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Proportionate Mortality from Pulmonary Tuberculosis Associated With Occupations -- 28 States, 1979-1990

The risk for occupational exposure to tuberculosis (TB) is increased among health-care and other workers exposed to persons with active TB, workers exposed to silica or other agents that increase the risk of progression from latent infection to active TB, and workers in occupations associated with low socioeconomic status (SES). Accurate estimates of and surveillance for occupationally associated TB are limited because reports of incident TB cases lack comprehensive occupational data (1). Although occupation is routinely recorded on death certificates, this information is not routinely coded and entered into vital statistics data files. To identify occupations associated with increased risk for TB mortality, CDC's National Institute for Occupational Safety and Health (NIOSH) used data from the National Occupational Mortality Surveillance (NOMS) database * to conduct a proportionate mortality study of persons with pulmonary TB by occupation for 1979-1990 (the most recent year for which data were available). This report presents the findings of the study.

Data collected in the NOMS database include each decedent's usual industry and occupation, coded using 1980 U.S. census codes (2). During 1979-1990, approximately 3.4 million mortality records that included a usual occupation (excluding "housewife") were reported to NOMS. For this study, data for blacks and whites were analyzed separately because of substantial differences in race-specific rates of pulmonary TB (1,3); numbers of deaths for other racial groups were too small to calculate stable estimates. Ethnicity was not routinely coded on death certificates until 1989 and could not be analyzed.

Indirectly age-standardized, race- and sex-specific proportionate mortality ratios (PMRs) were calculated by comparing the proportion of pulmonary TB deaths (International Classification of Diseases, Ninth Revision, code 011) among decedents in each occupational group to the proportion of pulmonary TB deaths among all decedents with a coded occupation (4). Confidence intervals (CIs) were calculated using the Mantel-Haenszel chi-square test or, when less than 1000 deaths were observed, the variance from a Poisson distribution. This analysis examined a total of 458 separate or combined occupational groups, comprising all 503 census occupational codes; of these 458 groups, 329 (71.8%) had one or more deaths attributed to pulmonary TB. Data are presented for the 21 occupational groups in which at least one of the race- and sex-specific categories had both 1) four or more

pulmonary TB deaths and 2) either a PMR greater than 200 or a PMR with a 95% CI that did not include 100.

From 1979 through 1990, a total of 2206 deaths was attributed to pulmonary TB. Of these deaths, 1024 (46.4%) occurred among workers in the 21 occupational groups that met the selection criteria. The 21 occupational groups were categorized into four risk groups (Table_1): 1) high potential for exposure to persons with TB (based on published reports and NIOSH health hazard evaluations {HHEs} **); 2) potential for substantial exposure to silica (determined using unpublished data from the National Occupational Exposure Survey {5} and the National Occupational Health Survey of Mining {6}); 3) low SES occupation (defined as a Nam-Powers socioeconomic index score less than 30 {where 1 signifies the lowest possible SES occupation and 100 the highest}) (7) without other recognized risk factors; and 4) unknown risk factors.

Of the 21 occupational groups that met the selection criteria, two race- and sex- specific groups were associated with potential workplace exposure to persons with TB: white male health services workers (health and nursing aides, orderlies, and attendants) (PMR=350; seven deaths) *** and white male funeral directors (PMR=299; four deaths) (Table_1). Six of the 21 occupational groups were associated with potential for high silica exposure. For white males, these groups comprised mining machine operators; operators of machinery used to grind, abrade, buff, or polish; nonconstruction laborers; and construction workers (particularly brick and stone masons, construction laborers, carpenters, and roofers); PMRs ranged from 134 (169 deaths) to 290 (six deaths). For black males, these groups comprised construction workers (particularly construction laborers); mixing and blending machine operators; and furnace, kiln, and oven operators, except food; PMRs ranged from 128 (105 deaths) to 376 (five deaths).

For two of the occupations associated with low SES that met the selection criteria (food preparation and service workers {particularly bartenders and cooks} and farm workers), previous reports have documented increased risk for TB (8). The other low SES occupations that met the selection criteria (e.g., housekeepers and butlers and nonfarm animal caretakers) have not previously been associated with increased risk for TB.

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Editorial Note

Editorial Note: In comparison with surveillance for TB based on incident symptomatic cases or TB skin-test conversions, mortality-based surveillance may be a relatively insensitive indicator of current occupational risks. However, except for studies of selected occupations, the findings in this report comprise the only available information about possible associations between occupation and TB infection. Furthermore, these findings identify several additional occupations associated with increased risk for TB, for which there are biologically plausible explanations. For example, the increased risk for funeral directors may reflect increased likelihood of exposure to infection from cadavers, and for mining machine operators, may reflect exposure to silica, which increases the risk of progression from latent infection to active TB. For occupational groups categorized "unknown risk," reasons for their elevated PMRs cannot be explained. These groups may be at increased risk through factors other than the three recognized in this analysis or may show elevated PMRs by chance alone.

The findings in this report are subject to at least four limitations. First, mortality-based surveillance data are not sensitive indicators of risk for disease because mortality is affected by a combination of several interacting factors. In particular, mortality from TB reflects exposure, infection, SES, access to and adequacy of medical care, and underlying medical conditions. Overall, such factors probably contributed to the approximately threefold greater proportion of pulmonary TB-related mortality among blacks than among whites in this study (0.18% and 0.05%, respectively). Second, the method of death certificate-based PMR analysis described in this report is subject to possible misclassification of usual occupation and cause of death and to potential biases inherent in the use of the PMR statistic as a risk estimator (4) and fails to compensate statistically for multiple comparisons. Third, death certificates lack information about lifestyle and other risk factors; therefore, no adjustment was made for possible confounding. Fourth, the timeliness of death certificates as a source of data is constrained by processing delays. Despite these limitations, these findings are important because of the strength and biological plausibility of many of the reported associations.

The recent increase in TB incidence and the occurrence of multidrug-resistant TB have focused attention on particular populations at high risk for disease and on the potential for transmission of infection to health-care workers. Occupation-based surveillance for TB can assist in identifying groups at high risk and indicate trends in the occurrence of infection in these workers. These surveillance findings also can assist in evaluating the effectiveness of prevention measures for groups previously established to be at risk, such as miners and agricultural workers.

To improve the detection and control of TB among occupational groups, CDC has proposed two surveillance activities (9): 1) collection and analysis of occupational information from TB case reports and 2) serial cross-sectional surveys of known high-risk populations (including selected occupations) to determine the prevalence of TB skin-test positivity. These data, in combination with ongoing collection and analysis of occupational information from death certificates, will enable comprehensive surveillance for monitoring recognized high-risk populations and identifying new at-risk groups.

References

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* Through a collaborative project with CDC (specifically NIOSH and the National Center for Health Statistics) and the National Cancer Institute, the following 28 states contributed occupation-coded death certificate data to NOMS for 1 year or more during 1979 -- 1990: Alaska, California, Colorado, Georgia, Idaho, Indiana, Kansas, Kentucky, Maine, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Washington, West Virginia, and Wisconsin.

** The NIOSH HHE program is a federally mandated program for investigation of suspected hazardous exposures or disease outbreaks in the workplace. As of March 1994, a total of 50 HHE requests related to TB had been received by NIOSH and 25 completed (NIOSH, unpublished data, 1994).

*** Based on the criteria used in this analysis, no other health-care workers had elevated PMRs.

Table_1

Note: To print large tables and graphs users may have to change their printer settings to landscape and use a small font size.

TABLE 1. Selected age-adjusted proportionate mortality ratios * (PMRs) for pulmonary tuberculosis (TB) and potential TB risk factors, by usual occupation, sex, and race of decedent + -- 28 states, 1979-1990

Potential TB risk factor/ Occupation of decedent & (1980 Census code)	Male White No.	Male White PMR	Male White (95% CI)	Male Black No.	Male Black PMR	Male Black (95% CI)	Female White No.	Female White PMR	Female White (95% CI)	Female Black No.	Female Black PMR	Female Black (95% CI)
Occupational TB exposure												
Funeral directors (018)	4	299 *	(82- 766)	1	135	(3- 754)	0	--	--	0	--	--
Health service occupations (445-447)	7	350 *	(141- 721)	1	24	(1- 135)	7	88	(35- 182)	5	73	(24- 169)
Nursing aides, orderlies, and attendants (447)	6	349 *	(128- 760)	1	28	(1- 156)	6	88	(32- 191)	5	79	(26- 185)
Occupational silica exposure												
Construction occupations (553-599, 865, and 869)	169	134 *	(114- 156)	105	128 *	(104- 155)	0	--	--	0	--	--
Brick and stone masons (553 and 563-564)	12	213 *	(110- 371)	11	159	(80- 285)	0	--	--	0	--	--
Carpenters (554, 567, and 569)	50	147 *	(109- 194)	9	97	(44- 184)	0	--	--	0	--	--
Roofers (595)	6	290 *	(106- 630)	1	53	(1- 293)	0	--	--	0	--	--
Construction laborers (869)	34	175 *	(121- 244)	61	156 *	(120- 201)	0	--	--	0	--	--
Mining machine operators (616)	54	276 *	(207- 360)	4	128	(35- 328)	0	--	--	0	--	--
Grinding/Abrading/Bufingf/Polishing												

machine operators (709)	7	265 *	(107-	547)	1	94	(2-	523)	0	--	0	--		
Mixing/Blending machine operators (756)	1	58	(2-	326)	5	376 *	(122-	878)	0	--	0	--		
Furnace/Kiln/Oven operators, except food (766)	1	27	(1-	153)	5	206 *	(67-	481)	0	--	1	15,000	(372-82,842)	
Laborers, except construction (889)	85	159 *	(127-	196)	92	111	(89-	136)	12	162	(84-	283)	8	147
(64-	291)													
Low socioeconomic status occupations														
Housekeepers and butlers (405)	0	--			1	303	(8-1,690)		2	187	(23-	676)	9	225 *
(103-	427)													
Food preparation and service workers (433-444)	19	170 *	(102-	266)	19	111	(67-	174)	17	103	(60-	164)	11	113
(56-	202)													
Bartenders (434)	6	194	(71-	422)	5	454 *	(147-1,059)		0	--	0	--		
Cooks, except short order (436)	9	258 *	(118-	490)	10	107	(51-	196)	7	109	(44-	224)	6	88
(32-	192)													
Farm workers (479)	13	206 *	(110-	352)	30	239 *	(162-	342)	0	--	4	160	(44-	411)
Nonfarm animal caretakers (487)	1	434	(11-2,419)		4	796 *	(217-2,038)		0	--	0	--		
Winding/Twisting machine operators (738)	7	330 *	(133-	680)	1	209	(5-1,164)		1	22	(1-	120)	0	--
Textile sewing machine operators (744)	4	254 *	(69-	650)	1	63	(2-	348)	11	111	(55-	198)	3	121
(25-	355)													
Vehicle washers and equipment cleaners (887)	0	--			6	383 *	(141-	835)	1	2,401	(64-13,380)		0	--
Unknown risk														
Entertainers (186-187, 193-194, and 198)	7	253 *	(102-	522)	0	--			0	--	0	--		
Technicians, not elsewhere classified (235)	5	211 *	(69-	493)	0	--			0	--	0	--		
Material recording, scheduling and distribution clerks (359-374)	17	108	(63-	173)	5	77	(25-	181)	4	234 *	(64-	600)	0	--
Farm operators (473 and 474)	125	117			60	159 *	(122-	205)	0	--	10	259 *	(124-	477)
Automobile mechanics (505-506)	27	159 *	(105-	232)	7	74	(30-	152)	0	--	0	--		
Electrical commercial/industrial equipment repair (523)	6	344 *	(126-	749)	1	194	(5-1,081)		0	--	0	--		
Butchers, bakers, and batch makers (686-688)	9	97	(45-	185)	10	226 *	(108-	415)	2	246	(30-	888)	1	280
(7- 1,562)														
Butchers (686)	4	69	(19-	177)	8	263 *	(113-	518)	1	550	(14- 3,064)		0	--

* Selection criteria: 1) at least four TB deaths in a race- and sex-specific group and 2) either a PMR >200 or a PMR with a 95% confidence interval (CI) excluding 100.

+ Source: 1979-1990 National Institute for Occupational Safety and Health, CDC, mortality data file; includes death records from 28 states (Alaska, California, Colorado, Georgia, Idaho, Indiana, Kansas, Kentucky, Maine, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Washington, West Virginia, and Wisconsin).