Ischemic Heart Disease and Acute Myocardial Infarction Mortality Among Police Officers

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The relationship between the occupation of police officer and ischemic heart disease (IHD) mortality was examined through case-control studies using 1968/78 death certificate records from Rhode Island and Utah. IHD was divided into two subcategories—acute myocardial infarction (AMI) and other IHD. In both states, the odds ratio (OR) for AMI was significantly elevated (Rhode Island, OR = 1.3; Utah, OR = 1.8), and was higher than the OR for other IHD (Rhode Island, OR = 1.1; Utah, OR = 1.4). The odds ratio for AMI was higher in the <65 yr age group (Rhode Island, OR = 2.1; Utah, OR = 2.1) than in the ≥65 yr age group (Rhode Island, OR = 0.9; Utah, OR = 1.6). These results suggest that the elevated risk for IHD among police officers observed in this and other studies is primarily due to an elevated risk for AMI. The pattern of diminishing risk with age suggests a risk factor, possibly stress, the effect of which diminishes when exposure ceases at retirement.

Ischemic heart disease has a multifactorial etiology.[1] Among possible occupational risk factors are certain chemical exposures (eg, carbon disulfide, carbon monoxide, heavy metals), physical stress (noise, heat, and cold), workplace psychologic stress, and physical inactivity at work.[2]

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The risk profiles for various manifestations of ischemic heart disease may differ.[3] The risk profile for the underlying atherosclerosis of chronic ischemic heart disease may not be identical to the risk profile for precipitation of acute myocardial infarction, which may involve acute coronary thrombosis, coronary artery spasm, and platelet aggregation.[4] In addition, the risk factors for fatal *vs* nonfatal acute myocardial infarction may differ. For example, obesity, cigarette smoking, and vigorous physical activity may be related to acute coronary deaths.[5]

Researchers from the National Institute for Occupational Safety and Health (NIOSH) have been engaged in cooperative activities with selected state health agencies to develop their occupational disease surveillance capabilities (Surveillance Cooperative Agreement Between NIOSH and States [SCANS] program). Both the Rhode Island and Utah health departments have participated in the SCANS program. A major activity of SCANS has been the coding of the usual occupation and industry entries from death certificates.

To generate leads for more definitive investigations, cause-specific mortality patterns by occupation and industry were examined using the proportionate mortality ratio (PMR) method. This paper reports on a more detailed examination of one of the leads that emerged from these PMR analyses—an excess of ischemic heart disease (IHD), and particularly acute myocardial infarction (AMI), among police officers.

Methods

Computer files of Rhode Island and Utah death certificate records from 1968 to 1978 included information

on the decedent's sex, race, age at death, underlying cause of death, usual occupation ("kind of work done during most of working life, even if retired"), and usual industry ("kind of business or industry"). Underlying cause of death was coded by state nosologists according to the Eighth Revision, International Classification of Diseases, Adapted for Use in the United States (ICDA).

Usual occupation and industry were coded by state coders according to the 1970 US Bureau of the Census classification system.[6] Occupation and industry coding was done for all Rhode Island and Utah resident decedents 16 years of age or older, with the exception of Rhode Island residents who died out-of-state in 1968. The copies of the certificates for these latter decedents, who accounted for 5% of the Rhode Island resident deaths in 1968, could not be located when the occupation and industry coding was performed.

For quality control of occupation and industry coding, and to more precisely define police officers for this study, records assigned US Bureau of the Census occupation codes 964 (policemen and detectives), 963 (marshals and constables), 965 (sheriffs and bailiffs), and 961 (firemen, fire protection (see below)) were double-checked against the original occupation and industry statements on the death certificates. Also double-checked were records with occupation code 962 (guards and watchmen) in combination with industry codes 917, 927, or 937 (federal, state, or local public administration), as some of these might be confused with police officers. Corrections were made to 4% of the Rhode Island records and 5% of the Utah records.

For Utah, decedents assigned occupation codes 963, 964, or 965 with industry codes 927 or 937 were included as police officers, with the exception of bailiffs. For Rhode Island, decedents assigned occupation codes 963 or 964 with industry codes 927 or 937 were included. Code 965 was excluded from the Rhode Island police officer definition because sheriffs in Rhode Island perform primarily administrative, rather than police, functions (personal communication with Mr. Ronald Andersen, Sheriff of Providence County, Rhode Island, 1987).

Nonspecific industry statements on the death certificate, such as "law enforcement" and "public safety" were assigned code 937. Federal government police (such as FBI agents and civilian police on military bases) and police, detectives, etc, who worked for private industry were not included as police officers for this study, because their duties and working conditions differ somewhat from those of municipal and state police officers.

The relationship between the occupation of police officer and IHD (ICDA codes 410–414) was examined using the case-control approach. In addition to IHD as a whole, two subclassifications—AMI (ICDA code 410) and other ischemic heart disease (OHID) (ICDA codes 411–414) (primarily chronic ischemic heart disease)—were examined.

In the case-control analyses, all non-circulatory disease causes of death (all causes except ICDA codes 390–458) were included in the control group. Craftsmen and kindred workers (occupation codes 401–580), a group similar to police officers in social status,[7,8] were used as the nonexposed comparison group.

Separate case-control analyses were performed for Rhode Island and Utah. The case and control groups were compared with respect to the frequency of decedents having a usual occupation of police officer, adjusting for year of death (1968 to 1973 and 1974 to 1978) and age at death (5-year age groups). Summary odds ratio (OR) estimators and χ^2 significance tests were calculated using the procedures developed by Mantel and Haenszel.[9] Test-based 95% confidence intervals (CI) were calculated by the procedure of Miettinen.[10]

Only white men were included in the analyses. There were no female police officer decedents, and only one nonwhite male police officer decedent, in Rhode Island. In Utah there were four women and one nonwhite man.

To test for the possibility of unanticipated biases explaining the results, the same case-control analyses were performed for firefighters, a group for which one might expect similar biases. Included as firefighters for this study were decedents assigned occupation code 961 with industry code 927 or 937.

Results

The results of the case-control analyses for police officers are shown in Table 1. In Rhode Island, the odds ratio for IHD was elevated only among police officers less than 65 years of age (OR = 1.7; CI = 1.2, 2.5). This odds ratio elevation was due to a high odds ratio for AMI for this age group (OR = 2.1; CI = 1.4, 3.1). The odds ratio for OIHD in the <65 yr age group was 1.2 (CI = 0.7, 2.1).

In Utah, the odds ratio for IHD among police officers was elevated in both the <65 yr age group (OR = 1.6; CI = 0.9, 2.9) and the ≥65 yr age group (OR = 1.6; CI = 1.1, 2.4). As in Rhode Island, the odds ratio for AMI in Utah (OR = 1.8; CI = 1.2, 2.6) was higher than the odds ratio for OIHD (OR = 1.4; CI = 0.9, 2.2). However, in Utah the odds ratio for OIHD was elevated in the ≥65 yr age group (OR = 1.6; CI = 1.0, 2.6). Also similar to Rhode Island, the odds ratio for AMI in Utah was higher in the <65 yr age group (OR = 2.1; CI = 1.2, 3.8) than in the ≥65 yr age group (OR = 1.6; CI = 1.0, 2.5). The odds ratio for AMI in the ≥65 yr age group was elevated in Utah, in contrast to the low odds ratio for AMI in this age group in Rhode Island.

The risk of AMI among police officers as a function of age at death is examined in more detail in Table 2. In both Rhode Island and Utah, the odds ratio was elevated in the 16–54 yr age group, peaked at ages 55–64 yr, and then declined in the older age groups.

In contrast to police officers, firefighters did not exhibit an elevated IHD risk. For both IHD and its subcategories, the odds ratios for the total age range were unity in Rhode Island and below unity in Utah. The analyses by age at death were unremarkable.

TABLE 1
Numbers of Deaths, Summary Odds Ratios, and 95% Confidence Intervals for Ischemic Heart Disease and its Subcategories by Age at Death Among Police Officers, 1968 to 1978

Age at Death, yr	Type of IHD		Non-circulatory Causes of Death		OR (CI)
	Police	Craftsmen	Police	Craftsmen	
Rhode Island					
All IHD					
<65	73	1,461	56	1,980	1.7 (1.2, 2.5)
≥65	101	3,872	92	3,324	1.0 (0.7, 1.3)
Total	174	5,333	148	5,304	1.2 (1.0, 1.5)
AMI					
<65	54	916	56	1,980	2.1 (1.4, 3.1)
≥65	47	1,788	92	3,324	0.9 (0.7, 1.3)
Total	101	2,704	148	5,304	1.3 (1.0, 1.7)
OIHD					
<65	19	545	56	1,980	1.2 (0.7, 2.1)
≥65	54	2,084	92	3,324	1.0 (0.7, 1.4)
Total	73	2,629	148	5,304	1.1 (0.8, 1.4)
Utah					
All IHD					
<65	22	965	43	2,174	1.6 (0.9, 2.9)
≥65	56	1,933	43	2,375	1.6 (1.1, 2.4)
Total	78	2,898	86	4,549	1.6 (1.2, 2.2)
AMI					
<65	21	700	43	2,174	2.1 (1.2, 3.8)
≥65	29	1,014	43	2,375	1.6 (1.0, 2.5)
Total	50	1,714	86	4,549	1.8 (1.2, 2.6)
OIHD					
<65	1*	265	43	2,174	0.3 (0.1, 1.9)
≥65	27	919	43	2,375	1.6 (1.0, 2.6)
Total	28	1,184	86	4,549	1.4 (0.9, 2.2)

* This result should be interpreted with caution because of the small number.

TABLE 2
Numbers of Deaths, Summary Odds Ratios, and 95% Confidence Intervals for Acute Myocardial Infarction by Age at Death Among Police Officers, 1968 to 1978

Age at Death, yr	AMI		Non-circulatory Causes of Death		OR (CI)
	Police	Craftsmen	Police	Craftsmen	
Rhode Island					
16–54	16	338	29	949	1.5 (0.8, 2.9)
55–64	38	578	27	1,031	2.5 (1.6, 4.1)
65–74	23	849	43	1,499	0.9 (0.6, 1.5)
≥75	24	939	49	1,825	0.9 (0.6, 1.5)
Utah					
16–54	8	249	31	1,230	1.9 (0.8, 4.6)
55–64	13	451	12	944	2.3 (1.1, 5.0)
65–74	17	532	21	1,155	1.7 (0.9, 3.3)
≥75	12	482	22	1,220	1.4 (0.7, 2.8)

Discussion

These results are consistent with other studies that have found an elevated risk for IHD (both mortality and morbidity) among police officers.[11–22] In addition, the present results, particularly those from Rhode Island, suggest that the elevated IHD mortality risk for police officers is primarily due to an elevated risk for AMI mortality.

To our knowledge, only two other studies have examined the risk of AMI in police officers.[23,24] In neither of these studies was an elevated risk observed. However, the power of one study was low.[23] The other study examined a group of police officers and firefighters as a whole; police officer-specific results were not presented.[24] In both studies, relatively young, initially healthy subjects were observed for a limited period (10 years[23] and 4.8 years[24], respectively). Thus selection biases may explain the negative findings in these studies.

In Rhode Island, the elevated odds ratios for IHD and AMI were restricted to the <65 yr age group. In Utah, the risk for AMI was higher in the <65 yr age group than in the ≥65 yr age group. Other studies that have examined the risk of IHD mortality among police officers by age have generally found this pattern of higher risk in the younger age range.[12,13,15,22]

A New Jersey study found a significantly elevated PMR for IHD among working police officers, but not among retired police officers.[21] In the present study, there is no information as to which decedents were active workers at the time of death. Many police officers retire before age 65, so we cannot assume that decedents in the <65 yr age group died when active workers.

Nevertheless, the pattern of increasing risk for AMI to age 55–64 yr (Table 2) followed by decreased risk at older ages suggests a risk factor the effect of which increases with length of exposure, and then decreases when exposure ceases at retirement. This risk factor may be particularly strong for mortality from AMI. Alternatively, those police officers who are exposed to the risk factor and/or who are susceptible to its effects may die prematurely from IHD (AMI), leaving behind surviving police officers who are at lesser risk because they were not exposed and/or they were less susceptible.

Psychologic stress is a likely risk factor. Police work is thought to be a high-stress occupation,[25,26] and there is a body of evidence linking stress with IHD.[27] In addition, traffic police officers and police riding in patrol cars may be exposed to carbon monoxide[28–30] from automobile exhaust, although the exposure may not be great.[29,30] Obesity and physical inactivity due to sedentary desk jobs or sitting in patrol cars may be additional risk factors.[31]

In Rhode Island (since 1961), but not in Utah, the surviving dependents of active and retired police officers and firefighters who die from heart disease automatically receive compensation (General Laws of the State of Rhode Island, Title 45, Chapter 19–12). This could create a bias toward the reporting of heart disease on the death certificates of police officer and firefighter decedents in Rhode Island. That no excess IHD was observed among Rhode Island firefighters, however, argues against the existence of this bias for police officers.

The low odds ratios for IHD, AMI, and OIHD among firefighters in both Rhode Island and Utah suggest that the results for police officers probably cannot be explained by other, unsuspected biases, as one might expect similar biases to be operating for these two occupational groups.

If police officers smoked more than craftsmen, part or all of the excess IHD among police officers could be attributed to smoking. In both Rhode Island and Utah, the PMR for lung cancer among police officers was below unity (R. Dubrow et al, unpublished results 1986), suggesting that police officers did not have a high smoking rate compared with the population as a whole. Data from the National Health Interview Survey for 1978 to 1980 indicate approximately the same percentage of current smokers among police officers and craftsmen.[32]

Due to the relatively small size of this study and the limitations of death certificate data,[33] this should be considered an exploratory study, requiring further follow-up. In particular, the suggested link between work as a police officer and AMI mortality should be pursued.

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References

1. Castelli WP: Epidemiology of coronary heart disease: The Framingham study. *Am J Med* 1984;76:4–12.

2. Goldhaber SZ: Cardiovascular effects of potential occupational hazards. *J Am Coll Cardiol* 1983;2:1210–1215.

3. Stokes J, Kannel WB, Wolf PA, et al: The relative importance of selected risk factors for various manifestations of cardiovascular disease among men and women from 35 to 64 years old: 30 years of follow-up in the Framingham study. *Circulation* 1987;75(suppl V):V65–V73.

4. Epstein SE, Palmeri ST: Mechanisms contributing to precipitation of unstable angina and acute myocardial infarction: implications regarding therapy. *Am J Cardiol* 1984;54:1245–1252.

5. Kannel WB, Thomas HE: Sudden coronary death: The Framingham study. *Ann N Y Acad Sci* 1982;382:3–21.

6. US Bureau of the Census: *1970 Census of Population Alphabetical Index of Industries and Occupations.* Washington, DC, US Government Printing Office, 1971.

7. Treiman DJ: *Occupational Prestige in Comparative Perspective.* New York, Academic Press, 1977, pp 306–315.

8. Duncan O: A socioeconomic index for all occupations, in Reiss AJ (ed): *Occupations and Social Status.* New York, Free Press, 1961, pp 109–138.

9. Mantel N, Haenszel W: Statistical aspects of the analysis of data from retrospective studies of disease. *JNCI* 1959;22:719–748.

10. Miettinen O: Estimability and estimation in case-referent studies. *Am J Epidemiol* 1976;103:226–235.

11. Guralnick L: *Mortality by Occupation and Cause of Death Among Men 20 to 64 Years of Age: United States, 1950.* Washington, DC, Public Health Service (Vital Statistics-Special Reports 53, No. 3), 1963.

12. Milham S: *Occupational Mortality in Washington State 1950–1979.* Cincinnati, National Institute for Occupational Safety and Health, DHHS [NIOSH] Publication No. 83-116, 1983.

13. Petersen GR, Milham S: *Occupational Mortality in the State of California 1959–1961.* Cincinnati, National Institute for Occupational Safety and Health, DHEW [NIOSH] Publication No. 80-104, 1980.

14. Registrar General: *Decennial Supplement, England and Wales, 1961: Occupational Mortality Tables.* London, Her Majesty's Stationery Office, 1971.

15. Registrar General: *Occupational Mortality, Decennial Supplement for England and Wales, 1970–1972.* London, Her Majesty's Stationery Office, 1978.

16. MacCubbin PA, Herzfeld PM, Therriault GD: *Mortality in New York State, 1980–1982: a Report by Occupation and Industry.* Albany, New York State Department of Health, 1986.

17. Kendrick M, Fuentes R: *Occupational Characteristics of Disabled Workers, by Disabling Condition—Disability Insurance Benefit Awards Made in 1959–1962 to Men Under Age 65.* Washington, DC, US Government Printing Office, Public Health Service Publication No. 1531, 1967.

18. Fischbach TJ, Dacey EW, Sestito JP, et al: *Occupational Characteristics of Disabled Workers 1975–1976: Analysis of Social Security Disability Benefit Allowances to Workers During 1975–1976.* Cincinnati, National Institute for Occupational Safety and Health, DHHS [NIOSH]Publication No. 86-106, 1986.

19. Walrath J, Rogot E, Murray J, Blair A: *Mortality Patterns Among U.S. Veterans by Occupation and Smoking Status.* Bethesda, National Institutes of Health, NIH Publication No. 85-2756, 1985.

20. Sardinas A, Miller JW, Hansen H: Ischemic heart disease mortality of firemen and policemen. *Am J Public Health* 1986;76:1140–1141.

21. Feuer E, Rosenman K: Mortality in police and firefighters in New Jersey. *Am J Ind Med* 1986;9:517–527.

22. Vena JE, Violanti JM, Marshall J et al: Mortality of a municipal worker cohort: III, Police officers. *Am J Ind Med* 1986;10:383–397.

23. Sparrow D, Thomas HE, Weiss ST: Coronary heart disease in police officers participating in the Normative Aging Study. *Am J Epidemiol* 1983;118:508–513.

24. Peters RK, Cady LD, Bischoff DP, et al: Physical fitness and subsequent myocardial infarction in healthy workers. *JAMA* 1983;249:3052–3056.

25. Kroes WH, Margolis BL, Hurrell JJ: Job stress in policemen. *J Police Sci Admin* 1974;2:145–155.

26. Cooper CL, Davidson MJ, Robinson P: Stress in the police service. *J Occup Med* 1982;24:30–36.

27. Dorian B, Taylor CB: Stress factors in the development of coronary artery disease. *J Occup Med* 1984;26:747–756.

28. Aronow WS, Harris CN, Isbell MW: Effect of freeway travel on angina pectoris. *Ann Intern Med* 1972;77:669–676.

29. Chovin P: Carbon monoxide: Analysis of exhaust gas investigations in Paris. *Environ Res* 1967;1:198–216.

30. DeBruin A: Carboxyhemoglobin levels due to traffic exhaust. *Arch Environ Health* 1967;15:384–389.

31. Williams MA, Petratis MM, Baechle TR, et al: Frequency of physical activity, exercise capacity, and atherosclerotic heart disease risk factors in male police officers. *J Occup Med* 1987;29:596–600.

32. Brackbill R, Frazier T, Shilling S: Smoking characteristics of US workers 1978–1980. *Am J Ind Med* 1988;13:5–41.

33. Dubrow R, Sestito JP, Lalich NR et al: Death certificate-based occupational mortality surveillance in the United States. *Am J Ind Med* 1987;11:329–342.

How To Get a Good Night's Sleep

To ensure the soundest sleep night after night—whether you are afflicted by a sleep disorder or not—Dr Martin Cohn, chief of the Sleep Disorders Center at Mt Sinai Medical Center in Miami Beach, Florida, suggests adopting the following habits:

- Wake up at the same time each morning, even on weekends, to establish a natural body rhythm; don't nap during the day.
- Have a light snack at bed time, especially if you eat an early dinner. Or drink some warm milk; it contains a natural chemical called tryptophan that induces drowsiness.
- If you can't sleep, get out of bed and go into another room until you're sleepy. In this way, you'll avoid associating the bedroom with sleeplessness.
- If you're bothered by noises or lights, consider using earplugs, room darkening shades, or eyeshades.
- Cut back on alcohol consumption and smoking, both of which can cause you to wake up in the middle of the night.
- Exercise regularly but not before bedtime.

—From "Vital Signs" in *McCall's*, 1988;CXV(9):75.