Social vulnerability indices: A pragmatic tool for COVID-19 policy and beyond

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SARS-CoV-2 does not affect all populations equally, highlighting the known social and economic determinants of health. Certain populations (i.e. communities that are racialized, have older age structures and/or lower socioeconomic status) have been disproportionately impacted with greater mortality and morbidity, while also being under-resourced to manage the pandemic response.[1] As the pandemic continues, and with the expectation of future variants or epidemics to come, identifying and locating communities with the most vulnerable individuals will become a key step to implementing targeted public health strategies and distributing resources equitably.

In *The Lancet Regional Health Europe*, Welsh and colleagues have constructed a static Socio-Ecological COVID-19 Vulnerability Index (SEVI) and a Vaccine Hesitancy Index (VHI) using routinely collected and publicly available data for 6790 small census geographic areas in England called Middle Super Output Areas (MSOAs).[2] After testing individual items for association with cumulative COVID-19 case rates, the final SEVI is composed of 18 items across four domains (socioeconomic, ecological, health services and epidemiological) which demonstrated statistically significant associations with COVID-19 case rates in multivariable models. Reflective of the findings of a national survey on vaccine hesitancy, the VHI consists of five items which are predictive of vaccine uptake on a community level. The authors used development and validation methodology to develop the indices in a randomly selected 60% of census areas, followed by validation of their indices in the remaining 40%. Using Spearman correlation coefficients, the SEVI was strongly correlated with COVID-19 cases, more so than each of its individual domains. The authors also evaluated it in relation to a previously published MSOA level vulnerability index developed by Daras and colleagues and found the SEVI to be more strongly predictive and simpler to calculate and implement.[3]

The paper by Welsh and colleagues is of particular interest for two reasons. First, the authors show how the SEVI can be used in real time by doing time-stratified analyses, dividing COVID-19 cases into segments before, during and after each national lockdown. With the exception of the time period before the first national lockdown, during which testing was limited and may not have reflected actual disease incidence, the SEVI was predictive in all time segments, with stronger associations outside of lockdown periods. These weaker associations during lockdowns may be due to behaviour change from the policy measures themselves, but could also reflect the inequitable impact of restrictive measures across diverse community settings and are a reminder of the importance of using policy interventions in a way that do not perpetuate vulnerability. For instance, people in vulnerable communities tend to disproportionately work in sectors with no work-at-home option, and as the authors point out, people with precarious employment may face barriers to testing due to fear of losing their jobs. As such, despite the predictive power of this community-level composite index, we should remember that there are still individual-level contributors to social vulnerability that are not captured in the SEVI. Second, in conjunction with the VHI, the authors demonstrate the geographical intersection of these indices. MSOAs in the most vulnerable quintile according to the SEVI and VHI (individually and combined) are reported and visualized using maps, clearly showing areas at the intersection of vulnerability and vaccine hesitancy. Effectively, the VHI acts as another domain in the SEVI, strengthening the point that optimal predictive value and learnings will arise from a comprehensive index including different and multiple domains relevant to the outcome.

This work builds on a rich and evolving history of indexes predicting social vulnerability in the fields of disaster management,[4] environmental hazards[5] and health.[6] These indices have been used for transnational

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comparisons,[7] within country analyses,[4–6] or constructed prospectively to include locally relevant data.[8] Depending on the aims and available data, they can include variables capturing vulnerability at ecological[3–5] or individual levels,[6,7] or both.[9] With many examples in the literature to create indices using individual or ecological variables, social vulnerability indices have become popular during this pandemic for good reasons.[10] SEVIs are pragmatic, harness available data, and can be a powerful tool for local and regional jurisdictions to optimize resource allocation. Additionally, compared with measures of vulnerability that are based on a single or small number of variables, or are binary or have a limited number of categories, calculation of composite indices as a continuous measure also captures gradations that can be useful to better differentiate risk and vulnerability when used by public health decision-makers.

In this era where each new disaster reminds us that individuals' vulnerabilities cannot be separated from their systematically disadvantaged communities, social vulnerability indices harnessing publicly available data offer a powerful tool to understand and consider equity in pandemic and public health policies.

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