



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Use of the Demographic and Health Survey framework as a population surveillance strategy for COVID-19

Governments worldwide are currently deliberating the feasibility of a national shutdown strategy to contain and mitigate the effect of coronavirus disease 2019 (COVID-19) on their country's population. Testing for COVID-19 is mainly being done among at-risk individuals (eg, those with influenza-like symptoms, people who have had contact with an individual testing positive for COVID-19, health-care professionals, or those with a travel history to an affected region),¹ thus an accurate value for how many individuals are truly infected is not known. Since at-risk individuals are not representative of the general population, it is impossible to obtain the true prevalence of COVID-19 in the population. Yet, establishing this value is vital to understand the morbidity and mortality risk in the population, particularly in low-income and middle-income countries (LMICs) such as India, which cannot absorb the socioeconomic and public-health fallout resulting from national shutdowns.

In the absence of universal testing, a random-sample-based population surveillance framework is urgently needed. We propose using the well established Demographic and Health Survey (DHS) framework as a solution to ascertain the true prevalence of COVID-19. We use as an example the National Family Health Survey (NFHS), India's version of the DHS that is led by the International Institute of Population Sciences under the Ministry of Health and Family Welfare.²

In 2002, India was projected to have 25 million HIV-positive individuals, with a prevalence of HIV in adults of 3–4%.³ These estimates were based on extrapolation of infection rates

among selected at-risk individuals. India used the NFHS to test for HIV in the general population, and estimates were sharply reduced to 2.5 million, with a prevalence of HIV in adults (aged 15–49 years) of 0.28%.⁴ This discrepancy showed the shortcomings of selective testing of at-risk individuals as the basis for understanding disease prevalence in a population.⁵

The NFHS has state-of-the-art infrastructure with a ready sampling framework. For more than 25 years the NFHS has served India well, providing reliable estimates of various population, health, and nutrition indicators. Layering a COVID-19-focused data-collection effort onto the NFHS infrastructure would keep operational costs low, with the major expense being laboratory costs for testing samples.

We estimated the minimum required sample of individuals who would need to be tested under three scenarios of anticipated COVID-19 prevalence in the population. Under a scenario of 0.5% prevalence, we would only need a sample of about 3000 individuals to be tested. The minimum required sample size increases to just over 15 000 under a rarer scenario of 0.1% prevalence and decreases to about 1500 if the anticipated prevalence is 1%. Should the anticipated prevalence of COVID-19 be any higher than 1%, the minimum sample size needed to reliably estimate the true prevalence would be smaller and, therefore, fewer resources would be needed.

This sampling approach could be implemented at state or district levels without great changes in the required sample size, unless we presumed a different anticipated prevalence for a specific state or district. The minimum sample sizes presented here are based on a simple random sampling strategy. Further appropriate stratifications and clustering of individuals by households would need to be considered.

India is not alone in its inability to establish the true number of

infected individuals in the country. Using an existing rich data-science infrastructure, India and other countries with established DHS sampling frames can provide vital data and insights to help guide an appropriate response to COVID-19, and show vision and leadership to prepare for the next pandemic.

We declare no competing interests.

Copyright © 2020. The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

*SV Subramanian, K S James
svsubram@hsph.harvard.edu

Harvard Center for Population and Development Studies, Cambridge, MA 02138, USA (SVS); Department of Social and Behavioral Sciences, Harvard T H Chan School of Public Health, Boston, MA 02115, USA (SVS); and International Institute for Population Sciences, Mumbai, India (KSJ)

- 1 Indian Council of Medical Research Department of Health Research. Strategy for COVID19 testing in India, version 4. April 9, 2020. https://icmr.nic.in/sites/default/files/upload_documents/Strategy_for_COVID19_Test_v4_09042020.pdf (accessed April 23, 2020).
- 2 International Institute for Population Sciences. National Family Health Survey, India: about NFHS. <http://rchiips.org/nfhs/about.shtml> (accessed April 22, 2020).
- 3 Gordon DF. The next wave of HIV/AIDS: Nigeria, Ethiopia, Russia, India, and China. September, 2002. https://pdfs.semanticscholar.org/3f03/3cc3622f18c6972660dd19fd2d3ba409606.pdf?_ga=2.198668143.1342463162.1586366906-700348898.1586366906 (accessed April 23, 2020).
- 4 International Institute for Population Sciences. HIV prevalence. [http://rchiips.org/nfhs/NFHS-3%20Data/VOL-1/Chapter%2012%20-%20HIV%20Prevalence%20\(422K\).pdf](http://rchiips.org/nfhs/NFHS-3%20Data/VOL-1/Chapter%2012%20-%20HIV%20Prevalence%20(422K).pdf) (accessed April 23, 2020).
- 5 Subramanian SV, Corsi DJ, Subramanyam MA, Smith GD. Jumping the gun: the problematic discourse on socioeconomic status and cardiovascular health in India. *Int J Epidemiol* 2013; **42**: 1410–26.



Published Online
April 29, 2020
[https://doi.org/10.1016/S2214-109X\(20\)30213-8](https://doi.org/10.1016/S2214-109X(20)30213-8)

For the DHS see <https://www.dhsprogram.com>