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Health Inequalities and Infectious Disease Epidemics: A Challenge for Global Health Security

Sandra Crouse Quinn and Supriya Kumar

In today's global society, infectious disease outbreaks can spread quickly across the world, fueled by the rapidity with which we travel across borders and continents. Historical accounts of influenza pandemics and contemporary reports on infectious diseases clearly demonstrate that poverty, inequality, and social determinants of health create conditions for the transmission of infectious diseases, and existing health disparities or inequalities can further contribute to unequal burdens of morbidity and mortality. Yet, to date, studies of influenza pandemic plans across multiple countries find little to no recognition of health inequalities or attempts to engage disadvantaged populations to explicitly address the differential impact of a pandemic on them. To meet the goals and objectives of the Global Health Security Agenda, we argue that international partners, from WHO to individual countries, must grapple with the social determinants of health and existing health inequalities and extend their vision to include these factors so that disease that may start among socially disadvantaged subpopulations does not go unnoticed and spread across borders. These efforts will require rethinking surveillance systems to include sociodemographic data; training local teams of researchers and community health workers who are able to not only analyze data to recognize risk factors for disease, but also use simulation methods to assess the impact of alternative policies on reducing disease; integrating social science disciplines to understand local context; and proactively anticipating shortfalls in availability of adequate healthcare resources, including vaccines. Without explicit attention to existing health inequalities and underlying social determinants of health, the Global Health Security Agenda is unlikely to succeed in its goals and objectives.

> *Our vision is a world safe and secure from global health threats posed by infectious diseases—where we can prevent or mitigate the impact of naturally occurring outbreaks and intentional or accidental releases of dangerous pathogens, rapidly detect and transparently report outbreaks when they occur, and employ an interconnected global network that can respond effectively to limit the spread of infectious disease outbreaks in humans and animals, mitigate human suffering and the loss of human life, and reduce economic impact.*[1]
>
> —Global Health Security Agenda

There is increasing recognition that global health and security are linked together.[2-5] In February 2014, multiple federal agencies in the United States, including the Departments of Health and Human Services, Defense, State, and Agriculture, the Centers for Disease Control and Prevention, and others, united to introduce an agenda for global health security.[3] Working with global partners from the World Health Organization (WHO), the World

Sandra Crouse Quinn, PhD, is Associate Dean for Academic Affairs, Senior Associate Director of the Maryland Center for Health Equity, and Professor, Department of Family Science, School of Public Health, University of Maryland, College Park. Supriya Kumar, PhD, MPH, is Research Assistant Professor, Department of Behavioral and Community Health Sciences, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania.

Organisation for Animal Health (OIE), the Food and Agriculture Organization (FAO) of the United Nations, and 30 countries, these federal agencies have committed multiple collaborative efforts to strengthen global abilities to anticipate, monitor, and respond to infectious disease outbreaks, either naturally occurring or man-made, over the next 5 years.[6]

In today's global society, infectious disease outbreaks can spread quickly throughout the world, fueled by the rapidity with which we travel across borders and continents. Given the recent emergence of novel infectious agents (eg, H7N9 influenza, Middle East respiratory syndrome-coronavirus, or MERS-CoV), there is a renewed focus on pandemic planning. The overarching goal of the Global Health Security Agenda (GHSA) is to "Prevent Avoidable Epidemics: including naturally occurring outbreaks and intentional or accidental releases," with a specific objective of "Reducing the number and magnitude of infectious disease outbreaks."[3] Another goal, "Respond rapidly and effectively to biological threats of international concern," has as an objective: "Improving global access to medical and nonmedical countermeasures during health emergencies."[3] To meet these goals, it is essential to focus on existing health inequalities and the social determinants that drive them.

This article seeks to demonstrate the need to account for health inequalities in preparedness planning, with substantial consideration of the example of preparedness planning for pandemic influenza. Our focus is specifically on how inequalities in populations and nations contribute to challenges in achieving the Global Health Security Agenda. While we acknowledge that major inequalities exist between nations, those inequalities are not the major focus here. Furthermore, many of the issues relevant to influenza preparedness planning, like planning for other potential infectious respiratory diseases, are indeed relevant to all nations across the income spectrum.

Social Determinants of Health and International Health Inequalities

Since Farmer[7] explored how the very frameworks used to describe infectious diseases obscured their origins in poverty and social inequalities, the literature has continued to grow, linking social determinants of health including poverty, race, ethnicity, social marginalization, physical environment, and other factors to infectious diseases, including influenza, malaria, tuberculosis, Ebola, and other diseases.[7-10] Although the WHO's Commission on the Social Determinants of Health did not focus substantially on infectious diseases in their report, *Closing the Gap,* they articulated an expansive plan to address the complex web of determinants that contribute to health inequalities that can further fuel many infectious diseases.[11] The report of the Special Programme for Research and Training in Tropical Diseases describes the relationship between infectious diseases and poverty, arguing that poverty contributes to conditions that cause infectious diseases and subsequently also prevent access to health care.[10] They describe infectious diseases as "a proxy for poverty and disadvantage" with subsequent increased risk factors "affecting populations with low visibility and little political voice," "imposing a heavy health and economic burden," and "having a greater impact where health systems are weak."[10(p14)] One of the few specific references to infectious respiratory diseases in the *Closing the Gap* report ties poverty to lower access to treatment for acute respiratory infections in sub-Saharan Africa.[11]

These reports and studies reinforce the general understanding that malaria, diarrhea, and tuberculosis are largely correlated with poverty.[7,10] The link between acute respiratory tract infection (which is the most relevant in pandemic preparedness planning), including influenza, and poverty has not been systematically reviewed and represents a gap in knowledge synthesis from published literature. Our purpose here is to draw attention to the often-unacknowledged link between acute respiratory infection and poverty by summarizing a few salient studies that suggest that poverty is as relevant in the context of acute respiratory tract infection, and specifically influenza, as it is in the context of diarrheal, malarial, or tubercular disease.

Even before the 2009 H1N1 influenza pandemic, Blumenshine et al[12] drew on a social and health disparities model[13] to articulate the potential causes of disparities in the US during an influenza pandemic. They conceptualized that differential exposure to influenza virus, differential susceptibility to disease, and differential access to health care once disease has developed may explain respiratory infection disparities. Although they focused on domestic concerns, the authors state that "the need for systematic and concrete planning to minimize the social disparities that can be expected to occur in the face of natural disasters such as an influenza pandemic apply worldwide,"[12(p714)] and they explicitly call for action from countries with large subgroups who live in poverty in a weak public infrastructure challenged to meet their needs under normal circumstances.[12]

In 2009, Quinn et al[14] operationalized the Blumenshine model, creating empirical measures for exposure, susceptibility, and access, and then used these measures in 2 waves of data collection in the US during the H1N1 pandemic (see Table 1). During the second wave of data collection in January 2010, they found that, indeed, the groups that were likely to have higher levels of exposure due to lack of access to resources that would enable social distancing did report having had influenzalike illness (ILI) and were also likely to have less access to care once disease developed (see Table 2).[14,15] In this research focused on the US, absence of workplace policies (paid sick days) contributed to a population attributable risk of 5 million additional ILI cases in the general population and 1.2 million additional cases among Latinos.[15] These results demonstrate that there is significant potential for existing social disadvantage to

Table 1. Measures of Exposure, Susceptibility, and Access to Care[14]

Measures of Exposure to Influenza
Structural Measures
➢ Working
➢ Living in a metro area
➢ Living in an apartment building
➢ Number of adults in household
➢ Number of children <18 in household
Work-Related Measures of Inability to Social Distance
➢ Difficulty staying home from work for 7-10 days
➢ Not able to work at home
➢ Will not get paid if stays home from work
➢ Does not have sick leave at job
➢ Could lose job or business if not able to go to work
➢ Job can only be done at workplace
Other Measures of Inability to Social Distance
➢ Difficulty finding daycare not with a group of children
➢ Difficulty avoiding public transportation
Measures of Susceptibility
Self-Reported Chronic Conditions
➢ Heart disease
➢ High blood pressure
➢ Cancer
➢ Diabetes
➢ Asthma
➢ Lung disease
➢ Immunosuppression
Measures of Access to Care
➢ No regular healthcare provider
➢ No health insurance
➢ Lack of insurance or money make it difficult to get flu shot
Measures of Discrimination
➢ Ever experienced discrimination/hassle when seeking health care

contribute to a greater burden of morbidity and mortality from influenza, thereby exacerbating disparities.

Although these studies were conducted in the US, we offer these measures (Table 1) and the results (Table 2) with 2 goals in mind. First, researchers and epidemiologists could use these measures as points of departure for developing appropriate measures for the specific national context in which they work. Second, these data indicate that even in high-income countries such as the US, racial and ethnic minorities are at greater risk in a pandemic because of social factors. Multiple epidemiologic studies and reviews have reported higher rates of hospitalization due to 2009 H1N1 pandemic among the poor, those living in poorer neighborhoods, and minorities in the US.[16-20] In addition, studies in other high-income nations uncovered ethnic and socioeconomic inequalities in hospitalization rates due to pandemic influenza, and our aim is to stimulate research to uncover the causal mechanisms—which may include upstream factors in addition to inequitable access to health care—behind these inequalities. In the UK, the most-deprived quintile had a mortality rate due to 2009 H1N1 influenza 3 times higher than the least-deprived quintile,[21] and South Asian ethnic groups and those living in socioeconomically deprived areas had disproportionately higher rates of laboratory-confirmed 2009 H1N1 influenza.[22] In Canada, a lower education, aboriginal ethnicity, and living in a highly deprived neighborhood were all associated with higher hospitalization rates due to 2009 H1N1.[23] The causal mechanisms leading to these disparities may differ by location, but our previous studies suggest a framework for designing research to uncover these mechanisms. For example, underlying conditions did not fully explain observed inequalities in hospitalization rates in Canada;[23] similarly, underlying chronic conditions and access to health care did not fully explain inequalities in New York City,[19] suggesting that factors further upstream, including differential rates of exposure to virus because of differences in social mixing or differential susceptibility to disease because of differences in vaccination behavior, may need to be examined.

Based on the findings of Blumenshine et al[12] and our own findings, we developed a conceptual model of the potential causes of inequalities in influenza burden.[24] The model presented here (Figure 1) builds on that original model by making explicit the proximal (functional) variables of interest and the distal (actionable) determinants of inequalities. These changes reflect evolution in our own understanding of the mechanistic basis for inequalities since the original publication.[24] We have realized that collecting data on behavioral and biological factors is key to our ability to test competing proposed hypotheses for the generation of inequalities in respiratory infection. Our model outlines potential causes of disease inequalities within countries and highlights the proximal (ie, downstream, mechanistic) behavioral and biological causes as well as their links to the distal (ie, upstream, social and policy) causes. Our aim is to provide a framework that countries can use to test the mechanisms that may lead to unequal levels of disease and death. It is only once these mechanisms and their relative impacts on disease inequalities are examined that we can test the impact of counterfactual policies to reduce inequalities in disease burden. For example, there may be multiple causes of the observed unequal levels of disease in a given location, including, say, differential vaccine uptake and differential hand-washing behavior. Alternative interventions may be devised to target these causes, and assessing the impact of these alternative policies/interventions—possibly in a simulation environment or with multiple arms in a randomized controlled trial—would allow evidence-based decision making at the country level.

Differential Exposure

Crowding in low-income households and neighborhoods is a potential mechanism by which differential exposure could

Table 2. Key Results from US Studies, 2009-10

Key Results[14]	
Measure	*At higher risk of disease*
Geographic and living situation	All minorities
Larger household size	Spanish-speaking Hispanics
Work-related inability to social distance	Spanish-speaking Hispanics
Difficulty accessing individual daycare	African Americans, Spanish-speaking Hispanics
Difficulty avoiding public transportation	All minorities
Prevalence of chronic conditions (susceptibility to complications)	African Americans marginally higher
Difficulty accessing health care	Spanish-speaking Hispanics
Discrimination when accessing health care	All minorities
Key Results from a Second Wave of Data Collection[15]	
▪ Higher incidence of influenzalike illness (ILI) was associated with greater inability to social distance at work and greater number of children in the home.	
▪ Latinos had significantly higher ILI incidence associated with these determinants.	
▪ Absence of workplace policies (sick leave) contributed to population attributable risk of 5M additional ILI cases in general population and 1.2M among Latinos.	

result.[25,26] Among Brazilian indigenous Guarani children, risk for acute respiratory infection was significantly related to household crowding.[27] Additionally, low-income employees are often unable to stay home when ill or with a sick child for lack of the ability to work from home or forego wages.[14,15,28] Socioeconomic disparities in access to paid sick days (as shown by the American Time Use Survey 2011[29]) and the ability to stay home from work when ill could lead to differential exposure to virus and, hence, disparities in influenza attack rates.[15] In low-income countries, subpopulations

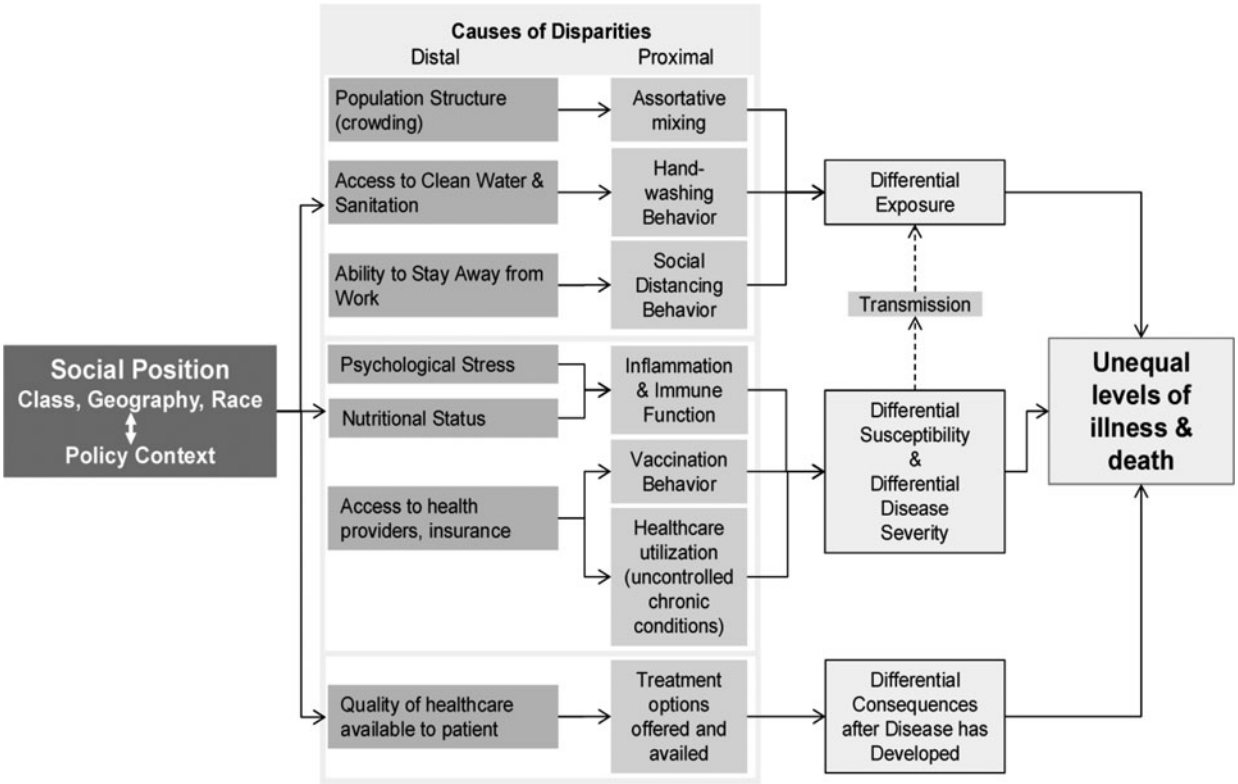

Figure 1. A mechanistic framework for countries to test the proximal (behavioral and biological) and distal (social and policy) risk factors that could lead to unequal levels of disease and death in an epidemic. Adapted from Blumenshine et al[12] and Kumar and Quinn.[24]

lack access to clean water and sanitation, not only putting them at risk for gastrointestinal infections, but also decreasing hand-washing behaviors and thus increasing respiratory infection spread. In Venezuela, child mortality—largely due to gastrointestinal and respiratory infections—was correlated with the multidimensional poverty index of households, which takes into account household education, health, and living standards (including access to water in the household).[30]

Differential Susceptibility

In the United States, psychological stress has been shown to be higher among low-income people[31] and may result in impaired immune function and hence greater susceptibility to disease.[31,32] Stress has also been suggested as a mechanism to explain disparities in influenza rates,[12,33,34] although its differential distribution in low- and middle-income countries remains unknown. Malnutrition—either hunger or obesity—is a risk factor for severe disease. In a study of outcomes among children hospitalized due to acute respiratory infection in Madagascar,[35] 2 out of 3 malnourished children died. Disparities in vaccine uptake rates could also cause differential susceptibility once exposed to the virus. Vaccine uptake rates differ by socioeconomic status because of a range of factors,[36] including ease of contact with the healthcare system and access to health insurance.

Differential Access to Health Care

Differential healthcare seeking behaviors may exist by income, potentially driven by differential access to health care. Such differences could lead to delays in seeking care in response to respiratory infection,[37] as well as differential quality of care available. Less access to health care may result in uncontrolled chronic conditions such as asthma and hence more severe disease.[25] The latter may lead to differential rates of antiviral prescriptions[38] and differential outcomes once hospitalized, thus feeding into the social consequences of ill health and further social stratification.[13]

In an example of one particular country, we studied the influenza pandemic planning and preparedness document for India and found that planning did not account for people's differential access to water and sanitation or health care, both of which could have large impacts on who is exposed and where disease persists.[24] In a country in which large proportions of the population are socially disadvantaged, the environmental and social determinants of exposure, susceptibility, and access to care present a compelling case for pandemic planning that grapples with these larger social forces.

More broadly, we believe that countries around the world should invest in a preparedness planning process that seeks to decrease inequalities in disease burden during an influenza or other pandemic in addition to reducing disease overall. Especially in low- and lower-middle-income countries in which a large proportion of the population is poor, measures to reduce the gap in disease burden through focused efforts to reach the poor may yield larger reductions in overall disease than measures that target the entire population without such focused efforts. Reductions in the disease burden among the poor in these countries would enhance global health security by reducing the likelihood of disease persisting among poor subpopulations and spilling over country borders. Yet, to date there has been inadequate attention to underlying inequalities and social determinants in pandemic planning.

Failure to Consider Social Disadvantage and Disparities

Over the past decade, there has been substantial concern about H5N1 and other influenzas sparking a pandemic, leading to the development of national influenza pandemic preparedness plans. In order to grapple with the impact of such pandemics on disadvantaged populations who already experience health and economic inequalities, the Bellagio Group articulated a set of principles and accompanying checklists. The checklist included:

- Identify and enumerate both those groups who are traditionally disadvantaged and those who are likely to be disproportionately affected by preparations for an influenza pandemic, responses to a pandemic, and by a pandemic itself;
- Engage disadvantaged groups and/or their representatives in the planning process; and
- Identify and address the special needs of disadvantaged groups in the context of recommendations and policies to prepare for and respond to an influenza pandemic.[39]

Because the evidence of existing disparities in previous infectious disease outbreaks and influenza pandemics is so well documented, Uscher-Pines and colleagues[8] used the Bellagio Group checklist's 3 principles in their analysis of 37 pandemic preparedness plans from low-, middle-, and high-income countries. Overall, they found that, although none of the plans systematically identified socially and economically disadvantaged groups, 10 high-income countries did mention some disadvantaged groups, including racial and ethnic minorities, surmising that existing health disparities could be problematic in a pandemic. They reported, however, that only 1 of the plans explicitly described how they engaged disadvantaged populations. When plans identified policies to address their populations, they generally limited their focus to culturally appropriate health communication or limited social services. None of the plans specifically discussed access to medical or public health interventions, such as vaccines, or addressed the impact of public health recommendations such as school closings, social distancing, or others on disadvantaged populations.[8]

Garoon and Duggan[40] further analyzed the same pandemic plans studied by Uscher-Pines, identifying key assumptions that shape the plans. They argue that plans treat pandemics as "equal opportunity" events that are global in nature, failing, from their perspective, to recognize that pandemics occur in local contexts with differential impacts on socially disadvantaged populations. They further argue that by focusing on "critical infrastructure and political, social and economic order," these plans actually "exacerbate pre-existing disadvantage in terms of biological, social and economic outcomes."[40(p1140)] They explicitly offer several other criticisms of pandemic plans: Even when they identify a population as vulnerable, they do not consider the heterogeneity within a population; they fail to understand the social forces and community dynamics that will affect both how populations respond to a pandemic and how they are differentially affected; they largely ignore particular groups such as immigrants, migrant workers, and, today, we would add refugees; and finally, they do not recognize the complex and rich nature of culture and its importance in planning.

The studies by Uscher-Pines et al and Garoon and Duggan are disturbing, and yet they reflect some of the gaps at the level of WHO consideration of pandemic planning. Indeed, the WHO's Pandemic Influenza Planning Framework itself focuses on the equitable sharing and access to viruses, vaccines, and other resources to address inequities between nations, but it does not address the issue of specific factors associated with differential risks for populations within nations.[41] Again in 2013, the WHO Pandemic Influenza Risk Management interim guidance had little to say about socially disadvantaged populations, either by poverty, race, ethnicity, religion, or indigenous status. There was no focus on disadvantaged populations in the guidance on assessment activities. In the document, the terms *vulnerable* and *high risk* were used but not defined. There was a call to seek feedback on attitudes and barriers that could affect compliance with directives during a pandemic and brief mention of the need for health communication and health education with vulnerable and high-risk populations. Although Annex 3 of the guidance considers ethical issues in pandemic planning, there is only brief mention of the need to consider equity in access to antivirals by vulnerable and disabled populations.[42] In the PIP Framework Partnership Contribution Implementation Plan, there is 1 mention of inequalities, with this statement: "A clearer picture of the health burden that influenza imposes on different populations should be established."[43(p5)]

Incorporating Disparities More Effectively

To meet the vision of the Global Health Security Agenda requires that planning for any pandemic—influenza or other infectious respiratory disease—explicitly examine the broader social determinants of health, social disadvantage, and existing disparities long before any actual pandemic. To include this as a specific focus in efforts to meet GHS objectives is essential to achieving the goals and objectives (Table 3).

In order to invest in preparedness plans that will facilitate achievement of global health security, however, countries need to use the periods between pandemics to examine the mechanisms by which unequal levels of disease and mortality may arise. The first goal of the Global Health Security Agenda is to "Detect threats early including detecting, characterizing, and transparently reporting emerging biological threats early through real-time biosurveillance."[3] This would include investing in surveillance systems capable not only of detecting outbreaks and novel agents early, but also of capturing sociodemographic information of incident cases. This early attention to sociodemographic information, coupled potentially with GIS capacity, could facilitate attention to the larger social, economic, and physical environment in which those cases occur. An interdisciplinary team, including anthropologists, demographers, sociologists, and others, could design the appropriate intersecting surveillance system that could yield a more complete understanding of the outbreak. Moreover, the ability to detect influenza and other respiratory disease outbreaks and understand the impact on populations already affected by inequities would be addressed by the broader WHO effort to foster national health equity surveillance systems that collect routine data on differential morbidity, mortality, healthcare access, physical environment, relative inequality, social inequities, and sociopolitical context, among other relevant measures.[11] However, we acknowledge that the capacity for surveillance is limited in many countries and that improvements via training, technology, and collaborations are, in fact, a strategy in the GHSA. Therefore, we would propose tests of such combined surveillance, which could examine its feasibility and the resources needed to implement it, and evaluate its effectiveness.

Moreover, engaging disadvantaged populations in the surveillance process by training local community health workers to report data using cell phone and SMS capacity would not only facilitate the surveillance effort, but also garner trust. The surveillance system itself would benefit from local knowledge, and the active involvement of community health workers may facilitate understanding of broader contextual factors that can drive outbreaks. The use of community health workers in this fashion would require appropriate planning and evaluation to determine training needs, potential obstacles, and ongoing monitoring to ensure its feasibility and effectiveness.

In the past decade, the WHO/African Regional Office and the CDC have implemented the Integrated Disease Surveillance and Response framework, with a goal of improving core in-country capacity for surveillance and response to outbreaks.[44] Although the framework has an established matrix of partners and specifies their roles in

Table 3. Recommendations

Goal: Detect threats early including detecting, characterizing, and transparently reporting emerging biological threats early through real-time biosurveillance by	
Objective	*Recommendation*
Launching, strengthening, and linking global networks for real-time biosurveillance	Work collaboratively with WHO to build capacity for national health equity surveillance with minimum capacity as defined by WHO.[11]
	Create an integrated surveillance system capable not only of detecting outbreaks and novel agents early, but also of capturing sociodemographic information of incident cases.
	Identify and engage socially disadvantaged populations prior to a pandemic and strengthen quantitative and qualitative data systems to foster understanding of the factors affecting them.
	Consider the use of interdisciplinary teams including anthropologists, sociologists, and demographers along with epidemiologists to contribute to development of such networks and systems.
	Evaluate the role of marginalized or disadvantaged populations as trained community health aides able to detect unusual events and identify contextual factors that may contribute to disease transmission.
Goal: Prevent avoidable epidemics including naturally occurring outbreaks and intentional or accidental releases by	
Objective	*Recommendation*
Reducing the number and magnitude of infectious disease outbreaks	Invest in social, epidemiologic, and computational public health research capabilities in low- and lower-middle-income countries to enhance their understanding of social inequalities in disease burden and enable policymaking to reduce these inequalities.
	Advocate for a change in WHO guidance to specify that pandemic planning must explicitly examine determinants of disparities prior to an actual pandemic and adhere to the Bellagio Group principles for pandemic planning.
	When possible, examine policy remedies that facilitate ability to social distance for the workforce.
Goal: Respond rapidly and effectively to biological threats of international concern by	
Objective	*Recommendation*
Improving global access to medical and nonmedical countermeasures during health emergencies	Develop international agreements prior to a pandemic that facilitate timely distribution of vaccine to low-income countries and other countries with substantial socially disadvantaged populations.
	Engage existing networks of community-based primary care clinics that are effective in providing care for socially disadvantaged populations.
	Identify socially disadvantaged populations prior to a pandemic and engage them to assess barriers to accessing care and implement feasible changes prior to a pandemic.

detection and control of an outbreak, it relegates community members and leaders to roles in the description and interpretation of disease outbreaks. While conceivably this could facilitate a broader perspective on inequalities and social determinants as factors in disease outbreaks, attention to inequalities is not identified specifically with any activities or as a role for any partner from community, health system, government, or nongovernment organizations. However promising this framework appears, Kasolo et al's[45] assessment of its implementation found that the community component has been operationalized in only a very limited fashion and that socioeconomic, behavioral, geographic, and logistical challenges remain barriers to timely and effective responses in many countries.

Surveillance data need to be made available in a timely fashion to researchers and analysts. An important part of this equation, especially in low- and lower-middle-income countries, is the need to increase the number of trained epidemiologists and public health practitioners who are primed to analyze these data so as to understand risk factors for disease. Infectious disease researchers have used cutting-edge computational modeling and simulation methods to

examine the impact of alternative policies on the size of epidemics. Models have been used to test intervention effectiveness during the 2009 H1N1 influenza pandemic and a potential H5N1 pandemic.[46-48] Models that showed that preventing air travel and closing schools would have minimal impact on the size of the epidemic informed policy in the US and other countries. Individual-based models can be used to examine the impact of interventions on inequalities. Outputs can be measured by geographic area or wealth quintile, thus quantifying policy impact on not only reducing disease burden overall, but also on reducing *inequalities* in disease burden.[49,50] Funding agencies should invest in computational modeling education programs in low- and lower-middle-income countries, similar to investments that the NIH has made in the US.[51]

The last point becomes especially salient when decisions need to be made quickly by policymakers in a country. Policymakers are more likely to work with and trust researchers from their own country. Investing in social, epidemiologic, and computational public health research capabilities in low- and lower-middle-income countries will enhance understanding of social inequalities in disease burden and enable policies that reduce these inequalities, as well as disease overall, ultimately enhancing global health security. Although its outcome is not yet known, one example of this is the partnership among the CDC, China CDC, Suzhou CDC, Suzhou Children's Hospital, and Fudan University to examine the economic burden of seasonal influenza among children in China as part of an effort to address vaccine policy in that country.[52]

Meeting the goal of "responding rapidly and effectively to biological threats by improving global access to medical and non-medical countermeasures"[3] demands that we address the major challenge of fair access to antivirals and vaccines. Farmer et al[53] discuss key steps to expanding access to cancer treatment in poor countries with a 2-pronged strategy: global pricing and procurement strategies in which multiple countries negotiate together for reduced prices, and careful planning so that treatment reaches resource-poor regions *within* these countries. A similar mindset is required in pandemic planning. Vaccine donation and distribution systems coordinated by WHO during the 2009 H1N1 influenza pandemic were designed to ensure access to vaccines at a basic level in low-income countries. However, in the WHO's evaluation of their H1N1 vaccine deployment efforts, they identified multiple challenges.[54] Although 122.5 million doses were pledged for donation, in fact those dosages would have covered only 10% of the populations of those countries eligible for donation. Given that eligible countries are low- and lower-middle-income countries, the likelihood of inadequate vaccine for populations already experiencing health inequalities is high. In the review of other criteria for distribution, there is no explicit recognition of inequalities that could contribute to greater disease burden among socially disadvantaged populations.

Vaccine donation itself may be facilitated by public policy deliberations prior to an influenza pandemic in order to understand and foster public support for donation.[55] We argue, however, that an additional focus on distribution in each country is required so that vaccine is made accessible to socially disadvantaged groups. The US CDC currently has articulated its cooperative agreements to Increase Vaccine Production and its International Influenza Vaccine Donation Partnership, both of which work in multiple countries to increase access to vaccines through both mechanisms.[56] The Partnership for International Vaccine Introduction unites WHO, regional offices of WHO, individual countries, the CDC, and industry to develop and sustain vaccine availability in low-income countries.[57] To what extent any of these initiatives include explicit attention to socially disadvantaged populations is unknown.

Challenges to Addressing Disparities and Strengthening Health Security

Clearly, to achieve global health security and alleviate unnecessary suffering caused by social disadvantage and the social determinants of health requires complex collaboration across multiple sectors. Both Inglesby and Fischer[4] and Bernard[2] echo the call for multisectoral efforts and yet recognize the organizational, political, and other obstacles that make these difficult to mount. Such planning for an influenza or other pandemic requires social interventions, policy initiatives, and enhancing access to care prior to the time of a pandemic. Yet, if undertaken, these efforts will yield health and societal benefits beyond the impact on infectious diseases.

Some may argue that the GHSA is knowingly blind to the issue of inequalities within or between countries and has as its motive the protection of higher-income nations. However, the PIP Framework explicitly addresses the inequalities between nations. We believe that neither the GHSA nor the PIP Framework gives true attention to inequalities within nations (which exist independent of national GDP) and their potential impact on disease transmission and resulting illness and death from influenza or other respiratory diseases with pandemic potential such as SARS or MERS-CoV.

Therefore, it is our role as public health and healthcare professionals to work within our organizations, with communities, and with policymakers to decrease unnecessary exposure, minimize susceptibility (eg, by enhancing access to vaccines when available), and assure care after disease has developed. To do so will reduce the unequal burden of morbidity and mortality. Our ability to accomplish that goal requires seeing pandemics for what they are: infectious diseases embedded in a social and political context—contexts defined by social determinants of health and unequal access to resources often resulting in behavioral and/or biological disparities between population subgroups. Policymakers and

public health leaders must take these existing inequalities into account when planning for pandemics in order to prevent unnecessary suffering and the perpetuation of health and broader social inequities.

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Address correspondence to:
Sandra Crouse Quinn, PhD
Associate Dean for Academic Affairs
Senior Associate Director, Maryland Center for Health Equity
Professor, Department of Family Science
School of Public Health
University of Maryland
2242CC SPH Building #255
College Park, MD 20742-2611

Email: scquinn@umd.edu