

Regional Social and Epidemiological Vulnerability to COVID-19 in Kenya

Introduction

Epidemics and pandemics disproportionately affect populations with greater impacts on the most vulnerable and less resilient communities. Hence Kenya's response to the COVID-19 pandemic calls for more context adapted public health measures reflecting our improved understanding of who is the most vulnerable and their geographical location. This policy brief presents evidence on localized vulnerability indices to identify areas and people who require greater support while highlighting inequities to inform the COVID-19 response in Kenya.

Significant health, socioeconomic, demographic and epidemiological disparities exist within Kenya; however, we know very little about how these vary across different counties. Fighting the COVID-19 pandemic calls for precision - understanding of who is most vulnerable and why, where the disease is likely to be spreading fastest, where the most vulnerable communities are located and where adaptations to interventions like social distancing may be necessary.

Key Messages

- We developed 3 indices for vulnerability to COVID-19 in Kenya; social vulnerability, epidemiological vulnerability, and an index that combines social and epidemiological vulnerability
- Using this indices, we assessed the regional vulnerability of the Kenyan population to COVID-19 at the sub-county level
- North-western and parts of eastern Kenya, with a population of approximately 6.9 million have the most vulnerable sub-counties when considering social vulnerability index
- Sub-counties in central, south-east and parts of western Kenya where approximately 7.2 million people reside were the most vulnerable based on the epidemiological vulnerability index mainly driven by a high prevalence of hypertension, smoking, and HIV
- Forty-six sub-counties in the central and surrounding areas, south-east and parts of western Kenya were the most vulnerable when the two indices were combined affecting approximately 7 million people

Understanding Vulnerability in the Kenya Context

What we have done – We have used a wide range of indicators to describe a range of social constraints and assess risk. We developed three COVID-19 specific vulnerability indices to describe both social vulnerability (affects the risk of infection and spread and resilience/recovery from impact) and epidemiological vulnerability (affects the risk of progression to severe disease) defined at the sub-county level in Kenya.

How these indices can be used

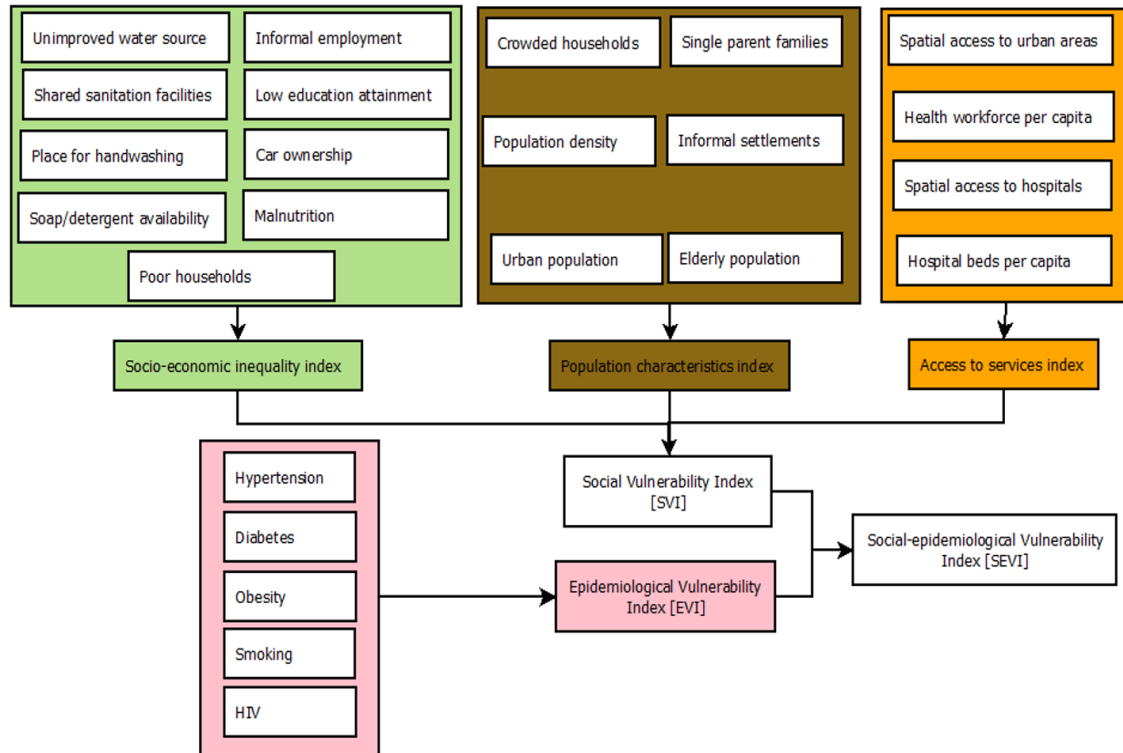
By identifying highly vulnerable areas, this indices can help inform policies and resource allocation. Some Examples

1. County services and non-governmental organizations: Guide allocation of limited resources to the areas that need them most.
2. Policymakers at county levels: Support emergency planning and inform choices about what types of public services and social economic support should be directed and where.
3. Private sector organizations: Direct efforts to support COVID-19 relief, such as providing water and soap and sanitary facilities, masks where they are most needed.
4. General public: Understand their community's vulnerability and advocate for resources where needed from national and county Government.

The Approach

The Social Vulnerability was defined using indicators related to socio-economic inequalities, population dynamics and access to services. The Epidemiological vulnerability captures diseases and comorbidities that affect the likelihood of disease progression hence affecting the severity of COVID-19 disease. The two indices were combined to create a combined index of overall vulnerability (Figure 1).

Figure 1 Schematic representation of data layers and approaches used to define social vulnerability index (SVI), epidemiological vulnerability index (EVI) and the combination of the two, social-epidemiological vulnerability index (SEVI) at the sub-county level in Kenya.



Key findings

The general observation is that Sub-counties in the north-western and parts of eastern Kenya are most vulnerable when considering social vulnerability index. At the same time, central and south-east regions are most susceptible based on the epidemiological vulnerability index affecting approximately 6.9 million and 7.2 million people, respectively. The index showed widespread inequities across sub-counties of Kenya.

Social Vulnerability

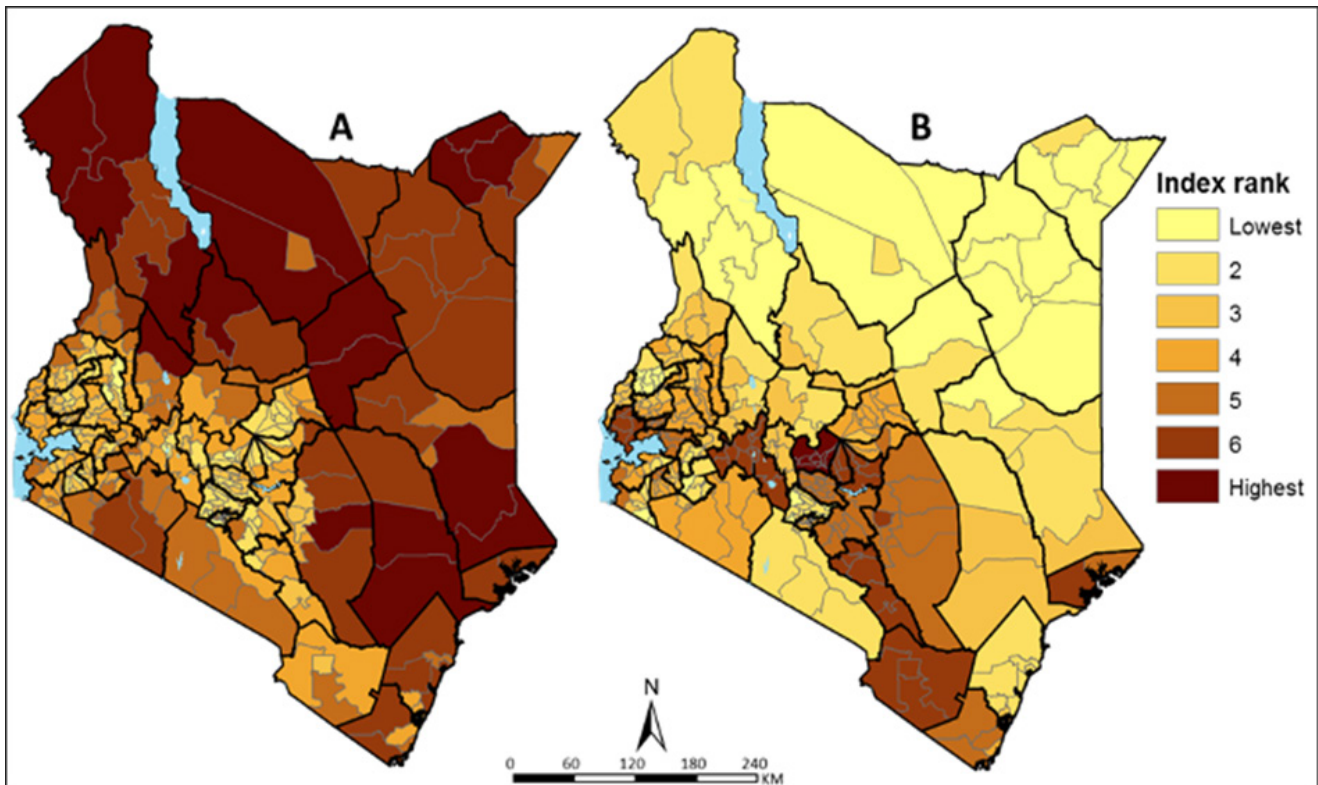
Some communities are more vulnerable than others – they have a limited ability to mitigate, treat, and delay transmission of a pandemic disease, and to reduce its economic and social impacts. The COVID-19 Social Vulnerability Index (SVI) identifies these communities within the context of the COVID-19 pandemic:

- North-western and parts of eastern Kenya have the most vulnerable sub-counties (Figure 2A). Approximately fifteen per cent (6.9 million) of Kenya's total population resides in the 49 sub-counties that were classified as highly vulnerable.
- The most vulnerable sub-counties in these counties have poor geographic access to health care services, are marginalized in terms of access to the nearest urban areas and are economically

disadvantaged (mainly poor households, poor access to improved water and sanitation and low education attainment) (Figure 3 & 4). Yet despite being the most vulnerable, the region has a low population density and fewer families with single parents relative to other parts of Kenya.

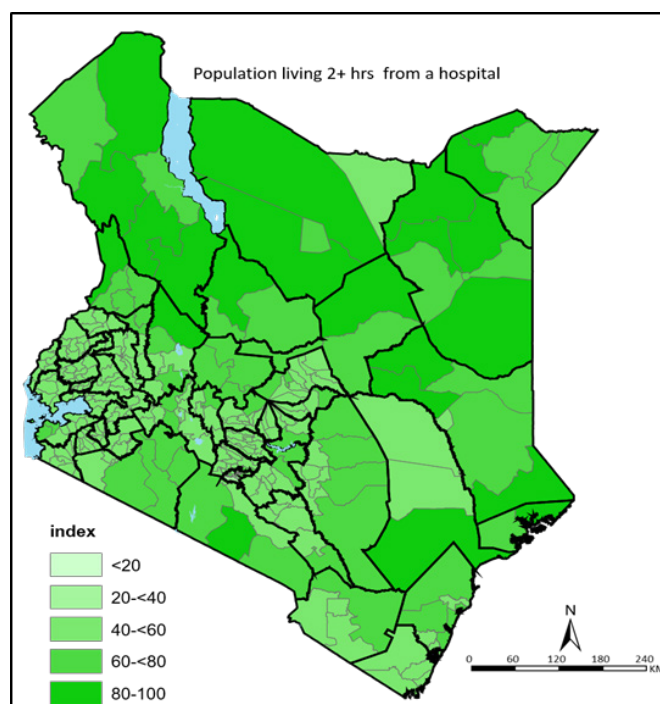
- The least vulnerable sub-counties in central and western Kenya have a lower proportion of the poor households, improved access to water and handwashing soaps/detergents, higher education attainment while most settlements are near urban areas and within 2 hours of the nearest hospital.
- Despite having low average vulnerability, the least vulnerable sub-counties have a high population density and a higher proportion of the elderly population. Additionally, sub-counties in central Kenya and adjacent areas have a slightly higher proportion of urban populations and predominance of single parent families. These areas are at risks of increased transmissions and house communities that are less resilient hence would suffer disproportionately from long term impact of the COVID-19. These communities are exposed to economic hardship due to job and income losses, food insecurity, and lack access to supplemental education initiatives and need to be prioritized for social support programmes.

Figure 2 Social vulnerability index (SVI) (A) and epidemiological vulnerability index (EVI) (B) across 295 sub-counties in Kenya grouped into seven ranks. Rank 1 and 2 are the least vulnerable sub-counties, while rank 6 and 7 are the most vulnerable.



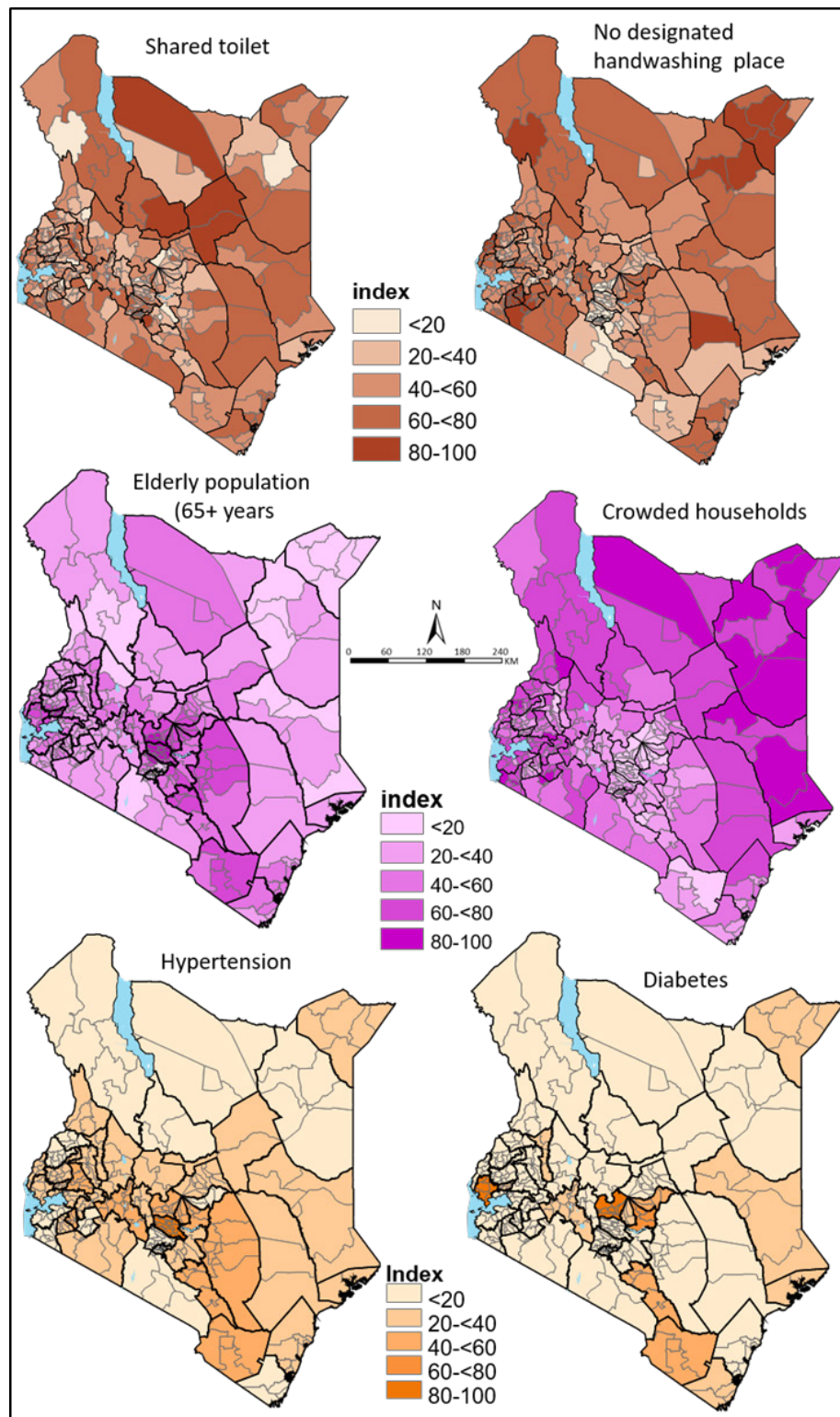
The vulnerability index delivers a measure through which to appreciate better factors that enable communities to remain resilient, inform on their ability to carry out personal protective measures, practice both hand hygiene and hygiene in the household, the challenges and success of social distancing, the feasibility of home-based care in a different context in Kenya. This index can be used to inform decisions on the disbursement of Government and county social support measures or identify those areas that require improved health services.

Figure 3 Map of Access to health services across 295 sub counties in Kenya showing population living within 2 hours of a hospital



Footnote Coverage and or prevalence rescaled a common scale ranging from 0 (least vulnerable) to 100 (most vulnerable)

Figure 4 Showing a subset of indicators included in the Social and Epidemiological Vulnerability Index across 295 sub counties in Kenya



Footnote Coverage and or prevalence rescaled a common scale ranging from 0 (least vulnerable) to 100 (most vulnerable)

Epidemiological Vulnerability (EVI)

- Sub-counties in central, south-east and parts of western Kenya where approximately 7.2 million people reside were the most vulnerable (Figure 2B) mainly driven by a high prevalence of hypertension and smoking, while HIV is more prevalent in western Kenya.
- High prevalence of obesity and diabetes is only evident in few sub-counties around central and south-east Kenya
- Though sparsely populated, northern and south eastern parts of Kenya were less epidemiologically

vulnerable and are therefore generally less vulnerable to severe diseases but more susceptible to infections and spread when considering their socioeconomic context

- There are exceptions in north-eastern, where Wajir county has a higher prevalence for both diabetes and hypertension, while Turkana county has a higher rate of smoking.

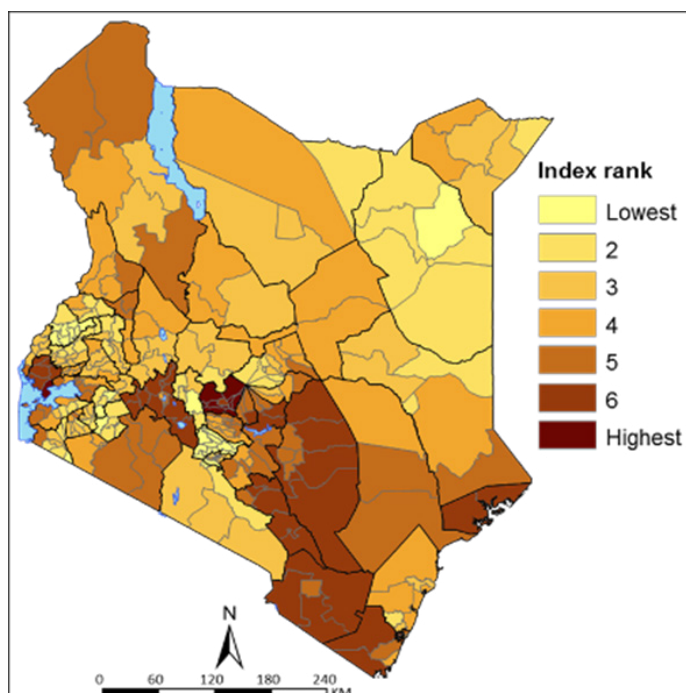
Based on the factors considered, the expectation is that in central, south-east and partly western Kenya will have populations that are more vulnerable to progression to severe disease if infected. These include elderly persons and/or persons with comorbidities and or immunocompromised populations.

Social and epidemiological vulnerability (SEVI)

The index has identified areas and subpopulations exposed to dual burden of increased risk of infection and spread and combined with high epidemiological vulnerability. Briefly:

- Forty-six sub-counties in the central and surrounding areas, south-east and parts of western Kenya were the most vulnerable when the two indices were combined affecting 15% (7.0 million) of Kenya's population. Figure 5
- Approximately 30% of the population live in sub-counties classified as the least vulnerable based on SEVI. These sub-counties are scattered across Kenya mainly in western (e.g. Bungoma county) and a few in north-eastern (e.g. Wajir county) and central (e.g. Kiambu County) Kenya.
- Different factors contribute to the overall vulnerability score. For example, Kiambu, recorded overall low scores (meaning least vulnerable) across almost all factors except it has high population density, high urban population, large elderly population, many households with shared toilets and high prevalence of smoking whose effect are masked in the combined index. Conversely, Wajir county in north-eastern had higher scores (meaning more vulnerable) for crowded and poor households, poor geographic access to hospitals and clean water and sanitation however the effect of these factors was neutralized by low scores from the other indicators.
- Parts of Kitui (central-east), Elgeyo Marakwet (partly western) and Narok (south-west) have areas with a high prevalence of smoking, hypertension and stunting, a higher proportion of elderly population, low access to improved water and sanitation and a smaller proportion of people within 2-hours of the nearest hospital.

Figure 5: Social- epidemiological vulnerability index (SEVI) across 295 sub-counties in Kenya grouped into seven ranks. Rank 1 and 2 are the least vulnerable sub-counties while rank 6 and 7 are the most vulnerable



High Priority Extremely Vulnerable Areas

Top 10 counties (Most vulnerable)	Bottom 10 Counties (Least vulnerable)
Mombasa	Wajir
Lamu	Bungoma
Nyeri	Mandera
Embu	Kiambu
Taita Taveta	Bomet
Kitui	Trans Nzoia
Kirinyaga	Nyandarua
Siaya	Kakamega
Makueni	Busia
Nakuru	Garissa

Footnote: Counties such as Busia and Mandera are unique because they are border counties hence face exceptional challenges.

The SEVI is not designed to predict which individuals will become infected with coronavirus or who will require hospitalization – instead, it tells us about the anticipated negative impact at the community level. This helps decision-makers target resources where they are most needed.

Recommendations	
SVI	<p>In vulnerable communities:</p> <ul style="list-style-type: none"> Adapt measures such as building temporary health facilities close to where most of the populations in these areas are located. Ensure access to improved water and sanitation. Targeted social programmes such as raising awareness for proper hygiene and for unambiguous social protection programmes. <p>In densely populated areas:</p> <ul style="list-style-type: none"> Ramp up active case finding, testing, and isolation. Protect sub counties with the high-risk population groups (most vulnerable elderly) by identifying and isolating high risk groups (shielding). <p>In urban settlements:</p> <ul style="list-style-type: none"> Improve housing facilities in the informal settlements and IDP camps. In this emergency context this may involve temporarily rehousing specific communities, increased supply of clean water and soap, community isolation centers for vulnerable peoples and economic support.
EVI	<ul style="list-style-type: none"> Identify ways of reducing exposure of high risk individuals through process of self-isolation where possible or stay at home/ work from home policies or even exemption from employment duties for all employees and especially those in essential services. Ensure Increased health system infrastructure including increasing the number of health workers, oxygen supplies and other essential equipment, hospital beds capacities in the areas expected to have higher proportion of severe cases.
SEVI	<ul style="list-style-type: none"> Target and monitor areas and subpopulations exposed to dual burden of increased risk of infection and spread and combined with high epidemiological vulnerability. Data from this index can be used in combination with information on confirmed cases, rate of growth of new cases, and confirmed COVID-19 deaths with individual predictor variables to tease apart which indicators seem to correlate best with transmissibility, which for increased risk of disease, and also to see how this changes our modelled forecasts.

Overall Conclusions

- COVID-19 is spreading at different rates across Kenya, most probably working its way through all 47 counties. Every community in Kenya will be affected by COVID-19 – but the impacts will not be the same in each. Therefore, targeted interventions that cushion against negative effects on the most vulnerable sub-counties are essential to respond to the current COVID-19 pandemic.
- The indices estimated presents tools that can be used by the Kenyan government and stakeholders to better plan especially in areas where COVID-19 has not been confirmed by prioritizing sub-counties that are moderately to highly vulnerable.
- These indices have identified indicators that shed light on factors that would drive the continued spread of disease and inform prediction on the burden of severe disease and mortality due to COVID-19 in Kenya
- While the interim measures will help ease the pressure and reduce vulnerability, there is a need to reduce disparities in the longer term, beyond the current COVID-19 pandemic in preparation for inevitable future epidemics. Implementation of strategies that address the socioeconomic determinants of health disparities and strengthening health systems is crucial to effectively prevent, detect and respond to future adverse health events or disasters in the country.
- Better quality data is needed to define a robust vulnerability index at high spatial resolution that can be adapted and used in response to future disasters and adverse health events in the long run.

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