salary band 5 makes it difficult to draw a definitive conclusion about this.

3.8.2 When interpreting Table 9, it should be noted that total percentages are in some cases lower than each of the individual percentages in the rows above them because of the difference in distribution by industry between males and females. Females are much more heavily weighted towards light industries than males.

Table 9. Female mortality as a percentage of male mortality by industry and salary band

	Salary band					
Industry	1	2	3	4	5	Total
light	69%	47%	38%	49%	60%	57%
mid	76%	53%	36%	39%	52%	68%
heavy	72%	57%	32%	40%	28%	53%
Total	67%	45%	32%	42%	53%	51%

3.9 MORTALITY BY NARROWER SALARY RANGES

3.9.1 The salary bands used in the preceding sections are fairly wide and it is worth examining whether the same trends would also hold for smaller increments in salary. Mortality rates by finer salary ranges for all industries combined are presented in Table 10 and Figure 1.

3.9.2 Tables B.23 and B.27 in Appendix B are similar but also distinguished by industry.

3.9.3 The female employment is heavily skewed towards light industries, whereas the male employment is much more evenly spread between industries. In order to make the male and female results directly comparable it was therefore necessary also to standardise by industry. The approach used was to weight results based on the industry distribution of male exposure within each salary band. In order to improve statistical credibility a category for workers earning R400 000 or more was added. This groups together the four highest salary bands and allows for a more realistic comparison of the male and female rates at high salaries

3.9.4 Approximate coefficients of variation have been included in Table 10 to give an indication of the uncertainty about the estimate of the mortality rate.

Table 10: Age- and industry-standardised aggregate mortality rates per mille split by 20 salary ranges

Salary band	Band range (R'000)	Average salary	Female-to-male mortality ratio	Coefficient of variation		Rate per mille	
				Male	Female	Male	Female
1	[0;20)	14 638	78%	0,0182	0,0229	14,1	11,1
1	[20;30)	25 182	76%	0,0142	0,0194	14,9	11,3
1	[30;40)	34 774	58%	0,0131	0,0247	13,8	8,1
2	[40;50)	44 931	57%	0,0134	0,0293	12,2	6,9
2	[50;60)	54 830	49%	0,0131	0,0346	13,4	6,6
2	[60;70)	64 757	45%	0,0152	0,0389	12,8	5,8
3	[70;80)	74 676	34%	0,0192	0,0475	10,5	3,6
3	[80;90)	84 798	36%	0,0230	0,0530	9,3	3,3
3	[90;100)	94 888	32%	0,0273	0,0606	8,2	2,6
3	[100;125)	112 047	31%	0,0202	0,0428	7,5	2,4
4	[125;150)	137 046	37%	0,0268	0,0496	6,1	2,2
4	[150;175)	161 996	35%	0,0307	0,0621	5,5	2,0
4	[175;200)	186 819	42%	0,0376	0,0722	4,4	1,8
4	[200;250)	222 684	43%	0,0334	0,0705	3,7	1,6
5	[250;300)	273 345	41%	0,0420	0,0962	3,5	1,4
5	[300;400)	344 304	46%	0,0423	0,1026	2,8	1,3
5	[400;500)	444 825	75%	0,0598	0,1601	2,4	1,8
5	[500;750)	599 026	28%	0,0650	0,1925	3,6	1,0
5	[750;1 000)	852 889	34%	0,1231	0,4472	1,6	0,5
5	[1 000;∞)	1 492 185	51%	0,1280	0,5000	1,9	1,0
5	[400;∞)	650 857	50%	0,0394	0,1155	2,7	1,3

3.9.5 Male mortality appears to change little up to a salary of R70 000 per annum and only thereafter really begins to decline, whereas for females the rate begins to decline almost immediately as salaries increase. Notice the clustering of male

observations between 13 and 15 per mille whereas the fitted curve—a simple trend line fitted using Excel's built-in regression tools—suggests that mortality should continue to climb as salaries reduce. Although this could be an artefact of the data, the pattern also appears for each industry grouping.

3.9.6 Between R70 000 and R250 000, mortality for males falls with increasing salary very quickly at first and then flattens out thereafter. For females, the rates fall more quickly and flatten out at R100 000.

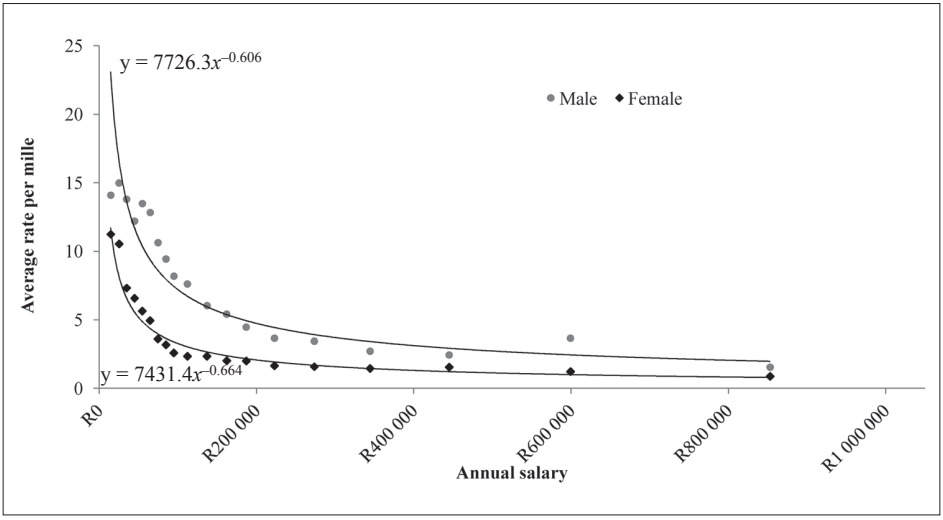

Figure 1. Age- and industry-standardised aggregate mortality rates per mille by salary

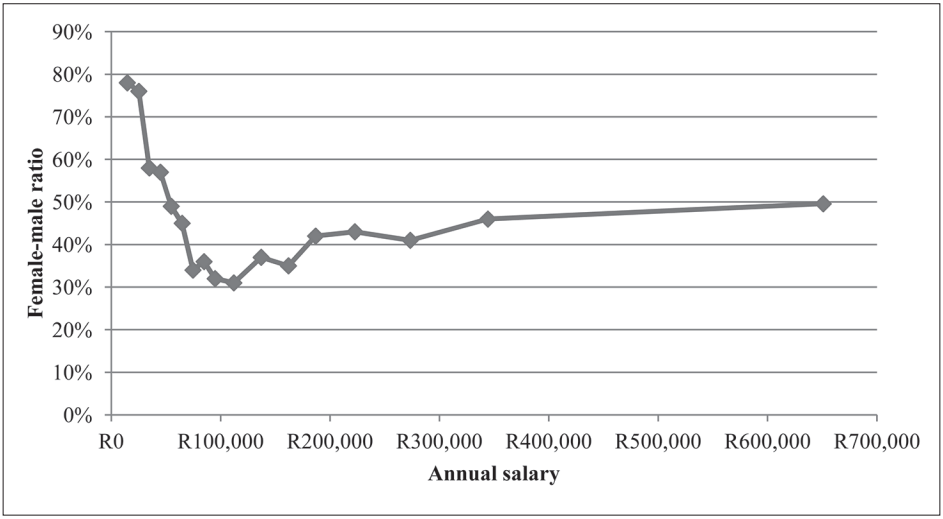

Figure 2: Female-to-male mortality ratio by salary

3.9.7 Although the data at the high salaries are quite sparse, Figure 2 suggests that the female-to-male mortality ratio with respect to salary could be u-shaped, falling from 80% at the lower salaries to a little over 30% for salaries from R80 000 to R180 000 per annum, rising to, perhaps, 50% at the higher salaries.

3.9.8 It may be that more females at low salaries are in fact receiving part-time remuneration, or form part of households where the main breadwinner is male and the overall household income is higher than for males earning similar salaries.

3.10 BY PROVINCE

3.10.1 The HIV prevalence varies considerably by geographic region, causing a significant regional variation in HIV-related mortality. Because of this, and other factors, mortality is highly associated with province in South Africa, although the effect might be expected to be more muted amongst the employed, particularly for female employees.

3.10.2 As in the preceding sections, the provincial results presented here have been standardised to the age profile of all male employees. In addition, these results have been standardised by industry in order to remove the effect of different industry distributions within the different provinces.

3.10.3 As explained in ¶2.5.2 the results are presented separately for the Western Cape (WC), Gauteng (GT) and KwaZulu-Natal (KZN) and all other provinces are grouped together. Data where the industry is unknown have been ignored. This accounts for roughly 20% of the exposure.

3.10.4 For comparison the official distribution of employment for 2007 as per the Labour Force Survey[3] is provided. The official numbers include both the formally and informally employed, whereas the data under consideration would only include the formally employed.

Table 11. Exposure by province

Province	Exposure	% of total	Labour Force Survey
WC	1 254 941	21%	14%
GT	3 447 001	58%	30%
KZN	670 055	11%	18%
other	622 218	10%	38%
Total	5 994 214	100%	100%

3.10.5 As can be seen from Table 11, the bulk of the experience is in Gauteng with only 21% and 11% in the Western Cape and KwaZulu-Natal, respectively, and only 10% in the remaining provinces. Compared with the official numbers there is a greater weighting towards Gauteng and the Western Cape than would be expected. This may be due to problems with accurately allocating schemes to the correct provinces as discussed

3 Statistics South Africa, Labour Force Survey: Historical Revision: September Series – September 2001 to September 2007, 2009

in section 2.5. It may also reflect a greater concentration of people in formal employment within Gauteng and the Western Cape, as well as sales patterns of group life insurance.

Table 12. Aggregated standardised mortality rate per mille and 95% confidence interval, by province and salary band: males

	Salary band					
Province	1	2	3	4	5	Total
WC	10,5 (10,0;11,1)	9,6 (9,2;10,0)	6,4 (6,0;6,8)	4,1 (3,8;4,4)	2,4 (2,1;2,7)	7,0 (6,8;7,2)
GT	14,6 (14,3;14,9)	13,3 (13,0;13,6)	9,2 (8,9;9,5)	5,1 (4,9;5,4)	2,7 (2,5;2,8)	9,9 (9,7;10,0)
KZN	16,4 (15,8;17,1)	15,6 (14,9;16,3)	9,3 (8,7;10,0)	5,7 (5,1;6,3)	3,1 (2,6;3,7)	12,5 (12,1;12,8)
other	14,0 (13,4;14,6)	12,5 (11,9;13,1)	8,9 (8,3;9,5)	4,8 (4,3;5,4)	3,1 (2,5;3,6)	10,4 (10,2;10,7)
Total	14,3 (14,0;14,5)	12,7 (12,5;12,9)	8,6 (8,4;8,8)	4,9 (4,7;5,1)	2,7 (2,5;2,8)	9,7 (9,6;9,8)

Table 13. Aggregated standardised mortality rate per mille and 95% confidence interval, by province and salary band: females

	Salary band					
Region	1	2	3	4	5	Total
WC	5,6 (5,2;6,1)	4,1 (3,7;4,5)	2,2 (2,0;2,5)	1,9 (1,6;2,1)	0,9 (0,6;1,2)	3,2 (3,1;3,4)
GT	11,0 (10,6;11,4)	7,4 (7,0;7,8)	3,3 (3,1;3,6)	2,0 (1,8;2,2)	1,4 (1,2;1,6)	5,6 (5,5;5,7)
KZN	13,0 (12,4;13,7)	9,2 (8,2;10,2)	3,1 (2,5;3,7)	2,5 (1,9;3,1)	1,4 (0,6;2,2)	9,2 (8,8;9,6)
other	9,0 (8,2;9,9)	6,4 (5,6;7,2)	2,4 (1,9;2,9)	2,3 (1,7;2,9)	1,5 (0,7;2,3)	5,2 (4,9;5,6)
Total	10,3 (10,0;10,5)	6,5 (6,3;6,8)	2,9 (2,8;3,1)	2,0 (1,9;2,2)	1,3 (1,1;1,4)	5,4 (5,3;5,5)

3.10.6 As can be seen from Tables 12 and 13 mortality in KwaZulu-Natal is clearly the heaviest of the provinces considered, whilst the lowest rates, especially for females, are observed in the Western Cape. Gauteng falls in between these two extremes and exhibits very similar experience to that of the overall average. In addition, for males, the rates for other provinces are similar to those in Gauteng.

3.10.7 As shown in Table 14, the female-to-male mortality ratio by salary band observed in Gauteng and KwaZulu-Natal is similar to the pattern illustrated in Figure 2. In the Western Cape the pattern is less pronounced.

3.10.8 These results are consistent with what we know about the HIV/AIDS pandemic. According to the antenatal survey in 2009, prevalence rates were 16,9% in the Western Cape, 39,5% in KwaZulu-Natal, 29,8% in Gauteng and 29,4% nationwide.[4] Hence one can deduce that KwaZulu-Natal is one of the regions in South Africa that has been the most heavily struck by the pandemic and has the highest level of HIV prevalence in the country. It therefore makes sense that we see the highest mortality here. The Western Cape has the lowest prevalence, and the prevalence in Gauteng is close to the national average, which is also consistent with the results in Tables 12 and 13.

Table 14. Female mortality as a percentage of male mortality by province and salary band

	Salary band					
Province	1	2	3	4	5	Total
WC	53%	43%	35%	46%	36%	46%
GT	75%	56%	37%	39%	52%	57%
KZN	79%	59%	33%	44%	44%	74%
other	60%	46%	29%	41%	47%	45%
Total	70%	50%	33%	40%	48%	53%

3.11 BY PROVINCE, SEX, SALARY AND INDUSTRY

3.11.1 Age-standardised rates that have been split by area, sex, province, salary and industry were then derived. This is the greatest level of detail at which sufficient statistical credibility might be expected. Even at this level there are some anomalous results that are probably due to small numbers of employees.

3.11.2 Full tables with the number of deaths and with applicable confidence intervals are included in Appendix B.

3.11.3 The mortality pattern noted in ¶3.10.2 is repeated for the provinces as shown in Table 15 and Table 16. However, the pattern is less apparent, particularly for female employees. The heaviest experience is once again observed in heavy industries at low salaries, and the worst experience is generally in KwaZulu-Natal, while the best experience is in the Western Cape.

3.11.4 The data are quite scanty at the higher salary bands, particularly for female employees.

3.12 BY AGE BAND

3.12.1 In this section the mortality experience by age is considered. In order to aid the comparison, results have been combined into five-year age bands, and results are split by sex, salary band and industry. The results are not credible for individual provinces and hence there is no provincial analysis. The results are shown graphically in

4 Department of Health, National HIV and Syphilis Antenatal Sero-Prevalence Survey in South Africa 2009, 2010

Figure 3 and the numerical results are available in Tables B.23 and B.27. For comparison, graphs of the population mortality rates from the ASSA2008 HIV/AIDS model have been included.[5]

Table 15. Aggregated mortality rate per mille, by province, industry and salary band: male, standardised to male age distribution

		Salary band					
Province	Industry	1	2	3	4	5	Total
WC	light	8,6	8,6	5,0	3,4	2,3	5,3
	mid	11,2	11,7	9,1	4,8	2,3	9,8
	heavy	11,6	9,0	6,2	4,8	2,7	7,7
GT	light	13,0	11,9	7,5	4,1	2,5	7,2
	mid	13,7	12,1	8,2	5,4	2,6	9,6
	heavy	16,8	14,9	11,8	6,7	3,6	13,5
KZN	light	13,0	13,2	6,8	4,4	2,9	10,0
	mid	17,6	12,9	10,8	5,9	2,3	12,5
	heavy	18,3	19,1	11,3	7,7	5,3	15,2

Table 16: Aggregated mortality rate per mille, by province, industry and salary band: female, standardised to male age distribution

		Salary band					
Province	Industry	1	2	3	4	5	Total
WC	light	5,5	3,9	2,2	1,6	0,9	2,9
	mid	4,5	4,4	2,6	1,2	0,8	3,8
	heavy	6,7	4,1	2,0	2,7	0,6	3,5
GT	light	8,6	5,9	2,7	1,8	1,3	4,0
	mid	11,9	6,6	3,0	1,9	1,4	7,2
	heavy	12,3	8,9	4,4	2,5	1,6	7,9
KZN	light	14,5	5,2	2,4	1,3	0,7	7,2
	mid	10,0	6,4	3,3	2,7	3,9	8,8
	heavy	14,3	13,7	3,8	4,2	1,3	10,6

3.12.2 The crude rates by age in Figure 3 show that the shape of mortality curves are very different for different salary bands. In each case the population mortality suggested by the ASSA2008 model lies above that of members of group schemes, the

5 Actuarial Society of South Africa, ASSA2008 AIDS and Demographic Model, 2011, www.actuarialsociety.org.za,03/10/2010

closest match both in terms of shape and overall level being in the lowest salary band (salary band 1) for heavy industries. This result is as expected since the total population profile would include a significant proportion of unemployed, informally employed and those too ill to be able to work. For females, mortality at low salaries shows a characteristic HIV/AIDS hump between ages 30 and 45, which is of a similar shape to the population mortality suggested by the ASSA2008 model. Thereafter mortality rates decrease until around age 50 before increasing once more. This shape may arise from the fact that few people who have contracted HIV/AIDS live past age 50 without access to anti-retroviral treatment. People are more likely to contract HIV/AIDS as young adults, which for people aged 50 at the time of this study would have been 20 to 30 years previously. At that time HIV/AIDS prevalence was still relatively low. Thus, the proportion of the people infected at the advanced ages is much smaller than at the younger ages.

3.12.3 This hump becomes less pronounced as salaries improve. At the two highest salary bands (salary bands 4 and 5) there is very little evidence of HIV/AIDS, although the results here are subject to random fluctuation owing to the sparseness of data. Although some researchers, such as Fox (2010), argue that the prevalence of HIV is positively correlated with wealth, others, such as Magadi (2013), argue that the relationship is complex and that the positive correlation of prevalence with wealth is largely based on rural populations. In urban populations, from which members of group schemes would be drawn, prevalence has been found to positively associated with poverty.

3.12.4 For males there is also evidence of HIV/AIDS mortality at low salaries, although the overall shape differs from that of females as mortality rates increase with age. The shapes of these curves are again similar to those of the ASSA2008 model, and are in all cases lower.

3.12.5 Owing to the small amount of exposure at ages 60 and beyond, the results observed here are subject to much uncertainty. However, in aggregate, ratios at these ages increase less steeply with age than those of the population as a whole, which might suggest that people in ill health are retiring earlier. The lower mortality of the members of group schemes, particularly at the older ages is evidence of the so-called 'healthy worker effect', as is detailed in Carpenter (1987) and Monson (1986).

4. DISCUSSION AND CONCLUSION

4.1 This study is the first of its kind in South Africa and provides a useful insight into the mortality of members of group schemes. To what extent these rates reflect the mortality experience of those in formal employment still needs further investigation; however, it is likely that they are a reasonable approximation of the mortality of those employed by large, well-established employers.

4.2 The age-standardised crude mortality rate for members of group schemes was found to be approximately 8 per mille, the rate for females being half the rate for males. By way of comparison, the crude rate for the national population aged 20 to 69 last

birthday for 2007 according to the ASSA AIDS and Demographic model[6] was 16,2 per mille, the rate for females being nearly 75% of that for males, mainly as a result of HIV, particularly amongst those not in formal employment.

4.3 Crude mortality rates for group life insurance in the US for 2003 to 2005 were 2,2 per mille (Group Life Insurance Experience Committee, op. cit.). Those for Canadian

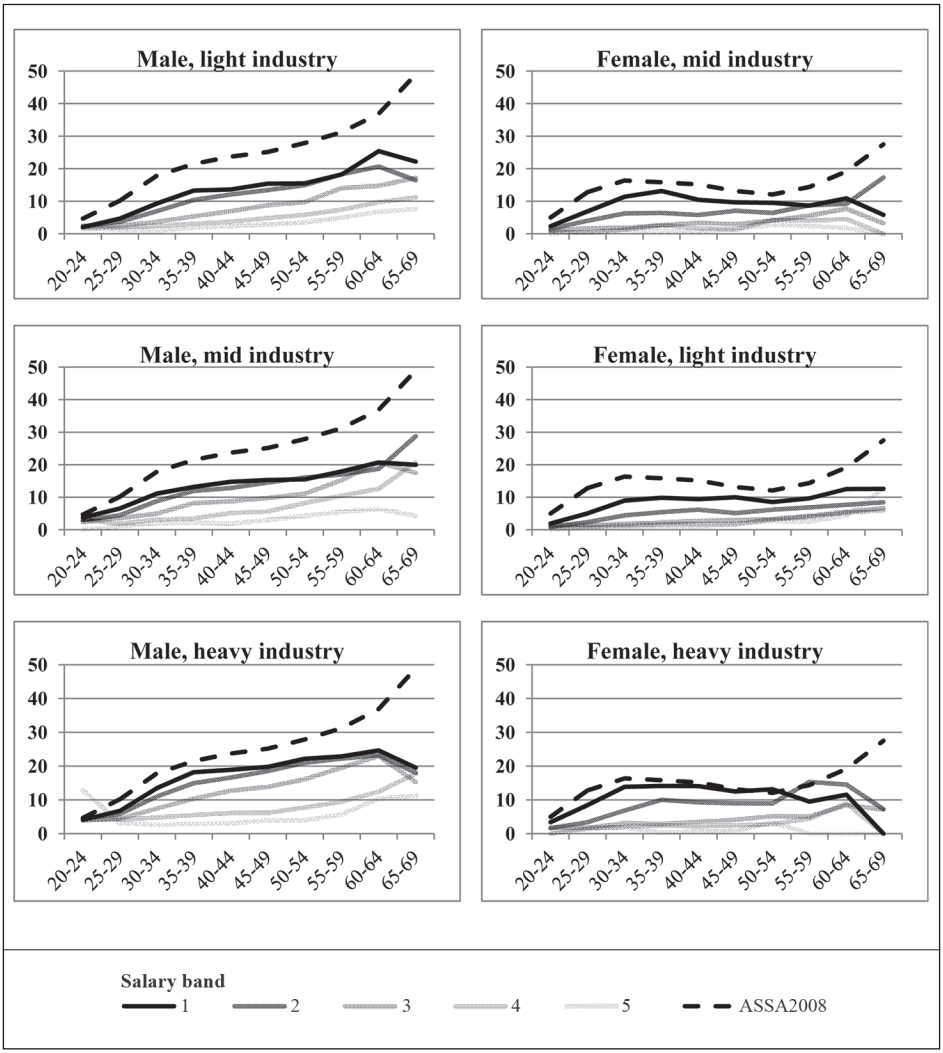

Figure 3. Crude mortality rates per mille by age band, industry, sex and salary band

6 Actuarial Society of South Africa, supra

group life insurance for 1989 to 1991 were 3,2 per mille (Committee on Expected Experience, op. cit.). In the US, the rate for females was more than 50% that of males (Group Life Insurance Experience Committee, op. cit.). In Canada the rate for females was less than 50% that of males (Committee on Expected Experience, op. cit.). Only the rates for the highest paid in the light industries in South Africa are comparable with these rates.

4.4 The mortality of the lowest-paid employees is 2 to 5 times as high as that of the highest-paid workers depending on industry. The relationship is strongly hyperbolic, which is consistent with previous research, such as Dowd et al. (2011). In addition, the mortality of female employees falls more quickly with increasing salary than that of males. In the R80 000 to R175 000 salary range, female mortality is approximately 35% of male mortality. This difference could reflect a difference in socio-economic class with relatively more males in households with lower per capita income.

4.5 Mortality rates by age show clear evidence of HIV/AIDS mortality for the lower salary bands and heavier industries, and of the healthy-worker effect and retirement of those in ill-health, and are lower than those from the population as a whole for all in formal employment.

4.6 Whilst the data will undoubtedly prove useful once graduated for costing and rating group schemes, they do suffer from some limitations, which make them difficult to interpret, particularly for other purposes.

4.7 Firstly, because they do not identify occupation, this becomes conflated with industry, making it difficult to interpret some of the patterns. In addition, care would need to be exercised when applying these rates to key individuals within a group. Life offices should be encouraged to collect data on occupation by broad classification in future.

4.8 Secondly, the data cannot distinguish between population groups. Due to the big differences in mortality by population group (Dorrington, Bradshaw &Wegner, unpublished; Dorrington, Moultrie & Timæus, unpublished) this could lead to misrating of industries, particularly geographically.

4.9 Thirdly, though the ranking of mortality rates by provinces seems largely sensible, the allocation of scheme experience to the provinces is arbitrary in certain cases. In addition, the limited number of provinces identified makes the use of province as a rating variable questionable.

4.10 Finally, these results cannot be used to distinguish schemes that offer continuation of cover during disability from those that do not and this could lead to distortion in applying the rates to the pricing of group schemes.

4.11 Readers who are interested in the graduated results are directed to the paper titled "Modelling the Mortality of Members of Group Schemes in South Africa" (Clur et al,, op. cit.).

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APPENDIX A

STATISTICS – TOTALS

A.1 Basic data analysis over the full period of investigation is presented in Tables A.1 to A.5.

Table A.1. Total exposure and deaths by sex

Sex	Exposure	Deaths
F	2 649 756	12 356
M	4 814 550	45 706
Total	7 464 306	58 062

Table A.2. Total exposure and deaths by age band

Age band	Exposure	Deaths
< 20	12 825	22
20–24	377 296	904
25–29	1 029 943	3 844
30–34	1 244 542	7 547
35–39	1 200 733	9 267
40–44	1 061 388	8 944
45–49	974 473	8 956
50–54	766 810	7 942
55–59	524 172	6 391
60–64	226 260	3 247
65–69	37 668	518
> 69	8 194	481
Total	7 464 306	58 062

Table A.3. Total exposure and deaths by salary band

Salary band	Exposure	Deaths
1	1 846 325	20 862
2	1 737 706	19 019
3	1 628 843	10 438
4	1 417 154	5 462
5	834 279	2 282
Total	7 464 306	58 062

Table A.4. Total exposure and deaths by two different industry classifications

Industry	Exposure	Deaths	Industry	Exposure	Deaths
A	1 333 931	5 369	light	3 555 436	18 300
B	2 221 505	12 930			
C	1 675 350	14 724	mid	1 675 350	14 724
D	834 707	10 332	heavy	1 952 563	23 023
E	1 117 855	12 691			
unknown	280 957	2 015	unknown	280 957	2 015
Total	7 464 306	58 062	Total	7 464 306	58 062

Table A.5. Total exposure and deaths by province

Province	Exposure	Deaths
Gauteng (GT)	3 454 988	27 970
Western Cape (WC)	1 259 581	6 865
KwaZulu-Natal (KZN)	671 469	7 265
Eastern Cape (EC)	243 227	1 789
Mpumalanga (MP)	141 587	1 272
Free State (FS)	79 074	883
Limpopo (LM)	78 301	679
North West (NW)	65 998	619
Northern Cape (NC)	15 848	112
Nationwide (RSA) and unknown	1 454 234	10 607
Total	7 464 306	58 062

A.2 Table A.6 presents deaths and exposure by calendar year. The drop in exposure in 2009 is caused by schemes that were renewed in 2010 after the data were extracted. For these schemes no exposure could be calculated beyond the 2009 renewal date.

Table A.6. Total exposure and deaths by calendar year

Year	Exposure	Deaths
2005	1 254 199	8 668
2006	1 462 438	11 419
2007	1 650 802	13 531
2008	1 755 278	13 360
2009	1 341 589	11 084
Total	7 464 306	58 062

A.3 Table A.7 shows deaths and exposure by scheme size. 'Scheme size' is defined as the average number of employees observed under the scheme across all census points.

The number of schemes is taken as a count of the schemes that have at least one census point in the 2009 calendar year.

Table A.7. Total exposure and deaths by scheme size

Scheme size	Exposure	Deaths	Number of schemes
0–20	268 926	2 868	7 539
20–200	1 420 166	11 381	6 467
200–1000	1 772 362	12 411	1 101
1000–5000	1 885 156	14 131	261
5000+	2 117 696	17 272	44
Total	7 464 306	58 062	15 412

A.4 Table A.8 shows the deaths and exposure by scheme growth. Schemes are defined as 'stable' where from one census point to the next the number of lives observed under the scheme has increased by less than 5%, and reduced by less than 5%. Growing and shrinking schemes have seen more than 5% growth or shrinkage, respectively.

Table A.8. Total exposure and deaths by scheme growth

Scheme growth	Exposure	Deaths
growing	2 380 860	17 628
shrinking	1 445 936	12 928
stable	3 637 510	27 506
Total	7 464 306	58 062

APPENDIX B

ADDITIONAL MORTALITY RESULTS

In this appendix, additional results are presented. In sections B.1 and B.2, additional results are presented for females and males respectively, and in section B.3, additional results are presented for all males and females combined. In sections B.4, B.5 and B.6, additional results are presented by province, by salary band and by age band respectively.

B.1 Females

Table B.1. Aggregated mortality rate per mille, by industry and salary band: females, not standardised

	Salary band					
Industry	1	2	3	4	5	Total
A	8,6	4,5	2,1	1,7	1,2	2,8
B	7,5	4,6	2,6	2,1	1,8	4,3
C	9,9	6,0	2,8	2,0	1,2	6,5
D	12,5	8,0	3,3	2,1	1,0	8,6
E	9,3	8,4	3,3	2,6	1,2	4,7
light	7,7	4,6	2,3	1,9	1,5	3,7
mid	9,9	6,0	2,8	2,0	1,2	6,5
heavy	12,0	8,2	3,3	2,5	1,1	6,6
Total	9,1	5,4	2,6	2,0	1,4	4,7

Table B.2. Aggregated mortality rate per mille, by industry and salary band: females, standardised to female age distribution

	Salary band					
Industry	1	2	3	4	5	Total
A	8,8	5,1	2,3	1,7	1,2	2,9
B	8,3	4,7	2,6	1,9	1,5	4,5
C	9,7	5,9	2,8	1,9	1,3	6,5
D	12,3	8,0	3,3	1,8	1,3	8,5
E	9,5	8,0	3,4	2,4	1,1	4,6
light	8,4	4,8	2,4	1,8	1,3	3,9
mid	9,7	5,9	2,8	1,9	1,3	6,5
heavy	11,9	8,0	3,4	2,3	1,2	6,5
Total	9,4	5,5	2,6	1,9	1,3	4,7

Table B.3. Aggregated mortality rate per mille, by industry and salary band: females, standardised to male age distribution

	Salary band					
Industry	1	2	3	4	5	Total
A	9,0	5,4	2,5	1,9	1,3	3,1
B	8,6	4,9	2,7	2,1	1,7	4,7
C	9,9	6,2	3,0	2,0	1,3	6,6
D	12,4	8,4	3,7	2,1	1,3	8,7
E	9,8	8,5	3,6	2,6	1,1	4,9
light	8,7	5,0	2,6	2,0	1,5	4,1
mid	9,9	6,2	3,0	2,0	1,3	6,6
heavy	12,0	8,5	3,6	2,5	1,2	6,7
Total	9,6	5,8	2,8	2,0	1,5	5,0

Table B.4. 95% confidence intervals to accompany Table B.3

	Salary band					
Industry	1	2	3	4	5	Total
A	(7,9;9,4)	(4,1;5,0)	(1,9;2,3)	(1,5;1,9)	(1,0;1,4)	(2,6;2,9)
B	(7,2;7,8)	(4,3;4,9)	(2,4;2,8)	(1,9;2,3)	(1,5;2,2)	(4,2;4,4)
C	(9,4;10,3)	(5,5;6,4)	(2,5;3,2)	(1,6;2,3)	(0,8;1,7)	(6,3;6,8)
D	(11,8;13,2)	(6,9;9,0)	(2,7;4,0)	(1,5;2,7)	(0,2;1,8)	(8,2;9,0)
E	(7,9;10,7)	(7,5;9,3)	(2,8;3,7)	(2,2;3,0)	(0,5;1,9)	(4,3;5,0)
light	(8,4;9,0)	(4,8;5,3)	(2,5;2,8)	(1,8;2,1)	(1,3;1,7)	(4,0;4,2)
mid	(9,4;10,3)	(5,7;6,7)	(2,6;3,4)	(1,7;2,4)	(0,9;1,8)	(6,4;6,8)
heavy	(11,4;12,6)	(7,8;9,2)	(3,2;4,0)	(2,1;2,9)	(0,6;1,7)	(6,5;7,0)
Total	(9,4;9,8)	(5,6;6,0)	(2,7;2,9)	(1,9;2,2)	(1,3;1,6)	(4,9;5,0)

Table B.5. Number of observed deaths by industry and salary band: female

	Salary band					
Industry	1	2	3	4	5	Total
A	510	406	436	358	110	1 820
B	2 183	1 051	642	400	122	4 398
C	2 185	640	220	116	28	3 188
D	1 154	218	100	44	6	1 523
E	170	341	221	140	11	883
light	2 692	1 456	1 079	758	232	6 217
mid	2 185	640	220	116	28	3 188
heavy	1 324	559	320	184	17	2 406
Total	6 201	2 655	1 619	1 059	278	11 811

B.2 Males

Table B.6. Aggregated mortality rate per mille, by industry and salary band: male, not standardised

	Salary band					
Industry	1	2	3	4	5	Total
A	13,6	10,4	6,4	4,0	2,5	5,8
B	12,2	10,9	7,0	4,0	2,4	7,9
C	13,0	11,8	8,4	5,2	2,6	9,7
D	17,3	15,1	11,5	5,6	4,4	13,5
E	15,8	14,8	11,4	6,7	3,9	12,2
light	12,5	10,8	6,8	4,0	2,5	7,1
mid	13,0	11,8	8,4	5,2	2,6	9,7
heavy	16,7	14,9	11,5	6,2	4,3	12,7
Total	14,3	12,9	8,9	4,9	2,7	9,8

Table B.7. Aggregated mortality rate per mille, by industry and salary band: males, standardised to male age distribution

	Salary band					
Industry	1	2	3	4	5	Total
A	12,2	9,3	5,3	3,6	2,7	5,2
B	9,5	10,2	6,6	4,1	3,0	7,1
C	11,9	11,6	8,9	5,4	3,2	9,5
D	16,0	16,0	12,3	5,9	4,3	13,4
E	13,2	16,6	12,6	6,7	3,9	12,7
light	10,0	9,9	6,1	3,9	2,8	6,4
mid	11,9	11,6	8,9	5,4	3,2	9,5
heavy	14,9	16,4	12,5	6,5	4,1	13,0
Total	12,4	13,2	9,0	5,0	3,1	9,5

Table B.8. 95% confidence intervals to accompany Table B.7

	Salary band					
Industry	1	2	3	4	5	Total
A	(11,3;13,0)	(8,6;9,9)	(4,9;5,7)	(3,4;3,9)	(2,4;2,9)	(5,0;5,4)
B	(9,1;9,8)	(9,8;10,5)	(6,2;6,9)	(3,8;4,4)	(2,7;3,2)	(6,9;7,2)
C	(11,5;12,3)	(11,2;12,0)	(8,5;9,3)	(5,0;5,8)	(2,8;3,5)	(9,4;9,7)
D	(15,5;16,4)	(15,4;16,6)	(11,7;12,9)	(5,4;6,4)	(3,7;5,0)	(13,1;13,7)
E	(12,7;13,8)	(16,2;17,0)	(12,1;13,1)	(6,4;7,1)	(3,4;4,5)	(12,5;12,9)
light	(12,1;12,9)	(10,4;11,1)	(6,6;7,1)	(3,8;4,2)	(2,3;2,6)	(7,0;7,3)
mid	(12,7;13,4)	(11,4;12,1)	(8,1;8,8)	(4,8;5,6)	(2,3;2,9)	(9,6;9,9)
heavy	(16,3;17,1)	(14,6;15,2)	(11,1;11,8)	(5,9;6,6)	(3,8;4,7)	(12,6;12,9)
Total	(14,0;14,5)	(12,6;13,0)	(8,6;9,0)	(4,8;5,1)	(2,6;2,9)	(9,6;9,8)

Table B.9. Number of observed deaths by industry and salary band: male

	Salary band					
Industry	1	2	3	4	5	Total
A	783	774	738	663	541	3 499
B	2 727	2 661	1 570	905	528	8 391
C	4 089	3 931	2 049	865	347	11 281
D	4 073	2 636	1 459	455	177	8 800
E	2 113	5 745	2 575	1 160	177	11 769
light	3 510	3 435	2 308	1 568	1 069	11 890
mid	4 089	3 931	2 049	865	347	11 281
heavy	6 186	8 381	4 034	1 615	354	20 569
Total	13 785	15 747	8 391	4 049	1 769	43 741

B.3 Combined

Table B.10. Aggregated mortality rate per mille, by industry and salary band: combined, standardised to male age distribution

	Salary band					
Industry	1	2	3	4	5	Total
A	11,4	7,8	4,1	2,9	2,1	4,5
B	10,4	8,1	4,8	3,1	2,2	6,4
C	11,8	10,4	7,1	4,4	2,4	8,8
D	16,0	14,1	9,9	4,8	4,0	12,5
E	15,2	14,1	9,5	5,7	3,5	10,9
light	10,6	8,0	4,5	3,0	2,2	5,7
mid	11,8	10,4	7,1	4,4	2,4	8,8
heavy	15,7	14,1	9,6	5,4	3,8	11,6
Total	12,5	10,8	6,5	3,8	2,4	8,1

Table B.11. 95% confidence intervals to accompany Table B.10

	Salary band					
Industry	1	2	3	4	5	Total
A	(9,9;11,0)	(6,4;7,2)	(3,2;3,6)	(2,5;2,8)	(2,0;2,4)	(3,9;4,1)
B	(8,2;8,7)	(7,3;7,8)	(4,3;4,7)	(3,0;3,3)	(2,5;2,9)	(5,7;5,9)
C	(10,8;11,4)	(10,0;10,6)	(7,1;7,7)	(4,2;4,8)	(2,5;3,1)	(8,5;8,8)
D	(14,6;15,4)	(14,3;15,4)	(10,0;11,0)	(4,6;5,5)	(3,3;4,4)	(12,1;12,6)
E	(12,3;13,4)	(15,3;16,1)	(9,9;10,7)	(5,4;6,1)	(3,0;4,0)	(11,1;11,5)
light	(10,3;10,8)	(7,8;8,2)	(4,4;4,7)	(2,9;3,1)	(2,1;2,3)	(5,6;5,8)
mid	(11,5;12,1)	(10,1;10,7)	(6,8;7,4)	(4,1;4,6)	(2,1;2,6)	(8,7;9,0)
heavy	(15,4;16,0)	(13,8;14,4)	(9,3;9,9)	(5,1;5,6)	(3,4;4,2)	(11,4;11,7)
Total	(12,3;12,6)	(10,6;10,9)	(6,3;6,5)	(3,7;3,9)	(2,3;2,5)	(8,0;8,1)

B.4 Provinces

Table B.12. Aggregated mortality rate per mille, by region and salary band: combined, standardised to male age distribution

	Salary band					
Province	1	2	3	4	5	Total
WC	8,4	7,7	4,4	3,2	2,0	5,5
GT	13,3	11,7	6,8	3,9	2,3	8,4
KZN	14,9	14,1	7,6	4,6	2,8	11,4
other	12,7	11,0	6,8	4,0	2,8	9,1
Total	12,7	11,1	6,4	3,8	2,4	8,1

Table B.13. 95% confidence intervals to accompany Table B.12

	Salary band					
Province	1	2	3	4	5	Total
WC	(8,0;8,7)	(7,4;8,0)	(4,2;4,6)	(3,0;3,4)	(1,8;2,2)	(5,4;5,6)
GT	(13,1;13,6)	(11,4;11,9)	(6,7;7,0)	(3,8;4,1)	(2,2;2,5)	(8,3;8,5)
KZN	(14,5;15,4)	(13,5;14,7)	(7,1;8,1)	(4,2;5,1)	(2,3;3,3)	(11,1;11,6)
other	(12,2;13,2)	(10,5;11,6)	(6,3;7,3)	(3,6;4,4)	(2,3;3,3)	(8,8;9,3)
Total	(12,6;13,0)	(10,8;11,1)	(6,2;6,5)	(3,7;3,9)	(2,2;2,5)	(8,1;8,3)

Table B.14. Number of observed deaths by province and salary band: male

	Salary band					
Province	1	2	3	4	5	Total
WC	1 220	1 998	910	603	345	5 076
GT	7 131	7 918	3 926	1 995	1 001	21 971
KZN	2 186	1 836	850	333	147	5 352
other	1 784	1 412	753	332	153	4 434
RSA	1 858	3 024	2 216	1 033	322	8 453
Total	14 179	16 188	8 655	4 297	1 968	45 286

Table B.15. Number of observed deaths by province and salary band: female

	Salary band					
Province	1	2	3	4	5	Total
WC	541	462	301	173	44	1 520
GT	3 139	1 324	801	514	154	5 932
KZN	1 477	249	100	67	15	1 907
other	441	244	101	75	17	878
RSA	824	478	386	279	70	2 036
Total	6 422	2 757	1 688	1 107	299	12 274

Table B.16. 95% confidence intervals for aggregated mortality rate per mille, by province, industry and salary band: male, standardised to male age distribution

	Salary band					
Province & Industry	1	2	3	4	5	Total
Western Cape						
light	(7,8;9,4)	(8,0;9,2)	(4,5;5,4)	(3,0;3,7)	(2,0;2,7)	(5,1;5,6)
mid	(10,3;12,1)	(10,7;12,7)	(7,8;10,4)	(3,7;5,9)	(1,4;3,2)	(9,3;10,3)
heavy	(10,3;13,0)	(8,3;9,6)	(5,4;7,0)	(4,0;5,6)	(1,6;3,8)	(7,3;8,1)
Gauteng						
light	(12,4;13,5)	(11,3;12,4)	(7,1;8,0)	(3,8;4,3)	(2,2;2,7)	(7,1;7,4)
mid	(13,1;14,3)	(11,6;12,7)	(7,7;8,8)	(5,0;5,9)	(2,2;3,0)	(9,4;9,9)
heavy	(16,3;17,3)	(14,5;15,4)	(11,2;12,4)	(6,1;7,2)	(3,1;4,2)	(13,2;13,7)
KwaZulu-Natal						
light	(12,2;13,9)	(11,9;14,5)	(5,9;7,8)	(3,5;5,4)	(2,1;3,7)	(9,6;10,5)
mid	(16,3;19,0)	(11,7;14,0)	(9,6;12,0)	(4,5;7,2)	(1,2;3,4)	(11,9;13,1)
heavy	(17,0;19,6)	(17,8;20,3)	(10,0;12,7)	(6,4;9,0)	(3,7;6,9)	(14,6;15,9)

Table B.17. 95% confidence intervals for the aggregated mortality rate per mille, by province, industry and salary band: female, standardised to male age distribution

	Salary band					
Province & Industry	1	2	3	4	5	Total
Western Cape						
light	(4,9;6,1)	(3,4;4,3)	(1,9;2,5)	(1,3;1,9)	(0,6;1,3)	(2,7;3,1)
mid	(3,7;5,2)	(3,5;5,2)	(1,6;3,6)	(0,3;2,0)	(–0,4;2,0)	(3,3;4,2)
heavy	(5,0;8,3)	(3,1;5,2)	(1,4;2,7)	(1,7;3,7)	(–0,8;2,1)	(3,0;4,0)
Gauteng						
light	(8,1;9,1)	(5,5;6,3)	(2,4;2,9)	(1,6;2,0)	(1,1;1,6)	(3,9;4,2)
mid	(11,2;12,6)	(5,8;7,4)	(2,4;3,5)	(1,4;2,4)	(0,7;2,0)	(6,9;7,6)
heavy	(11,4;13,1)	(7,8;10,0)	(3,8;5,1)	(1,9;3,1)	(0,7;2,5)	(7,5;8,4)
KwaZulu-Natal						
light	(13,2;15,7)	(4,1;6,4)	(1,7;3,1)	(0,8;1,9)	(–0,1;1,4)	(6,6;7,7)
mid	(9,3;10,8)	(4,8;7,9)	(1,8;4,8)	(1,0;4,4)	(0,1;7,7)	(8,1;9,4)
heavy	(12,6;16,0)	(11,1;16,3)	(2,3;5,2)	(2,5;6,0)	(–0,6;3,2)	(9,6;11,6)

Table B.18. Aggregated mortality rate per mille, by province, industry and salary band: combined, standardised to male age distribution

	Salary band					
Province & Industry	1	2	3	4	5	Total
Western Cape						
light	6,9	6,4	3,4	2,6	1,9	4,2
mid	8,7	9,4	7,0	3,8	2,0	7,8
heavy	10,2	8,1	4,9	4,2	2,5	6,7
Gauteng						
light	10,8	9,1	4,9	3,0	2,1	5,8
mid	13,0	10,9	6,9	4,5	2,4	9,0
heavy	15,8	14,4	10,2	5,7	3,3	12,5
KwaZulu-Natal						
light	13,5	10,4	5,1	3,1	2,4	9,1
mid	12,8	11,5	9,5	5,1	2,5	10,9
heavy	17,1	18,3	9,6	6,9	4,7	14,2

Table B.19. 95% confidence intervals to accompany Table B.18

	Salary band					
Province & Industry	1	2	3	4	5	Total
Western Cape						
light	(6,5;7,4)	(6,0;6,9)	(3,2;3,7)	(2,3;2,8)	(1,7;2,2)	(4,0;4,3)
mid	(8,1;9,3)	(8,7;10,1)	(6,1;7,9)	(2,9;4,6)	(1,3;2,8)	(7,4;8,2)
heavy	(9,1;11,3)	(7,5;8,7)	(4,3;5,4)	(3,6;4,9)	(1,5;3,5)	(6,4;7,0)
Gauteng						
light	(10,4;11,2)	(8,7;9,4)	(4,7;5,1)	(2,8;3,1)	(2,0;2,3)	(5,6;5,9)
mid	(12,6;13,5)	(10,5;11,4)	(6,5;7,3)	(4,2;4,9)	(2,1;2,7)	(8,7;9,2)
heavy	(15,4;16,3)	(13,9;14,8)	(9,7;10,7)	(5,3;6,2)	(2,8;3,8)	(12,3;12,7)
KwaZulu-Natal						
light	(12,8;14,2)	(9,5;11,3)	(4,4;5,7)	(2,5;3,6)	(1,7;3,1)	(8,7;9,4)
mid	(12,1;13,5)	(10,5;12,4)	(8,5;10,6)	(4,0;6,2)	(1,4;3,6)	(10,5;11,4)
heavy	(16,0;18,1)	(17,1;19,4)	(8,5;10,7)	(5,8;8,0)	(3,4;6,1)	(13,6;14,7)

Table B.20. Number of observed deaths by province, industry and salary band: male

	Salary band					
Province & Industry	1	2	3	4	5	Total
Western Cape						
light	350	680	388	316	226	1 959
mid	523	533	200	78	30	1 366
heavy	254	706	257	146	32	1 395
Gauteng						
light	1 506	1 694	1 139	772	553	5 664
mid	1 917	1 807	1 031	517	213	5 486
heavy	3 598	4 260	1 675	617	163	10 313
KwaZulu-Natal						
light	836	368	180	90	55	1 528
mid	589	500	332	85	23	1 529
heavy	698	920	300	131	40	2 089

Table B.21. Number of observed deaths by province, industry and salary band: female

	Salary band					
Province & Industry	1	2	3	4	5	Total
Western Cape						
light	298	266	223	135	35	956
mid	138	100	28	8	2	276
heavy	61	64	36	23	1	184
Gauteng						
light	1 150	765	499	356	119	2 890
mid	1 097	268	119	63	15	1 561
heavy	829	255	159	72	10	1 324
KwaZulu-Natal						
light	478	81	47	25	4	635
mid	674	64	19	11	4	772
heavy	272	101	26	23	2	425

B.5 Salary bands

Table B.22. Aggregated mortality rates per mille split by 20 salary bands; age standardised

Salary band	Band range (R'000)	Male			Female		
		light	mid	heavy	light	mid	heavy
1	[0;20)	12,6	12,8	16,5	11,2	10,5	11,6
1	[20;30)	13,1	15,4	16,3	8,8	11,6	13,5
1	[30;40)	12,0	11,7	17,1	6,6	6,9	10,2
2	[40;50)	12,0	11,1	13,3	5,8	6,4	8,2
2	[50;60)	10,7	12,5	15,6	4,5	6,1	8,2
2	[60;70)	9,2	11,8	15,9	3,9	4,8	7,8
3	[70;80)	7,7	9,2	14,4	3,2	3,2	4,3
3	[80;90)	7,1	8,2	13,0	2,6	3,5	4,1
3	[90;100)	6,8	7,8	10,4	2,3	2,3	3,4
3	[100;125)	6,0	8,3	8,9	2,0	2,4	2,7
4	[125;150)	5,0	6,4	7,4	2,0	2,0	2,6
4	[150;175)	4,8	5,3	6,4	1,8	1,6	2,4
4	[175;200)	3,7	4,9	5,4	1,8	1,4	2,1
4	[200;250)	3,1	4,2	5,0	1,4	2,2	1,5
5	[250;300)	3,1	3,9	4,3	1,4	1,2	1,6
5	[300;400)	2,5	2,5	4,2	1,3	0,8	1,7
5	[400;500)	2,5	1,9	2,7	1,2	5,4	–
5	[500;750)	2,4	2,4	11,5	1,2	1,0	–
5	[750;1 000)	1,5	0,9	3,1	0,8	–	–
5	[1 000;∞)	1,3	1,1	6,3	1,3	–	–

B.6 Age band

Table B.23. Mortality rates per mille by age band, industry and salary band: male

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	2,0	2,3	2,0	1,6	2,1	2,1
25–29	4,6	3,6	2,5	2,0	1,1	3,1
30–34	9,3	7,0	3,7	2,4	1,1	4,8
35–39	13,3	10,4	5,4	3,1	1,8	6,3
40–44	13,6	12,1	6,9	3,7	2,3	7,0
45–49	15,4	13,4	8,8	4,8	2,9	8,0
50–54	15,5	14,9	9,7	5,8	3,5	8,5
55–59	18,2	18,3	14,0	7,4	5,0	10,8
60–64	25,4	20,6	14,8	9,7	6,8	13,1
65–69	22,2	16,5	17,2	11,2	7,6	13,7
mid						
20–24	3,8	2,9	2,3	3,1	–	3,3
25–29	6,5	4,5	3,5	1,9	1,1	4,8
30–34	11,1	8,8	5,0	3,2	2,1	7,7
35–39	13,2	11,9	8,2	3,5	2,2	9,5
40–44	14,7	12,9	8,8	5,2	1,9	10,2
45–49	15,3	14,5	9,8	5,6	3,0	10,9
50–54	15,5	16,1	11,1	8,2	4,3	12,1
55–59	17,9	17,0	15,2	10,4	5,5	14,3
60–64	20,7	18,7	20,7	12,6	6,3	16,4
65–69	20,0	28,7	17,5	20,7	4,3	18,2
heavy						
20–24	4,1	4,5	3,9	4,1	12,9	4,2
25–29	6,7	5,8	4,4	4,1	3,2	5,8
30–34	13,5	11,0	7,4	4,8	2,6	10,0
35–39	18,2	14,9	10,4	5,5	2,9	12,7
40–44	18,9	16,6	12,7	6,1	3,0	13,7
45–49	19,8	18,5	13,8	6,2	4,0	14,4
50–54	22,2	21,0	16,1	7,8	4,0	16,4
55–59	22,9	22,2	19,5	9,4	5,7	18,4
60–64	24,6	23,2	22,9	12,5	10,4	20,8

Table B.24. 95% confidence intervals to accompany Table B.23

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	(1,6;2,5)	(1,8;2,9)	(1,5;2,6)	(0,7;2,4)	(–0,7;5,0)	(1,8;2,4)
25–29	(4,2;5,1)	(3,1;4,1)	(2,1;2,8)	(1,6;2,3)	(0,6;1,6)	(2,9;3,3)
30–34	(8,6;10,0)	(6,3;7,6)	(3,2;4,1)	(2,1;2,8)	(0,8;1,3)	(4,6;5,0)
35–39	(12,3;14,3)	(9,5;11,2)	(4,8;5,9)	(2,7;3,5)	(1,5;2,1)	(6,0;6,6)
40–44	(12,4;14,8)	(11,1;13,1)	(6,2;7,7)	(3,2;4,2)	(2,0;2,7)	(6,7;7,3)
45–49	(14,0;16,8)	(12,3;14,6)	(7,9;9,7)	(4,2;5,4)	(2,4;3,3)	(7,6;8,3)
50–54	(13,7;17,2)	(13,6;16,3)	(8,6;10,8)	(5,1;6,6)	(3,0;4,0)	(8,1;8,9)
55–59	(15,9;20,5)	(16,5;20,1)	(12,5;15,6)	(6,4;8,4)	(4,3;5,7)	(10,3;11,4)
60–64	(21,6;29,3)	(17,8;23,4)	(12,4;17,1)	(8,0;11,3)	(5,6;7,9)	(12,2;14,0)
65–69	(15,6;28,8)	(11,0;22,0)	(11,8;22,6)	(7,3;15,1)	(4,8;10,4)	(11,7;15,7)
mid						
20–24	(3,0;4,5)	(2,1;3,7)	(1,2;3,5)	(1,0;5,3)	(0,0;0,0)	(2,8;3,8)
25–29	(5,9;7,2)	(3,8;5,1)	(2,8;4,3)	(1,2;2,5)	(0,0;2,1)	(4,4;5,1)
30–34	(10,3;11,9)	(8,0;9,6)	(4,2;5,7)	(2,5;3,8)	(1,3;2,8)	(7,3;8,1)
35–39	(12,2;14,1)	(11,0;12,8)	(7,2;9,1)	(2,8;4,2)	(1,5;2,9)	(9,1;9,9)
40–44	(13,6;15,9)	(11,9;13,8)	(7,8;9,7)	(4,3;6,0)	(1,3;2,5)	(9,7;10,7)
45–49	(14,0;16,6)	(13,4;15,6)	(8,7;10,8)	(4,7;6,6)	(2,2;3,8)	(10,4;11,5)
50–54	(14,0;17,0)	(14,8;17,4)	(9,9;12,3)	(6,9;9,5)	(3,3;5,3)	(11,5;12,7)
55–59	(16,0;19,9)	(15,4;18,6)	(13,6;16,9)	(8,6;12,2)	(4,2;6,8)	(13,5;15,1)
60–64	(17,3;24,0)	(16,1;21,4)	(17,6;23,8)	(9,8;15,4)	(4,4;8,2)	(15,1;17,7)
65–69	(12,1;27,8)	(19,3;38,2)	(9,0;25,9)	(12,2;29,3)	(0,7;7,9)	(14,7;21,6)
heavy						
20–24	(3,4;4,8)	(3,4;5,5)	(2,6;5,2)	(1,6;6,6)	(–4,8;30,5)	(3,6;4,7)
25–29	(6,2;7,3)	(5,1;6,6)	(3,7;5,2)	(3,2;5,0)	(1,0;5,4)	(5,4;6,1)
30–34	(12,7;14,3)	(10,2;11,8)	(6,6;8,3)	(4,0;5,5)	(1,5;3,6)	(9,5;10,4)
35–39	(17,2;19,2)	(14,0;15,8)	(9,4;11,3)	(4,8;6,2)	(2,0;3,8)	(12,3;13,2)
40–44	(17,7;20,1)	(15,7;17,5)	(11,7;13,7)	(5,3;6,9)	(2,1;4,0)	(13,2;14,2)
45–49	(18,4;21,1)	(17,6;19,5)	(12,9;14,8)	(5,4;6,9)	(3,0;5,0)	(14,0;14,9)
50–54	(20,5;23,9)	(20,0;22,0)	(15,0;17,2)	(6,9;8,7)	(3,0;5,0)	(15,8;16,9)
55–59	(20,9;24,9)	(21,0;23,4)	(18,0;21,0)	(8,2;10,7)	(4,2;7,1)	(17,7;19,1)
60–64	(21,3;28,0)	(21,3;25,1)	(20,3;25,6)	(10,0;14,9)	(7,4;13,3)	(19,7;22,0)

Table B.25. Observed exposure by age band, industry and salary band: male

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	43 467	25 530	23 985	8 516	994	102 492
25–29	76 826	54 582	70 145	56 446	18 199	276 199
30–34	72 137	59 052	69 150	76 583	51 932	328 853
35–39	51 973	55 463	58 829	71 180	67 568	305 014
40–44	36 899	47 072	48 247	56 733	63 274	252 225
45–49	29 048	39 775	41 469	49 949	60 723	220 965
50–54	19 405	30 546	31 944	39 155	52 357	173 407
55–59	13 393	21 250	22 190	27 293	39 903	124 029
60–64	6 592	10 117	10 604	13 528	20 554	61 395
65–69	1 971	2 093	2 250	2 826	3 825	12 966
mid						
20–24	26 640	16 578	6 748	2 635	209	52 810
25–29	61 567	42 648	24 524	16 457	3 878	149 073
30–34	65 838	54 504	33 127	25 795	12 672	191 937
35–39	57 085	55 617	34 744	27 221	18 419	193 085
40–44	45 231	51 153	35 121	25 826	19 095	176 426
45–49	36 226	46 031	35 768	24 202	19 055	161 282
50–54	25 446	35 774	30 602	18 725	16 481	127 028
55–59	17 614	24 767	20 701	12 225	11 911	87 219
60–64	7 028	10 270	8 157	6 046	6 571	38 072
65–69	1 252	1 243	945	1 087	1 262	5 789
heavy						
20–24	31 539	14 843	9 214	2 540	158	58 294
25–29	80 129	41 099	30 906	18 337	2 556	173 027
30–34	79 917	60 046	40 407	33 347	9 235	222 952
35–39	67 460	71 941	43 230	39 500	13 706	235 837
40–44	51 791	78 823	47 677	39 921	13 732	231 945
45–49	42 437	83 948	55 147	45 267	15 668	242 467
50–54	29 984	75 955	48 863	38 232	14 774	207 808
55–59	21 854	56 653	32 671	22 979	10 732	144 890
60–64	8 326	24 407	12 893	8 069	4 643	58 338

Table B.26. Number of observed deaths by age band, industry and salary band: male

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	88	60	49	13	2	213
25–29	357	198	173	111	21	860
30–34	670	411	255	184	55	1 576
35–39	690	575	315	218	123	1 920
40–44	502	568	335	209	148	1 761
45–49	448	535	364	240	173	1 760
50–54	300	456	311	228	181	1 476
55–59	244	389	311	202	199	1 345
60–64	167	209	157	131	139	803
65–69	44	34	39	32	29	178
mid						
20–24	101	48	16	8	–	173
25–29	402	191	87	31	4	715
30–34	733	480	165	81	26	1 485
35–39	752	663	285	95	40	1 834
40–44	667	657	308	133	36	1 801
45–49	554	668	349	137	57	1 765
50–54	395	575	339	154	71	1 534
55–59	316	421	316	128	66	1 245
60–64	145	192	169	76	41	624
65–69	25	36	17	23	5	105
heavy						
20–24	128	66	36	10	2	243
25–29	539	239	137	75	8	998
30–34	1 076	660	300	160	24	2 219
35–39	1 227	1 074	448	217	40	3 006
40–44	979	1 309	606	243	42	3 178
45–49	839	1 556	764	279	63	3 500
50–54	665	1 596	786	297	59	3 403
55–59	499	1 258	638	217	61	2 673
60–64	205	566	296	100	48	1 216

Table B.27. Mortality rates per mille by age band, industry and salary band: female

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	1,9	0,9	1,3	0,7	–	1,4
25–29	5,0	2,3	1,4	0,9	0,8	2,4
30–34	9,0	4,4	1,8	1,2	0,7	3,5
35–39	9,9	5,4	2,2	1,6	1,2	3,9
40–44	9,4	6,2	2,7	1,8	1,0	4,2
45–49	10,0	5,1	3,0	1,8	1,7	4,2
50–54	8,5	6,2	3,3	3,2	2,7	4,6
55–59	9,7	6,9	4,3	3,9	2,4	5,3
60–64	12,5	7,7	5,5	5,2	4,4	6,6
65–69	12,6	8,4	6,7	5,9	12,7	8,6
mid						
20–24	2,3	1,5	1,0	0,7	–	1,8
25–29	6,9	4,0	1,7	0,4	0,5	4,2
30–34	11,4	6,3	1,9	1,2	1,1	6,8
35–39	13,1	6,4	2,6	2,6	0,8	8,1
40–44	10,4	5,8	3,4	1,7	0,8	7,0
45–49	9,6	7,1	2,9	1,3	1,6	6,8
50–54	9,5	6,4	4,1	4,2	2,6	7,0
55–59	8,6	8,7	5,6	4,0	2,4	7,3
60–64	10,9	9,2	7,7	4,5	1,7	8,1
65–69	5,8	17,3	3,2	–	–	5,6
heavy						
20–24	3,4	1,6	1,8	–	–	2,2
25–29	8,4	3,4	1,7	1,4	1,9	4,0
30–34	13,8	6,8	3,1	2,0	1,7	6,5
35–39	14,1	10,0	2,9	2,4	0,3	7,2
40–44	14,1	9,3	3,5	2,1	0,7	7,5
45–49	12,5	9,0	4,1	2,5	0,9	7,0
50–54	13,1	8,9	5,2	2,8	3,3	7,6
55–59	9,5	15,3	5,1	4,4	–	8,5
60–64	11,5	14,5	8,5	9,0	–	10,6

Table B.28. 95% confidence intervals to accompany Table B.27

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	(0,5;1,2)	(0,9;1,7)	(0,1;1,3)	(0,0;0,0)	(1,2;1,6)	(0,5;1,2)
25–29	(1,9;2,7)	(1,2;1,6)	(0,6;1,1)	(0,3;1,3)	(2,2;2,5)	(1,9;2,7)
30–34	(3,8;5,0)	(1,5;2,1)	(0,9;1,4)	(0,4;1,0)	(3,3;3,7)	(3,8;5,0)
35–39	(4,7;6,1)	(1,9;2,6)	(1,3;1,9)	(0,8;1,5)	(3,7;4,2)	(4,7;6,1)
40–44	(5,4;6,9)	(2,3;3,2)	(1,5;2,2)	(0,6;1,4)	(3,9;4,5)	(5,4;6,9)
45–49	(4,4;5,8)	(2,5;3,5)	(1,4;2,2)	(1,1;2,2)	(3,9;4,4)	(4,4;5,8)
50–54	(5,3;7,1)	(2,7;3,9)	(2,6;3,7)	(1,9;3,5)	(4,3;5,0)	(5,3;7,1)
55–59	(5,7;8,0)	(3,4;5,1)	(3,2;4,7)	(1,5;3,4)	(4,8;5,8)	(5,7;8,0)
60–64	(5,6;9,7)	(4,1;7,0)	(3,9;6,6)	(2,4;6,4)	(5,8;7,5)	(5,6;9,7)
65–69	(3,3;13,6)	(2,6;10,7)	(2,3;9,6)	(4,1;21,2)	(6,3;10,9)	(3,3;13,6)
mid						
20–24	(0,6;2,4)	(0,0;1,9)	(–0,7;2,0)	(0,0;0,0)	(1,2;2,3)	(0,6;2,4)
25–29	(3,0;5,0)	(1,0;2,4)	(0,0;0,8)	(–0,5;1,5)	(3,7;4,7)	(3,0;5,0)
30–34	(5,0;7,5)	(1,1;2,6)	(0,6;1,9)	(0,2;2,1)	(6,2;7,4)	(5,0;7,5)
35–39	(5,2;7,6)	(1,7;3,5)	(1,6;3,6)	(0,0;1,5)	(7,5;8,7)	(5,2;7,6)
40–44	(4,6;6,9)	(2,3;4,5)	(0,8;2,6)	(–0,1;1,7)	(6,4;7,6)	(4,6;6,9)
45–49	(5,8;8,4)	(1,8;4,0)	(0,4;2,1)	(0,2;3,0)	(6,2;7,4)	(5,8;8,4)
50–54	(4,9;7,9)	(2,6;5,6)	(2,6;5,9)	(0,4;4,8)	(6,3;7,8)	(4,9;7,9)
55–59	(6,5;11,0)	(3,5;7,7)	(2,0;6,0)	(–0,3;5,1)	(6,3;8,3)	(6,5;11,0)
60–64	(5,2;13,1)	(3,9;11,5)	(1,4;7,6)	(–1,6;5,1)	(6,3;9,8)	(5,2;13,1)
65–69	(0,7;33,8)	(–3,0;9,4)	(0,0;0,0)	(0,0;0,0)	(1,5;9,6)	(0,7;33,8)
heavy						
20–24	(0,4;2,8)	(0,6;3,0)	(0,0;0,0)	(0,0;0,0)	(1,5;3,0)	(0,4;2,8)
25–29	(2,2;4,5)	(1,1;2,4)	(0,7;2,2)	(–0,7;4,4)	(3,5;4,6)	(2,2;4,5)
30–34	(5,2;8,4)	(2,3;3,9)	(1,3;2,7)	(0,2;3,2)	(5,9;7,1)	(5,2;8,4)
35–39	(8,0;12,0)	(2,0;3,7)	(1,6;3,2)	(–0,3;0,9)	(6,5;7,9)	(8,0;12,0)
40–44	(7,4;11,2)	(2,5;4,5)	(1,3;3,0)	(–0,3;1,7)	(6,8;8,3)	(7,4;11,2)
45–49	(7,0;11,0)	(2,9;5,3)	(1,5;3,5)	(–0,3;2,0)	(6,3;7,8)	(7,0;11,0)
50–54	(6,8;11,1)	(3,6;6,8)	(1,6;4,0)	(0,5;6,2)	(6,7;8,5)	(6,8;11,1)
55–59	(12,0;18,6)	(3,0;7,1)	(2,5;6,4)	(0,0;0,0)	(7,2;9,7)	(12,0;18,6)
60–64	(9,5;19,5)	(4,3;12,6)	(4,6;13,3)	(0,0;0,0)	(8,3;12,8)	(9,5;19,5)

Table B.29. Observed exposure by age band, industry and salary band: female

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	43 496	29 772	31 542	7 251	711	112 771
25–29	69 193	54 496	90 006	53 871	11 674	279 240
30–34	64 755	49 169	86 217	78 226	29 050	307 417
35–39	53 248	45 299	71 367	73 418	33 724	277 057
40–44	42 752	42 974	57 609	58 436	27 278	229 048
45–49	34 337	38 641	49 815	50 907	22 800	196 500
50–54	22 967	29 289	37 018	38 514	16 495	144 283
55–59	14 115	18 985	24 093	25 843	10 318	93 355
60–64	5 030	7 009	10 234	11 566	4 257	38 096
65–69	1 303	1 212	1 565	1 746	663	6 489
mid						
20–24	11 592	6 884	4 148	1 468	86	24 179
25–29	28 649	14 258	12 957	8 213	1 991	66 069
30–34	36 399	15 831	13 999	11 120	4 544	81 893
35–39	38 058	16 284	12 238	10 109	5 261	81 949
40–44	37 446	17 394	10 199	8 323	4 063	77 425
45–49	31 633	15 853	9 587	7 436	3 149	67 658
50–54	21 827	11 486	7 272	5 881	2 069	48 535
55–59	12 801	6 660	4 864	3 866	1 269	29 459
60–64	2 974	2 253	2 034	1 811	586	9 658
65–69	351	243	317	304	84	1 299
heavy						
20–24	6 548	4 398	4 739	1 179	60	16 925
25–29	16 995	9 867	17 704	9 493	1 093	55 153
30–34	19 909	10 345	20 759	14 919	2 935	68 866
35–39	19 204	9 769	16 215	13 821	3 628	62 637
40–44	17 070	9 701	12 418	10 845	2 850	52 883
45–49	14 020	8 855	10 989	10 367	2 451	46 682
50–54	9 314	7 333	7 656	7 539	1 542	33 383
55–59	5 531	5 283	4 775	4 620	837	21 044
60–64	1 834	2 224	1 861	1 840	335	8 094

Table B.30. Number of observed deaths by age band, industry and salary band: female

	Salary band					
Industry & Age	1	2	3	4	5	Total
light						
20–24	83	26	42	5	–	156
25–29	349	128	126	48	9	659
30–34	580	218	153	93	21	1,065
35–39	525	246	160	119	39	1,089
40–44	402	266	157	107	28	960
45–49	342	197	148	91	38	818
50–54	196	181	122	122	44	665
55–59	137	130	103	102	25	496
60–64	63	54	57	61	19	253
65–69	16	10	10	10	8	56
mid						
20–24	27	10	4	1	–	42
25–29	197	57	22	3	1	280
30–34	414	99	26	14	5	558
35–39	500	104	32	26	4	666
40–44	390	100	35	14	3	542
45–49	305	112	28	9	5	459
50–54	207	73	30	25	5	341
55–59	110	58	27	16	3	214
60–64	32	21	16	8	1	78
65–69	2	4	1	–	–	7
heavy						
20–24	22	7	8	–	–	38
25–29	143	33	31	14	2	223
30–34	276	71	64	30	5	446
35–39	272	98	47	33	1	450
40–44	240	90	43	23	2	399
45–49	175	80	45	26	2	328
50–54	122	65	40	21	5	254
55–59	52	81	24	21	–	178
60–64	21	32	16	17	–	86