Berwick and Chen (1), describing melanoma patients' and controls' recall of sunburn experiences 2 years after an original interview, noted relatively poor correspondence between the first and second interview statements. Gefeller and Brenner (2, p. 707), commenting on that work in a letter to the Journal, observed that "cases were aware of their diagnosis at both tests" and stated, "A more appropriate framework for evaluating systematic differences between cases and controls in answering questions on sunburn-related issues would consist of a test-retest approach in which the first exposure ascertainment takes place prior to the awareness of the cases that they have melanoma and the retest is performed after the diagnosis of melanoma."

Regrettably, neither the paper nor the letter mentioned a recent study described by Weinstock et al. (3) in which precisely that experimental design was used among melanoma patients. In that study, recall bias was measured in groups drawn from the 1976 Nurses' Health Study cohort of 121,700 female nurses. It included an additional design feature that made a finding of recall bias much more convincing than the Berwick and Chen comparison of case and control recall (1). Weinstock et al. (3) compared recall of tanning ability (presumably recognized among nurses as reflecting susceptibility to melanoma) by each of three groups on a 1982 questionnaire with recall on a 1984–1986 questionnaire. The first group, called the prevalent group, comprised 87 nurses whose melanoma was diagnosed before the 1982 inquiry about tanning history; the second, called the incident group, involved 34 nurses whose melanoma was diagnosed after the 1982 inquiry, that is, between 1982 and 1984; and the third, a control group, consisted of 234 randomly sampled nonmelanotic age-matched nurses. The measures were the changes in reported degree of tanning ability from the 1982 questionnaire to the 1984–1986 questionnaire.

The new design feature was recall of a personal characteristic, hair color, which presumably was considered neutral with respect to melanoma risk among most nurses in the early 1980s.

A comparison of the 1982 questionnaire responses on tanning ability with those of the 1984–1986 questionnaire showed that, out of a possible range of −3.0 to +3.0, the mean change from 1982 to 1984–1986 was 0.03 ± 0.06 (standard error) for the prevalent group, −0.24 ± 0.12 for the incident group, and 0.06 ± 0.04 for the control group. Weinstock et al.'s table 2 (3, p. 243). A Kruskal-Wallis test of the three groups yielded a p value of 0.035, the low p value, and this was verified in individual group tests. In contrast, out of a possible range of −1.0 to +1.0, the mean change in hair color response was 0.00 ± 0.03 among the prevalent nurses, 0.00 ± 0.04 among the incident nurses, and 0.02 ± 0.00 among the controls (p = 0.84).

Clearly, the major outcome variables, reported tanning ability and sunburn history, differ in the studies by Weinstock et al. (3) and Berwick and Chen (1). Tanning history recalled in 1982 and 1984–1986 may have differed from sunburn history recalled in 1987–1989 and 1990 in terms of susceptibility to recall bias. Nevertheless, the putative connection of tanning history with future melanoma in the nurses' minds was probably less powerful than that of sunburn history. If that is indeed true, then the finding by Weinstock et al. (3), being thus conservative with respect to the perceived influence of the relevant variable, is the more persuasive in favor of there being recall bias.

The Weinstock et al. study (3) may not provide an acceptable basis for a final judgment on recall bias, but its findings suggest caution in drawing inferences in studies involving knowledge or ignorance of a disease state. After learning that they had breast cancer, patients studied by Kreitler et al. (4) showed similar bias on another outcome, repressiveness. Blaney (5) has written an excellent review of the role of affect in recall bias.

REFERENCES

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THE AUTHORS REPLY

We appreciate the interest that Dr. Fox (1) has shown in the epidemiologic issues surrounding correct classification of exposure and the difficult problem of recall bias. While our study (2) was focused on the reliability of any subject's reporting of sunburn history, we did find a substantial degree of misclassification that was nondifferential. It is quite important to be cautious in interpreting the results of interview studies wherein the respondents are aware of their disease status. This is a fundamental tenet of epidemiology that is important to reiterate and keep in mind when interpreting results from case-control studies.

We did in fact refer to the paper by Weinstock et al. (3) (our reference 18) on page 1036 and observed that their study was potentially subject to artifact, since two somewhat different questions were asked of subjects in lieu of a test-retest study (2). However, Dr. Fox makes two important points. First, if recall bias did exist, it would probably be
stronger for history of sunburn than for tanning ability, as the media have publicized widely the dangers of sunburn in developing skin cancer, particularly melanoma, but have publicized much less the role of tanning ability. Second, the literature in the behavioral sciences may be useful to epidemiologists in designing and analyzing questionnaire data.

Evaluation of the reliability of a subject's recall is critical, since the credibility of epidemiology depends on having a clear understanding of the extent to which these studies are able to answer public health questions.

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GEFELLER AND BRENNER REPLY

We thank Dr. Fox (1) for his comments on the need to assess the presence of recall bias when studying risk factors for cutaneous malignant melanoma. The intention of our letter (2) was to point out that the test-retest design nested within a case-control study that was adopted by Berwick and Chen (3, 4) is only able to address the reproducibility of exposure information and the presence of differential change in recall that is dependent on case-control status. Since melanoma patients in the study were aware of their diagnosis at both interviews, we argued that such a design can never provide compelling evidence about the presence or absence of recall bias per se. Thus, our comments were directed only at methodological aspects of the reliability study by Berwick and Chen (3).

Fox draws attention to a paper by Weinstock et al. (5), which we are well aware of and which also was referenced by Berwick and Chen (3). In that study, the change in exposure recall was compared between controls, melanoma cases who were aware of their diagnosis at both (postal) interviews, and those cases who knew their diagnosis only at the second interview. A limitation noted by Fox was the fact that the wording of questions was not identical on the two questionnaires. Thus, the results of the study are difficult to interpret. However, we join Fox in his view that the data support the presence of recall bias with regard to the ascertainment of tanning ability, as a systematic change in the responses due to different wording of questions would not have been confined to one group only (those melanoma cases who received their diagnosis between the two interviews).

The question of reliability and validity of exposure information has also been addressed in other case-control studies on melanoma risk factors—for example, in the South Ontario study (6,7). Here, in a subgroup of the study population, personal interviews were conducted among persons with suspected melanoma who did not yet know their final diagnosis. Further information on reliability was provided by a mail survey of another subsample, using the same questions as those asked in the interview.

When considering the risk factor "previous severe sunburns," Walter et al. (6,7) found that 37 percent of 43 cases who were unaware of their melanoma diagnosis at the time of the interview reported being exposed, compared with 29 percent of the other 540 melanoma cases. However, this slight difference did not reach statistical significance (p = 0.30, Fisher's exact two-tailed test; all figures were recalculated from Walter et al.'s table 6 (7, p. 757)). Details on Walter et al.'s additional results, which did not point to the presence of recall bias (termed "rumination bias" by Walter et al.) for all factors studied, can be found in the original papers (6,7).

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