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VALIDITY OF PATIENT-REPORTED SEXUALLY TRANSMITTED DISEASE. DR Newman, ML Kamb,* TA Peterman, JM Douglas, J Zenilman, G Bolan, F Rhodes, J Rogers, and Project RESPECT Study Group (Centers for Disease Control, MS E-46, Atlanta, GA 30333)

Objective: In research studies, sexually transmitted disease (STD) history is often based on patient report. We sought to assess the validity of self-reported STD. Methods: We used longitudinal data from a trial of HIV/STD counseling done 6/95- 10/97. 4328 participants had baseline interviews and STD tests, were assigned an intervention, and followed with interviews at 3, 6, 9, and 12 months and STD tests at 6 and 12 months and whenever they wanted an STD check (interim exam). Interviews asked about STD care during the prior 3 months and diagnosis and/or treatment of specific STD. Tests were Gram stain, gonorrhea culture, chlamydia PCR, and (women) wet mount and trichomonas culture. In this analysis, we studied only patients interviewed within 100 days following an interim exam with STD testing. We compared STD reported in the subsequent interview to the clinical/laboratory record, and used generalized estimating equations (GEE) to estimate the contribution of various factors to incorrect reporting. Results: 521 patients (245 men and 276 women) had 572 interim visits for STD checks with subsequent interviews (267 from men and 305 from women); 157 (27%) had discrepancies between patient report and clinical/laboratory record. In 93 interviews (16%) the patient denied infection when an STD was documented in the clinic record. In 38 interviews (7%) the patient reported an STD was treated at the clinic when the chart had no record of infection. In 26 interviews (5%) patients misidentified their infection. On multivariate analysis, men were more likely to incorrectly report recent STD infection; race/ethnicity, age, clinic, and time between STD diagnosis and self-report were not related to discrepant report. Conclusions: Even within a 3 month interval, 27% of self-reported STD were incorrect; use of longer intervals is probably leads to larger error. In studying symptomatic STD diagnosed at the study sites, we underestimated error. Most STD are asymptomatic, and patients may have sought care at other sites; both would lead to additional under-report.

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EVALUATING NON-LINEARITIES IN THE EXPOSURE-RESPONSE RELATIONSHIP USING NONPARAMETRIC SMOOTHING AND CONDITIONAL LOGISTIC REGRESSION. PA Sullivan,* EA Eisen, D Kriebel, SR Woskie, and DH Wegman (Division of Respiratory Disease Studies, National Institute for Occupational Safety and Health, Morgantown, WV 26505)

This paper applies nonparametric smoothing techniques in exploratory epidemiologic analysis to help describe exposure-response relationships. Typically, dose-response models assume that the relation between exposure and response is linear on some scale. Many disease mechanisms, however, such as sensitization or carcinogenesis, may produce non-linearities in the dose-response curve. Moreover, linear models may be inappropriate in occupational epidemiology studies where the healthy worker effect can lead to an apparent plateau or even down-turn in risk among the more highly exposed. Occupational epidemiologists typically resort to categorical exposure variables to avoid linearity assumptions, but results are not robust to changes in cut-points. Nonparametric graphing methods make no a priori assumption about the shape of the exposure-response curve and so can identify empirical cut-points between homogeneous exposure categories. As illustrated using data from a study of stomach cancer risk among auto workers exposed to metalworking fluids, exposure categories based on empirically identified cut-points were evaluated in conditional logistic regression models that controlled for confounding. Model fit was better and the risk estimates higher than in models based on traditional cut-points (selected a priori). For example, initial categorical analysis based on quartiles of the exposure distribution found an odds ratio of 1.4 (95% CI 0.8-2.5) in the highest category of exposure ($\geq$ 1.9 mg/m^3). Empirical cut-points identified after smoothing resulted in a model with better fit, a higher cut-off for the highest exposure category, and an odds ratio of 1.9 (95% CI 1.0-3.6) among those exposed to at least 4 mg/m^3. These methods have potential widespread application in epidemiologic analysis.

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THE HEALTHY WORKER EFFECT AMONG 12 COHORTS OF FEMALE NUCLEAR WEAPONS WORKERS. G. Wilkinson,* R. Priore, R. Graham, N. Trieff, M. Fries, B. Young, J. Jones, L. Ray, and J. Loughlin (State University at Buffalo, Buffalo, NY 14214)

The healthy worker effect is a well known bias which affects studies of male workers. Far less is known how this bias may influence studies of female workers. We estimated the healthy worker effect among 12 cohorts of female nuclear weapons workers, who were hired from the mid 1940s through 1979, and followed for mortality through 1994. We made cohort-specific and pooled external comparisons based on U.S. mortality rates from all causes and all cancers for all workers, badged workers and unbadged workers. We also directly compared badged with unbadged workers. A strong healthy worker effect is present for all cohorts except one, and for the combined cohort. Standardized mortality ratios (SMRs) for individual cohorts range from 54 to 97 for all causes of death, and from 59 to 92 for all cancers. Pooled SMRs of 76 are observed for all causes and for all cancers. SMRs of 69 for all causes and 71 for all cancers are found for badged workers; SMRs of 78 for all causes and 77 for all cancers are observed for workers not issued a radiation badge. Cox regression models which compared survival among unbadged with badged workers resulted in relative risk estimates of 1.25 (95% confidence limits (CL):1.19, 1.31) for all causes of death and 1.17 (95% CL:1.08, 1.28) for all cancers. We conclude that a strong healthy worker effect exists for female nuclear workers, that it is stronger for workers who hold jobs that require a radiation dosimeter, and that it can confound internal as well as external comparisons.

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CORRECTION FOR MEASUREMENT ERROR TO THE GENERALIZED ROC CRITERION WHEN MULTIPLE MARKERS ARE AVAILABLE FOR THE DIAGNOSIS OF DISEASE. Enrique F. Schisterman (Harvard University, Boston, MA 02115)

The discrimination between disease and healthy individuals is a difficult task in epidemiological research. Multiple biomarkers are often measured on patients and are available to the researcher. Under normality assumptions, Su and Liu provided a method that finds best linear combination of these multiple biomarkers. Their method maximizes the generalized ROC criterion (the area under the ROC curve), which is V = a'Y and U = a'X, where $a = (\Sigma_x + \Sigma_y)^{-1}(\mu_y - \mu_x)$. Reiser and Fáraggi provided the confidence intervals for the ROC criterion based on the non-central F distribution. In the presence of measurement error, the estimated area under the ROC curve is bias. If the measurement errors between the biomarkers are not correlated, the area under the ROC curve is attenuated towards the null hypothesis. However, if the errors are correlated, the direction of the bias depends on the amount and sign of correlated measurement errors. Using the method of moments, the unbiased and corrected for measurement error estimate to the Su and Liu area under the ROC curve estimate is $\hat{A} = \Phi\left(\sqrt{(\hat{\mu}_x - \hat{\mu}_y)'(\hat{\Sigma}_x - \hat{\Sigma}_{x_e} + \hat{\Sigma}_y - \hat{\Sigma}_{y_e})^{-1}(\hat{\mu}_x - \hat{\mu}_y)}\right)$. Using the delta method, we found the variance of and computed its confidence interval. Using a simulation study, we evaluated the coverage properties of our confidence intervals and found it to be good for a large numbers of situations.

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