Drs. Muliyil, *et al.* Reply to the Letter from Drs. Nishioka and Goulart

TO THE EDITOR:

Drs. Nishioka and Goulart feel that, since cases were at higher risk for leprosy than the controls, the results regarding the protective efficacy of BCG found in our study could be misleading. They base their concern on the fact that the proportion of subjects with household contact with leprosy is higher among cases than controls. In our study we adjusted for the effect of household contact, both with "infectious" and "non-infectious" cases in the household. In addition, we adjusted for the effect of having a family member with leprosy outside the household. Despite these analytic procedures, Drs. Nishioke and Goulart remain skeptical of our interpretation of our results. They suggest matching cases and controls according to exposure in the households.

We agree that matching controls to cases by their exposure to leprosy in the household would be a possibility that might better control for exposure. However, this matched design would create other problems. Intrafamilial contact can act as a confounder only if it is also associated with BCG vaccination. In areas where contacts of leprosy cases are being selectively vaccinated with BCG, a case-control study which ignores this policy can result in an underestimation of the protective effect of BCG. The reverse would be the case if contacts of cases generally tend to have lower BCG coverage than the general population being studied.

In our study, we selected controls matched for age, sex and the geographic locality. The locality matching resulted in a good balance between cases and controls with respect to a number of socioeconomic variables. These socioeconomic factors could have had a significant influence on the chance of exposure of BCG, the risk of leprosy and the chance of being diagnosed as having leprosy by the health care system. In fact, we did attempt to select an extra control for each case who had intrafamilial contact with another case from among healthy contacts of other known index cases of similar severity. In doing this, we had to give up matching for locality. In South India, the BCG coverage varies with localities as does the emergence and diagnosis of new cases of leprosy. Apart from the difficulty in finding a suitable number of age- and sex-matched controls with a similar history of intrafamilial contact, we also faced the difficult task of adjusting for the effect of different geographical areas when we attempted to match for household exposure. Therefore, we feel that the method of selection of controls and data analysis

we selected is preferable to the procedure recommended by Drs. Nishioka and Goulart.

—Jayaprakash Muliyil, M.D., M.P.H.
Department of Community Medicine
Christian Medical College
Vellore, India

—Kenrad E. Nelson, M.D.
Earl Diamond, Ph.D.
Department of Epidemiology
Johns Hopkins University
School of Hygiene and Public Health
Baltimore, Maryland, U.S.A.