Commentary: Socio-economic determinants of tuberculosis in Recife, Brazil

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Multilevel (or hierarchical) analysis is of particular interest to explanations of tuberculosis (TB) incidence and prevalence, as TB has long been considered a disease of socio-economic deprivation. Cantwell et al.\(^1\) published a seminal study in 1998 demonstrating an association of TB with crowding, poverty and low education in the USA, although it was entirely an ecological analysis rather than a multilevel one. The article by Ximenes et al.\(^2\) is interesting in its multilevel analysis for the area of Recife, Brazil. The authors’ model identified least ownership of goods or little personal wealth as being most associated with TB. They conclude that studies of TB should include variables describing the area or context of TB, in addition to individual-level risk factors.

Readers should be aware of some of the limitations of the study by Ximenes et al.\(^2\) The selection bias (i.e. including only half of all TB cases in the area) is considerable, but the authors did all they could to acknowledge this limitation and adjust for it in their analysis (by weighting responses). It is possible that inappropriately selected cases were weighted, since only those cases residing in an area with sufficient health personnel to interview patients (and thus more likely to select patients in wealthier areas) were included; this would result in fewer poor areas being represented in the final sample. However, this limitation would lead to an underestimation of the associations that the authors found.

Other limitations might have skewed results unpredictably. Human immunodeficiency virus (HIV) status was not ascertained for cases or for controls. While the authors dismiss this limitation as not likely to be a problem, infection with HIV is the greatest known risk factor for TB progression and, as such, should ideally be included in any analysis of TB associations. In other settings, HIV prevalence is highly associated with poverty (such that one might be considered a proxy for the other). In Recife, TB prevalence is highest in the age groups that are also likely to be the highest in HIV prevalence. There might be some synergy between HIV, poverty and age that is inherent in the results.

Also not included in the authors’ analysis was malnutrition, which is mentioned in the introduction as a key socio-economic factor. Lonnroth and Raviglione\(^3\) found that malnutrition was the greatest contributor to global TB incidence in their recent study of population-attributable risks.

The authors’ choice of literacy and computer ownership for creation of a composite interaction variable is perplexing. Considering the most extreme category for each variable, Table 3 in their article shows that the most significant area variables (in the order: from most to least) in bivariate analyses were: number of cars owned, followed by a tie among employment, ownership of computers or air conditioning. Literacy was less significant than several other variables. Regarding methods of analysis of this composite variable, inclusion of an interaction term of computer ownership multiplied by literacy requires inclusion of both computer ownership and literacy separately in the final multivariable model for accurate interpretation of the interaction term. This was not done.

Finally, the authors did not answer their question: Is it better to be poor in a rich area, or rich in a poor area? They only showed that being poor in Recife was associated with TB. An answer to the question would require a comparison of TB incidence in various areas, controlling for individual-level wealth. They could have classified each of the 53 census areas in Recife as rich or poor (based on some scoring of various census variables), included the areas in the multivariate model, and then examined TB incidence controlling for individual-level wealth. Had they done so, they would have been able to estimate TB incidence for rich persons in poor areas, poor persons in rich areas, poor persons in poor areas and rich persons in rich areas.

Conflict of interest: None declared.

References

1. Cantwell MF, McKenna MT, McCray E, Onorato IM. Tuberculosis and race/ethnicity in the United States: impact

2 Ricardo Arrees de Alencar X, Maria de Fátima Pessoa Militão de A, Wayner VS et al. Is it better to be rich in a poor area or poor in a rich area? A multilevel analysis of a case–control study of social determinants of tuberculosis. *Int J Epidemiol* 2009;**38**:1285–94.