Exhibit 265

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Female Laundry and Dry Cleaning Workers in Wisconsin: A Mortality Analysis

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Abstract: The mortality patterns of 671 female laundry and dry cleaning workers for the period 1963-1977 were analyzed, using Wisconsin death certificate data. Results fail to show an overall increase in malignant neoplasms, but elevated risk was found for cancers of the kidney and genitals (unspecified), along with a smaller excess of bladder and skin cancer and lymphosarcoma. (*Am J Public Health* 1981; 71:305-307.)

Introduction

Blair, *et al,* reporting data on causes of death among laundry and dry cleaning workers in St. Louis, suggest an elevated cancer risk resulting from multiple exposures to various dry cleaning fluids, including tetrachloroethylene, carbon tetrachloride, trichloroethylene, and other petroleum solvents.[1] Tetrachloroethylene, which since 1950 has been the primary dry cleaning fluid in the United States, has been found to cause an increase in hepatocellular carcinomas in laboratory rats.[2] Human exposure can cause kidney and liver abnormalities, irritation of eyes and upper respiratory tract, together with symptoms associated with central nervous system depression—fatigue, nausea, drowsiness and memory impairment.[3] As part of an ongoing study of female occupational mortality in Wisconsin, we analyzed the death certificate records of 671 female laundry and dry cleaning workers for the period 1963-1977. The relative risks for 25 major causes of death were evaluated, comparing laundry and dry cleaning workers with other female workers. Dry cleaning workers, who are more likely to experience chemical exposures, could not be separated from laundry workers because they share the same occupational code.

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Materials and Methods

Of the 247,800 coded death certificate records obtained from the Wisconsin Bureau of Health Statistics, less than 1 per cent lacked an occupational statement. Consequently, the data represent an excellent population for the analysis of occupational mortality. Information on marital status, occupation, age at death, year of death, and underlying cause of death was abstracted for all white females 18 years and older. Non-white females made up less than 3 per cent of the total, and were therefore omitted for the sake of homogeneity. Approximately 160,000 records with occupation listed as housewife were omitted from the data file to minimize confounding factors arising from the comparison of employed individuals with those showing no history of employment. The final data file consisted of 66,230 death records. A program was written to conform the 7th and 8th revisions of the International Classification of Diseases to a single usable code, following which 671 records representing laundry and dry cleaning workers were identified. The age distribution of these workers cross classified with year of death is shown in Table 1.

The basic analysis consisted of testing for associations between occupation and cause of death by calculating cause-specific proportionate mortality ratios (PMRs) for 25 major causes of death. Mortality of laundry and dry cleaning workers was compared to that for all other working females during the same time period using the Mantel-Haenszel chi-square with one degree of freedom. Age at death and marital status were used as control variables by generating PMRs for specified levels of each. Appreciable changes in PMR could not be attributed to either, and the results are not reported here, nor are the death rates age adjusted.

Blair, *et al,* observed that laundry and dry cleaning workers are generally low paid, and that differences in mortality patterns may be due to differences in socioeconomic status.[1] Consequently, we compared laundry and dry cleaning workers with both the entire population of working females and with a population derived from other low wage occupations. This group consisted primarily of occupations listed under the categories of service workers and operatives (Census Codes 612-890) of the U.S. Census Classification Code.

TABLE 1—Distribution of Deaths by Age and Year 1963–77, for 671 Female Laundry and Dry Cleaning Workers from Wisconsin

Year of Death	Age of Death (years) 18–44	45–64	65+	Total
1963–65	4	37	70	111
1966–68	5	30	63	98
1969–71	6	41	100	147
1972–74	3	35	110	148
1975–77	3	30	134	167
TOTAL	21	173	477	671

Results and Discussion

The results, given in Table 2, show that elevated risk was found for cancers of the kidney and genitals (unspecified), along with smaller excesses of skin and bladder cancer. Elevated risk was also found for cancer of the cervix uteri, for ischemic heart disease, and for diabetes mellitus, but these effects declined using lower wage occupations as the control, with only diabetes remaining statistically significant. A reduction of risk for "other causes of death" was found, but it is likely that this result is associated with the elevated risks observed elsewhere. An important aspect of proportionate mortality analysis is that an excess of deaths due to one cause in a population of fixed size must be compensated by deficiencies elsewhere.

The presence of elevated PMRs for cancer of the kidney and bladder is interesting. Other work has suggested that primary cancers of the bladder, ureter and, pelvis are associated with each other.[5, 6] Human exposure to tetrachloroethylene is known to cause kidney impairment, but carcinogenic effects have not been found.[2] Cigarette smoking has been found to be associated with increased risk of renal and bladder cancer,[7, 8] and working women have been found to smoke more than non-working women.[9] However, when we used only working women as controls, we did not find higher levels of lung cancer among laundry and dry cleaning workers.

Our results differ from Blair, *et al,* in some important areas. We did not find elevated risk for "all malignant neo-

TABLE 2—Observed and Expected Deaths and Proportionate Mortality Ratios for Selected Causes of Death among Laundry and Dry Cleaning Workers, 1963–1977, Using All Occupations and Lower Wage Occupations as Controls.

Control			All Occupations		Lower Wage Occupations	
Cause of Death	ICD Codes (7th rev)	Observed Deaths	Expected Deaths	PMR	Expected Deaths	PMR
Infectious and Parasitic Disease	001–138	1	4.2	24	3.8	26
All Malignant Neoplasms	140–205	141	147.4	96	141.5	100
Stomach	151	2	5.9	34	7.0	29
Colon	153	21	20.4	103	19.1	110
Rectum	154	6	5.0	119	4.9	125
Liver and Biliary Passages	155–156	4	4.5	89	5.7	71
Pancreas	157	9	7.7	117	8.3	108
Lung	162	10	10.2	98	10.6	95
Breast	170	27	37.4	72	31.5	86
Cervix uteri	171	10	5.1	195*	7.1	141
Uterine corpus	172	4	5.1	77	4.5	89
Ovary	175	7	13.4	52	12.7	55
Genitals (unspecified)	176	4	0.8	495**	0.9	467**
Kidney	180	7	2.7	257*	2.8	253*
Bladder	181	5	2.6	189	2.6	190
Skin	190–191	4	1.9	207	1.5	263
Lymphosarcoma	200	6	3.4	179	3.4	175
Leukemia	204	4	6.0	67	5.0	81
Other Cancers	—	11	15.4	71	13.9	79
Diabetes Mellitus	260	25	14.1	177*	16.3	154*
Ischemic Heart Disease	420	233	206.4	113*	221.6	105
Other Cardiovascular Disease	400–468	156	150.9	103	147.5	106
All Pneumonia	490–493	15	16.3	92	14.1	106
Other Respiratory	470–527	6	7.2	83	6.5	92
Other Deaths	—	94	124.2	76**	120.4	78**

*$p \leq .05$
**$p \leq .01$
PMR = Observed/Expected × 100

plasms," nor for cancer of the liver. Both studies found elevated risk of cervical cancer. However, in our data the elevated risk declined when the comparison was made with low wage occupations, and failed to achieve statistical significance. This suggests that the elevated PMR for cervical cancer could be subject to confounding because of socioeconomic factors. We also found lower than expected deaths for leukemia, although a slight excess of lymphosarcoma was indicated. An association between chronic exposure to benzene and excess deaths caused by certain malignant lymphomas has been suggested in a recent study.[10] As Blair, *et al,* point out, benzene has had limited use in dry cleaning as a spot remover. While the present study does not provide confirmation for that of Blair, *et al,* it should be borne in mind that there are differences between our study design and theirs. Our sample is larger and more homogeneous, and we obtained a better matched control population using other working women from the same state of similar socioeconomic status. The absence of data regarding duration of employment together with the inability to distinguish between laundry and dry cleaning workers necessitates a cautious interpretation of the data. Furthermore, in other regions of the country non-white females constitute a larger proportion of laundry and dry cleaning workers, a group eliminated from our population.

Nevertheless, the present study does not absolve dry cleaning chemicals as risk causing agents. The significant elevations for cancer of the kidney and genitals, together with elevated risks for lymphosarcoma, skin and bladder cancer would rather suggest further studies, perhaps using death certificate data from other states which are now becoming increasingly available in machine readable form.

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