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Estimates of anti-SARS-CoV-2 antibody seroprevalence in Iran

Hossein Poustchi and colleagues[1] reported SARS-CoV-2 antibody seroprevalence in the general population and high-risk occupational groups across 18 cities in Iran. However, there are several major concerns regarding their study design, analysis, and results.

First, although appendix 2 of the Article mentions cities as clusters, it is unclear how these clusters were selected. The inverse of the selection probability of individuals, which is a function of probability of cluster selection and unknown here, should be used as weights in the analyses.[2]

Second, the sample size calculation has errors. In the design effect formula, n is calculated as $\sum m^2 / \sum m = 1180{\cdot}2$ (where m is the cluster size)[3] but not the number of clusters (n=18), as mentioned in appendix 2. Also, the intracluster correlation (δ) of 0·05 is too high for large clusters (such as those encountered in the study by Poustchi and colleagues), without any supporting references. Furthermore, it is unclear whether the seroprevalence (p) of 0·15 refers to the general population or high-risk groups, and again no references are given on the reported value.

Third, the bootstrap procedure described in appendix 2 mimics simple random sampling and does not consider clustering in the design, leading to too narrow confidence intervals (CIs). In fact, the appropriate bootstrapping procedure for cluster designs would draw the cluster units rather than individual units with replacement. Alternatively, one can use cluster-robust standard errors.[4] The CIs are also narrow due to uncertainties in the sensitivity and specificity estimates. A Monte-Carlo bias analysis from an appropriate probability distribution of sensitivity and specificity can be used for overcoming this problem.[5]

Fourth, a seroprevalence of 72·6% for Rasht city seems to be an overestimate and inconsistent with the results of other studies, which reported estimates of about 23·7% for Rasht and 27·5% for Guilan province in April and mid-June, respectively.[5,6] This difference cannot be attributed to the different design and analysis of those studies. Moreover, a SARS-CoV-2 seropositive status seems to be durable (at least up to 8 months after infection)[7] and can probably protect people from reinfection.[8] The alarming (red) status of Rasht during the previous months[9] is not consistent with Poustchi and colleagues' estimated seroprevalence, which is higher than the presumed threshold of COVID-19 herd immunity (50–67%).[10]

Finally, as seroepidemiological studies can affect decisions related to immunisation programmes and pandemic control measures, we believe that the results of Poustchi and colleagues' study should be more carefully interpreted, and we hope for studies with more robust design and analysis.

We declare no competing interests.

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