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STUDY OF MYOCARDIAL INFARCTION

AT WASHINGTON WORKS PLANT

This study was conducted to evaluate the incidence of cases of myocardial infarction among male wage and salary roll employees at the Washington Works Plant from 1956 to 1973. Dr. Y. I. Power, Plant Physician, requested the investigation because some workers had complained that the occurrence of heart attacks among employees seemed excessive.

DESIGN AND METHODS

A computer search of the morbidity files in Wilmington produced a list of cases for this retrospective study. A case is defined as any male employee who suffered a first myocardial infarction (M.I.) between January 1, 1956, and December 31, 1973. This definition includes persons who recovered from an acute M.I. and those who died suddenly from coronary heart disease. Persons who had left work for any reason were considered potential propositions during only those years in the study period when they were active employees. Females were excluded from the study, as they represent a group too small in size for statistical analysis.

Additional data concerning plant population statistics and occupational profiles for each case were obtained from records at Washington Works.

Sixty-one cases of M.I. were observed during the eighteen-year period. A breakdown by age categorization within three-year periods for salary roll and for wage roll men is presented in Table I.

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Age-specific Du Pont Company rates for male wage roll and salaried personnel were used to compute the expected number of M.I.'s at Washington Works. Again, three-year time periods were selected for this determination. It would not have been sufficient to have referred to the 1973 figures, nor to have averaged or otherwise aggregated the rates over the eighteen years, because a trend toward lower incidence in the Du Pont Company has occurred in recent years. The Company rates are shown in Table II. The observed number of myocardial infarctions at Washington Works and the number of cases predicted according to Company statistics are presented in Table III for wage roll and for salary roll employees.

ANALYSIS

No excess incidence of M.I. is evident among the male wage roll employees. The expected number of M.I.'s is 34.0; 32 were observed. One notices that the number of cases has been increasing over the years at Washington Works. One suggested explanation is that with an increasing percentage of employees over the age of fifty, both at Washington Works Plant and in the Company (Table IV), more M.I.'s are to be expected.

Among salaried employees, the observed incidence of myocardial infarction is significantly higher than the expected number, under the assumption that cases follow a Poisson distribution: 29 M.I.'s were observed; 21.5 is the expected number ($P \approx .06$). The high overall incidence is largely the result of elevated rates in recent years. In the period from 1971 to 1973, the difference between observed and predicted numbers is great:

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12 observed cases versus 5.3 expected cases ($P = 0.008$) whereas in the preceeding years no differences between observed and expected numbers were significant. ($P > .10$ for all comparisons).

Further investigation of occupation reveals that the high frequency of M.I. cases among salaried employees is seen largely in foremen. Twenty of the twenty-nine cases occurred among the population of foremen at Washington Works: 8 were mechanical foremen, 9 were production foremen, 2 were laboratory foremen, and 1 was a yard and transportation foreman. Approximately thirty-five percent of the salaried men at the plant are foremen. Since the age distribution of foremen is comparable to that of all salaried employees at Washington Works, one would expect that only 10 of the observed M.I.'s would present in this occupational class (35% of 29), compared to the 20 which occurred among foremen.

The foremen studied range in age at onset of the attack from 35 to 65 years. Both the mean and the median number of years of experience as foremen prior to M.I. is 9.0. The range is 1 week to 25 years.

Patrolmen, a group representing three percent of the Washington Works population, also showed a somewhat elevated incidence of M.I. Four cases were observed among patrolmen, whereas the expected number is 1.4 (3% of 29). The age at onset for these patrolmen, however, ranges from 55-59 years; this is older than the median age at onset for the entire group, which is about 50 years. This consideration explains the increased incidence among patrolmen. Distribution of M.I. cases among employee work classifications is presented in Table V.

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: SUMMARY

This study examines incidence of myocardial infarction among male employees at Washington Works over an eighteen-year period. Using Du Pont Company rates as the referrent, it was found that no excess of M.I. cases occurred among wage roll persons, whereas among salaried men, elevated morbidity rates obtain. The target group among salaried employees is foremen. Increased incidence in this group cannot be explained by their age distribution. One asks, then, if some aspect of the work routine is a causal link in the development of coronary heart disease, or if some personal characteristic which predisposes one to become a foreman is a risk indicator for M.I. As a result of the findings of this study, the Biostatistics Group in Wilmington will explore the possibility of a Company-wide investigation of morbidity among foremen.

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TABLE I
AGE DISTRIBUTION OF M.I. CASES BY THREE-YEAR
PERIODS AT WASHINGTON WORKS, 1956-1973

Age	Male Wage (Number of Employees)						Total
	<u>1956-58</u>	<u>1959-61</u>	<u>1962-64</u>	<u>1965-67</u>	<u>1968-70</u>	<u>1971-73</u>	
20							0
20-24					1		1
25-29							0
30-34			2				2
35-39		2			3	1	6
40-44		2	1				3
45-49		1	1	2	3	1	8
50-54	1	1		3	1		6
55-59				1		3	4
60-64						2	2
Total	1	6	4	6	8	7	32

Age	Male Salary (Number of Employees)						Total
	<u>1956-58</u>	<u>1959-61</u>	<u>1962-64</u>	<u>1965-67</u>	<u>1968-70</u>	<u>1971-73</u>	
20							0
20-24							0
25-29							0
30-34			1				1
35-39			1				1
40-44					1	2	3
45-49		3			2	1	6
50-54		1	1	2	1	2	7
55-59		1		1	1	7	10
60-64				1			1
Total	0	5	3	4	5	12	29

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TABLE II

Age-Specific Du Pont Company Rates,
Per 100,000, of MI Cases

WAGE - MEN

Age	1956-58	1959-61	1962-64	1965-67	1968-70	1971-73
20	0.0	0.0	0.0	0.0	0.0	0.0
20-24	0.0	0.0	0.0	5.1	12.4	0.0
25-29	4.0	0.0	6.0	4.2	11.7	4.5
30-34	18.6	21.3	34.4	10.6	15.8	0.0
35-39	88.7	117.7	114.6	55.8	111.8	86.2
40-44	178.2	282.7	254.9	191.2	242.0	183.6
45-49	484.7	384.0	358.4	385.4	372.9	422.5
50-54	707.9	812.1	630.7	674.4	565.3	648.2
55-59	883.3	962.5	713.8	895.9	919.6	804.4
60-64	940.8	910.3	857.4	989.7	1,064.9	1,169.8
*TOTAL	280	357	259	267	275	271

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SALARY - MEN

Age	1956-58	1959-61	1962-64	1965-67	1968-70	1971-73
20	0.0	0.0	0.0	0.0	0.0	0.0
20-24	0.0	0.0	0.0	0.0	0.0	0.0
25-29	0.0	0.0	0.0	0.0	7.0	0.0
30-34	6.2	13.8	56.4	8.3	7.6	20.5
35-39	57.9	84.0	68.8	119.9	43.5	64.9
40-44	247.2	184.4	237.7	175.2	206.4	180.0
45-49	458.7	451.7	450.7	342.7	312.4	343.4
50-54	703.9	683.1	552.3	645.5	459.9	476.2
55-59	1,001.0	1,007.1	936.7	849.8	776.5	707.0
60-64	1,327.9	903.3	1,165.6	1,024.2	1,141.0	972.5
*TOTAL	354	330	331	303	271	215

*Age-adjusted rate

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TABLE III

OBSERVED NUMBER OF M.I. CASES AT WASHINGTON
WORKS AND EXPECTED NUMBER OF M.I. CASES,
BASED ON DU PONT COMPANY MORBIDITY

		Male Wage						Total
		<u>1956-58</u>	<u>1959-61</u>	<u>1962-64</u>	<u>1965-67</u>	<u>1968-70</u>	<u>1971-73</u>	
Observed		1	6	4	6	8	7	32
Expected		2.2	3.8	4.9	6.0	8.2	8.9	34.

		Male Salary						Total
		<u>1956-58</u>	<u>1959-61</u>	<u>1962-64</u>	<u>1965-67</u>	<u>1968-70</u>	<u>1971-73</u>	
Observed		0	5	3	4	5	12	29
Expected		1.5	2.5	3.5	3.9	4.8	5.3	21.5

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TABLE IV

Age Categorization of Male Employees at
Du Pont Company and Washington Works, 1956-1973

DU PONT COMPANY
WAGE AND SALARY COMBINED*

Age	1956-58	1959-61	1962-64	1965-67	1968-70	1971-73
< 50	203,712	181,142	186,413	205,110	197,957	183,441
≥ 50	44,287	49,733	58,954	67,960	72,259	74,020
% ≥ 50	18%	22%	24%	25%	27%	29%

WASHINGTON WORKS
WAGE AND SALARY COMBINED*

Age	1956-58	1959-61	1962-64	1965-67	1968-70	1971-73
< 50	3,136	4,421	4,712	5,528	6,370	6,031
≥ 50	151	322	526	744	1,000	1,225
% ≥ 50	4%	7%	10%	12%	14%	17%

*Each number represents the cumulative mid-year population for the three-year period.

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TABLE V

OBSERVED NUMBER OF M.I. CASES BY OCCUPATION
AND EXPECTED NUMBER OF M.I. CASES, BASED ON
OCCUPATIONAL DISTRIBUTION AT WASHINGTON
WORKS, MALE SALARIED EMPLOYEES

<u>OCCUPATION</u>	<u>% OF SALARIED EMPLOYEES AT WASHINGTON WORKS</u>	<u>OBSERVED NUMBER OF M.I.'S</u>	<u>EXPECTED NUMBER OF M.I.'S*</u>
Foremen	35%	20	10.2
Supervision through Management	23%	3	6.7
Specialists	2%	1	1.4
Analysts, Accountants	3%	0	.9
Engineers	22%	0	6.4
Clerical	10%	0	2.9
Patrolmen	3%	4	.9
Draftsmen	2%	1	1.4
TOTAL		<u>29</u>	

*expected number = % x 29

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