United States
Environmental Protection Agency

Office of Chemical Safety and
Pollution Prevention

Final Risk Evaluation for Asbestos Part 1: Chrysotile Asbestos

Summary of External Peer Review and Public Comments and Disposition

Supplemental File for Epidemiologic Studies of Automotive Mechanics

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Evaluation of Epidemiologic Studies of Mesothelioma Among Automotive Mechanics

The EPA evaluated a paper presenting a review and meta-analysis of research on mesothelioma risks among motor vehicle mechanics that was cited in public comments at the June, 2020 SACC meeting (Garabrant et al., 2015, 3019965), the original research papers included in that meta-analysis, and one other paper cited in the Committee comments (Van den Borre & Deboosere, 2015, 3088106). The EPA did not search for additional papers presenting data on cancer risks among automotive mechanics or other workers performing maintenance and repair on automotive brakes.

Summary and Conclusions

The EPA conducted a critical review of the meta-analysis by Garabrant et al. (2015, 3019965), 14 of the 16 original epidemiologic studies included in that analysis, and the more recent study by van den Borre & Deboosere (2015, 3088106). Two other studies included in the Garabrant analysis were not available for review. From our evaluation of this evidence, EPA have reached the following conclusions regarding the three questions posed.

1. Are the studies of motor vehicle mechanics sufficiently sensitive to detect a cancer effect of commercial chrysotile asbestos?
The studies reviewed by the EPA have poor sensitivity to detect cancer hazards from commercial chrysotile asbestos. The low sensitivity of these studies is a consequence of exposure assessment methods that do not specifically identify asbestos exposure in individual workers, and of potential bias from the use in most studies of referent groups that include other workers exposed to asbestos.

2. Can the studies of motor vehicle mechanics be used to derive a unit risk estimate as was done in the draft Risk Evaluation, i.e., is there an exposure and response data sufficient to derive lung cancer and/or mesothelioma risk?
The studies reviewed by the EPA concern only mesothelioma. None of them provide quantitative exposure-response data that could be used to derive a unit risk for that disease.

3. Describe the available data to compare fiber size distributions for motor vehicle mechanics compared to other conditions of use.
The epidemiologic studies reviewed by the EPA do not provide data on associations of cancer among motor vehicle mechanics with asbestos fiber concentrations, types, or size distributions. Other studies may be available that provide data on fiber-size distributions without investigating health effects.

EPA's review of the evidence and the conclusion's basis are detailed below.

Review and meta-analysis of mesothelioma among motor vehicle mechanics

Garabrant et al. (2015, 3019965) searched the PubMed and Embase electronic databases for epidemiologic studies of mesothelioma among motor vehicle mechanics published through May

2014; additional searches were conducted for unpublished studies. Eligible studies were scored for quality using criteria adapted by the authors from standard instruments and were assigned to 3 groups based on their scores. Sixteen studies were ultimately included in the narrative review and meta-analysis. Relative risks (RRs) for motor mechanics were not reported in four of the included studies, so the authors estimated crude RRs from other data in the reports or obtained from the authors. The meta-analysis was carried out with standard methods. The meta-RR for all 16 studies was 0.80 (95% CI 0.61-1.05) with significant heterogeneity between studies. Meta-RRs for the three quality groups were 0.76 (95% CI 0.46–1.25), 1.09 (95% C I 0.76–1.58) and (95% CI 0.73 0.49–1.08) by descending quality score. For 4 studies that reported data specifically for workers performing brake work, the meta-RR was 0.64 (95% CI 0.38-1.09). The authors concluded that their meta-analysis "provides evidence that motor vehicle mechanics, including workers who were engaged in brake repair, are not at an increased risk of mesothelioma."

Although the authors did not describe this review as such, the methods used are largely consistent with standard systematic review methodology. Nevertheless, while the methods appear to be generally adequate, there are concerns about the quality of the available studies and the extent to which they are able to support quantitative analysis of the cancer hazard from exposure to asbestos in automotive brake materials.

Included studies

Fourteen of the 16 studies reviewed by Garabrant et al. (2015, 3019965) and one additional study mentioned in Committee comments from the July, 2020 SACC meeting were available for review and are summarized below. Two other studies analyzed by Grabrant et al., including one registry-based case-control study (Hansen et al. 2003, 6885998) and one registry-based study of occupational mortality (HSE, 2013), were not available for this review.

The studies included by Garabrant et al. (2015, 3019965) and available for this review included 10 studies analyzed as case-control studies of mesothelioma (McDonald & McDonald, 1980, 133 ; Teta et al. 1983, 205; Hessel et al. 2004, 3530960; Rake et al. 2009, 733522; Teschke et al. 1997, 3081326; Agudo et al. 2000, 733601; Aguilar-Madrid et al. 2010, 2621487; Rolland et al. 2010, 3078972; Woitowitz & Rödelsperger 1994, 3081776; Roelofs et al., 2013, 3541736), one occupational cohort study that provided data for multiple cancers (Merlo et al., 2010, 1255274), one register-based descriptive study of mesothelioma (McElvenney et al., 2005, 3089646) and two death-certificate-based studies of general occupational mortality (Washington DOH, 2011, 6984619; NIOSH, 2011, 6984620).

None of the available studies reported quantitative exposure-response data for cancer risk in relation to asbestos exposure, quantitative asbestos exposure levels, or assessments of fiber type or size distribution. Likewise, no study provided even a qualitative assessment of individual exposure to asbestos from work with motor vehicle brakes or other automotive maintenance and repair tasks. The assessment of exposure to asbestos in the available studies depends, instead, on a variety of indirect approaches. Studies are reviewed below in order of the specificity of the information they provide about potential exposure to asbestos in automotive brake work.

The most specific information about the risks associated with exposure to asbestos from brake materials is available from three case-control studies in which information about potential sources of asbestos exposure was obtained by interview or questionnaire.

Hessel et al. (2004, 3530960) re-analyzed a previous case-control study of mesothelioma in three area of the United States to focus on brake mechanics. Occupational and exposure histories were obtained through interviews with next of kin in the original study. Analyses compared individuals who had ever done brake work to those who had not. The OR adjusted for age and 8 other activities assumed to involve potential exposure to asbestos was 0.82 for any (95% CI 0.46–1.41) for any brake work and 0.82 (95% CI 0.36–1.80) for occupational brake work. After deleting cases and controls with a history of any of the 8 activities involving potential exposure, the OR for occupational brake work was 0.62 (95% CI 0.01–4.71).

A broader range of potential sources of asbestos exposure was investigated in two other case-control studies. Teschke et al. (1997, 3081326) studied mesothelioma surveillance data to identify occupational sources of exposure to asbestos in British Columbia, Canada. Information about occupational history and work tasks was obtained by interview with subjects or next of kin. In analyses including all cases and controls, the age-adjusted odds ratios (ORs) were 0.8 (95% CI 0.2-2.3) for ever having worked as a vehicle mechanic and 0.3 (95% CI 0.0-1.4) for ever having done brake lining installation and repair. The OR for vehicle mechanics was reduced to 0.4 after excluding individuals who had ever worked in occupations with known exposure to asbestos, but a parallel analysis for brake installation and repair was not conducted. The unexposed referent group for these ORs was not specifically stated, but calculations from data in the paper suggest it was all other occupations or tasks.

Rake et al. (2009, 733522) studied the association of mesothelioma with lifetime occupational and residential exposure to asbestos in Britain. Mesothelioma cases were identified through a survey of health care providers and matched with controls sampled at random from primary care rolls. Data on occupational and residential history and other sources of exposure to asbestos were collected by postal questionnaire and telephone interview. Reported occupations and activities were ranked by mesothelioma risk according to the results of a previous descriptive study also included in the Garabrant et al. review (McElvenney et al., 2005, 3089646). Motor vehicle mechanics were included in the low-risk group, which constituted the unexposed referent for most analyses, and no risk data were reported for this group. An OR of 0.4 (95% CI 0.1 – 1.7) for the task of "vehicle maintenance involving work with brakes or gaskets" was reported in the text; the referent group for this OR was not stated.

A small study by Woitowitz and Rödelsperger (1994, 3081776) also reported on mesothelioma among motor vehicle mechanics. Data for mechanics were apparently obtained from a larger case-control study of mesothelioma in Germany, but neither the sources of cases and controls or of exposure information is reported in this publication. Numbers of cases and hospital and population controls who had worked as mechanics or done brake work are reported in a table, but ORs are not provided. For this study, Garabrant et al. (2015, 3019965) analyzed ORs for motor vehicle mechanics "definitely engaged in brake service" of 0.89 (0.31–2.47) and 0.87 (95% 0.43–1.70) compared to population and hospital controls, respectively. These ORs cannot be reproduced from the data presented by Woitowitz and Rödelsperger (1994, 3081776) and

were apparently calculated by Garabrant et al. using data obtained directly from the original authors. The unexposed referent for these ORs was not reported.

Two other case-control studies in Spain (Agudo et al. 2000, 733601) and Mexico (Aguilar-Madrid et al. 2010, 2621487) investigated associations of mesothelioma with potential occupational exposures to asbestos classified by expert review of occupational histories. However, neither study reported a measure of association for motor vehicle mechanics. Agudo et al. (2000, 733601) did report numbers of cases and controls for motor vehicle mechanics in a footnote, and a crude OR of 0.62 for the risk of mesothelioma in motor vehicle mechanics relative to subjects never employed in occupations with high risk of asbestos exposure can be calculated using these data. Aguilar-Madrid et al. (2010, 2621487) classified exposures in a similar manner, but did not report ORs for specific occupations or industries. Crude ORs for automobile mechanics can be calculated from data provided in a table, but do not match those analyzed by Garabrant et al.

As part of a large descriptive study of mesothelioma in North America, McDonald & McDonald (1980, 133) conducted a case-control analysis of the occupational exposures. Occupations elicited in interviews with next of kin were ranked according to potential for exposure to asbestos using a list obtained from other researchers. The occupation of "garage workers" was assigned to a presumed low-exposure group for which the OR was not reported. However, numbers of cases and controls among garage workers and other occupations in the same group are reported in a table and can be used to compute crude ORs. Garabrant et al. analyzed an OR of 0.92 based on a comparison of garage workers to other occupations in the same low-exposure group. The OR for garage workers compared to the group of unexposed occupations would be more appropriate and can also be calculated (OR 1.6).

In a study of mesothelioma cases from the Connecticut tumor registry matched with deceased cases, Teta et al. (1983, 205) classified occupations obtained from death certificates and city directories into classes of known, likely and possible asbestos exposure. The OR for ever working in the "automobile repair and related service" industry category was 0.65 (95% CI 0.08-5.63). The unexposed referent for the OR is not stated but appears to be never having worked in any exposed industry.

In a retrospective cohort study of the impact of air pollution on municipal bus drivers and maintenance workers, Merlo et al. (2010, 1255274) reported a SMR of 1.27 (95% CI 0.66-2.43) for bus maintenance workers compared to the regional population. No information was reported about asbestos or work with brakes.

All 5 of the remaining studies (McElvenney et al., 2005, 3089646; Rolland et al. 2010, 3078972; Milham et al., 2011, 6984619; NIOSH, 2011, 6984620; Roelofs et al., 2013, 3541736) reported ORs or proportionate mortality ratios (PMRs) by occupation or industry category without further classification of asbestos exposure. Rolland et al. (2010, 3078972) coded occupational histories obtained in interviews with mesothelioma cases and general population controls. ORs were generated by occupation and industry with all other occupations or industries as the referent group. The OR for working ≥6 months versus never as a motor vehicle mechanic was 1.50 (95% CI 0.76-2.95). Roelofs et al. (2013, 3541736) coded the usual occupation and industry of

mesothelioma cases and controls with other cancer from the Massachusetts cancer registry. Standardized morbidity odds ratios (SMORs) were generated for each occupation compared to all others. The SMOR for automobile mechanics was 2.1 (95% CI 1.1-4.0). In a registry-based descriptive study of mesothelioma in Britain, McElvenney et al. (2005, 3089646) reported PMRs by occupation using the usual occupation reported on the death certificate. The PMR for "motor mechanics" was 0.48 (95% CI 0.37-0.62). The references to Milham (Washington DOH, 2011, 6984619) and NIOSH (NIOSH, 2011, 6984620) are links to interactive web sites that allow users to generate PMRs by cause of death and occupational category, presumably with all other occupations as the referent. The PMRs from these sources analyzed by Garabrant et al. (2015, 3019965) could not be reproduced, possibly because of additions to the database in ensuing years.

Additional study

Committee comments from the July, 2020 SACC meeting referenced a study in Belgium by van den Borre & Deboosere (2015, 3088106). The study authors linked records of 2001-2009 mesothelioma deaths in 2 Belgian regions with data from the 1991 census. Occupational history information from both sources was categorized to 3 groups reflecting the potential for asbestos exposure. SMRs were reported for broad groups and for selected industries. Data were not reported for the automotive industry or for the subcategory of automotive maintenance & repair subcategory. However, the authors stated that workers in the automotive industry, among others, "do not seem to experience significant excess in mortality due to asbestos-related diseases."

Comments

The major limitation of the studies reviewed here is the lack of specific data on asbestos exposure. None of the 15 available studies provides information on fiber concentrations, cumulative fiber exposures, fiber type, or fiber-size distributions. Neither do any of the studies provide individual-level qualitative assessment of work with asbestos brake parts or other asbestos-containing automotive components.

In the absence of direct assessment of asbestos exposure, potential exposure was assessed in several studies by inference from self- or proxy-reported tasks (3 studies), by expert review of occupational histories (2 studies) or by applying matrices or lists of asbestos-exposed jobs to occupational histories (3 studies). The source of task information in one other study was not reported. All other studies simply reported associations of mesothelioma morbidity or mortality with occupation or industry titles.

Subject and proxy reports can identify specific tasks and exposures to the extent that the respondents had knowledge of them and are able to recall them. However, the four studies that assessed work with automotive brakes did not report whether workers used asbestos brake components. Because not all brake pads and shoes contain asbestos, workers may not be able to report whether they worked with such components. Studies based solely on broad occupational groups have more limited sensitivity to detect risks arising from work with brake parts or other components containing asbestos, as many workers will may not have done such work.

A second important limitation is that none of the available studies provides exposure-response data. In most studies, associations are reported for ever having engaged in a particular occupation

or task or for having done so "usually" or for some minimum amount of time. Five other studies did not report associations for pertinent tasks or occupations, although some measures of association can be computed from data provided in these papers.

A third limitation is related to the choice of the unexposed referent group to which automobile mechanics are compared. Ideally, the referent group should consist of workers with no exposure to asbestos. However, among the 10 studies in which the authors reported risk data for auto mechanics or work with brakes, the referent group in 7 studies was reported to be or could be inferred to be all other occupations or industries. In one study (Teta et al. 1983, 205), the referent group was explicitly stated to be workers not employed in jobs with known, likely or possible exposure, and in two studies (Merlo et al., 2010, 1255274; Van den Borre & Deboosere, 2015, 3088106) the general population served as the referent. The selection of all other occupations as the referent is cause for concern because this would include workers in occupations known to have high levels of exposure to asbestos and high risks of mesothelioma in the referent category. This would exert a downward bias on the relative risk downward for occupations with lower exposure.

Conclusions

The conclusions of this review of the 15 original studies summarized above follow with respect to the questions posed in EPA's technical directive.

1. Are the studies of motor vehicle mechanics sufficiently sensitive to detect a cancer effect of commercial chrysotile asbestos?

Overall, the studies reviewed by the EPA have poor sensitivity to detect a cancer hazards from commercial chrysotile asbestos. None of the studies directly assessed exposure to asbestos. Information on fiber type is therefore lacking. The most sensitive studies are four case-control studies that reported risks associated with a history of working with automotive brakes, which may contain asbestos. However, none of these studies evaluated whether asbestos-containing brake components were actually used. The remaining 11 studies report risks based on broader occupational categories, such as automobile mechanics. These studies have low sensitivity, as the numbers of workers actually exposed to asbestos was not ascertained. The sensitivity of the majority of the available studies may also have been reduced by the selection of referent groups that include other workers exposed to asbestos, which can exert a downward bias on measures of association.

2. Can the studies of motor vehicle mechanics be used to derive a unit risk estimate as was done in the draft Risk Evaluation, i.e., is there an exposure and response data sufficient to derive lung cancer and/or mesothelioma risk?

The studies reviewed by the EPA concern only mesothelioma. None of them provide exposure-response data that could be used to derive a unit risk.

3. Describe the available data to compare fiber size distributions for motor vehicle mechanics compared to other conditions of use.

The epidemiologic studies reviewed by the EPA do not provide data on associations of cancer with asbestos fiber concentrations, types, or size distributions. Other studies may be available that provide data on fiber-size distributions without investigating health effects.

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Evaluation of Epidemiologic Studies of Lung Cancer Among Automotive Mechanics

The EPA reviewed epidemiologic studies reporting risk data for lung cancer among motor vehicle mechanics that were listed in the June, 2020 SACC report prior to Recommendations 48 and 49. This review is based on the studies available to the EPA; although other studies may present data on asbestos exposures or lung cancer risks among automotive mechanics or other workers performing maintenance and repair on automotive brakes, the EPA was not aware of such studies and did not search for them.

Summary and Conclusions

The EPA critically reviewed 11 case-control studies and 1 prospective cohort study. All of the available studies were broadly focused investigations of associations of lung cancer with occupation or industry categories based on information obtained by interview or questionnaire. None of the studies was focused on automotive mechanics, and none included quantitative exposure-response analyses of lung cancer risk in relation to asbestos fiber exposure, quantitative measures of asbestos fiber concentrations or size-distributions, or qualitative assessments of individual asbestos exposure. Two other studies (Williams et al., 1977, 4911; Hrubec et al., 1992, 6875651) were not available for review. While the EPA was not able to review these studies, it is evident from the abstracts and EPA's knowledge of the field that these studies employed similarly broad approaches and would not provide quantitative exposure data.

The most informative studies were large, population-based case-control studies that adjusted for smoking and other lung cancer risk factors and classified occupation and industry titles according to a matrix of potential exposure to occupational carcinogens. Most other case-control studies and the prospective cohort study contrasted risks among individuals who ever or usually held various occupations, including automobile mechanics, to those who never did so. The studies judged to be most informative reported a modest, non-significant increase (Consonni et al., 2010, 380084) or no increase (Richiardi et al., 2004; 699205, Guida, 2011, 2571776) in lung cancer risk for automobile mechanics compared to occupations with no known or suspected exposure to lung carcinogens. One them reported a non-significant relative risk of 1.2 (95% confidence interval (CI) specifically for automobile brake workers (Vineis et al., 1988, 79604). While these studies are adequate in overall quality, it is likely that they are affected by non-differential misclassification of asbestos exposure, because not all automobile mechanics work on brakes and not all brakes contain asbestos. This form of measurement error tends to bias relative risks toward the null value of 1.0. The less informative studies are likely to suffer from additional biases related to inadequate control for confounding by tobacco smoking, the use of controls with other diseases, and comparing auto mechanics to other occupations that could involve exposure to asbestos.

Based on this review, the EPA conclude that the studies of lung cancer in automotive mechanics cited in the SACC report do not provide a basis for deriving an IUR for lung cancer and asbestos exposure.

Similarly, none of the studies provide data on asbestos-fiber size distributions in automotive repair environments. Such information may be available from exposure studies that do not assess associations with cancer, but EPA was not aware of such studies and did not search for them.

Case-Control Studies

Lerchen et al. (1987, 24407) obtained lifetime occupational histories in interviews with lung cancer cases identified from the New Mexico tumor registry and controls from the general population. Odds ratios (ORs) were reported for ever versus never having worked in selected industries and occupations the authors judged to involve increased risk of lung cancer and for exposure to diesel exhaust fumes, asbestos and wood dust. Smoking-adjusted ORs were 0.9 (95% CI 0.5-1.9) for auto mechanics and 1.1 (95% CI 0.7-1.7) asbestos exposure. An OR for asbestos exposure among auto mechanics was not reported.

Benhamou et al. (1988, 4868) reported on associations of lung cancer and occupation in French men who participated in a previous international case-control study of lung cancer and smoking. Cases and controls were apparently identified from hospital records and lifetime occupational histories were obtained by questionnaire. ORs were reported for having worked versus never worked in selected occupations. The smoking-adjusted OR for automobile mechanics was 1.06 (95% CI 0.73-1.54).

In a study aimed at estimating the contribution of occupational exposure to the burden of lung cancer, Vineis et al. (1988, 79604) combined data from case-control studies in 5 areas of the United States. Cases and controls were identified from hospitals or death certificates, or from a cancer registry in one study. Information on jobs held for at least 6 months was collected in interviews with subjects or next of kin and grouped according to published matrix of occupations and industries with known or suspected exposure to occupational carcinogens (Simonato & Saracci, 1983, 6984621). A smoking-adjusted OR of 1.2 (95% CI 0.9-1.7) was reported for individuals who had ever been automobile brake workers compared to those who never worked in any exposed occupation.

Morabia et al. (1992, 79634) studied the role of occupational exposure in lung among participants in an established multicenter hospital-based case-control study in the United States. Information on usual occupation and exposure to 44 specific agents was collected by interview. An OR of 0.7 (no CI or p-value reported) for automobile mechanics and repairmen was reported.

Swanson et al. (1993, 6875603) reported on the association of lung cancer risk and duration of employment in an established case-control study of lung cancer among Black and white men in Detroit, Michigan. Lung cancer cases and controls with colorectal cancer were identified from the Detroit cancer registry and lifetime occupational histories were collected by telephone interview with subjects or proxies. ORs were stratified by race and were reported only for occupation and industry titles with significantly increased ORs or significant trends with duration of employment. Control for covariates was not described, so the reported ORs may not be adjusted for important risk factors such as age or smoking. For automobile mechanics, ORs were greater than 1.0 for all employment durations and both races, with a significant trend only

for Black men. No significant trend was reported for employment in the automotive services industry.

Results of a hospital-based case-control study of lung cancer and occupation in Buenos Aires, Argentina were reported by Matos et al. (2000, 1019232). Lung cancer cases and controls with various other diseases unrelated to tobacco smoking were recruited from hospitals and interviewed to collect information on occupational history, including tasks performed in jobs held for more than one year. Analyses compared participants never versus never employed in a given occupation or industry and results were reported for selected "high-risk" jobs. Smoking adjusted ORs of 2.1 (95% CI 1.0-4.5) for motor vehicle mechanics and 1.2 (95% CI 0.5-2.7) for the motor vehicle repair industry were reported.

Occupational risk factors for lung cancer were investigated in a population-based case-control study of lung cancer in Northern Italy (Richiardi et al., 2004, 699205). Lifetime occupational histories were collected through interviews with subjects and were grouped using an exposure matrix similar to that used by Vineis et al. (1988, 79604). Workers ever employed as a motor vehicle mechanic were classified to the group of occupations and industries with suspected exposure to carcinogens and were compared to workers with no known or suspected exposure in the analysis. The adjusted OR for motor vehicle mechanics was 1.1 (95% CI 0.6–2.0) adjusted for smoking and other risk factors.

MacArthur et al. (2009, 699235) assessed associations of occupation and industry titles with all lung cancer and lung cancer histologic subtypes in a large case-control study based on the British Columbia Cancer Registry. All other registered cases with non-lung cancer served as controls. Occupational histories were collected by self-administered questionnaire, and analyses compared usual occupation and any occupation ever held to all other occupations. Adjusted ORs for motor vehicle mechanics and repairers were 0.90 (95% CI 0.68 -1.19) for usual occupation and 1.06 (95% CI 0.89 -1.26) for ever having held that occupation.

Consonni et al. (2010, 380084) investigated associations of lung cancer and occupation in a large population-based case-control study in Italy that was originated to explore environmental and genetic factors in lung cancer. Lifetime occupational histories were collected in personal interviews and grouped using an approach similar to that of Vineis et al. (1988, 79604) according to a matrix of jobs with known or suspected exposure to occupational carcinogens (Ahrens & Merletti, 1998, 737541). The OR for motor vehicle mechanics was 1.29 (95% CI 0.72, 2.33) compared to occupations with no known or suspected exposure and adjusted for smoking and other risk factors.

A similar approach was taken in a study of environmental causes of lung cancer in France (Guida, 2011, 2571776). Lifetime occupational histories obtained in interviews were grouped according to a matrix of jobs with known or suspected occupational exposure to carcinogens (Ahrens & Merletti, 1998, 737541; Consonni et al., 2010, 380084). An OR of 1.06 (95% CI 0.73–1.54) adjusted for smoking and other risk factors was reported for motor vehicle mechanics.

Corbin et al. (2011, 699244) examined associations of occupation and lung cancer in an existing population-based case-control study in New Zealand. Incident lung cancer cases were identified from a national cancer registry and controls were recruited from electoral rolls. Occupational histories were obtained by telephone or personal interview and grouped according to the risk of lung cancer expected from previous studies. ORs were estimated for ever versus never having been employed in a given occupation, adjusted for smoking and other risk factors. The occupation of "motor mechanic" was classified as a priori high-risk: the OR was 1.22 (95% CI 0.59-2.51) and increased to 1.32 (95% CI 0.73-2.39) after semi-Bayes adjustment for multiple comparisons.

Prospective Cohort Study

Veglia et al. (2007, 3079516) examined associations of occupation and lung cancer in a large, European prospective cohort study originally designed to investigate associations of diet and cancer. Information about employment in 52 jobs previously linked to elevated risk was obtained by questionnaire. Exposure to several agents of particular interest, including asbestos, was assigned to job titles by expert consensus. Among men and women with any history of exposure to asbestos the adjusted rate ratio (RR) for incident lung cancer was 1.53 (95% CI 1.2–1.9). In analyses of selected occupational categories, the RR for "car repair workers" was 1.27 (95% CI 0.8-2.0) adjusted for smoking and other risk factors.

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