Written evidence from Robin Howie Associates (ASB0021)

Abstract

This paper assesses the validity of HSE's statement to the Minister that "statistical research does not support the view that former teachers and nurses are at particular risk compared to the general population. … Until recently 'teacher' was not reported any more frequently on such death certificates than expected numbers based on all causes of death in the general population."

It is considered that from examination of information published by the HSE the above statement is very badly faulted and fails to address HSE's own data. The problem is that HSE uses Proportional Mortality Ratios (PMR) as their index of disease occurrence in different occupations but fails to appreciate that PMR are indices of relative risk: not indices of absolute risk.

It is proposed that a better index of absolute risk would be to express the number of observed mesothelioma deaths in each occupation as a ratio of the All Cause Deaths for each occupation.

Author's cv

Robin Howie has been involved in Occupational Hygiene since 1974. He gained a BOHS Diploma in Occupational Hygiene in 1982 and was president of the British Occupational Hygiene Society in 1997/98. His main areas of interest are in: the assessment and control of the risks associated with asbestos; the reality of personal protective equipment performance in real workplaces; the relationship between noise exposure and noise induced hearing loss; and, heat stress/strain. He has designed and led studies to determine the performance of respirators and protective clothing during asbestos removal and was the Senior Occupational Hygienist in a project to develop noise exposure standards for divers and others working under hyperbaric conditions. A significant proportion of his time is spent on legal expert work; mainly in the field of asbestos-induced diseases. He has prepared over 800 legal reports for Scottish Courts: mainly relating to asbestos-induced diseases. He has published over a hundred occupational hygiene papers and articles.

Health and Safety Executive (HSE) officials have advised the Minister for Employment that "statistical research does not support the view that former teachers and nurses are at particular risk compared to the general population. … Until recently 'teacher' was not reported any more frequently on such death certificates than expected numbers based on all causes of death in the general population."

HSE currently uses Proportional Mortality Ratios (PMR) to assess whether mesothelioma deaths in any occupation are higher than expected.

The section on "Interpretive issues" in page 3 of HSE (2013) notes that the "Proportional Mortality Ratios summarise mortality among occupational groups relative to the average level for Great Britain as a whole. … **but do not represent absolute measures of risk**." (My emphasis.) That is, the Proportional Mortality Ratios (PMR) only represent the **relative risk** between different occupations, they do not indicate that mesothelioma deaths in any of occupations is above that of persons not occupationally exposed to asbestos.

The text on page 26 of HSE (2013) notes that the calculation of PMR is based on the "**assumption that occupation is not related to mesothelioma risk**". (My emphasis.") Table 7 on page 27 illustrates how PMR are calculated. In essence all observed mesothelioma deaths are "smeared" pro-rata to the age-matched numbers of all cause deaths (ACD) across all occupations – see column 3.

As a non-statistician I find it odd that having adopted an analysis technique that is predicated on the assumption that occupation is not related to mesothelioma risk, the statisticians then ignore the fact that the starting assumption is proven to be incorrect for about half of all mesothelioma deaths, but continue to use the outcome of the analysis.

For example, Table 2 on page 5 lists the 19 male occupations with 4-digit Job Codes with the highest PMR. These Job Codes account for 4286 of the total of 8984 mesothelioma deaths in all occupations. That is, for these Job Codes their own mesothelioma deaths should have contributed to about 50% of the "Expected" number of deaths in the PMR calculations. However, the "Expected" number of deaths for these 19 Job Codes was only 1785. Consequently, the balance of 2501 deaths from these Job Codes was "smeared" over all other Job Codes pro-roto to the numbers of ACD: so, exaggerating the "Expected" figures and underestimating the PMR for all other Job Codes. Note also that in Table 2 of HSE (2013) all of the PMR for these 19 Job Codes presented have PMR above 100.

HSE appears to define Job Codes with PMR below 100 as having no evidence of higher than expected number of mesothelioma deaths. However, such interpretation of PMR is directly in contradiction to the statement that the PMR values have no absolute significance!

HSE (2020 a) gives ACD and mesothelioma deaths for all 4-digit Job Codes and ranks all Job Codes with about 10 or more observed or "Expected" deaths from highest PMR, Rank 1 downwards.

From HSE (2020 a) there were 261 and 131 mesothelioma deaths in teachers and nurses respectively between 2001 and 2018.

The relevant figures for the period 2011-2018 for secondary and primary school teachers, teaching assistants, nurses and nursing auxiliaries are summarised below from HSE (2010 a):

Table 1: PMR for males and females in teaching and nursing professions

Job Code Occupation	Males*			Females			
	Meso dth	Expected	PMR	Meso dth	Expected	PMR	Rank
2314 Secondary teachers	47	74.9	62.7	9	14.2	63.4	27
2315 Primary teachers	2	8.9	22.5	69	31.9	216.1	3
6125 Teaching assistants	-	-	-	20	10.9	183.7	4
2231 Nurses	11	25.5	43.2	49	55.1	88.9	18
6141 Nursing auxiliaries	8	9.8	81.4	19	24.0	79.0	19

Note: *All above male occupations were ranked 100 or lower.

From the above both female primary teachers and female teaching assistants had PMR substantially higher than 100 and were ranked 3 and 4 for female workers respectively.

The lower ranking for male staff in schools and hospitals as compared with females simply reflects that the “high risk” jobs in construction, building and heavy industry; that accounted for the large majority of male mesothelioma deaths in the data, i.e. the single-digit Job Codes 5, 8 and 9, were primarily male jobs during the 1950s-1970s: the dates during which recent mesothelioma patients were likely to have been exposed to asbestos.

However, if mesothelioma deaths are expressed as rates for the Job Codes where the rates depend only on the number of deaths in the Job Groups of interest the data pattern changes substantially: as shown in table **2** below:

TABLE 2: Mesothelioma deaths v All Cause Deaths

Job Codes Occupations	Males			Females		
	Meso dths	ACD	Rate*	Meso dths	ACD	Rate*
2314 Secondary teachers	47	7376	6.4	9	4706	1.9
2315 Primary teachers	2	893	2.2	69	10626	6.5
6125 Teaching assistants	-	-	-	20	4383	4.6
2231 Nurses	11	3055	3.6	49	18537	2.6
6141 Nursing Auxiliaries	8	1280	6.3	19	7849	2.4

Note: *Rate - number of mesothelioma deaths per 1,000 ACD

From the above the Rates for male codes 2314 and 6141 and female code 2315 are similar as are the Rates for male code 2315 and female codes 2314, 2231 and 6141. The Rates for male code 2231 and female code 6125 are intermediate between the above rate ranges.

From HSE statistical tables such as meso 02 or meso 03, HSE (2020 b, c) about 50% of male and female mesothelioma deaths since about 2000 occurred after age 74. As occupation is not considered in the statistics after age 74, the occupational tables currently underestimate the true levels of mesothelioma deaths in all occupations by about a factor of 2, and possibly more so for those in the “higher” socio-economic occupations which have greater life expectancy than those in "lower" socio-economic occupations.

Do the above mesothelioma death numbers support the view that former teachers and nurses are not at particular risk compared to the general population?

We can approach the above question from a number starting points: are the mesothelioma rates for former teachers and nurses above the assumed background level?

HSE (c2003) noted that “A PMR of 100 does not represent the “background” risk for mesothelioma (the level that would be expected in the absence of all asbestos exposure). A hypothetical group of men with zero exposure to asbestos would record a PMR of approximately 6. At the same time, it must be remembered that a male PMR of (say) 30 does not necessarily represent a 5-fold background risk arising in that occupation, since the relevant occupation may not be the last one held. A hypothetical group of women with zero exposure to asbestos would record a PMR of approximately 30. This does not mean that women have a higher background risk of mesothelioma than men, rather, because the total number of mesotheliomas is much lower for women, the small number of background cases represents a higher proportion of the total.”

Do any of the reported PMR for teaching or nursing professions exceed 6 for males or 30 for females?

All of the relevant male Job Codes had PMR greater than 20 and all of the female Job Codes had PMR greater than 63: see Table 1.

That is, all relevant Job Codes had PMR substantially higher than persons with zero exposure to asbestos.

Since the early 2000s it has been recognised that mesothelioma may cause idiopathic deaths.

Tan and Warren (2009, 2011) concluded that the idiopathic mesothelioma rates in males and females in GB are about 1.1 and 1.3 per million per year respectively.

However, from HSE (undated), which covered mesothelioma deaths by Local Authority Areas over the period 1976-1991: a period during which diagnosis of mesothelioma should have been secure and during which mesotheliomas due to low-level exposures during the post-war period would have been relatively unlikely, there were 91 Local Authority Areas with a total female population of about 3.4 million in which no mesothelioma deaths had been observed.

For these 91 Local Authority Areas the female mesothelioma rate between 1976-1991 would have been less than about 0.02 per million per year.

From Tan and Warren (2011) about 72 mesothelioma deaths would have been expected for such a population.

Assuming that male and female idiopathic mesothelioma rates should be about equal, Tan and Warren (2009, 2011)'s idiopathic mesothelioma rates in males and females in GB are about a factor of about 60 too high as compared with the figure for females in the above 91 Local Authority Areas with zero female mesothelioma deaths.

DfE (2019) notes that in England there were 441,000-453,000 full time equivalent Teachers and 218,000-264,000 full time equivalent Teaching Assistants between 2010 and 2018. RCN (2020) notes that there were 529,000-648,000 Nurses and 229,100-319,400 Nursing auxiliaries and nursing assistants employed in the UK between 2009-10 and 2018-19.

It will be assumed herein that in GB over the period 2001-2018 there would have been about: 0.5-0.6 million of each of teachers and nurses and about 0.3 million of each of teaching assistants and nursing auxiliaries and assistant nurses.

As the above occupational data will include ages up to about 65 whereas the mesothelioma data cover up to age 74, it is necessary to address the additional number of persons between ages 66 and 74. If it were assumed that those classified as teachers and nurses up to age 74 would probably have had an about 40-year career followed by an about 10-year period of

retirement, the total number of current and former teachers and nurses up at age 74 would have been about 25% higher than noted above, i.e. about 0.63 million teachers and about 0.75 million nurses.

Teaching assistants, nursing auxiliaries and assistant nurses may have had different career histories from teachers and nurses. It is therefore not possible to "correct" the population numbers for these occupations for numbers between ages 65 and 74.

Crude mesothelioma death rates, i.e. rates not corrected for age distribution, in working and retired teachers and nurses over that period would have been about: teachers: 261/0.63 million/18 years = ~23/million/year and nurses 131/0.75 million/18 years =~10/million/year.

The above observed mesothelioma rates of ~23/million/year and ~10/million/year were about 20 and 8 times higher in teachers and nurses respectively than the idiopathic rates predicted by Tan and Warren (2009, 2011), or about 1,000 or 500 times higher respectively than the idiopathic rate for females in the 91 Local Authority Areas noted above.

Do the above data indicate support the HSE's view that former teachers and nurses are not at particular risk compared to the general population?

I suggest that the answer to the above question is that working or retired teachers or nurses are at very much higher risk of developing mesothelioma that those in the general population and that HSE's conclusion is demonstrably both incorrect and dangerously misleading.

Teacher and nurse mesothelioma deaths today may mainly reflect exposures to asbestos during the 1950s-1970s.

Are today's teachers and pupils at risk of developing mesothelioma from asbestos in schools? Similarly, are today's nurses at risk of developing mesothelioma from asbestos in hospitals?

HSE (2004) stated that of the approximately 20,400 primary schools and 3,400 secondary schools in the UK, some 13,000 were built between 1945 and 1974, when the use of Asbestos-Containing Materials (ACM) in buildings was at its peak, and that many other school premises would have been refurbished during or since that period, so providing the potential for the introduction of asbestos and that: "This suggests that a high proportion of our present schools contain asbestos and represent the potential to release deadly fibres".

In 2019 the BBC sent Freedom of Information requests to all 243 NHS Trusts in Britain to ask if they ran hospitals containing asbestos. Of the 211 Trusts that responded 198 said that they ran hospitals containing asbestos, BBC (2019). The BBC also found that 352 claims had been made against trusts between January 2013 and December 2017 by people who had developed asbestos-related disease in NHS buildings.

Ms. Jo. Stevens MP, Chair of the All Party Parliamentary Group for Occupational Health and Safety, urged the Government to conduct an audit to "ensure every trust knows the extent of asbestos in their premises and has a plan for dealing with it".

It is presumed that some proportion of the schools and hospitals of 2004 may have been either demolished altogether, have been significantly updated and/or have had ACM removed.

However, it should be noted that many asbestos removals of the past were carried with poor working practices. For example, in 2003, a then HSE Principal Inspector commented that anecdotal reports suggested that around 20% of asbestos removal contracts were clean-ups of previous poor removal work, Stear (2003).

The concern today is that if teachers were exposed to asbestos in the 1950s-1980s in schools in which asbestos-containing materials had been installed, any teachers working in any such surviving schools could still be being exposed to airborne asbestos fibres. Similar concerns will apply to nurses and axillary nurses serving in hospitals containing asbestos-containing materials being exposed to airborne asbestos fibres.

The critical issue that must be addressed is that if teachers had been significantly exposed to asbestos in schools in the past, or currently, then it would be highly likely that their pupils would also have been, or will currently be being, exposed to asbestos.

It will be appreciated that over a working career of about 30-40 years each teacher will have taught about 500-1,000+ pupils: so, in total deaths terms, the number of mesothelioma deaths in former pupils may substantially exceed the number of deaths in working or retired teachers, and may significantly contribute to the "background" mesothelioma level in the general population.

The critical difference between teachers and pupils is that although there are Job Codes for teachers or former teachers there is no Job Code for "former school pupils". In essence, it can be assumed that all persons born or educated from age about 5 in the UK will effectively be former school pupils: some proportion of whom will have lived in Local Authority housing and/or attended schools containing asbestos.

At my uninvited instigation the Committee on Carcinogenicity (CoC) in 2013 addressed the relative mesothelioma risks from equal exposures to asbestos for children and adults and recognised that children are likely to have higher risks of developing mesothelioma than adults contemporaneously equally exposed to asbestos, CoC (2013). The CoC accepted that the lifetime risk of developing mesothelioma following a 10-year exposure is expected to be about 5 times greater for a child first exposed at age 5 than for an adult first exposed at age 30.

I also indicated to the CoC that due to recent increases in life expectancy, children's risk of developing mesothelioma could be further exacerbated due to their greater life expectancy as compared with their teachers.

However, the CoC failed to address the consequences of exposure of new-borns in their homes or of current increases in life expectancy.

Given the use of asbestos-containing materials in Local Authority housing constructed between about 1945 and 1970, it is considered that the risk to new-borns and young children living in such homes should be addressed: particularly so as such children could be exposed to asbestos in their homes for up to about 100-140 hours per week.

Predicted life expectancies from ONS (2021) are summarised below for new-borns.

TABLE 3: Life expectancy for today's new-borns

Gender	Life expectancy (years)			
	Average	1 in 4	1 in 10	Percentage reaching age 100
Male	88	97	101	14%
Female	90	99	102	19%

Note that each 10-year increase in life expectancy beyond 80 years about doubles mesothelioma risk.

The mesothelioma risks for equally exposed new-borns and 5-year-olds with long life expectancy relative to the risk for 30-year-olds to age 80 are outlined below:

TABLE 4: Correction factor for Hodgson and Darnton (2000) mesothelioma model v age at first exposure and likely age at death, i.e. factor by which risk is higher than for equally exposed 30-year-olds to age 80

Likely age at death (years)	Age at first exposure (years)		
	0	5	30
80	7	5	1
90	11	9	2
100	17	14	4

Note that the above relative risks are based on a 40 hours per week exposure. For children with a potential exposure period of about 100 hours per week the mesothelioma risk would be about doubled, from Hodgson and Darnton (2000).

It is relevant to note that in the ***Sunday Telegraph*** of 21st February 2021 Mr. Robert Halfon MP, Chair of the Education Select Committee, reported that "one in three new teachers leave the profession after five years".

If such loss rate is, or was, typical over periods of decades the number of "short duration" former teachers will be very much larger that the number of teachers who will retire with "teacher" recorded as their last occupation.

In addition, as early-in-career exposures to asbestos are more potent in causing mesothelioma than equal later-in-career exposures these early-in-career exposures are critical in lifetime mesothelioma risk.

West (1997) categorised airborne fibre concentrations in buildings as being: no asbestos present - <0.000001 fibres/ml; asbestos present in good condition – up to 0.001 fibres/ml; maintenance work in progress – up to 0.04 fibres/ml; and, asbestos materials present in poor condition – up to 0.3 fibres/ml. The same author commented that a mean level of 0.0005 fibres/ml was "typical" inside buildings containing asbestos-containing materials in good condition.

If a 25-year old adult was exposed to 0.0005 fibres/ml of amosite for 1 year, the mesothelioma risk to age 80 would be about 4 per million per year, Hodgson and Darnton (2000).

It should be noted that in the Willmore v Knowsley Metropolitan Borough Council the Court held that "a level above that commonly found in the air in buildings and the general outdoor environment" would materially increase the risk of developing mesothelioma, Nicol (2009). This Judgement was upheld by both the Court of Appeal and the Supreme Court.

Health and Safety Executive (2001, 1992, 1988) concluded that an imposed risk of 1 per million per year was the limit of "acceptable" risk.

The above risk of 4 per million per year from a one-year exposure to "typical" levels of asbestos in buildings containing asbestos-containing in good condition therefore exceeds the defined level of "acceptable" risk.

I consider that without data from routine monitoring of airborne fibre concentrations in schools and hospitals built prior to about 1985; irrespective of any asbestos remediation since that date; neither school nor hospital managers will have any evidence that they have met or are meeting their duties as specified in Sections 2 and 3 of the 1974 Act.

All such monitoring MUST be undertaken while the building(s) are in full occupation, as without normal disturbance of the building structures, normal air movements due to wind effects will rapidly dilute any ongoing fibre release into the building.

I consider that unless HSE actively enforces such monitoring, it will be failing to meet its duties as specified in Section 18 of the 1974 Act.

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ASSESSMENT OF MESOTHELIOMA RISK IN TEACHING AND NURSING PROFESSIONS

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