

A Retrospective Cohort Study of Disability Among Chemists

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This retrospective cohort study examines disability among 3,686 men and 75 women who were employed as chemists in 1959 and who were followed through 1977. Overall, the chemists experienced fewer absences of eight or more consecutive days than expected on the basis of the experience of other salaried employees of the chemical company. Among the men, fewer claims than expected were observed for absences due to benign and unspecified neoplasia, heart disease, and peptic ulcer, and to diseases of the urinary system, bones and joints, and skin. Also, the chemists had lower than expected incidence rates of first myocardial infarction (90 observed, 149.8 expected). The deficits may be attributable to exposure misclassification or to confounding by smoking or socioeconomic status. A slight excess was seen for absences due to mental disorders.

In response to reports of excess cancer mortality among chemists,¹⁻⁶ a retrospective cohort study of chemists employed by Du Pont was undertaken.⁹ In addition to mortality and cancer incidence data, the investigation yielded information regarding nonmalignant, nonfatal illnesses. These diseases may also be related to occupational chemical exposures.¹⁰

This paper compares the frequency of illnesses resulting in disability of eight days or more among chemists and among other salaried employees of E. I. du Pont de Nemours and Company, Inc.

Materials and Methods

The populations studied and the methods of investigation are identical to those described in an associated report, "A Retrospective Cohort Study of Mortality and Cancer Incidence Among Chemists."¹¹

Disability Frequency. — Disability was ascertained by review of the Medical Division accident and health insur-

ance (AHI) claim file. Under the group insurance plan, claims are submitted for benefits for nonoccupational injuries and for illnesses that result in eight or more consecutive days of disability. To enroll in the plan, employees must have at least six months of service and must pay a monthly premium. The participation rate among eligible employees is about 97%. Coverage ceases after employee termination from Du Pont. AHI claims may not be submitted for injuries or illnesses currently acknowledged to be occupationally related, which are covered by the Workmen's Compensation Insurance Program. The AHI plan has been described in detail elsewhere.¹²

The AHI claims contain the diagnosis for the illness, the number of days of disability, the treatment given, and some employee demographic data. The diagnosis, certified by the attending physician, has been coded according to the *International Classification of Diseases, Adapted for Use in the United States*.^{13, 14} The Seventh Revision was used from 1964 through 1968, and the Eighth Revision from 1969 through 1977. The claims of the study subjects were identified by matching on Social Security number and name.

For all diseases combined and for 46 diagnostic categories two outcomes were investigated: number of claims and average number of days of disability per claim. The estimated expected frequency of claims was generated by multiplying the nonchemist age- and calendar year-specific rates by the appropriate number of chemist person-years and summing over the strata. Person-years were accumulated from January 1, 1964, to termination of Du Pont employment, or, if earlier, to the close of the observation period, December 31, 1977. The person-years continue to accrue after submission of the first claim because the subjects can have repeated absences due to one or several illnesses. The expected average number of days per claim was obtained by dividing the expected number of days of disability by the expected number of claims. Ratios (O/Es) were calculated by dividing the observed numbers by the expected numbers and multiplying by 100.

The effects of age and decade hired and of usual company department group were evaluated. For each value of the factors, the expected number was generated by the experience of the nonchemists with the same value for

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Table 1. — Observed and Expected Frequency of Disability* by Cause Among Male Chemists, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency			Average Days Per Claim		
	Obs	Exp	O/E‡	Obs	Exp	O/E
Total	1,989	2,939.5	68	34.1	35.8	95
Infective and parasitic diseases	83	85.0	98	20.0	27.6	72
Malignant neoplasia	72	99.6	72	73.4	78.0	94
Neoplasia, benign and nature NOS§	18	36.4	49	21.8	25.3	86
Mental disorders	65	57.7	113	51.7	49.2	105
Diseases of the nervous system and sense organs	102	140.7	72	38.4	32.3	119
Diseases of the cardiovascular system, except heart disease	182	251.1	72	31.8	36.6	87
Diseases of the heart	158	274.7	58	69.0	73.2	94
Infections of the respiratory system	223	324.2	69	17.8	17.0	104
Other diseases of the respiratory system	63	84.4	75	23.2	23.7	98
Peptic ulcer	53	98.1	54	32.7	30.2	109
Appendicitis	35	50.6	69	25.0	28.2	89
Hernia of the abdominal cavity	213	243.9	87	27.8	31.3	89
Other disease of the digestive system	172	244.4	70	33.4	32.1	104
Diseases of the urinary system	68	125.1	54	24.8	26.9	92
Diseases of the genital organs	70	101.1	69	28.2	28.4	99
Arthritis and rheumatism	37	49.3	75	44.4	39.6	112
Diseases of bones and joints	171	351.2	49	34.0	35.8	95
Accidents, poisonings, and violence	103	144.9	71	33.5	34.2	98
Diseases of the skin	16	52.7	30	24.3	20.2	120
Residual	85	124.4				

*Disability of eight or more consecutive days

†See appendix A for code from International Classification of Diseases, Adapted, Eighth Revision¹⁴

‡O/E = (observed/expected) x 100

§NOS = Not otherwise specified

the factor. The authors also examined the effects of alcoholism.¹¹ The diagnostic criteria for alcoholism are given in the associated report on mortality and cancer incidence.⁹

Myocardial Infarction Incidence. — Since 1956, the Medical Division has maintained a file with data on all employees who were diagnosed with a first acute myocardial infarction or who died suddenly from coronary heart disease. The Division receives notification of these events by two methods: through disability claims submitted under the accident and health insurance plan described previously and through claims for benefits from a group life insurance plan. All employees with at least one year of service are enrolled in the life insurance plan.

The file is restricted to records of active employees whose disease was confirmed by electrocardiograms, laboratory findings, autopsy records, or clinical histories. Persons whose disease was limited to angina pectoris, coronary insufficiency, or chronic myocardial ischemia are excluded. The diagnostic criteria were not strictly defined, but have been dependent on the clinical acumen of the physicians at the Du Pont Medical Division. Although the criteria may have changed over time, there is no reason to suspect variation from the chemists to the nonchemists. The surveillance system covers the entire company and was established over 20 years prior to the initiation of this cohort study.

The file contains information on blood pressure and body weight obtained during annual physical examinations preceding the myocardial infarction and found in the employee medical records. A case is classified as hypertensive if, during the previous ten years, there were at least two successive annual readings of 150 mm Hg or more systolic, or 94 mm Hg or more diastolic. Subjects

are also classified by the percentage that the body weight exceeds the ideal weight during the year before the attack. The ideal weight is determined from the tables of desirable weights from the Metropolitan Life Insurance Company. The file has been described in detail in other studies.¹⁶ It was not feasible to retrieve the study subjects' medical records from the plants to obtain comparable risk factor data on the non-cases.

Cases among the study subjects were ascertained by review of the myocardial infarction file, matching on Social Security number and name. Using a computer program developed by Monson,¹⁷ the observed number of myocardial infarction cases diagnosed during the years 1964 to 1977 was compared to the estimated expected number based on the experience of the nonchemists. For this analysis, person-years accrued from January 1, 1964, to the earliest of three dates: date of first acute myocardial infarction, date of termination from Du Pont, or December 31, 1977. Standardized incidence ratios (SIRs) and 95% confidence intervals were calculated, assuming a Poisson distribution for the observed number of events.¹⁸ The effects of the following factors were investigated: age hired, decade hired, diagnosed alcoholism, and ever and usual department affiliation.

Results

Disability Frequency. — Table 1 presents the observed and expected frequencies of disability, by cause, for the male chemists. While actively employed at Du Pont, the 3,686 male chemists accrued 44,839.3 person-years of observation and filed 1,989 claims for benefits for non-occupational illnesses and injuries. Based on the experience of the nonchemist cohort, 2,939.5 claims were expected, yielding a ratio of 68. The observed average number of

**Table 2. — Observed and Expected Frequency of Disability* Due to Mental Disorders (ICDA 290-315)†
Among Male Chemists, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.**

	Claim Frequency			Average Days Per Claim		
	Obs	Exp	O/E‡	Obs	Exp	O/E
Total	65	57.7	113	51.7	49.2	105
Age hired						
16-19	6	5.2	115	69.3	52.1	133
20-24	22	19.3	114	47.6	38.9	122
25-29	24	20.0	120	54.8	47.3	116
30-64	13	14.6	89	44.6	47.2	94
Decade hired						
1920-1929	5	1.3	385	80.4	66.9	120
1930-1939	6	6.1	98	73.8	55.7	133
1940-1949	17	16.0	106	46.1	52.5	88
1950-1959	37	38.7	96	46.7	39.3	117
Usual department group						
Plastic resins and fibers	28	25.0	112	53.5	54.5	98
Basic chemicals and finishes	15	13.2	114	61.1	39.0	157
Petrochemicals	4	7.1	56	29.0	41.8	69
Elastomers	3	6.8	44	26.0	34.7	75
Research, development and engineering	12	3.8	316	53.9	48.6	111
Atomic energy	3	2.6	115	33.3	60.7	55

*Disability of eight or more consecutive days

†International Classification of Diseases, Adapted, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

days per claim was 34.1, as compared to 35.8 expected (O/E = 95).

Absences due to mental disorders are slightly more frequent among the chemists than expected (65 claims observed, 57.7 expected, O/E = 113; average number of days per claim was 51.7, 49.2 expected, O/E = 105). The O/Es appear excessive upon consideration of the overall ratio of 68 for claims due to all causes. Table 2 presents the frequency of claims due to mental disorders according to work history characteristics. The relative frequency of claims is elevated among chemists hired during the period 1920 to 1929 or before age 30. Chemists usually employed in research, development and engineering had a threefold increase in claims filed for disability due to mental disorders (12 observed, 3.8 expected, O/E = 316). Slight excesses also were seen in the following departments: plastic resins and fibers, basic chemicals and finishes, and atomic energy. Alcoholic chemists sub-

mitted more claims than expected for neuroses (11 observed, 2.6 expected, O/E = 421) and other mental disorders (19 observed, 16.5 expected, O/E = 115), compared to alcoholic nonchemists. Nonalcoholic chemists experienced 22 absences due to neuroses (27.6 expected, O/E = 80), and 13 absences due to other mental disorders (12.7 expected, O/E = 102).

Fewer claims than expected were submitted for absences due to benign and unspecified neoplasia, heart disease, and peptic ulcer, and to diseases of the urinary system, bones and joints, and skin.

The frequencies of all causes of disability among chemists and nonchemists were compared by department

Table 3. — Observed and Expected Frequency of Disability,* for Selected Causes, Among Male Chemists Usually Employed in Plastic Resins and Fibers, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency		
	Obs	Exp	O/E‡
Total	736	1,000.6	74
Other infective and parasitic diseases	12	9.7	124
Unspecified viral infections	12	8.0	150
Neuroses	17	11.8	144
Other diseases of the respiratory system, except tonsillectomy	27	25.3	107
Anal fissure and fistula	9	5.6	161
Synovitis and bursitis	9	7.0	129
Residual	650	933.2	—

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

Table 4. — Observed and Expected Frequency of Disability,* for Selected Causes, Among Male Chemists Usually Employed in Basic Chemicals and Finishes, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency		
	Obs	Exp	O/E‡
Total	612	723.9	85
Streptococcal sore throat	5	1.1	471
Unspecified viral infections	8	4.7	170
Other infective and parasitic diseases	12	9.2	130
Malignant neoplasia	29	26.8	108
Neuroses	6	4.1	148
Other diseases of the nervous system	43	30.4	141
Acute respiratory infection	17	14.0	121
Influenza	26	22.7	115
Hernia of the abdominal cavity	64	58.0	110
Other diseases of the urinary system	11	9.6	114
Arthritis and rheumatism	16	10.2	157
Residual	375	533.1	—

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

Table 5. — Observed and Expected Frequency of Disability,* for Selected Causes, Among Male Chemists Usually Employed in Petrochemicals, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency		
	Obs	Exp	O/E‡
Total	203	242.3	84
Pneumonia	9	4.9	184
Duodenal ulcer	6	4.2	142
Hernia of the abdominal cavity	26	22.8	114
Residual	162	210.4	—

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

group. Excesses are seen for several diagnostic categories and departments, but the ratios are based on small numbers of claims. For five departments, Tables 3 through 7 present illnesses whose O/Es are elevated, limiting mention to findings based on five or more claims and differences of at least one between the observed and expected numbers of claims. No notable excesses were seen in elastomers or in administration.

For all causes of disease, the nonalcoholic chemists filed 1,886 claims, while 2,831.6 were expected (O/E = 67). Among the identified alcoholic chemists, 103 claims were filed, as compared to 96.6 expected on the basis of the experience of the identified alcoholic nonchemists (O/E = 107). Elevated ratios were seen among the alcoholic chemists in several diagnostic categories, but only a few were based on five or more claims: mental disorders (i.e., alcoholism, depression, or neuroses); cardiovascular disease excluding heart disease; influenza; duodenal ulcer; and synovitis and bursitis (Table 8).

During the period 1964 to 1977, the female chemists accrued 769.2 person-years of observation and filed 54 claims (Table 9). On the basis of the experience of the female nonchemists, 73.4 claims were expected (O/E = 74). The average number of days per claim was 31.7,

Table 6. — Observed and Expected Frequency of Disability,* for Selected Causes, Among Male Chemists Usually Employed in Research, Development, and Engineering, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency		
	Obs	Exp	O/E‡
Total	164	192.8	85
Neuroses	5	1.7	302
Other mental disorders (alcoholism, depression)	7	2.1	327
Other diseases of the nervous system	10	8.3	121
Acute respiratory infection	5	3.9	127
Other diseases of the respiratory system, except tonsillectomy	7	5.5	126
Hernia of the abdominal cavity	19	17.1	111
Other diseases of the digestive tract	13	5.4	239
Other diseases of the genital organs	6	4.4	137
Other diseases of the bones and joints, except synovitis and bursitis	7	4.3	164
Residual	85	140.1	—

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

Table 7. — Observed and Expected Frequency of Disability,* for Selected Causes, Among Male Chemists Usually Employed in Atomic Energy, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency		
	Obs	Exp	O/E‡
Total	133	154.1	86
Acute respiratory infection	6	3.5	170
Pneumonia	6	4.6	130
Ulcer of the duodenum	7	3.6	195
Hernia of the abdominal cavity	15	13.6	110
Gallbladder disease	5	2.4	209
Hyperplasia of the prostate	5	1.0	483
Accidents, poisonings, and violence	11	7.0	156
Residual	78	35.7	—

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

slightly less than the expected average of 32.7 (O/E = 97). Slight excesses were seen in the numbers of claims due to infective and parasitic diseases and to malignant neoplasia. Two claims were submitted for absences due to neuroses, 0.6 were expected. Too few claims were submitted by the women to be analyzed in detail.

Myocardial Infarction Incidence. — While actively employed at Du Pont and prior to diagnosis of a first myocardial infarction, the 3,686 male chemists accrued 44,550.1 person-years of observation. Ninety men suffered their first myocardial infarction during the years 1964 to 1977. Based on the experience of the nonchemists, 149.8 myocardial infarctions were expected, yielding an SIR of 60 (95% confidence interval = 48-74). No excesses or trends are seen in the analysis of myocardial infarction, work history, and diagnosed alcoholism.

To investigate the effects of potential risk factors, data are needed from all subjects, regardless of disease status. The myocardial infarction file contains records of blood pressure and body weight for people with myocardial infarctions, but no comparable data are easily accessible for people without the disease. However, among men who developed a first myocardial infarction during the

Table 8. — Observed and Expected Frequency of Disability,* for Selected Causes, Among Male Chemists Identified as Alcoholic, Aged 20-64 Years, 1964-1977, Based on the Male Nonchemist Cohort.

Cause†	Claim Frequency		
	Obs	Exp	O/E‡
Total	103	96.6	107
Neuroses	11	2.6	421
Other mental disorders (alcoholism, depression)	19	16.5	115
Other diseases of cardiovascular system, excluding heart disease	7	3.7	188
Influenza	5	2.8	178
Ulcer of duodenum	5	2.5	198
Synovitis and bursitis	5	0.1	—
Residual	51	68.4	—

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

Table 9. — Observed and Expected Frequency of Disability* by Cause Among Female Chemists, Aged 20-64 Years, 1964-1977, Based on the Female Nonchemist Cohort.

Cause†	Claim Frequency			Average Days Per Claim		
	Obs.	Exp.	O/E†	Obs.	Exp.	O/E
Total	54	73.4	74	31.7	32.7	97
Infective and parasitic diseases	5	1.5	333	13.2	19.2	69
Malignant neoplasia	6	3.1	192	43.2	73.0	59
Neoplasia, benign and nature NOS§	9	9.1	99	36.7	39.4	93
Neuroses	2	0.6	—	37.0	55.4	—
Diseases of the nervous system and sense organs	1	2.2	45	100.0	35.4	283
Diseases of the cardiovascular system, except heart disease	4	4.4	91	17.8	29.0	61
Infections and other diseases of the respiratory system	10	11.6	86	22.5	20.4	110
Diseases of the digestive system	3	1.3	225	27.3	40.7	67
Diseases of the breast and genital organs	5	8.0	62	27.6	30.1	92
Diseases of bones and joints	3	4.0	75	12.3	25.8	48
Accidents, poisonings, and violence	3	4.4	69	81.3	36.6	222
Residual	3	23.2	—			

*Disability of eight or more consecutive days

†See Appendix A for code from ICDA, Eighth Revision¹⁴

‡O/E = (observed/expected) × 100

§NOS = Not otherwise specified

years 1964 to 1977, the chemists had a smaller proportion of cases with hypertension or obesity than the nonchemists. Smoking histories were not available for any study subjects, but the chemists' extremely low lung cancer incidence and mortality suggest low prevalence of smoking.⁹ No myocardial infarctions were diagnosed among the female chemists.

Discussion

This paper describes the frequency of disability among actively employed chemists. Associations between illness and department are presented. Overall, the chemists experienced fewer absences of eight or more consecutive days than expected on the basis of the experience of the nonchemist comparison group. Fewer claims than expected were submitted for absences due to benign and unspecified neoplasia, heart disease, and peptic ulcer, and to diseases of the urinary system, bones and joints, and skin. Mental disorders were responsible for more disability among the chemists than expected. The rates of absences attributed to neuroses, depression, alcoholism, and other diseases of the nervous system were greater among the chemists than among the nonchemists usually employed in plastic resins and fibers, basic chemicals and finishes, research, development and engineering, and atomic energy.

Some chemicals to which the Du Pont chemists may have been exposed have been associated with the development of neuroses, other mental disorders, and other nervous system disorders. For example, exposure to organic solvents can result in depression of the central nervous system, fatigue, mental depression, anorexia, irritability, inattentiveness, and irritation of the respiratory tract.¹⁹ Exposure to carbon disulfide has been associated with psychological and neuropathological effects; however, myocardial infarction incidence, also associated with carbon disulfide exposure,²⁰ was not elevated in the cohort. Tetraethyl lead, produced by Du Pont and included in basic chemicals and finishes, is associated with

neuroses, impaired psychological performance, and central nervous system damage.^{21, 22}

The excess of mental disorders is not consistent with Pell's earlier study²³ of Du Pont research personnel. The research group had lower incidence rates of illness due to mental disorders and neurological disorders than the other salaried personnel.

The other previous studies of chemists were mortality studies; therefore it is not possible to compare results with respect to nonfatal mental illness, but deaths due to suicide can be examined. The mortality study of this cohort revealed more deaths due to suicide than expected among male chemists no longer actively employed by Du Pont.⁹ Li et al.²⁴ reported a higher proportion of deaths due to suicide among American Chemical Society members dying before age 65. The chemists who died after 64 years of age were as likely to die as a result of suicide as were members of the general population. Chemists who died in Washington state between 1950 and 1971 had approximately twice the proportion of deaths due to suicides expected.² California chemists who died during the years 1956 to 1961 had a PMR of 248 for suicide (18 observed, 7 expected).³ The Registrar General's report⁶ on deaths in England and Wales during 1970 to 1972 also showed excess suicides among chemists. The Pell study²³ of research personnel showed fewer suicides than expected on the basis of U.S. general population mortality rates. Suicide is combined with accidents as a cause of death in the published reports on the Swedish chemistry graduates and the category had fewer deaths than expected.^{5, 25}

Chemists who are identified alcoholics have higher disability rates than alcoholic nonchemists for mental disorders, cardiovascular diseases excluding heart disease, influenza, duodenal ulcer, and synovitis and bursitis. Diagnosed alcoholics appear to lose the health advantage, relative to the nonchemists, of being chemists. There may be interactions between alcohol and chemical exposures, as described in the toxicological literature.²⁶ Many

chemicals induce hepatitis which in turn can alter alcohol metabolism. Conversely, alcoholic liver damage can alter metabolism of chemicals. The diagnoses mentioned earlier were also found to be excessive in a case-control study of absenteeism among alcoholics.²⁷

The combination of alcohol and occupational chemical exposures does not appear to adversely effect the mortality experience of the chemists. In this cohort, cirrhosis deaths were not more frequent than expected, compared to the experience of the nonchemists (5 observed, 5.7 expected).⁹ Deaths due to cirrhosis were less common than expected in American Chemical Society chemists dying under age 65.¹ More deaths than expected occurred in members over age 64 from cirrhosis of the liver. Milham² reported no excess in cirrhosis deaths among Washington chemists. None of the other published reports on chemists contained data on cirrhosis.

Chemists had a lower incidence rate for first myocardial infarction than nonchemists. Deficits in O/E's were seen for absences due to acute myocardial infarctions and other ischemic heart disease, but more standardized diagnostic criteria are needed to allow internal comparisons over time and for comparisons with other incidence studies.

Deficits in myocardial infarction mortality were observed in most of the previous chemist studies. Swedish chemistry graduates,⁵ chemists dying in Washington state,² professional and technical staff at Dow Chemical Company,²⁸ and research personnel at Du Pont²³ experienced fewer deaths due to cardiovascular disease than expected. However, the research personnel had slightly higher rates of absences due to heart diseases and other cardiovascular disease than expected. Li et al.¹ reported a higher proportion of deaths due to diseases of the heart than expected. Chemists in the Guralnick report⁸ had approximately the same number of deaths due to coronary heart disease as expected.

The deficits in disability and myocardial infarction incidence may be attributable to confounding or to exposure misclassification. Potential confounding factors are socioeconomic status and smoking habits. Chemists are on the average more educated than nonchemists. They may have altered their dietary habits, which is a possible explanation for the decrease in the U.S. heart disease mortality.²⁹⁻³⁰ The Du Pont chemists may smoke less than the nonchemists,⁹ thereby reducing their risk for myocardial infarctions and many other causes of disability.

Exposure misclassification may be occurring. Some of the nonchemists at Du Pont sustain exposure to hazardous chemicals which may be obscuring risks associated with the occupation of chemist.

Summary

This paper describes disability among actively employed chemists. Associations between cause of illness and department group are presented. Overall, the chemist experienced fewer absences of eight or more consecutive days than expected on the basis of comparison with a nonchemist group. Fewer claims than expected were observed for absences due to benign and unspecified neoplasia, heart disease, and peptic ulcer, and to diseases of the urinary system, bones and joints, and skin. Also, the

chemists had lower than expected incidence rates of first myocardial infarction. A slight excess was seen among all chemists for absences due to mental disorders. The alcoholic chemists experienced higher disability rates than alcoholic nonchemists for absences due to all causes combined, and to mental disorders, cardiovascular disease excluding heart disease, influenza, duodenal ulcer, and synovitis and bursitis.

Stricter diagnostic criteria for myocardial infarction, data on potential confounding factors, and more detailed exposure histories are needed for further research on illness among chemists.

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Appendix A

Causes of Disability and Code from the International Classification of Diseases, Adapted, Eighth Revision.¹⁴

Cause*	ICDA Code
Infective and parasitic diseases	000-136
Streptococcal sore throat	034
Mumps	072
Unspecified viral infections	079
Other	000-136, except above
Malignant neoplasia	140-209
Neoplasia; benign and nature NOS†	210-239
Mental Disorders	290-315
Neuroses	300
Other	290-315, except 300
Diseases of the nervous system and sense organs	320-389
Neuralgia and neuritis	350-355
Other	320-389, except above
Diseases of the heart	390-429
Acute myocardial infarction	410
Other ischemic heart disease	411-414
Other	390-429, except above

Cause*	ICDA Code
Diseases of cardiovascular system, except heart disease	430-458
Cerebrovascular disease	430-438
Hemorrhoids	455
Other	440-458, except 455
Infections of the respiratory system	460-491
Acute respiratory infections	460-465
Influenza	470-474
Pneumonia	480-486
Bronchitis	490-491
Other diseases of the respiratory system	492-519
Tonsillectomy	500
Other	492-519, except 500
Peptic ulcer	531-533
Ulcer of stomach	531
Ulcer of duodenum	532
Ulcer, NOS†	533
Appendicitis	540-542
Hernia of abdominal cavity	550-553
Other diseases of the digestive system	520-577
Gastritis and duodenitis	535
Gastroenteritis and colitis	561
Anal fissure and fistula	565
Gall bladder disease	574-576
Other	520-577, except above
Diseases of the urinary system	580-599
Calculus of kidney and ureter	592
Other	580-599, except 592
Diseases of male genital organs	600-607
Hyperplasia of prostate	600
Prostatitis	601
Other	602-607
Diseases of breast and female genital organs	610-678
Diseases of the skin	680-709
Pilonidal cyst	685
Other	680-709, except 685
Arthritis and rheumatism	710-718
Diseases of bones and joints	720-738
Displacement of intervertebral disc	725
Affection of sacroiliac joint	726
Synovitis and bursitis	731
Other	720-738, except above
Accidents, poisonings, and violence	E800-E999

*Diagnostic categories were grouped by E. I. Du Pont Epidemiology Section for use in epidemiologic surveillance system

†NOS = Not otherwise specified