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Mitigating the impacts of the COVID-19 pandemic on vulnerable populations: Lessons for improving health and social equity

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ABSTRACT

The COVID-19 pandemic had an inequitable and disproportionate impact on vulnerable populations, reversing decades of progress toward healthy populations and poverty alleviation. This study examines various programmatic tools and policy measures used by governments to support vulnerable populations during the pandemic. A comparative case study of 15 countries representing all World Health Organization's regions offers a comprehensive picture of countries with varying income statuses, health system arrangements and COVID-19 public health measures. Through a systematic desk review and key informant interviews, we report a spectrum of mitigation strategies deployed in these countries to address five major types of vulnerabilities (health, economic, social, institutional and communicative). We found a multitude of strategies that supported vulnerable populations such as migrant workers, sex workers, prisoners, older persons and school-going children. Prioritising vulnerable populations during the early phase of COVID-19 vaccination campaigns, direct financial subsidies and food assistance programmes were the most common measures reported. Additionally, framing public health information and implementing culturally sensitive health promotion interventions helped bridge the communication barriers in certain instances. However, these measures remain insufficient to protect vulnerable populations comprehensively. Our findings point to the need to expand fiscal space for health, enlarge healthcare coverage, incorporate equity principles in all policies, leverage technology, multi-stakeholder co-production of policies and tailored community engagement mechanisms.

1. Introduction

The COVID-19 pandemic triggered both public health and economic crisis, aftershocks of which can still be felt in the third year of the disease management. By October 18, 2022, the pandemic had caused a total of 625 million infected cases and 6.57 million fatalities globally (Worldmeter, 2021). The World Bank projected that the slow in global economic growth from 5.5% in 2021 to 4.1% in 2022 and 3.2% in 2023, coupled with a rise in inflation and debt, will dampen economic recovery, especially among low- and middle-income countries (The World Bank, 2022).

During a public health crisis, vulnerable populations experience far more negative health and socioeconomic impacts than the general population due to pre-existing wealth inequality and social exclusion (Saalim et al., 2021). Vulnerable populations are broadly defined as 'people facing exclusion and discrimination based on age, disability,

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race, ethnicity, gender, income level, migratory status, and those caught up in conflict and are stateless' (Barron et al., 2022). Low incomes in the informal economy and employment inequalities, lack of access to essential health services, high population density and various social protection measures including, but not limited to, clean water and sanitation, an ecosystem conducive to practice hygiene, food security and digital technology point to the need to augment the policies surrounding vulnerable populations (Barron et al., 2022).

Studies conducted in 18 countries have shown that older persons and those who are immune-compromised were prone to developing severe symptoms, getting hospitalised and dying from the virus (Oliveira et al., 2021; Shams et al., 2020; Siegel and Mallow, 2020). In India, COVID-19 posed an immediate threat to migrant workers, daily wage workers and the destitute, who often live in overcrowded living conditions with poor sanitation (Banerjee and Bhattacharya, 2020). Likewise, the cramped living conditions in the dormitories became hotspots for disease transmission among migrant workers in Singapore during the early days of the pandemic (Koh, 2020). The situation for migrant workers with chronic conditions such as human immunodeficiency virus (HIV) was especially dire (Lodge and Kuchukhidze, 2020). Evidence also suggests that migrant workers and other vulnerable populations with pre-existing conditions, in particular HIV, faced dual burdens during the pandemic—financial burden in accessing health services and mental health burden stemming from their fear of worsening health conditions should they contract COVID-19 (Lodge and Kuchukhidze, 2020; Kumar, 2021). Moreover, there has been evidence pointing to the inability of people living with HIV to obtain life-saving medications in 59 countries during the pandemic (Diaz et al., 2021).

Economic vulnerability is another key determinant for countries with inadequate social security measures, as the pandemic pushed vulnerable households with limited or no savings to the brink of poverty (International Labour Organization, 2020). The pandemic also adversely impacted employment, where many workers in the informal sector had to discontinue their work due to movement restriction measures (Saalim et al., 2021; International Labour Organization, 2020). A qualitative study in Bangladesh revealed that economic vulnerability largely manifested in the forms of loss of income and inadequate resources for basic needs amongst those in the informal sector (Wasima and Rahman, 2022).

Social vulnerability was also reported during this crisis, which is a key determinant for the susceptibility to the COVID-19 infection. A recent systematic review identified seven categories of social vulnerability: household, community composition, racial status, socioeconomic status, community health status, public health infrastructures, education and information technology and communication (Fallah-Aliabadi et al., 2022). Studies conducted in the US indicated that ethnic minority groups suffer from limited financial resources and insecure housing, thus compromising their abilities to maintain social distancing (Biggs et al., 2021; Smith and Judd, 2020). In addition, the pandemic disrupted education which impedes the cognitive and psychological development of children, while women are more prone to sexual abuse and other forms of domestic violence (Saalim et al., 2021).

Different dimensions of vulnerabilities often intersect in many households, particularly in the working-age households. As such, it is important to understand how these factors interact with one and another, and how they exacerbate the existing disparities. A study conducted in six West African countries reported that overcrowded and cramped living conditions in prisons became fertile grounds for disease transmission (Saalim et al., 2021). In the US, 2.3 million people are estimated to be severely affected by the pandemic as they were unable to gain access to equitable healthcare or stay financially stable. The higher prevalence of chronic diseases among vulnerable populations and other risk factors often place them at higher risk of infection than the general population (Chung and Yi, 2021; Shadmi et al., 2020).

While studies have documented the health and socioeconomic impacts to various vulnerable populations(Saalim et al., 2021; Siegel and Mallow, 2020; Shadmi et al., 2020), they have been rather regionally focused (Saalim et al., 2021; Siegel and Mallow, 2020; Shadmi et al., 2020). There is a paucity of evidence that systematically examines health system responses or targeted strategies to address the pandemic's health, social, institutional and economic impacts on vulnerable populations.

This study intends to fill this gap by examining various programmatic tools and policy measures taken by governments to support the vulnerable populations during the pandemic by examining: (i) How do governments respond to mitigate the different forms of vulnerabilities impacting the vulnerable populations during the pandemic? (ii) What implications and strategies can be drawn to improve health and social equity for vulnerable groups to prepare for future health emergencies?

2. Conceptual framework

Vulnerability is generally defined as 'the overlapping of several individual, social, and programmatic aspects, which expose and render certain population groups more susceptible to disease than others (Oliveira et al., 2021). A recent scoping review of the impacts of physical distancing measures to the vulnerable populations has identified 11 vulnerable population groups to be most affected by the COVID-19 pandemic. These include the elderly, children/students, low-income populations, migrant workers, prisoners, people with disabilities, sex workers, domestic violence victims, refugees, ethnic minorities, and gender minorities (Li et al., 2023). Another study examining the socio-economic effects of the pandemic echoed the above classification of vulnerable populations, and further highlighted that people with mental health problems, people who use substances or in recovery, the homeless and those with communicative difficulties or less visible populations should be the main target for policy-makers when crafting mitigation strategies (Douglas et al., 2020).

We adopted a vulnerability framework by Li et al. (2023) while simultaneously incorporating established vulnerability definitions by the National Bioethics Advisory Commission of the United States (NBAC (National Bioethics Advisory Commission of the United States), 2001). Further, we integrated theoretical definitions and empirical insights from other recent studies on vulnerable populations, within and outside the context of COVID-19 (Mikolai et al., 2020; Mishra et al., 2020; OECD. COVID-19, 2020; Yale University, 2023), to construct a framework encompassing the categorisation of different domains of vulnerabilities. The definitions and examples of vulnerability are shown in Table 1 below.

Anchoring on this definitional framework, we examined and analysed health system responses and system-level mitigation strategies in the form of programmatic tools and policy measures implemented by national governments to address each of these vulnerabilities. It is important to note that these vulnerabilities are often intertwined as vulnerable populations often face several of these vulnerabilities concurrently. Therefore, it is vital to contextualise the pandemic as a form of humanitarian crisis at the national and international levels. Beyond the immediate health threats, the impacts are felt in other dimensions such as employment, housing and education. With the breakdown of global supply chains resulting from the pandemic and further aggravated by the ongoing war between Russia and Ukraine, heightened inflationary pressures are significantly felt by the vulnerable populations. While many policy measures are designed to protect the general population, some may have unintended consequences, causing unforeseen harm that disrupt access to health and other material or social resources for certain segments of the population (Frank et al., 2022). For instance, the enforcement of social distancing measures has also inadvertently shut down the mechanisms for advocacies and other pre-pandemic social provisions during the earlier stages of the pandemic. With this context in mind, the proposed framework enables us to capture the mitigation strategies that address not only the immediate impacts but also the ripple effects of the pandemic on vulnerable

Table 1
Definitions and examples of different types of vulnerabilities in the context of the COVID-19 pandemic.

Categorisation of Vulnerabilities and Definitions	Examples
1) Health vulnerability: Exhibit serious health conditions and lack of access to health services, inadequate financial protection towards health.	Chronically sick or disabled people, terminally ill or seriously ill subjects, indigenous people and migrant workers with poorer baseline health statuses, high risks of exposure to virus, high risks of developing severe COVID-19 symptoms or COVID-19 complications and lack of access to health services.
2) Economic vulnerability: Epidemic-induced income shocks that could result in overnight and systemic poverty.	Dependent persons, or impoverished people with adverse employment conditions (unemployment, working on temporary contract, part-time employment, self-employment, informal sector workers, or migrant workers); adverse financial conditions (payment arrears, or low-income); digital and connectivity conditions (lack of internet access, or lack of access to computers or other digital devices).
3) Social vulnerability: Disadvantaged in the distribution of social goods and services.	Populations exposed to poor quality housing (lack of access to necessities, e.g., water and sanitation) or overcrowded housing; the socially isolated; populations vulnerable to violence (sex workers, domestic violence victims).
4) Institutional or deferential vulnerability: Subject to formal authority of others or informal subordination to others.	Prisoners, institutionalised older persons, physically and mentally challenged populations who are institutionalised, and school-going children.
5) Cognitive or communicative vulnerability: Diminished capacity to understand and communicate.	Children, migrant populations, people with speech and/or hearing impairment, people struggling with communication due to low subjective well-being or poor mental health conditions.

populations.

3. Methods

We adopted a comparative case study approach to examine the mitigation strategies adopted by governments from 15 countries, including Brazil, China, Germany, India, Indonesia, Iran, Mexico, Nigeria, Singapore, South Africa, Spain, Thailand, Vietnam, USA and the UK to support vulnerable populations from March 2020 till September 2021. These countries were purposely selected as they reflect each of World Health Organization (WHO)'s regions and depict varying health system arrangements, COVID-19 epidemiological trajectories, public health measures and Universal Health Coverage (UHC) status. Selecting a fair representation of countries offers diverse insights to the COVID-19 pandemic responses.

For each country, we drew data from a combination of in-depth desk reviews that were complemented by in-depth interviews with stakeholders from host countries. We started with desk reviews by consolidating published academic articles, grey literature, peer-reviewed journals, policy documents, and reports from multilateral and private/non-governmental entities. The experts in health and social policy in our research team performed the desk reviews. Furthermore, the research member that performed the review of a particular country either resides in that country, or is a health policy expert in that country. The interviews were used to complement the desk reviews both in terms of filling gaps in the data and to simultaneously validate the data through the interview responses. We supplemented this with in-depth key informant interviews to fill any gaps in the initial desk review process (study approved by the National University of Singapore Institutional Review Board, reference: NUS-IRB-2021-172).

We conducted a total of 61 in-depth interviews with key stakeholders in the field of health systems research, health policy and national response from the private and public sectors to improve the quality and completeness of our data sets. Policymakers, researchers and medical practitioners were included.

These key informants were identified via snowball sampling in which subsequent key informants were identified from the recommendations or referrals of the initial pool of informants. The in-depth interviews were recorded and transcribed verbatim. Data analysis was conducted based on pattern matching and explanation building in case study research (Yin, 2014). To build the case narratives, we traced the epidemiological profiles and trajectories of COVID-19 and documented the health system governance, extent of UHC and government's mitigation strategies to minimise the various impacts on vulnerable populations from March 2020 till September 2021. We then analysed the breadth and depth of these mitigation strategies for different types of vulnerabilities and identified implementation gaps.

4. Findings: strategies to mitigate the impacts of COVID-19 on vulnerable populations

4.1. Mitigation strategies to address health vulnerability

Most governments have responded to addressing health vulnerability among the vulnerable populations by introducing person-centered public health measures to curb COVID-19 transmission, ramping up vaccination programmes to target selected vulnerable populations and deploy different financing mechanisms to extend health coverage to vulnerable populations previously not covered by the mainstream health financing schemes.

Human rights-centered public health measures are one of the most far-reaching mitigation strategies to address health vulnerability faced by specific vulnerable populations prone to COVID-19 infections, such as migrant workers and domestic violence victims. In Singapore, widespread outbreaks of COVID-19 among migrant workers at the early stage of the pandemic exposed social inequalities in housing conditions between migrant workers and the general population due to overcrowding in dormitories which posed a challenge for the government to break the virus transmission chains (Yi et al., 2021). In addition, mental health issues stemming from their initial COVID-19 diagnosis including initial fear and anxiety were also reported (Goh et al., 2020). Consequent to this outbreak, treatment capacities and public health control measures were quickly ramped up. Immediate isolation of migrant workers, contact tracing, the establishment of medical posts with multidisciplinary teams of healthcare workers in the migrant workers' dormitories, including peer support and counselling services, distributing thermometers and oximeters, increase in primary health responses, expansion of telemedicine services were some of the most commonly reported strategies to reduce transmission in the living spaces of the vulnerable populations (Yi et al., 2021; Goh et al., 2020).

Equitable access to vaccines and health services is another vital strategy taken to address health vulnerability among vulnerable populations. Across all 15 countries examined in this research, the national COVID-19 vaccine plans made provisions for prioritising the vulnerable populations in their initial vaccination strategies to mitigate the risks among the most at-risk first. These countries prioritised the elderly, patients with co-morbidities and frontline health workers before the rest of the population (Center for Disease Control and Prevention (CDC), 2021; UK Department of Health and Social Care, 2021; Adebowale, 2021). In the UK, the government had taken additional measures to set up mobile vaccination units for populations in the rural areas, the homeless, people escaping abuse and those without internet access (UK Department of Health and Social Care, 2021). In addition, the UK government had also made vaccination to be compulsory among the social care staff as a broad measure to protect the residents in the social care institutions (Cormacain et al., 2020). While vaccination programmes are

phased out universally in most countries reviewed, inequity in the distribution of vaccines remains in Sub-Saharan Africa, with 1.2 billion people in the continent remaining unvaccinated as of January 2022, highlighting a systemic failure in the global distribution of COVID-19 vaccines (Sibide, 2021).

In terms of health financing, many countries responded swiftly to bridge the gaps in health access by deploying varying degrees of health financing tools to actively make health services available to vulnerable populations. For example, some countries such as China, Germany, Singapore, Spain, Thailand, UK and Vietnam have extended either health insurance entitlement or health services coverage for COVID-19 related treatment to vulnerable populations, especially migrant workers, refugees and stateless persons who were previously uninsured. Rapid legal reforms and policy mandates in these countries help to actively enroll vulnerable populations to the national health insurance systems or ensure that free and uninterrupted health provisions are extended to the vulnerable populations at the point of care (World Health Organization, 2021a; Ke and Zhang, 2020; OECD, 2020a; Thailand Ministry of Public Health, 2021).

Table 2 highlights the mitigation strategies to address health vulnerabilities among the vulnerable populations and exemplar countries that implemented these strategies.

4.2. Mitigation strategies to address economic vulnerability

To mitigate the economic vulnerability faced by vulnerable populations, almost all governments have responded with the expansion of fiscal measures to provide both direct and indirect financial assistance, as well as adjusting existing criteria for various financial institutions or arrangements.

Direct financial subsidies in the forms of unconditional cash transfers, subsistence allowances, income support, low-interest loans and in-kind donation were universally observed in almost all 15 countries examined in this study. Emergency funding was activated, and reserves were drawn to enable various stimulus packages to be launched by governments to provide unconditional cash transfers, subsistence allowances, income support, low-interest loans, unemployment benefits and in-kind donation to populations made economically vulnerable due to the pandemic. Existing conditional cash transfer programmes were broadened in several countries (BBC News, 2021; UK Government, 2020; Thailand Budget Bureau, 2021; Lowe et al., 2021; Amul et al., 2021; Lustig and Mariscal, 2021; Economic Commission for Latin America and the Caribbean (ECLAC), 2020; OECD, 2020b; Lu et al., 2020; IMF, 2021a; Palik, 2020; IMF, 2021b; South African Government, 2021; Olivia et al., 2020).

In addition, indirect financial subsidies in the form of tax credits, tax deferral and paid sick leaves were also observed in most countries. Some countries, notably the UK, Vietnam and Mexico, have enhanced the social protection package, and enacted laws to provide indirect economic support to populations made economically vulnerable due to the pandemic mainly in the forms of tax credits, tax deferrals, tax rate reduction, utility subsidies and paid sick leaves (Chung and Yi, 2021; Goh et al., 2020; Amul et al., 2021; Lustig and Mariscal, 2021).

Expansion of existing social security programmes was another strategy deployed to address the economic vulnerability faced by populations that lost their jobs due to the pandemic, especially low-income populations working in the informal economy. This strategy was commonly observed in countries such as US, Mexico, Iran, Brazil and the UK, and included measures such as the expansion of unemployment insurance programmes, suspension of eviction due to default rental payment, concessions for utility bills, or delay in rental payments and extension of housing to the homeless populations (Chung and Yi, 2021; Lustig and Mariscal, 2021; Economic Commission for Latin America and the Caribbean (ECLAC), 2020; Palik, 2020; Library of Congress, 2021; Cromarty, 2021).

Adjustment of existing criteria for various financial support packages is another prominent measure deployed by the governments, especially in Spain, UK and China. Request for delay in rental payments and removing or adjusting the existing criteria for financial assistance programmes for low-income individuals or households were some of the common examples where eligibility criteria was adjusted to meet the evolving needs of the vulnerable (Saalim et al., 2021; BBC News, 2021; UK Government, 2020; Lu et al., 2020; Library of Congress, 2021).

Table 3 highlights the mitigation strategies to address economic vulnerabilities among the vulnerable populations and exemplar countries that implemented these strategies.

Table 2
Mitigation strategies to address health vulnerabilities and exemplar countries.

Mitigation Strategies to Address Health Vulnerabilities	Exemplar Countries
Human rights centered public health measures	UK: Enhanced surveillance efforts to detect domestic violence victims through routine inquiry (integrating surveillance efforts into remote primary health consultations or active syndromic surveillance from local health protection teams), linking police records and health datasets to actively identify persons at risk of domestic violence; implement targeted interventions to support domestic violence victims. (Sibide, 2021) Germany: Extended video consultation hours for persons with psychiatric conditions in the outpatient setting to ensure continuity of care and therapeutic services for mentally challenged populations during the pandemic.
Equitable access to vaccines and health services	Brazil: Vulnerable populations encompassing population groups with higher social and economic vulnerabilities and they were identified as Afro-descendants and the indigenous communities already living with high-level of co-morbidities and other infectious diseases, and faced limitations in accessing healthcare services, people living on the streets, refugees living in shelters, people with permanent disabilities and populations deprived of freedom, received priorities to be among the first to be vaccinated. (World Health Organization, 2021a) Vietnam: The poor and beneficiaries of social assistance schemes were also prioritised in the early vaccination drive. (Ke and Zhang, 2020) UK: Mobile vaccination units and a free helpline were established for people residing in highly rural areas to enable easier access to vaccination and related information. (Yin, 2014)
Financial protection for health	Spain: A drastic reform was passed at the early phase of the pandemic to establish a resilient coverage policy to ensure that everybody who needs healthcare does not lose health coverage despite the fiscal constraints posed by the pandemic, including undocumented migrants who were previously excluded from health system access. (Center for Disease Control and Prevention (CDC), 2021) China: All treatment costs related to COVID-19 were borne by the government. Domestic migrant patients would enjoy the same level of health benefits as the locals (i.e. free treatment with no requirement of deposit to hospital accounts), and deductibles were removed. (UK Department of Health and Social Care, 2021) UK, Germany, Singapore, Thailand & Vietnam: Migrant workers could access COVID-19 treatments free of charge.

4.3. Mitigation strategies to address social vulnerability

Mitigation strategies to address social vulnerability were largely focused on enhancing existing social protection measures and the

Table 3
Mitigation strategies to address economic vulnerabilities and exemplar countries.

Mitigation Strategies to Address Economic Vulnerabilities	Exemplar Countries
Direct financial subsidies	US: The "Coronavirus Preparedness and Response Supplemental Appropriation Act" provided US$8.3 billion in emergency funding to the federal agencies. The "Coronavirus Aid, Relief, and Economic Security Act' (CARES) enabled the activation of a US$2.2 trillion stimulus package to provide cash payments to the low-income, support loan programmes for struggling businesses, and increase unemployment insurance and healthcare funding. (Chung and Yi, 2021) UK: The introduction of 'Universal Credit' and 'Working Tax Credit' enabled £20 (US$22.17) per week to be given to the low-income population who were out of jobs. (OECD, 2020a; Thailand Ministry of Public Health, 2021) Brazil: An emergency relief package was introduced to provide cash transfers to more than 67 million people, including informal workers, the poor, and mothers responsible for supporting the family. (UK Government, 2020) India: A relief and stimulus package worth $260 billion focusing on food security measures (including free grain distribution), in-kind donation (i.e. cooking gas), and direct cash transfers were provided for farmers, women, the elderly people with disability, widows, construction workers, and beneficiaries of existing schemes was rolled-out in March 2020. Earlier, the government also announced a one-time cash transfer of $13.31 to 30 million senior citizens and $6.65 a month to about 200 million low-income women for three months. (Chung and Yi, 2021; Amul et al., 2021) Iran: Three million poorest citizens received cash payments during the pandemic, while another four million households received low-interest loans, partially subsidised by the government. The government also supported the unemployment insurance fund. (Lustig and Mariscal, 2021) South Africa: Income support, social grants for six months, social relief of distress (SRD) funds for the unemployed who were not covered by the social grants or unemployment insurance, provision of food parcels for families losing breadwinners were implemented to address the economic impacts faced by the vulnerable populations. (OECD, 2020b) Nigeria, Indonesia & Thailand: The existing conditional/unconditional cash transfer programmes were expanded to assist low-income families and the transient poor. (Chanda et al., 2020; Bernardeau-Serra et al., 2021; Lu et al., 2020)
Indirect financial subsidies	US: The "Families First Coronavirus Response Act" enabled the government to provide paid sick leaves, tax credits, free COVID-19 testing, and Medicaid funding. (Chung and Yi, 2021) Vietnam: A social protection package was launched to support tax deferrals and tax rates reductions for populations made economically vulnerable due to the pandemic. (CCI France Vietnam, 2021) Mexico: Subsidies were given to cover basic utilities and internet service to low-income neighbourhoods at certain states. (BBC News, 2021)
Expansion of existing social security programmes	US, Mexico & Iran: Unemployment insurance was expanded by the federal government (in the US), city governments (in Mexico) and the central government (in Iran). (Chung and Yi, 2021; BBC News, 2021; Lustig and Mariscal, 2021) Brazil: Suspension of eviction due to default rental payment. (UK Government, 2020) Spain: Concession for utility bills or delay in rental payments. (IMF, 2021a) UK: Extension of housing to the homeless populations by activating emergency funding to move rough sleepers to longer term accommodation. (Palik, 2020)
Adjustment of eligibility criteria for various financial support packages	Spain: Those in vulnerable situations can request for a delay in their housing rental payments during the state of alarm. (IMF, 2021a) UK: The calculation of 'Universal Credit' and 'Working Tax Credit' entitlement removed the minimum income floor for the self-employed. (OECD, 2020a; Thailand Ministry of Public Health, 2021) China: Dynamic adjustments used to calculate the entitlements for the low-income households ('Dibao' households) in means-testing were suspended in areas with severe outbreaks. (Lowe et al., 2021)

deployment of new and innovative measures to address the emergent predicaments faced by vulnerable populations.

One of the most common strategies deployed by the governments to address social vulnerability was introducing food assistance programmes. Examples include coming up with a stimulus package to boost food security, establishing Joint Technical Taskforce to facilitate the movement of food distribution across the country, distributing food vouchers and food rations and using technology to facilitate food distribution (Chung and Yi, 2021; IMF, 2021a; Olivia et al., 2020; Greenhalgh, 2020; BhagatRB et al., 2020).

Designing targeted and group-specific policies is another strategy deployed as a mitigation strategy for addressing social vulnerability. This strategy is notably observed in countries with sizeable vulnerable populations that possess unique needs. For instance, community organisations in the UK assisted the homeless in relocating and decongregating by providing private bedrooms and bathrooms to minimise community transmission. New protocols were also put in place to help enforce social distancing measures in the shelters (Mladenov and Brennan, 2021). In the US, the Indiana state government, made an executive decision to prevent evictions and foreclosures of sheltered homes for low-income and homeless populations during the pandemic, whereby those awaiting COVID-19 test results or needing quarantine could prolong their stay (Rodriguez et al., 2021). Likewise, China and Thailand have also implemented targeted measures to assist older adults, population with disability and sex workers to address various social challenges that they faced during the pandemic (Chung and Yi, 2021; Janyam et al., 2020).

Table 4 highlights the mitigation strategies to address social vulnerabilities among the vulnerable populations and exemplar countries that implemented these strategies.

4.4. Mitigation strategies to address institutional vulnerability

Mitigation strategies to address institutional vulnerability have been largely observed among several vulnerable populations such as school-going children, the elderly, prisoners and migrant workers.

An example of a mitigation strategy taken to address institutional vulnerability among school-going children is a flexible administrative arrangement to increase flexibility to the existing rules. This measure was most notably reported in Indonesia and the US and includes giving more autonomy and flexibility to the state educational agencies to

Table 4
Mitigation strategies to address social vulnerabilities and exemplar countries.

Mitigation Strategies to Address Social Vulnerabilities	Exemplar Countries
Food assistance programmes	India: The government distributed a relief and stimulus package worth $260 billion focusing on food security measures and other in-kind donations targeting farmers, women, older adults with disability, widows, construction workers, and beneficiaries of existing schemes. (Chung and Yi, 2021; Amul et al., 2021) Non-governmental organisations and commercial companies were mobilised by the government to assist migrant workers who needed support, including providing them with essential health and hygiene kits and food supplies. The government of Kerala (a state in India) used technology such as a geo-tracking system to ensure that migrant workers received food access. (South African Government, 2021) Nigeria: A Joint Technical Task Force was created to facilitate the movement of food and agricultural products in the country during the lockdown. (Greenhalgh, 2020) Indonesia: Food vouchers (*Kartu Sembako*) were expanded to cover five million more families, and apart from needy households, assistance was extended to the unemployed and displaced workers. (Lu et al., 2020) UK: Vouchers for free school meals for eligible children were also given during the lockdown periods. (IMF, 2021b)
Designing targeted and group-specific policies	India: Technology-based solutions such as automation of various nodes along the food supply chain and a digital platform were developed by the government to provide food assistance at scale to ensure timely disbursement of food assistance to families losing their breadwinners through a central beneficiary database known as the 'Targeted Public Distribution System'. (BhagatRB et al., 2020) China: Local government and civil society organisations in major cities such as Shanghai provided social support to vulnerable populations at risk of prolonged isolation during the pandemic, such as older people and people with disabilities, to ensure that their care needs were met. (Chung and Yi, 2021) Thailand: Community-based organisations provided immediate and various critical public health responses to support the sex workers population, such as delivering free anti-retroviral drugs and COVID-19 test kits to them as their needs and predicaments were largely hidden, even before the pandemic. (Cromarty, 2021)

dictate the distribution of emergency funding to the schools, removing limitations on the rules revolving around the utilisation of educational funds to enable the purchase of health supplies, and internet data credit and subscriptions to online learning platforms for home-based learning (World Health Organization, 2021b; Reid, 2022).

To protect the elderly, most countries designed precautionary measures to safeguard elderly populations, especially those institutionalised in residential care homes, prone to developing severe COVID-19 symptoms. These include tightening infection control and prevention practices, ensuring adequate access to a steady supply of personal protective equipment, implementing safe distancing measures, split-zone arrangements, suspension of visitations, disinfection, contact tracing and quarantining of close contacts should there be active COVID-19 cases detected (Frank et al., 2022; Mühle et al., 2020).

Tightening existing rules and protocols is another mitigation strategy deployed to protect vulnerable populations such as prisoners. Prisoners have been regarded as populations prone to institutional vulnerability due to overcrowding in prison cells (Shadmi et al., 2020). In Thailand and Singapore, specific protocols were implemented so that prisoners diagnosed with COVID-19 were treated in the hospitals, social distancing measures and mask-wearing were enforced out of the prison cells, newly admitted prisoners were subjected to quarantine before they were allowed to mingle with the general inmate population and guidelines for the prevention, control, and management of COVID-19 were enforced (World Health Organization, 2021c; Tan, 2020).

Table 5 highlights the mitigation strategies to address institutional vulnerabilities among the vulnerable populations and exemplar countries that implemented these strategies.

4.5. Mitigation strategies to address communicative vulnerability

Mobilisation of village health volunteers to increase the outreach of public communications regarding COVID-19 was the most common mitigation strategy adopted to improve government's communicative ability to reach out to vulnerable populations. Evidence is abounding on the significant role civil society organisations and community health workers played in maintaining essential services in the pandemic, especially during the lockdown periods. This whole of society approach can help to effectively integrate needs of vulnerable population in the health systems (Ballard et al., 2020). In Thailand, village health

Table 5
Mitigation strategies to address institutional vulnerabilities and exemplar countries.

Mitigation Strategies to Address Institutional Vulnerabilities	Exemplar Countries
Flexible administrative arrangement to increase the flexibility of existing rules	Indonesia: Rules regarding the utilisation of the School Operational Assistance (BOS) funds in the education sector were relaxed to enable more flexible use of the funds to facilitate online learning for the student. (Mladenov and Brennan, 2021) US: The Education Stabilization Fund under the CARES act which provides a total of US$13.5 billion grants to the states across the country allow state education agencies the flexibility to distribute funds to the school districts based on their respective and emergent needs. (Rodriguez et al., 2021)
Design precaution measures to safeguard and ringfence institutionalised senior citizens	Germany: A 'Task Force Care Homes' was established from April to September 2020 to protect care homes from further outbreaks and deaths. The task force put in place measures to protect the elderly, especially those in care homes. (Janyam et al., 2020) Singapore: A Multi-Ministry COVID-19 Taskforce was established as a special taskforce to coordinate various pandemic responses, including enforcing measures to safeguard senior citizens who were housed in residential care homes. (Frank et al., 2022)
Tighten existing rules and protocols in the prison	Thailand: Specific strategies were taken to protect the prisoners from COVID-19 transmission by ensuring that prisoners who were diagnosed with COVID-19 received adequate treatment and enforcing all prevention, control and management of COVID-19 in the prisons. (Nigeria Presidential Task Force on, 2021) Singapore: Mandatory mask wearing in prisons, enforcement of social distancing among prisoners during recreation time, segregation of new inmates for 14 days before joining the general inmate population. (Government of India Department of Food and Public Distribution, 2021)

volunteers played a crucial role in health advocacy and among vulnerable populations in rural areas to influence compliance with public health measures (Chen and Assefa, 2021).

Civil society-led advocacy campaigns to propose equitable policy actions to the government are another mitigation strategy that addresses communicative vulnerabilities faced by vulnerable families and populations with hearing and/or speech impairment. To assist vulnerable families and children, a civil society-based coalition network in Mexico was established to develop a list of evidence-based action points for the federal government to consider when assisting vulnerable families and children, including the implementation of evidence-based social communication campaigns to promote self-care, mental health, sensitive childcare and prevent domestic violence (Vilar-Compte et al., 2020). To address the communicative vulnerability faced by populations with speech and hearing impairment, civil society organisations launched advocacies to demonstrate their plights which include highlighting that mask-wearing prevented lipreading, reduced clarity of voice and reduced volume among people with hearing and speech disabilities (Eskytė et al., 2020).

Implementation of culturally sensitive health promotion interventions and community engagement strategies were also implemented to cater to the diverse needs of vulnerable populations. In African countries such as South Africa and Nigeria, risk communication and community engagement strategies which include awareness campaigns, community radio, COVID-19 story blog, SMS, toll-free line and other social media tools helped different stakeholders to respond to the varying needs such as people living with disabilities and people living with HIV (Adebisi et al., 2021). In addition, establishing communication channels and mental health support for migrant workers who cannot return home due to travel restrictions to allow them to communicate with their family members and ensure that they are provided with mental health support needed during isolation. The co-creation of such material and communication mechanisms can improve these groups' uptake and adherence to public health measures.

Table 6 highlights the mitigation strategies to address communicative vulnerabilities among the vulnerable populations and exemplar countries that implemented these strategies.

Table 6
Mitigation strategies to address communicative vulnerabilities and exemplar countries.

Mitigation Strategies to Address Communicative Vulnerabilities	Exemplar Countries
Mobilisation of village health volunteers to increase the outreach of risk communications regarding COVID-19	Thailand: One million village health volunteers were mobilised to facilitate public health communication during the COVID-19 pandemic through a clear command structure that implemented a coherent risk communication strategy of "stay home, stop the virus, for our nation" through a nationwide campaign. (Reid, 2022)
Civil society-led advocacy campaign to address the gaps in government-led responses	Mexico: A coalition network known as 'El Pacto poor la Primera Infancia', which comprised non-governmental organsiations, foundations, and research institutions, served to protect vulnerable families with young children when gaps in public communications from the government were detected. The coalition partnered with other major educational institutions to develop a list of evidence-based action points for the federal government to consider in responding to the crisis brought about by the COVID-19 pandemic. (Mühle et al., 2020) UK: A few charities signed a letter urging the government to account for the needs of 11 million deaf and hard-of-hearing people in the UK by raising their unique concerns associated with mask-wearing during the pandemic. (World Health Organization, 2021c)
Implementation of culturally sensitive health promotion interventions and community engagement strategies	India: Counsellors and helplines were activated to facilitate communications between migrant workers and their family members to support migrant workers who were stranded and faced consternation due to the enforcement of social distancing measures. (South African Government, 2021) UK & Germany: The civil society and non-governmental organisations were vital in producing migrant-focused health promotion material to fill the governments' gaps in communicating COVID-19 to the public. Translation of information such as treatment seeking and vaccination for COVID-19 into multiple languages and launching a digital campaign combining both web and social media platforms in multiple languages were implemented widely to communicate COVID-19-related public information to the migrant populations. (Cormacain et al., 2020; Ballard et al., 2020)

5. Discussion

We documented a range of mitigation strategies deployed to address five major types of vulnerabilities faced by different vulnerable populations. Prioritisation of vulnerable populations such as older persons, immuno-compromised and migrant workers in the early phase of COVID-19 vaccination plans, direct financial subsidies and food assistance programmes were the most common measures reported, which address health, economic and social vulnerabilities. Targeted and group-specific strategies were deployed to help specific vulnerable populations such as migrant workers, sex workers, prisoners, older people and school-going children. Furthermore, this study highlights the importance of framing effective public health information and implementing culturally sensitive health promotion interventions as tools that cater to the diverse needs of vulnerable groups. While health vulnerability may be more dominantly observed during the pandemic, all other vulnerabilities intersect to create far-reaching impacts to the vulnerable populations. Even though a multitude of mitigation strategies adopted by different countries to address a singular vulnerability are laudable, a multipronged approach in the formulation and implementation of mitigation strategies that could holistically address multiple converging vulnerabilities are warranted.

Our findings shed light on the pivotal roles civil society and non-government organisations can play in addressing various social, institutional and communicative vulnerabilities during a crisis. For instance, in Thailand, India, Mexico and the UK, the indispensable roles of civil society came to light to aid in addressing the intricate vulnerabilities faced by groups such as migrant workers, sex workers and people with disabilities when governments and health systems failed to provide equitable support and protection to these at-risk groups. Evidence from China showed that the government was able to boost its capacities to respond to the rising needs of vulnerable populations with support from civil society organisations to address social vulnerability faced by the older population (Cai et al., 2021).

The plights of the vulnerable populations highlight the need to strengthen social solidarity, health equity and shared responsibility nationally and internationally. The extent to which governments and civil societies must scramble to address the multiplicity of vulnerabilities faced by different vulnerable populations suggests that countries have overlooked the human rights impacts of this pandemic which impinge on not only the rights to health for vulnerable populations, but also their economic, social and cultural rights. Indeed, access to food,

employment, housing, water, sanitation, personal safety and social security are all social determinants of health that culminate in health equity. As such, it is crucial that health systems and governments safeguard not only the rights to health for vulnerable populations which entail access to high-quality healthcare services, vaccines and health information but also the economic, social and cultural rights that collectively shape population health outcomes. By doing so, governments should espouse the principles of equity and non-discrimination, in addition to encouraging civic participation as well as instituting mechanisms of accountability and transparency to uphold the human rights foundation of public health measures in managing public health emergencies (de Mesquita et al., 2020). Chiefly, ensuring health service access for the general population while putting the most vulnerable first will confer multifold benefits to the health system. As these pockets of the population are more predisposed to infection and suffer from more adverse complications if infected, offering access to high-quality care will serve to preserve, to an extent, health system capacities. This can be performed through the measures explained throughout the paper, namely by removing medical costs and enhancing physical access to meet vulnerable populations where they are and when they need these services. More importantly, equitable provision of services needs to persist beyond the COVID-19 pandemic. Governments need to chart a path to a more person-centered and resilient health system to better meet the health needs of vulnerable populations going forward.

The COVID-19 pandemic has exposed the vulnerabilities of many health systems, especially in those with existing health inequities, to respond effectively to the rising caseloads and health needs of vulnerable populations. The major strength of this study lies in the plethora of information derived from 15 countries which illuminate the importance of strengthening social protection for vulnerable populations. Specifically, our study sparks preliminary debates and conversations around the readiness and competence of a health system to enforce strict distancing rules while mobilising health and social resources rapidly to manage a public health emergency more broadly and comprehensively. Achieving these would require adaptive governance and swift response from the governments, as highlighted in some of the exemplary countries in this study. In addition, this study raises the importance of examining factors beyond the commonly understood health, social and economic vulnerabilities and to delve into the investigation of other types of vulnerabilities such as institutional and communicative vulnerabilities, which tend to be given less attention (Barron et al., 2022; Hussain and Arif, 2021; Armocida et al., 2020; Lee et al., 2021). On this note, there is ample room for all health systems to consider improving the depth and breadth of their UHC coverage to improve health system resilience. The major limitation of our research entails the heterogeneity in the amount and extent of information gathered from different countries. In addition, these qualitative and narrative-based information preclude the ability to compare and appraise the effectiveness of the strategies taken by all the 15 countries to mitigate the five different vulnerabilities discussed in the paper. Due to this reason, we were not able to examine the barriers encountered in deploying these strategies, including evaluating whether some of the strategies have led to improved or worsened outcomes.

This study offers five policy implications and suggests the need for concurrent implementation of a conjunction of measures to cushion the impact of future pandemics on vulnerable populations. First, this study echoes many other studies that have called for stronger government commitment to UHC agendas, including expanding coverage for undocumented migrants and refugees who were not covered prior to the pandemic (Onarheim et al., 2018; Guinto et al., 2015; Abubakar and Zumla, 2018; Tschirhart et al., 2021; Legido-Quigley et al., 2019). This would entail broadening the depth and breadth of UHC and re-engineering mechanisms to improve the health system's capacity to capture vulnerable populations. Migrant workers and refugees were some of the most affected vulnerable populations during the pandemic. To truly embrace the spirit of universality, UHC needs to include an extension of health provisions to these marginalised populations in the post-pandemic era to effectively detect, contain and control both communicable and non-communicable diseases among them (Legido-Quigley et al., 2019).

Second, there is a need to diversify revenue portfolios to increase fiscal space for health to strengthen UHC development and social protection for vulnerable populations. This would allow the governments to tailor the health systems better to address the multi-dimensional needs of the vulnerable populations to lighten the disease burden and minimise their socioeconomic shocks in future pandemics.

Third, governments should tailor the pandemic response protocols based on the needs of different vulnerable populations. Our findings suggest that targeted group-specific policies and interventions are important to address the heterogeneities in vulnerable population groups. For instance, the sporadic outbreaks of COVID-19 in migrant workers' dormitories, long-term care facilities, prisons and informal settlements warrant more institutionally tailored protocols to minimise transmission. These protocols should also address the intersectoral challenges faced by the vulnerable populations due to the co-existence of different vulnerabilities.

Fourth, governments should leverage digital technologies to improve public health communications and to address the 'hidden needs' among vulnerable populations. As the examples in the UK and Germany have shown, digital technologies and social media can be effectively used to deliver crucial public health information to vulnerable populations such as migrant populations who are less likely to access mainstream public communication campaigns due to language and cultural barriers. India has also demonstrated how digital technologies such as digital platforms can be applied to accurately identify vulnerable populations' locations to ensure timely assistance delivery. In addition, digital technologies such as virtual platforms and smartphone apps specifically designed to reach targeted population groups can also address other 'hidden needs' among vulnerable populations, such as mental health issues due to prolonged isolation.

Fifth, collaborative healthcare in the forms of direct community engagement, co-production of health provision plans with the direct recipients and public-private partnerships should be encouraged so that the governments can respond more effectively to the needs of vulnerable populations (Turk et al., 2021; Abdalla et al., 2021; Baxter and Casady, 2020). A vital lesson to improve health system capacity and social security response is to strengthen public-private partnerships and co-production of health provision by building proactive, collaborative, synergistic and strategic partnerships among the government as the providers, vulnerable populations as direct recipients of health and social services, and the private actors as both providers and intermediaries. The partnerships should incorporate an equity lens in policy formulation and implementation to ensure that health and social protection remain a priority Seddighi et al., 2021. A participatory approach that allows vulnerable populations to have a voice in decision-making is central in the design of solutions that meet their needs (Turk et al., 2021; Abdalla et al., 2021). Furthermore, the civilians and the private sector (which includes non-government organisations, charitable foundations and private companies) are pivotal actors in responding to the unique circumstantial needs faced by different vulnerable populations during the pandemic, especially in situations when governments failed to intervene. Some countries have also demonstrated that impacts could be amplified when private sectors were mobilised to work hand-in-hand with the governments to address health system incapacity Baxter and Casady, 2020, Seddighi et al., 2021. All in all, whole-of-government and whole-of-society approaches are needed to bring about the above structural reforms that address broader social, political, economic and environmental determinants of equity in the context of a health emergency like the COVID-19 pandemic, besides increasing the adaptive capacity of the vulnerable populations to weather similar crisis in the future.

Based on our findings and the five policy implications discussed, we propose specific policy recommendations to account for the different types

of vulnerabilities experienced by the vulnerable populations at the heart of their policy responses (see Fig. 1). These specific recommendations can serve as a compass to help prepare health systems and governments to better respond to the complex needs and diverse circumstances faced by vulnerable populations in future health emergencies.

6. Conclusion

While a spectrum of mitigation strategies has been deployed to address different vulnerabilities, these efforts within countries were rarely enough to protect vulnerable populations comprehensively.

Fig. 1. Policy recommendations for addressing different types of vulnerabilities faced by vulnerable populations for future health emergencies.

Notably, less visible and hidden populations such as migrant workers, refugees, sex workers, prisoners and people with disabilities were largely neglected in formal policy responses. This paper presents specific recommendations that are focused and targeted when approaching different types of vulnerabilities impacting different vulnerable populations. Instrumentally, countries need to use this pandemic as a window of opportunity to prioritise the right to UHC for vulnerable populations, including determining the basic level of health services that should be made available, accessible and acceptable by all. The overlapping vulnerabilities experienced by the vulnerable populations also call for more policy attention toward the social, economic and political determinants of health during the pandemic. This should include follow-up interventions to strengthen social protection policies to safeguard the vulnerable populations' social, economic and cultural rights guided by equity principles. Only by positioning vulnerable populations at the forefront of national responses and equitably integrating them into health systems can we build a more resilient health system that can ably and effectively withstand external shocks resulting from future public health emergencies.

Author contributions

SYT drives the conceptualization, data curation, formal analysis, investigation, methodology, project administration, data validation, data visualization, and writing of the original draft. CDF and MV support conceptualization, data curation, formal analysis, investigation, methodology, project administration, data validation and critically review and edit the draft. PH, PLJC, AP, TM, FH, LPP, YM, KBG, SN, HW, JL support data curation, investigation, data validation, and critically review and edit the draft. HLN supervises the research, acquires funding, and provides input for conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualization, and reviewing and editing of the draft.

Role of the funding source

The funder has no influence in study design; in the collection, analysis and interpretation of data; in the writing of the articles; and in the decision to submit it for publication.

Declaration of competing interest

None.

Data availability

Data will be made available on request.

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