Distance of residence in 1984 may be used as exposure surrogate for the Bhopal disaster

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Sir,

We read with interest De’s conclusions\(^1\) that the lung function impairments in the Bhopal population were associated with gas exposure, lower socio-economic status, and smoking. Prior studies have also shown that poorer people living in kuccha houses sustained greater exposure to the gas because of proximity of residence to the Union Carbide plant\(^2\). However, the high prevalence of tobacco smokers/ex-smokers in the exposed group is a major confounder which may also account for the study findings. An exposure-response analysis may have helped determine whether gas exposure is truly associated with pulmonary impairment but the author did not attempt such an analysis because of possible recall bias. We suggest that using distance of individual in the residence at the time of gas release in 1984 will serve as a surrogate measure of exposure. Such an approach was successfully used in the ten-year follow up community survey conducted by the International Medical Commission on Bhopal (IMCB)\(^3,4\) and may help determine if the association of gas exposure with respiratory impairment is truly present in this hospital-based study.

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Authors’ response

Sir,

I thank Drs Dhara and Acquilla for their interest in my article\(^1\) and appreciate their suggestion to analyze the exposure-response relationship using the distance of individual residence at the time of disaster. The surrogate markers used in earlier studies to determine the severity of MIC exposure are: death of family members or neighbours, immediate symptoms and severity of symptoms, hospitalization, perceptions of the presence of MIC and locality of residence at the time of disaster\(^2\). Except for the distance of residence from the Union Carbide Plant, the collection of other parameters from illiterate (61% population in severely affected area 41% in moderate to mildly affected area were illiterate)\(^2\) after two decade is subjected to high recall bias. The effect of distance of residence was further influenced by additional variables, e.g. duration of exposure, protective measures used by them at that time (i.e. cover of face, splashing of water on face, etc.), and their activity after the disaster (i.e. ran away from their houses, stayed inside their house).
Therefore, the distance of individual residence at the time of disaster alone may be inadequate to assess the severity to MIC exposure. The approximate distance of residence of our study population was calculated using their registration numbers (registration numbers were assigned as per satellite health centers nearer to their original residence) and no differences in prevalence of different lung function abnormalities was observed.

The IMCB survey reported high respiratory morbidity among exposed survivors and documented its relationship with the distance of residence from the Plant. The FEF$_{25-75\%}$ was significantly reduced (84% of predicted) among those who were residing nearer to the plant. However, no such association was observed for the other important indices of lung function \textit{i.e.} FEV$_1$, FVC and FEV$_1$/FVC. The FEF$_{25-75\%}$ is a variable spirometric parameter to assess small airway function and it depends upon the subjects’ expiratory effort during spirometry. Therefore, the FEF$_{25-75\%}$ values were not utilized in this study.

Unlike previous studies, the result demonstrated the high prevalence of obstructive lung function abnormalities among gas victims. The observation was based on retrospective analysis of spirometry data and hence the direct exposure-response relationship could not be evaluated. It was postulated that cumulative effect of other known confounding factors for developing obstructive lung function \textit{i.e.} smoking, low economic conditions might have influenced the observations. Even after excluding the current and ex smoker from both the groups, the relative risks in our study remained similar. The community based study using these results will be required to determine the true association of MIC and lung function abnormalities.

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