AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 30:643-644 (1996)

LETTER TO THE EDITOR

Possible Misclassification Did Not Obscure Detection of Exposure-Response

KEY WORDS: pneumoconiosis, COPD, coal dust, mortality risk, death certificate data

In his letter (1996), Dr. Tuteur expresses concern about the basis for our conclusion: "Significant exposure-response relationships were found for cumulative exposure to respirable coal mine dust and mortality either from pneumoconiosis or from chronic bronchitis or emphysema as underlying and contributing causes of death" [Kuempel et al., 1995]. We believe that the data presented in our paper do support this conclusion.

Dr. Tuteur bases much of his concern on the results from the lifetable analyses, in which standardized mortality ratios (SMR) were estimated from comparisons with U.S. population rates. He suggests that our results simply indicate that "death rate among coal miners is less than the rate of the general population and that the overall mortality rate is not influenced by intensity of coal mine dust exposure." The observation of mortality rates among working coal miners lower than expected based on comparison with the general population rates is consistent with the healthy worker effect [Fox and Collier, 1976]. Furthermore, for pneumoconiosis as an underlying cause of death, the SMRs do in fact increase with increasing cumulative exposure group. This finding is supported by the Cox proportional hazards analyses, in which the mortality rates are compared *within* the coal miner cohort, thus avoiding the possible bias of comparison with general population rates.

Dr. Tuteur suggests that there may have been a tendency for physicians to "attribute death to coal workers' pneumoconiosis to 'help' families obtain benefits." The existence and magnitude of such bias is speculative; however, in order for such bias to explain the results of the proportional hazards analysis, physicians would have had to consistently and systematically overdiagnose pneumoconiosis in relation to increasing cumulative exposure to respirable coal mine dust. Instead, it seems more likely that the effect of this possible misclassification would be to underestimate the exposure-response relationship because of the variability that would be introduced in the response data. Yet, despite this possible misclassification, the exposure-response relationship in our analysis is highly statistically significant for pneumoconiosis mortality and statistically significant for chronic bronchitis or emphysema mortality (see Table V). Moreover, the radiographic evidence of pneumoconiosis, determined by independent readers, agrees with these findings [Kuempel et al., 1995] (see Table VII).

As Dr. Tuteur points out, we discuss in our paper the limitations in interpreting studies based on death certificate information, including the extent to which inferences can be made about the pathological causes of death [Selikoff, 1992]. Our analyses that include both underlying and contributing causes of death minimize the possible bias from disagreement among physicians on the primary cause of death [Gau and Diehl, 1982] and Dr. Tuteur's concern that "all factors that contributed to death might not be included."

Dr. Tuteur is also concerned that miners who were age 65 or older at the time of medical examination were omitted from analyses. As stated in our paper, these 61 miners (0.7% of the total)—who were still working at and beyond retirement age—were purposefully omitted prior to analysis because they were assumed to represent a selected, healthy-worker survivor group whose inclusion could have introduced bias. Subsequently, we tested this assumption by comparing proportional hazards models with and without these miners, and we determined that the results of the exposure-response analyses were not affected by the omission of these miners. For pneumoconiosis mortality, the coefficient (β) and standard error (SE) for cumulative exposure were nearly identical in the model either with (β = 0.0298, SE = 0.00926) or without (β = 0.0301, SE = 0.00935) the miners aged 65 and older.

Address reprint requests to Ms. E. Kuempel, NIOSH, 4676 Columbia Parkway, MS C-32, Cincinnati, OH 45226.

Accepted for publication October 4, 1995.

We agree with Dr. Tuteur's suggestion for the need to confirm these findings with subsequent analyses in which the cause of death information is supplemented and verified with available pathological data.

Eileen D. Kuempel, BS
NIOSH and University of Cincinnati
Leslie T. Stayner, PhD
NIOSH, Cincinnati, Ohio
Michael D. Attfield, PhD
NIOSH, Morgantown, WV
C. Ralph Buncher, ScD
University of Cincinnati

REFERENCES

Fox AJ, Collier PF (1976): Low mortality rates in industrial cohort studies due to selection for work and survival in the industry. Br J Prev Soc Med 30:225–230.

Gau DW, Diehl AK (1982): Disagreement among general practitioners regarding cause of death. BMJ 284:239–241.

Kuempel ED, Stayner LT, Attfield MD, Buncher CR (1995): Exposure-response analysis of mortality among coal miners in the United States. Am J Ind Med 28:167–184.

Selikoff IJ (1992): Use of death certificates in epidemiological studies, including occupational hazards: Discordance with clinical and autopsy findings. Am J Ind Med 22:469–480.

Tuteur PG (1996): Question to answer requires valid data. Am J Ind Med 30:642.