Parental Occupation and Wilms’ Tumor: Results of a Case-Control Study

Greta R. Bunin,2 Catharie C. Nass, Shira Kramer,3 and Anna T. Meadows

Children's Hospital of Philadelphia Division of Oncology, Department of Pediatrics, University of Pennsylvania, Philadelphia, Pennsylvania 19104 [G. R. B., S. K., A. T. M.], and School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, Maryland 21205 [C. C. N.]

ABSTRACT

Parental occupational exposures for Wilms’ tumor were investigated in a pair-matched case-control study. The timing of the exposures in relation to the child’s conception and birth was studied, as were the two forms of Wilms’ tumor: genetic (prezygotic origin) and nongenetic (postzygotic origin). Cases who were under 15 yr of age at diagnosis during 1970 to 1983 were identified through the registries of three main hospitals treating childhood cancer in the Greater Philadelphia area. Controls were selected by random digit dialing and were matched to cases on race, birth date, and telephone area code and exchange. Because of a low participation rate among blacks, results are reported only for the 88 white matched pairs whose parents participated in telephone interviews. Children whose fathers held jobs in a job cluster that consisted mostly of machinists and welders were at significantly increased risk. The increase was highest for preconception exposure (odds ratio = 5.3, P = 0.006). The effect of preconception exposure was higher for the 26 genetic cases than for the 42 nongenetic cases. The other 20 cases were excluded from the subgroup analyses for various reasons. Further analyses did not elucidate an exposure common to machinists and welders that might explain the findings.

INTRODUCTION

A number of studies have investigated the possible role of parental occupation in the development of cancer in children (1–8). The early age of occurrence of Wilms’ tumor suggests that prenatal factors, such as parental occupational exposures, might play an etiological role. As some Wilms’ tumors are believed to result from a mutational event in a parental germ cell prior to the child’s conception (9), preconception occupational exposures might affect the risk of these genetic cases. For nongenetic cases, the initiating carcinogenic event is most likely to occur during pregnancy, and occupational exposures might increase the risk of such events.

Previous studies have reported an increased risk of Wilms’ tumor associated with paternal occupational exposure to lead (5), hydrocarbons (5), ionizing radiation (6), and boron (7). Paternal employment as mechanic or machinist was associated with urinary tract cancers (8), most of which would be Wilms’ tumors. All of these studies used the father’s occupation at the time of the child’s birth or during the pregnancy but lacked data on preconception occupations.

The present study sought to replicate and extend earlier findings by investigating parental occupation in relation to timing of exposure and form of Wilms’ tumor.

MATERIALS AND METHODS

The methods are described in more detail in our report of the nonoccupational results of this study (10).

Received 8/6/87; revised 10/7/88; accepted 10/28/88.

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked advertisement in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

This research was supported by NIH Grants CA 29275 and CA 11796. Presented in part at a meeting of the Society for Epidemiologic Research, Pittsburgh, PA, June 1986.

2 To whom requests for reprints should be addressed, at Children’s Hospital of Philadelphia, Children’s Cancer Research Center, 34th and Civic Center Blvd., Room 9028, Philadelphia, PA 19104.

3 Present address: RidgeCom, Inc., 342 E. Spring Avenue, Ardmore, PA 19003.

All histologically confirmed Wilms’ tumor cases under 15 yr of age at diagnosis during the period 1970 to 1983 who received treatment or consultation at one of three Philadelphia area tertiary care hospitals were identified through the hospitals’ registries. Additional eligibility criteria were physician approval to contact parents, index child not adopted, diagnosis not at autopsy, biological mother English speaking and available for interview, residence at diagnosis in Pennsylvania, Delaware, New Jersey, or Maryland, and residence at interview in the USA.

Controls were selected by random digit dialing and were pair-matched to cases on telephone area code and exchange, date of birth (±3 yr), and race. The random digit dialing procedure has been described previously (11). Briefly, the area code and the three digit exchange of the case’s telephone number were retained, and a set of telephone numbers was formed by randomly generating the last four digits of the number. The generated telephone numbers were called in order. Each was called until a contact was made or until 9 attempts at different times of the day and week were made. A prepared text was used to determine whether a potential matched control was available.

Mothers and fathers of cases and controls were interviewed separately by telephone concerning their residential, occupational, medical, and reproductive histories as well as medical histories of the child and his/her first and second degree relatives. If the father was not available, the mother provided a proxy interview. Total interview time per family ranged from 2 to 3 h.

Cases were classified as genetic or nongenetic based on clinical and pathological information. Cases with bilateral disease or nephroblastomatosis as determined by one pediatric pathologist were classified as genetic. [Nephroblastomatosis has been hypothesized as the precursor lesion of the genetic form of Wilms’ tumor (12).] Those with unilateral disease without nephroblastomatosis and without a Wilms’ tumor-associated anomaly (13) were considered nongenetic. As it is not clear whether cases with only a Wilms’ tumor-associated anomaly are genetic or nongenetic, such cases were considered to be an intermediate group.

Occupations of mothers and fathers were coded by industry and job title according to the classification scheme of Hoar et al. (14). All jobs held from age 18 to the reference date were coded. The reference date was, for the case, 6 mo prior to diagnosis, and for the control, the date on which the control was the same age as the case was on the reference date. Occupational exposures were assigned according to the JEM4 of Hoar et al. (14) in which 501 occupations were linked to any of 376 exposures. By the scheme of Hsieh et al. (15), each job was assigned to one of 30 clusters having similar exposures and degrees of exposure.

The JEM and clusters were modified slightly for use in this study. The JEM links welders and machinists in some industries with multiple exposures but the same jobs in other industries with few exposures. The machinists and welders with few exposures are included in a job cluster with office workers in the same industry. The present study assigned all machinists and welders the longer list of exposures and degrees of exposure.

Specific exposures and job clusters were analyzed as dichotomous variables for each of three time periods: (a) prior to the index child’s conception; (b) during pregnancy; and (c) between birth and the reference date. Parents with one or more jobs in a particular cluster were considered exposed and all other parents were considered unexposed. The analysis of specific exposures considered moderate or high exposure versus no or low exposure. Low exposure in this JEM usually describes the exposure of office workers in an industry having significant exposures to other workers.

Demographic characteristics of cases and controls were compared by paired t tests, McNemar’s tests, and χ² statistics. Odds ratios for

4 The abbreviation used is: JEM, job exposure matrix.
matched variables. Statistical significance was defined at the 5%
associations observed. Odds ratios of less than 1.0 add information
this report presents the number of analyses performed and significant
Conditional multiple logistic regression was used to adjust for possible
matched pairs were calculated for potential risk factors, and the corre-
confounding variables. Conditional multiple logistic regression was used to adjust for possible
confounding variables. Statistical significance was defined at the 5% level.
As multiple comparisons produce significant associations by chance,
this report presents the number of analyses performed and significant
associations observed. Odds ratios of less than 1.0 add information
relevant only to the multiple comparisons issue, as occupational expo
sures probably do not decrease the risk of cancer in offspring.

RESULTS

Cases

Of the 200 cases of Wilms’ tumor identified, 152 were white, 45 were black, and 3 were Asian. Although nonwhites were originally included in the study, their participation rates were low, and results, therefore, are reported only for whites. Of the 152 white cases, 28 (18%) were ineligible for a variety of reasons. Eleven cases lived outside the four state area at diagnosis or outside the USA at interview, 6 were not approved by medical personnel for contact, 3 had non-English-speaking parents, 4 were first diagnosed at autopsy, 3 were adopted, and 1 had unavailable records. Of the 124 eligible cases, 19 (15%) were lost to follow-up, 10 (8%) refused to participate, and 7 (6%) had not been matched to controls when the study ended. The participation rate was 71% with 88 cases included in the study population.

The participating cases were similar to the nonparticipating cases and to a population-based series of cases from the same geographical area in the distribution of sex, age, stage at diagnosis, and laterality. The nonparticipating cases had been diagnosed, on average, 9 yr in the past compared to 5.5 yr for the participating cases.

Classification of Genetic and Nongenetic Cases

The genetic form of Wilms’ tumor occurred in 28 cases (32%) (two of these were familial), the nongenetic form in 42 (48%), and the “intermediate” form in 6 (7%). The small number of “intermediate” cases precluded their separate analysis. As the two familial cases may have inherited a Wilms’ tumor gene, they were excluded from analysis of possible preconception and gestational risk factors. The form of the remaining 12 cases could not be classified, as determination of nephroblastomatosis could not be made or was inconclusive, and the case had neither bilateral disease nor a Wilms’ associated anomaly.

Control Selection

To obtain 88 controls, 2186 telephone numbers (an average of 25 per case) were called. Of all the numbers, 55% were residential. Of these, 22% of the households refused before it could be determined if any children or any eligible children lived there. Thirteen percent of the calls to residences resulted in the identification of eligible control families. Of 159 such families identified, 88 (55%) completed the interview. Of the 88 participating controls, 54 (61%) were the first eligible control family identified, 24 (27%) were the second, and the other 10 (11%) required the identification of 3 to 6 eligible families.

Demographic Characteristics

Cases and controls did not differ significantly in family income, proportion of parents remarried, parents’ educational level, parents’ marital status, or parental age at the index child’s birth. Mothers of cases and controls did differ significantly in

religion ($P = 0.01$), but fathers did not. Compared to control
mothers, more case mothers were Protestant and fewer were
Catholic.

Job and Interview Characteristics

Significantly more control than case father interviews were
proxy interviews with the mothers (43% versus 31%, $P = 0.02$). The mean age at first reported job was lower for case than
control fathers (16.7 versus 18.0 yr). The case-control difference
was partially explained by the excess of control fathers inter-
viewed by proxy; the case-control age difference was 0.9 yr for
fathers interviewed directly and 0.5 yr for fathers interviewed
by proxy. To avoid any bias caused by case fathers reporting
jobs starting at a younger age than control parents, only jobs
held at age 18 or older were analyzed. With this restriction,
case and control fathers reported similar numbers of jobs in
each time period (Table 1).

For mothers, the mean age of first reported job was lower for
controls than cases (17.4 versus 18.1 yr). Case and control
mothers reported similar numbers of jobs during the pregnancy
and after the birth. However, case mothers reported significa-
antly more preconception jobs than did control mothers (2.8
versus 2.4, $P = 0.02$) (Table 1).

Paternal Occupation

Analyses of Job Clusters and Associated Exposures. Analyses of Hsieh’s occupation clusters were performed. The only statistically significant findings were for Cluster 6 (Table 2), which is linked to aromatic hydrocarbons, aliphatic hydrocarbons, metals, and inorganic compounds. For all cases, the odds ratios were high and statistically significant for exposure before conception and during pregnancy. The genetic group showed higher odds ratios than the nongenetic, with an odds ratio of 6.0 occurring for preconception exposure. The results for all cases and the genetic group remained after adjustment for father’s proxy status. As shown in Table 3, the exposed cases and controls were almost exclusively machinists or welders. All held their Cluster 6 jobs after age 18. Most of the case fathers who held Cluster 6 jobs in the preconception period held the same job during the pregnancy or at the child’s birth. If occupation only at birth or during pregnancy was considered as in most of the previous studies, the odds ratio for preconception exposure would have been slightly lower, 4.3.

The poor participation rate among blacks precluded their inclusion in the analysis, and occupational data on the father were obtained for only 5 case-control pairs. Those data, how-

<table>
<thead>
<tr>
<th>Table 1 Mean number of reported jobs (held at age 18 or older) for case and control, proxy and nonproxy interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before conception</td>
</tr>
<tr>
<td>Fathers</td>
</tr>
<tr>
<td>Case</td>
</tr>
<tr>
<td>Nonproxy</td>
</tr>
<tr>
<td>Proxy</td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Nonproxy</td>
</tr>
<tr>
<td>Proxy</td>
</tr>
</tbody>
</table>

| Mothers$^b$ | | |
| --- |
| Case | 2.8 | 1.1 | 1.3 |
| Control | 2.4$^c$ | 1.1 | 1.3 |

$^a$ Between birth and reference date.
$^b$ Includes jobs in the home, such as homemaker; not stratified by proxy/nonproxy, as there were only 3 proxy interviews for mothers.
$^c$ $P = 0.02$ for case-control difference.

Downloaded from cancerres.aacrjournals.org on April 14, 2017. © 1989 American Association for Cancer Research.
PARENTAL OCCUPATION AND WILMS' TUMOR

Table 2  Paternal occupation and Wilms' tumor: results for Cluster 6 by time period and form

Cluster 6 is characterized by exposure to aromatic hydrocarbons, aliphatic hydrocarbons, metals, and inorganic compounds.

<table>
<thead>
<tr>
<th></th>
<th>Preconception</th>
<th>Pregnancy</th>
<th>Postnatal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude OR</td>
<td>Ratio</td>
<td>Adjusted OR</td>
</tr>
<tr>
<td>All cases</td>
<td>6.0</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Genetic</td>
<td>6.0</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Nongenetic</td>
<td>3.0</td>
<td>1.6</td>
<td>1.6</td>
</tr>
</tbody>
</table>

|                  |              | 95% CI    | Adjusted OR|              | 95% CI | Adjusted OR|              | 95% CI | Adjusted OR|
|                  |              |           |           |              |        |           |              |        |            |
| All cases        | 1.5-28.6     | 1.2-23.7  | 1.4-2.2   | 1.5-28.6     | 1.2-23.7 | 1.4-2.2 | 1.5-28.6 | 1.2-23.7 | 1.4-2.2   |
| Genetic          | 0.7-277      | 0.4-195   | 0.5-30.3  | 0.7-277      | 0.4-195  | 0.5-30.3 | 0.7-277 | 0.4-195  | 0.5-30.3  |
| Nongenetic       | 0.5-30.3     | 0.5-30.3  | 0.5-30.3  | 0.5-30.3     | 0.5-30.3 | 0.5-30.3 | 0.5-30.3 | 0.5-30.3 | 0.5-30.3  |

* OR, odds ratio; CI, exact 95% confidence interval.
* Ratio of case exposed-control unexposed to case unexposed-control exposed pairs.
* Odds ratio adjusted for father's proxy status.
* P ≤ 0.01.
* P < 0.05.

Table 3  Fathers with cluster 6 jobs held in any time period

<table>
<thead>
<tr>
<th></th>
<th>Cases</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machinist</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Welder</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Scrap metal worker</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Paper manufacturing jobs</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Paste-up artists</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>5</td>
</tr>
</tbody>
</table>

ever, corroborate the results for whites; three case and no control fathers held jobs in Cluster 6.

To explore further the association with Cluster 6, the exposures common to welders and machinists were investigated. These exposures according to the JEM are benzene, diethylene glycol, beryllium, chromium, iron, lead, silver, tin, and zinc. No significantly elevated odds ratios were observed for any of these exposures for either subgroup or for the entire group. However, odds ratios of 1.8 to 3.0 were observed among the genetic cases for preconception exposure to silver, tin, iron, and beryllium. Elevated odds ratios occurred for pregnancy (odds ratio = 2.8, P = 0.07) and postnatal (odds ratio = 2.2, P = 0.07) exposure to diethylene glycol. For both time periods, the stronger association occurred among the nongenetic cases (odds ratios = 3.5 and 2.7).

Nonsignificantly elevated odds ratios occurred for Clusters 4 and 9. For Cluster 4, characterized by exposure to aromatic hydrocarbons, nonionizing radiation, and other physical agents, an odds ratio of 6.0 (based on 7 discordant pairs) was observed for pregnancy exposure. The exposed cases had a variety of occupations including auto body mechanic, plumber, and trucking loader. An odds ratio of 6.0 (based on 7 discordant pairs) was observed for preconception exposure to Cluster 9. Exposure to aromatic hydrocarbons, aliphatic hydrocarbons, and ionizing radiation characterizes Cluster 9; exposed cases had jobs as physicians or in chemistry or biology.

Forty-two odds ratios for job clusters by time period and form of Wilms' tumor were calculated and tested for significance. Two positive associations with Cluster 6 and a negative association with another cluster reached statistical significance.

Analyses to Replicate Previous Observations. Analyses were performed which attempted to replicate previously reported associations with paternal occupations and exposures (5-8). Odds ratios were calculated for all cases for each of the three time periods. Previous studies reported associations with lead, aromatic hydrocarbons, ionizing radiation, and employment as a mechanic or machinist. Using the classification schemes used in these studies, no significantly elevated odds ratios were observed. An odds ratio of 2.0 (10:5) was observed for occupations with radiation exposure as defined by Hicks et al. Analyses for the genetic and nongenetic groups were uninformative.

Exposure to hydrocarbons, lead, and ionizing radiation were also assessed using the JEM. No significant associations were observed. As aromatic hydrocarbons are diverse, six subgroups were analyzed by the JEM. The odds ratio for preconception exposure to aromatic nitro compounds was elevated (odds ratio = 1.8, P = 0.10), and the effect was concentrated and statistically significant among the genetic cases (odds ratio = 8.0, P = 0.05). The exposed fathers among the genetic cases held jobs as painters, electricians, or lab workers. For the exploratory analyses of hydrocarbon subgroups, 52 tests of significance were performed; three statistically significant associations were observed (the positive association cited and two negative associations).

Wilkins and Sinks used the JEM to assign exposure and observed a significantly elevated odds ratio for paternal boron exposure and nonsignificantly odds ratios of 3.5 or above for 23 other substances (7). In analyses to replicate these findings, elevated odds ratios were observed among the genetic cases for exposure to boron (odds ratio = 5:0, P = 0.07), nitrobenzene (4:0), chlorinated benzenes (4:0), ethylene chlorohydrin (4:0), dichloroethyl ether (5:1), acetone (4:0), acetate (4:0), and nitroparaffins (4:1). All the elevated odds ratios resulted from the same four case fathers who held jobs as painters. For the nongenetic group, an elevated odds ratio (4:1) was observed for radium. These fathers held jobs as physicians, chemists, and laboratory technicians.

Maternal Occupation

Analyses of job clusters were performed. Few clusters contained enough mothers to permit analysis. Out of the 30 clusters, only 6 were analyzed for preconception exposure, 3 for pregnancy exposure, and 3 for postnatal exposure. About 25 odds ratios were calculated; none was statistically significant.

Previous studies and the analyses described above observed associations of Wilms' tumor with occupational exposures of fathers. Analyses investigated whether or not exposures of mothers to the same agents also increased the risk. Three or fewer mothers had jobs with hydrocarbons, lead, or ionizing radiation exposure, as classified in previous studies. Mothers of four cases and one control were exposed to boron, according to the JEM; two case mothers had exposure in the preconception period and two in the postnatal period.

Analyses of aromatic hydrocarbons, lead, and ionizing radiation were also performed using the JEM. No statistically significant odds ratios were observed. The effects of exposure to the six subgroups of aromatic hydrocarbons were analyzed. A significant odds ratio occurred for preconception exposure to aromatic amino hydrocarbons (odds ratio = 2.6, P = 0.005). The odds ratio for the genetic form (3.5) exceeded that for the nongenetic form (1.8). For all cases combined, elevated odds ratios were also observed for pregnancy (odds ratio = 5:0, P = 0.07) and postnatal (odds ratio = 6:0, P = 0.13) exposure.
Mothers with exposure to aromatic amino hydrocarbons worked as electronics workers, chambermaids, clothing manufacturing workers, and dental assistants. Another category of hydrocarbons, aromatic azo compounds, was associated with a significantly elevated risk (odds ratio = 6.0, \( P = 0.04 \)) for preconception exposure. The exposed mothers held jobs as hairdressers, lab workers, cosmetic salespersons, and clothing manufacturing workers. The small numbers of exposed mothers precluded analyses of other time periods and of Wilms’ tumor form. In the exploratory analyses of hydrocarbon subgroups, 36 odds ratios based on more than three exposed mothers were calculated and tested for statistical significance. Two odds ratios were significantly elevated.

Analyses of the exposures shared by machinists and welders were performed. No significantly elevated odds ratios were observed.

**DISCUSSION**

The most striking observation in this study was the association of Wilms’ tumor with the paternal job cluster that includes machinists and welders. The analyses suggested the strongest effect for preconception exposure among the genetic cases, but the small numbers of exposed subjects in the subgroups require that this finding be interpreted very cautiously. A preconception effect for genetic cases fits predictions of the two-hit model of carcinogenesis (9). According to this model, the major determinant of the genetic form of Wilms’ tumor is the mutation present at conception. Preconception exposures of the parents could play an etiological role only in the genetic form by causing a mutation in a parental germ cell. In fathers, exposure years before the child’s conception theoretically could affect the stem cells that give rise to the sperm. An effect on paternal stem cells leading to a new mutation has been suggested for several rare genetic conditions (16, 17).

Previous studies of Wilms’ tumor reported case excesses in job groupings that included machinists or welders. Kantor et al. included machinists among their hydrocarbon-related jobs and welders among their lead-related jobs, and both groups showed significant excesses among Wilms’ tumor cases (5). Kwa et al. (8) observed an excess of mechanics and machinists (as a group) among fathers whose children developed urinary tract cancers. Interestingly, an excess of metal-related occupations among case fathers has also been observed for brain cancer.

The present study did not elucidate an exposure common to machinists and welders that might explain the association. Although some metals showed elevated odds ratios, the job clusters characterized by heavy exposure to metals did not. Limitations of the JEM may have prevented the elucidation of an etiological exposure. In studies of lung and bladder cancer, analyses using the JEM have detected some but not all known carcinogens (18, 19). Limitations of the JEM, the occupational data collected, or other aspects of the studies might have resulted in the failure to find significant associations for these carcinogens. The JEM, like any such matrix, assesses the potential for exposure rather than actual exposure. For example, the JEM links employment as a welder in the metal industry to 16 metals, but it seems likely that most welders would have exposure to only some of these metals. Thus, misclassification of exposure to a specific metal would occur for many welders and would reduce the power of detecting an association with exposure to that metal. Inaccuracies in the JEM may exist and result in further misclassification. Schemes for assessing occupational exposures, including the JEM used here, have been compared and found to differ substantially (20). Misclassification due to limitations of the JEM could have reduced the study’s power to detect associations with specific exposures.

The results for paternal exposure to boron, nitrobenzene, chlorinated benzenes, ethylene chlorohydrin, dichloroethyl ether, acetone, acetate, and nitro paraffins warrant discussion as they corroborate observations from a previous study. Using the same JEM, Wilkins and Sinks reported odds ratios of 3.5 or above for each of these substances. As in the present study, painters comprised a substantial proportion of the fathers exposed to boron and the seven hydrocarbons. Some of these substances are rare and are unlikely to be used by most painters. The significance of these findings appears to be a possible increased risk associated with employment as a painter due to one or more of the cited exposures or to another exposure.

Because of the exploratory nature of the analyses, the other significant results must be considered only suggestive. Nonetheless, the results for paternal exposure to aromatic nitro hydrocarbons and maternal exposure to aromatic amino hydrocarbons fit predictions of the two-hit model in that the increased risk occurred for preconception exposure among the genetic cases. Maternal exposure to aromatic azo hydrocarbons also increased the risk of Wilms’ tumor.

The hypotheses that paternal lead and hydrocarbon exposure as defined in previous studies increased the risk for the development of Wilms’ tumor were not substantiated. The study had sufficient power to detect risks of 2 to 3 for these exposures. Although the sample size was sufficient to detect moderate increases in risk, misclassification of exposure as discussed above might have reduced the power of the study. That possibility suggests that the negative results be interpreted cautiously. A nonsignificant odds ratio of 2.0 for paternal occupation with radiation exposure provided some corroboration of a previously reported association.

The results did not appear to be explained by selection bias. Although the participation rate among controls was low, cases and controls were similar in family income and parents’ education. More importantly, the proportions of case and control fathers with blue collar, white collar, and professional and managerial occupations were similar. Case-control pairs in which the control was not the first eligible control identified were as closely matched on socioeconomic variables as were pairs in which the first eligible control participated. Although selection bias cannot be ruled out, it is difficult to imagine a bias that produces a strong effect for machinists and welders but not for other blue collar jobs.

As in any case-control interview study, recall bias must be considered. To minimize recall bias, this study did not use self-reported exposures and used only jobs held at age 18 or older. Although significantly more control than case fathers were interviewed by proxy, the main finding remained after adjustment for proxy status. In addition, case and control fathers reported similar numbers of jobs. A significant difference occurred in the number of preconception jobs held by case and control mothers; however, that difference resulted mostly from differences in reporting of short-term jobs held while in school, most of which did not involve significant exposures.

This study refined methods used in previous studies by analyzing exposures or jobs in three potentially relevant time periods and for both forms of Wilms’ tumor. Results of this study suggest an association of Wilms’ tumor with paternal...
occupation as a machinist or a welder. No associations were observed with the larger occupational groupings of previous studies that included machinists or welders. Thus, the results reported here differ in being specific for welders and machinists. This study also corroborated a previous report of increased risk associated with several exposures assigned to painters by the JEM. The associations reported here await replication and refinement in future studies with more cases.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Jane Chatten for pathological review; Ira Caplan for computer programming; Jack L. Elias for manuscript preparation; and Mary Gordon-Rowson, Carol Symmes, and the late Helen Peterson for interviewing.

REFERENCES

Parental Occupation and Wilms' Tumor: Results of a Case-Control Study


Access the most recent version of this article at: http://cancerres.aacrjournals.org/content/49/3/725

Sign up to receive free email-alerts related to this article or journal.

To order reprints of this article or to subscribe to the journal, contact the AACR Publications Department at pubs@aacr.org.

To request permission to re-use all or part of this article, contact the AACR Publications Department at permissions@aacr.org.