MORTALITY FROM DIABETES AND ISCHAEMIC HEART DISEASE IN TEXTILE WORKERS

Francesca Zanardi[1]
E. Clare Harris[2]
Terry Brown[3]
Simon Rice[4]
Keith T Palmer[2]
David Coggon[2]

[1]Occupational Medicine Unit, Alma Mater Studiorum, University of Bologna, Italy
[2]MRC Epidemiology Resource Centre, University of Southampton, UK
[3]Institute of Environment and Health, Cranfield University, UK
[4]Mathematical Sciences Unit, Health and Safety Laboratory, Buxton, UK

Correspondence to:
Professor David Coggon
MRC Epidemiology Resource Centre
Southampton General Hospital
Southampton
SO16 6YD
UK

Tel: # 44 2380 777624
Fax: # 44 2380 704021
Email: dnc@mrc.soton.ac.uk

Key words: mortality, occupation, diabetes, ischaemic heart disease, textile workers, India, immigrants

Running title: Diabetes and heart disease in textile workers

Abstract

Background

To explore possible explanations for elevated mortality from diabetes among male garment manufacturers and repairers in England and Wales during 1979-1990, we extended analysis by 10 years, looking also at other textile workers and at deaths from ischaemic heart disease (IHD).

Methods

We used data on some 3.5 million deaths to compute proportional mortality ratios (PMRs) for diabetes and IHD, standardised for age and social class, in 10 job groups concerned with manufacture of, or work with, textiles. For 1993-2000, we carried out additional analyses by place of birth.

Results

Among men, mortality from diabetes was elevated in nine of the 10 textile job groups, with overall PMRs of 147 (95%CI 131-165) during 1979-90 and 170 (95%CI 144-199) during 1991-2000. Proportional mortality from IHD was also consistently high, although to a lesser extent. In female textile workers, mortality from both diseases was close to that for other occupations. In both sexes, mortality from diabetes and IHD was increased among people born in the Indian sub-continent (PMRs 353 and 139 in men; 262 and 130 in women). In men, the proportion of deceased textile workers who had been born in the Indian sub-continent (11.4%) was much higher than for all occupations (1.8%), but there was no similar differential for women (1.1% v 0.7%). When PMRs for male textile workers were standardised for place of birth, they were lower, but still significantly elevated (133, 95% CI 110-159 for diabetes and 109, 95% CI 105-114 for IHD).

Conclusions

There is no obvious occupational hazard that could explain an increased risk across such a wide range of textile occupations that is specific to men. One possible explanation is uncontrolled residual confounding related to place of birth. This could be tested through suitably designed morbidity surveys.

Main messages:

- Male textile workers in England and Wales have consistently elevated mortality from diabetes and ischaemic heart disease.

- The increased risk, which does not extend to women, is explained, at least in part, by an unusually high proportion of immigrants from the Indian sub-continent in the occupations concerned.
- An occupational hazard seems unlikely, since the increased risk applies to a wide variety of textile occupations, but only to men.
- Suitably designed morbidity surveys would help to clarify whether confounding by place of birth fully explains the observed pattern of mortality.

Policy implications:

Current evidence does not point to a hazard in the workplace requiring preventive action.

What this paper adds:

- Men employed in the manufacture and repair of garments in England and Wales have previously been found to have high mortality from diabetes, but it has not been clear whether this indicated an occupational hazard, confounding by non-occupational causes of the disease, or a chance occurrence.

- Analysis of newly available data indicates that the excess mortality from diabetes has been persistent and substantial, extends to a wide range of other occupations in the textile industry, is limited to men, and is at least partly explained by a relatively high proportion of men in the occupations concerned having been born in the Indian subcontinent.

- There is no obvious occupational hazard that could explain an increased risk across such a wide range of textile occupations that is limited only to men.

- A more likely explanation is uncontrolled residual confounding by non-occupational risk factors, and this could be tested through suitably designed morbidity surveys.

Introduction

Analysis of occupational mortality in England and Wales for the period 1979-80 and 1982-90 indicated an unusually high proportion of deaths from diabetes among men employed in the manufacture and repair of garments [1]. The excess mortality did not extend to women in the same jobs, and it was hypothesised that it might have occurred because the occupations concerned included a high proportion of immigrants from the Indian sub-continent, among whom the prevalence of diabetes is known to be elevated [2]. Other possible explanations could be chance or an unrecognised occupational hazard in the clothing industry.

Data have now become available for a further 10-year period from 1991 to 2000, and we have used this new information to explore in more detail the risk of death from diabetes in garment and textile workers, and also from ischaemic heart disease (IHD), which like diabetes is more common in immigrants from the Indian sub-continent [3]. In particular, we aimed to assess whether there might be an occupational hazard of diabetes in garment and textile workers.

Method

The Office for National Statistics (previously the Office of Population Censuses and Surveys) provided us with data abstracted from death certificates on all deaths in England and Wales during 1979-80 and 1982-90 (at ages 20-74 years) and 1991-2000 (at ages 16-74 years). For each death we were given the sex, age, year of death and last full-time occupation of the decedent, together with the underlying cause of death coded to the ninth revision of the International Classification of Diseases (ICD 9). Occupations for deaths during 1979-1990 were coded to the 1980 OPCS classification [4], and those during 1991-2000 to the 1990 Standard Occupational Classification [5]. From these occupational classifications, we defined larger job groups [1,6], of which 10 (listed in Table 1) related to textiles or fabrics. Social class, classified to six main strata, was derived from the decedent's occupation by standard algorithms [7]. For the years 1993-2000, we were also given the place of birth of the decedent, which for the purposes of this report was classified as UK, Indian sub-continent or "other".

Analysis was based on deaths for which there was a reported occupation (1,564,981 men in 1979-80 and 1982-90, and 1,202,888 in 1991-2000; 322,775 women in 1979-80 and 1982-90, and 408,152 in 1991-2000), and focused on the relation of

occupation to death from diabetes (ICD9 250) and IHD (ICD9 410-414). Associations were characterised by sex-specific proportional mortality ratios (PMRs), which were expressed as percentages and standardised for age and social class, with confidence intervals (CIs) based on the Poisson distribution. Some PMRs were additionally standardised for place of birth.

Results

Among all male textile and fabric workers combined, there were 291 deaths from diabetes during 1979-90 (PMR 147, 95%CI 131-165) and 154 during 1991-2000 (PMR 170, 95%CI 144-199). As shown in Table 1, elevations of risk were observed consistently for all of the component job groups except knitters and clothing cutters. The highest PMRs were in spinners and winders (182 and 252), tailors and dressmakers (215 and 235) and sewers and embroiderers (192 and 197).

As a group, male textile and fabric workers also had significantly, although less markedly, increased proportional mortality from IHD, with PMRs of 111 (95%CI 109-113) in 1979-90 and 113 (95%CI 108-117) in 1991-2000. Again, the excess applied to almost all component job groups, the one exception being bleachers, dyers and finishers during 1979-90 (Table 1). However, the highest PMR (in sewers and embroiderers during 1991-2000) was only 128. The most consistent elevations of PMR were in spinners and winders, weavers and “other textile workers”.

In female textile and fabric workers, patterns of mortality from diabetes and IHD were less remarkable (Table 2). The overall PMR for diabetes during 1991-2000 was 111 (95%CI 98-126) based on 248 deaths, but in 1979-90 it was only 84 (95%CI 75-94). Moreover, none of the three job groups with the highest PMRs in men had a PMR in women in either period that was greater than 115. PMRs for IHD were significantly increased in 1979-90, but in 1991-2000, the elevation was marginal (PMR 103). As in men, job groups that consistently had the highest PMRs were spinners and winders, weavers and “other textile workers”.

Table 3 shows PMRs for men and women (all occupations combined) during 1993-2000 according to place of birth. In both sexes, mortality from diabetes was substantially elevated among people born in the Indian sub-continent (PMR 353, 95%CI 326-380 for men and PMR 262, 95%CI 196-342 for women). PMRs for IHD were also increased in people born in the Indian sub-continent, although to a lesser

extent (139 in men and 130 in women). During the same period, the proportion of deceased male textile and fabric workers who had been born in the Indian sub-continent (11.4%) was much higher than for all occupations (1.8%). However, there was no similar differential for women (1.1% v 0.7%).

Table 4 shows PMRs for diabetes and IHD in textile and fabric workers during 1993-2000, stratified by place of birth. In men, mortality was elevated for both diseases in each of the three place of birth groups examined, although standardisation for place of birth as well as age and social class gave lower PMRs than in Table 1 (133 for diabetes and 109 for IHD). In women, PMRs after additional adjustment for place of birth were unremarkable.

Discussion

This analysis confirms earlier observations of high proportional mortality from diabetes among men employed in the manufacture and repair of clothing in England and Wales, and indicates that the excess extends to most other occupations involving production of, or work with, textiles. Similar but less marked elevation of mortality was also apparent for IHD, although the job groups with the highest PMRs were not the same as for diabetes. PMRs were reduced after adjustment for place of birth, but remained significantly elevated. In contrast, mortality from diabetes and IHD in female textile and fabric workers was not clearly and consistently different from that in all occupations combined.

The consistency of PMRs over time, with relatively tight confidence intervals, especially in analyses for all textile and fabric workers combined, makes it extremely unlikely that this unusual pattern of mortality is attributable to chance. Nor does it seem plausible that PMRs as high as those for diabetes in male textile and fabric workers could be explained by unusually low mortality from other causes.

The explanation previously proposed for the high mortality from diabetes among male garment workers was that many immigrants from the Indian sub-continent worked in these occupations [1]. Our analysis confirmed that an unusually high proportion of deceased male textile and garment workers were born in the Indian sub-continent, whereas no similar concentration was found in deceased female textile and fabric workers. Moreover, Table 3 demonstrates that, as expected, people born in the Indian sub-continent had high mortality from diabetes and IHD, a

phenomenon that is likely to reflect the impact of various risk factors including genetic constitution, patterns of nutrition both early and later in life, and levels of physical activity. However, among male textile and garment workers, mortality from both diseases was consistently high within individual place of birth strata, and after standardisation for place of birth, the PMR for diabetes was still clearly elevated (133, 95%CI 110-159). For IHD, it was also high, but at a level (109) that might perhaps be explained by unusually low mortality from other common causes of death (i.e. a difference in the denominators rather than the numerators of proportions).

The persistent high mortality from diabetes after adjustment for place of birth raises the possibility of an unrecognised hazard in the workplace. Various occupational exposures have been linked with an increased risk of diabetes, including arsenic, dioxins and other chlorinated organic compounds, N-nitroso compounds and cutting oils [8]. However, none of these associations is well established, and none of the chemicals is a major exposure across the range of textile and fabric occupations in which mortality from diabetes was elevated. Nor is it apparent why these or any other occupational hazard of diabetes in textile and fabric workers should be specific to men.

Suspicion remains, therefore, that the increased PMR for diabetes, even after adjustment for place of birth, may be a product of uncontrolled residual confounding. It is possible, for example, that male textile and fabric workers include high representation of a subset of Asian-born immigrants with exceptionally high rates of diabetes.

The best way to resolve the continuing uncertainty may be through morbidity surveys in different groups of textile workers, comparing their prevalence of diabetes with that of controls from the same communities who have worked only in other occupations.

Acknowledgements

We thank the Office for National Statistics for providing us with data. The Health and Safety Executive provided financial support for analytical work carried out by the Health and Safety Laboratory. Clare Harris was supported by the Colt Foundation. Vanessa Cox helped in preparation of data files at the MRC Epidemiology Resource Centre.

Competing Interests: None declared

References

1. Drever F (ed). *Occupational Health Decennial Supplement*. London: HMSO, 1995 (Series DS no. 10).
2. Barnett AH, Dixon AN, Bellary S. et al. Type 2 diabetes and cardiovascular risk in the UK south Asian community. *Diabetologia* 2006;49:2234-46.
3. Harding S, Rosato M, Teyhan A. Trends for coronary heart disease and stroke mortality among migrants in England and Wales, 1979-2003: slow declines notable for some groups. *Heart* 2008;94:463-70.
4. Office of Population Censuses and Surveys. *Classification of Occupations 1980*. London: HMSO,1980.
5. Office of Population Censuses and Surveys. *Standard Occupational Classification Vol. 1*. Structure and definition of major, minor and unit groups. London: HMSO, 1990.
6. Coggon D, Harris EC, Brown T. et al. Occupational mortality in England and Wales 1991-2000. http://www.statistics.gov.uk/downloads/theme_health/Occupational-mortality.pdf (accessed 161109)
7. Office of Population Censuses and Surveys. *Standard Occupational Classification. Vol. 3*. Social classifications and coding methodology. London: HMSO, 1991.
8. Longnecker MP, Daniels JL. Environmental contaminants as etiologic factors for diabetes. *Environ Health Perspect* 2001; 109 (suppl 6); 871-6.

License Statement

Table 1 Mortality from diabetes and ischaemic heart disease in textile and fabric workers, men aged 16-74 years, England and Wales, 1979-2000.

Job Group	Diabetes						Ischaemic Heart Disease					
	1979-80, 1982-90[a]			1991-2000			1979-80, 1982-90[a]			1991-2000		
	Deaths	PMR[b]	95% CI	Deaths	PMR[b]	95% CI	Deaths	PMR[b]	95% CI	Deaths	PMR[b]	95% CI
Preparatory fibre processors	12	153	79 - 268	6	174	64 - 379	331	110	99 - 123	96	103	83 - 126
Spinners and winders	23	182	115 - 273	15	252	141 - 416	540	114	105 - 124	198	124	108 - 143
Weavers	26	126	82 - 185	19	174	105 - 272	912	112	104 - 119	367	119	108 - 132
Knitters	14	130	71 - 218	8	99	43 - 196	475	109	100 - 120	251	112	98 - 126
Bleachers, dyers and finishers	28	153	102 - 222	16	124	71 - 202	719	98	91 - 105	395	109	99 - 121
Other textile workers	102	127	104 - 155	32	191	131 - 270	3305	117	113 - 121	513	114	104 - 124
Tailors and dressmakers	49	215	159 - 284	32	235	161 - 332	951	106	99 - 113	399	104	94 - 115
Clothing cutters	11	99	50 - 178	5	79	26 - 183	454	105	96 - 115	184	103	89 - 119
Sewers and embroiderers	12	192	99 - 335	13	197	105 - 337	265	110	97 - 124	217	128	111 - 146
Other workers with fabrics	14	184	100 - 308	8	135	58 - 266	319	106	95 - 118	188	112	97 - 130
All textile and fabric workers	291	147	131 - 165	154	170	144 -199	8271	111	109 - 113	2808	113	108 - 117

[a]Data for the period 1979-80 and 1982-90 are for ages 20-74 years
[b]PMRs standardised for age and social class

Table 2 Mortality from diabetes and ischaemic heart disease in textile and fabric workers, women aged 16-74 years, England and Wales, 1979-2000.

Job Group	Diabetes						Ischaemic Heart Disease					
	1979-80, 1982-90[a]			1991-2000			1979-80, 1982-90[a]			1991-2000		
	Deaths	PMR[b]	95% CI	Deaths	PMR[b]	95% CI	Deaths	PMR[b]	95% CI	Deaths	PMR[b]	95% CI
Preparatory fibre processors	7	98	39 - 201	2	96	12 - 345	157	116	99 - 136	36	101	71 - 140
Spinners and winders	21	61	38 - 94	12	77	40 - 134	805	124	115 - 133	293	111	99 - 125
Weavers	37	87	61 - 120	28	143	95 - 207	888	110	103 - 118	366	116	105 - 129
Knitters	13	108	58 - 185	14	110	60 - 185	242	107	94 - 121	191	95	82 - 110
Bleachers, dyers and finishers	5	154	50 - 360	6	143	52 - 310	70	115	90 - 145	67	100	78 - 127
Other textile workers	55	79	60 - 103	7	65	26 - 134	1481	113	108 - 119	195	111	96 - 128
Tailors and dressmakers	40	80	57 - 109	45	115	84 - 154	930	98	92 - 104	570	92	84 - 100
Clothing cutters	6	80	29 - 173	9	195	89 - 371	122	86	71 - 102	67	92	71 - 117
Sewers and embroiderers	110	90	74 - 108	117	109	90 - 131	2267	100	96 - 104	1813	104	99 - 108
Other workers with fabrics	7	81	33 - 167	8	112	48 - 220	163	99	84 - 115	113	101	84 - 122
All textile and fabric workers	301	84	75 - 94	248	111	98 - 126	7125	106	104 - 109	3711	103	99 - 106

[a]Data for the period 1979-80 and 1982-90 are for ages 20-74 years
[b]PMRs standardised for age and social class

Table 3 **Mortality from diabetes and ischaemic heart disease in all occupations combined by place of birth, men and women aged 16-74 years, England and Wales, 1993-2000.**

Place of Birth	Diabetes			Ischaemic Heart Disease		
	Deaths	PMR[a]	95% CI	Deaths	PMR[a]	95% CI
Men						
UK	8529	91	89 - 93	244996	100	99 - 100
Indian sub-continent	666	353	326 - 380	6683	139	136 - 142
Other	984	151	142 - 161	15277	91	89 - 92
Women						
UK	2766	93	90 - 97	49556	100	99 - 101
Indian sub-continent	53	262	196 - 342	423	130	118 - 143
Other	377	175	158 - 193	3238	94	91 - 97

[a]PMRs standardised for age and social class

Table 4 **Mortality from diabetes and ischaemic heart disease in textile and fabric workers according to place of birth, men and women aged 16-74 years, England and Wales 1993-2000.**

Place of birth	Diabetes			Ischaemic heart disease		
	Deaths	PMR	95% CI	Deaths	PMR	95% CI
Men						
UK[a]	60	123	94 -158	1550	108	103 - 114
Indian sub-continent[a]	44	146	106 -196	304	106	94 - 119
Other[a]	16	140	80 - 228	226	126	110 - 143
All places[b]	120	133	110 - 159	2080	109	105 - 114
Women						
UK[a]	155	108	92 - 126	2572	102	99 - 106
Indian sub-continent[a]	2	63	8 - 227	30	93	63 - 133
Other[a]	27	99	65 - 144	218	104	91 - 119
All places[b]	184	106	91 - 122	2820	102	99 - 106

[a]Analysis restricted to people with this place of birth

[b]Analysis standardised for place of birth (UK, Indian sub-continent, other) as well as age and social class