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Global Health Governance and Its Role in Health Equity: The Case of Covid-19

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GLOBAL HEALTH GOVERNANCE AND ITS ROLE IN HEALTH EQUITY: THE CASE OF COVID-19

A THESIS SUBMITTED BY

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Declaration of Authorship

I, Wafa Abu El Kheir-Mataria, declare that this thesis titled, "Global Health Governance and its Role in Health Equity: The Case Of Covid-19" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
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Abstract

In the globalized world, we are living in, health became the joint responsibility of individuals, their governments, and the global health governance system. Moreover, based on the right to health, health equity is increasingly in demand, and adopting it to a global level has become an even more complex task to realize. This thesis is focuses on health equity at a global level. The main research questions addressed are: Is health equity present at an intercountry /global level? how is it related to Global Health Governance (GHG)? Is GHG performing well in achieving health equity? what are the reasons behind this performance? What needs to be changed for better future performance? And finally, the importance of different GHG actors in the current GHG system and how their roles might change following their performance during Covid-19?

To answer these questions, different methodologies were used. First, a systematic scoping review was conducted to define the current state of practice based on the published literature in the relevant areas and to formulate the base for this thesis. Second, a meta-analysis was performed to address one of the behavioral determinants of health leading to health equity, it addressed parental acceptance to vaccinate their children against Covid-19 in Low and Middle-Income Countries (L&MICs). The result of this meta-analysis was compared to High-Income Countries (HICs) to delineate differences in behavior according to countries' economies. Third, a concentration index and its decomposition analysis were conducted to define; first, the presence of health inequities at the inter-country level according to countries' economic status, and second to determine the factors contributing to these health inequities, when present. Forth, a Delphi analysis was completed to reach a panel expert consensus on GHG performance during Covid-19, as well as the factors behind this performance and what future changes are needed for better health equity. Finally, a social network analysis was done to determine the centrality of GHG actors during Covid-19 and whether actors' centralities would change following the Covid-19 crisis.

The scoping systematic review demonstrated that research in the field concerning GHG, health equity and Covid-19 concentrated on human rights and equity in the context of Covid-19 as well as on the needed GHG structural changes, laws and regulations, the political and economic power role in decision making, and the private sector role. The meta-analysis provided evidence that the proportion of parents in

L&MICs accepting to vaccinate their children against Covid-19 (49%) is lower than the global level due to parents' concerns about vaccine efficacy, safety, and possible side effects. The concentration index analysis clearly showed that the distribution of the Covid-19 vaccine among countries is inequitable, where rich countries had a higher ability to secure the vaccine than poor countries. The decomposition of the concentration index strongly suggested that the main factors contributing to in the inequity in the distribution of Covid-19 vaccines are: the political stability of the country, the level of universal health coverage, and the power imbalance in GHG. The Delphi consensus study concluded that GHG performance in Covid-19 was not optimal, which in turn limited the achievement of Covid-19 vaccines' global equity. For better GHG performance, GHG structure, actors' representation, accountability system, and underlying priorities and values require future modification. Lastly, the social network analysis highlighted the following: first, few actors are central to GHG, namely: WHO, UNICEF, governments, funding actors and research agencies. Second, legitimacy, financial resources and broad connections with other important actors are factors that enhance the centrality of actors. And third, certain actors' centralities are forecasted to likely change following Covid-19.

This thesis investigated and delineated the connection between GHG and health equity and explored the factors affecting this connection. In doing so many questions arose regarding GHG, equity and the underlying factors. The final recommendation based on this research is that further investigation, based on expanded quality data is imperative. The following areas, in particular, are suggested: what determines the structure and functionality of GHG – the actors or the events? How to achieve better/more equitable actors' representation in GHG? How to concentrate on human rights as the main value for GHG decisions? What political and legal reform and accountability measures are needed and how would they be enforced? The power dynamics in decision-making in GHG and its consequences.

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"I would like to express my heartfelt gratitude to my parents, to whom I owe everything: thank you for your unconditional love, for always being there for me, trusting me and supporting me.

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List of Abbreviations

CDC	**Centre for Disease Control and Prevention**
CEPI	**Coalition for Epidemic Preparedness Innovations**
CI	**Concentration Index**
GHG	**Global Health Governance**
COVAX	**COVID-19 Vaccines Global Access**
CSDH	**Commission on Social Determinants of Health**
EBM	**Evidence Based Medicine**
FHI	**Family Health International**
GAVI	**Global Alliance for Vaccines and Immunization**
GDP	**Gross Domestic product**
GF	**Bill & Melinda Gates Foundation**
GHC	**Global Health Council**
GO	**Government**
GU	**Global Un-governance**
HICs	**High Income Countries**
IMCI	**Immaterial Capacities Index**
LICs	**Low Income Countries**
L&MICS	**Low- and Middle-Income Countries**
MCI	**Material Capacities Index**
MFI	**Malaria Foundation International**
MSF	**Médecins Sans Frontières**
NGOs	**Non-Governmental Organizations**
NPM	**New Public Management**
ODA	**Net official development assistance**
PAI	**Population Action International**
PCN	**Population Council – New York**
PPPs	**Public Private Partnerships**
PRISMA-ScR	**Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Review**
PS	**Political Stability and Absence of Violence/Terrorism**

RA	**Research Agencies**
SMCI	**Semi-Material Capacities Index**
SNA	**Social Network Analysis**
STP	**Stop TB Partnership**
TGF	**The Global Fund to Fight AIDS, Tuberculosis and Malaria**
TVH	**Total Vaccinations per Hundred**
WB	**World bank**
WHO	**World Health Organization**
WPI	**World Power Index**
UHC	**Universal Health Coverage**
UMICs	**Upper Middle-Income Countries**
UN	**United Nations**
UNDP	**United Nations Development Program**
UNICEF	**United Nations Children's Fund**
VM	**Vaccine Manufacturer**
VPP	**Vaccine courses delivered as a proportion of country population**

List of Symbols

CI	**Concentration Index**
N	**the number of countries**
hi	**the health variable (vaccine accessibility indicator) for the country i**
μ	**the mean of the health variable**
ri	**is the fractional rank of country i across the health stratifier (GDP/ capita)**
β_k	**coefficients**
ε_i	**error term**

Chapter 1

Introduction

Health is defined as the "state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"(1). This World Health Organization (WHO) definition describes health as a state, a state of the individual. However, through time individuals' health was found to be related to various external factors that extend beyond individual control. Individuals health is directly affected by the environment she/he lives in starting from the direct entourage such as home to the wider environment like neighborhood, school, work place, etc.(2). Today with the Covid-19 pandemic and the manner it spread, it become evident that the individual's environment extends even further extend beyond national borders reaching global dimensions.

This fact leads to the question: who is responsible for individuals' health? The individual? the government? Or supranational entities? Individuals are to be held responsible for health determinants that they can manipulate such as their behavior. As for determinants pertaining to the environment they live in, the responsibility is then scaled up to the authority responsible of organizing and providing for the society, i.e. the government (3). However, while this may have been accurate before globalization. Today nations are more prone to external influences that can affect health both directly and indirectly. A case in point is the availability and promotion of certain sorts of food and goods shown to be related to certain types of Non-Communicable Diseases (NCDs) while the increased trade and increased ease of travel augment the speed of spread of infectious diseases. Globalization necessitated the creation of a new dimension of authority that surpasses governments to manage transborder issues such as health (4). The most recent example of transborder challenges that required a global intervention is Covid-19. It has demonstrated that similar incidents cannot be handled at an individual and national level but demands a global well incarnated through supranational organizations and regulations (5). Today, this is known today as Global Health Governance (GHG).

In addition to the fact that health promotion needs the involvement of higher organizational structures, it is a right for all humans. Right to health is "the right to the enjoyment of the highest attainable standard of physical and mental health" (6). It was first enumerated in the Universal Declaration of Human Rights by the United Nations' 1948. Since then, it has come to be represented in many international agreements. Since health is a right then all humans are to enjoy it equally. This has provided the base to the notion of health equity. Health equity is the "the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically or geographically"(7). Here again comes the question who is responsible for achieving health equity in the current context of globalization? Given their roles, both national governments and the GHG are responsible for achieving health equity (5).

This thesis concentrates on these two aspects; GHG and health equity and aims at delineating the connection between them as a way to expand the thinking of health determinants to exceed the national level to global level. The thesis also aims at relating global health inequities to structural GHG factors and propose future GHG reforms to achieve global health equity.

Based on review of the literature, the following hypothesis is put forth: Global Health Governance (GHG) has not reached maturity in achieving health equity per the tenets of Human Rights.

Thereafter this thesis has five main objectives:

1. To establish the backbone for the thesis through acquiring a comprehensive knowledge of what has been published on Global Health Governance (GHG) in relation to health equity in the context of Covid-19.
2. To demonstrate the presence of health inequities at countries' level and relate these inequities to structural factors at a global level using Covid 19 vaccine distribution as a case study for this research.
3. To demonstrate behavioral difference between L&MICS and HICs towards Covid-19 vaccine as a factor contributing to the differences in acquisition of Covid-19 vaccine between the two categories of countries.

4. To understand GHG system performance during Covid-19 and the reasons behind this performance and to investigate possible GHG modification to enhance global health equity.
5. To model and analyze the current community of GHG actors in the context of Covid-19 and investigate possible future changes in their roles.

The thesis is organized to address each of these objectives following an overarching contextual framework. Synthesis of the data integrating the specific findings are provided in the concluding chapter.

Chapter 2

Literature review

The literature review within this chapter aims at introducing the main concepts used within the thesis which are governance and equity. To fulfil its aim this chapter has three main sections: Governance, governance in health, and health equity. each of the sections concentrated on the definitions, theories, models and frameworks for either of these two concepts. Governance in health, although built on the main concept of governance, it still has its specificities making it a relatively new governance research domain and for that it has its own section in this literature review chapter.

It should be noted that this chapter, by no means cover the literature review intended for whole thesis. This due to two reasons: first, this thesis has a systematic scoping review chapter which serves as the base for this thesis's other chapters, and second, each of the other four chapters (thesis's studies) has its introduction/background section that contain the needed literature for that study.

Governance: Definitions, Theories and Models

Background and history

Governance as a construct has a long history. The scholarly interest in this notion has led to its continuous evolution such that it has become a significant paradigm which provides new paths of actions for practitioners (8). In the 1990s, governance gained a lot of interest from international organizations, most notably the United Nations (UN) and the World Bank (WB). These entities adopted governance as central to their work and produced a set of indexes to measure governance and rate countries. Governance as a term, has become well established in organizational and political sciences fields. However, in the health field it is a relatively new term, coming into the fore following the end of WWII and the establishment of international organizations and the start of the globalization era.

Definitions

Effectively, governance must have a dynamic nature, as it evolves in synchronization with the change in a body's fortune and circumstances, such as resources, economy, trade, institutions, social values and political relations. This dynamism renders and absolute definition of governance "blurry" or elusive (9). Indeed, the literature demonstrates the paucity of definitions for governance. The simplest definition is by Pierre and Peters (10), they stated that governance is " a process of steering and of control" in order to reach collective goals. Although this definition gives the impression of simplicity, it entails a certain degree of underlying complexity. If governance is a process, then it involves inputs, implementation and outcomes. Each of these components has several intervening factors that needs to be accounted for and considered in order to have successful governance. Bevir (11) also considered governance a process, but concentrated on the fact that this process has several elements that are used with the intention of organizing a specific society. He defined governance as "all the processes of interaction be they through the laws, norms, power or language of an organized society".

The WB defines governance differently. The WB states that "Governance is the manner in which power is exercised in the management of a country's economic and social resources for development" (12). In this definition the key word is power, so governance is power used to promote development. In the WB definition there is no mention of norms, language nor society which highlights the difference in the end goal of governance in the two definitions, in Bevir definition the aim is organizing society while the WB definition stresses development as the main aim. Finally Keping in his paper (13) looked at governance in terms of power and explained governance through differentiating it from the government. According to Keping, governance is different from government. Both government and governance involve authority. However, for governments, the authority is centralized while governance, the authority is not centralized but rather distributed between different actors including the government, private sector and Non-Governmental Organizations (NGOs). The power in governance is based on coordination, cooperation, negotiation, and partnership between different actors who have a common goal.

Theories underlying the concept of governance

Theories are analytical lenses that help understand a phenomenon or notion. Several theories may exist covering the same notion. Given the complexity, governance theories are multidisciplinary, they are based in political science, public administration, sociology, economics, law and science, where applicable (8). According to Heady (14), governance can be understood as referring to three main theories: organizational theory, cultural theory, and structural-functional theory. Nevertheless, authors in the "Handbook on Theories of Governance" (8) have detailed nine theoretical backgrounds to governance. These include:

Collective action theory is about collective social dilemmas where the decision on one individual affects the payoffs of another individual. Solving the dilemma involves governance measures that ensure that at least one individual will benefit without harming the other. This theory is beneficial in analyzing global health challenges, especially the ones concerned with managing public goods (e.g., knowledge, health) and common resources pooling. Taking the case of Covid 19, governance is essential in assuring no exclusion of any government or population from acquiring the information or access to vaccine in the aim of protecting other nations or certain industries interests (15).

Organization theory explains how constructs are related to each other. The relation between these constructs is seen as the reason behind a certain phenomenon. Theories of organization include bureaucracy, rationalism and division of labor. Organizational theory can be useful in understanding governance. In this aspect, governance is considered as a process dependent on organizational factors (e.g., capacity, specialization, affiliation, and coupling). Manipulating one or more of these factors would result in change in governance which entails increasing the likelihood of certain outputs (16).

Public management theory is mainly the addition of New Public Management (NPM). NPM is a model of public management that aims at managing the public sector in ways that are more in line with the management in the private sector where accountability concentrates on the results rather than the processes (17). Before NPM, public services were managed and governed through the old public administration. With the increased number of organizations involved in service delivery, old public

administration is no longer enough alone. Both NPM and old public administration are needed to govern all the involved organizations (18).

Planning theory, there are several theories related to planning. Some concentrate on the objective of planning, others concentrate on the process and the rest concentrate on the context within which planning is done. These planning theories contextualize planning between administration and policy. Moreover, within the last type, is the collaborative planning which is used in governance. Collaborative planning is an innate mode of interactive governance. The downside of collaborative planning is the difficulty to reach consensus among involved parties (19).

State theory, the importance of this theory originates from the claimed shift from government to governance. According to the state theory, the state has three core elements: political administrative apparatus, defined territory, and population along with the legitimate power and authority. Thus, the state is central with a hierarchical system. Governance, on the other hand, lacks the fixed juridico-political institutions making it difficult to define in terms of statehood. Nevertheless, the nature of governance aligns better with the globalization movement and the growth of social complexity (20).

Democratic theories, democratic systems enable non-state actors (e.g., social and private) to grow to become more influential, with increased role in the governance process. However, the degree of influence depends on the extent of involvement allowed by the governing system. Also adopting the governance approach would affect the traditional democracy, it might enhance or deteriorate the known democracies through weakening the existing structures (21).

Public law and regulatory theory deals with the shift of public law making from the government to include other actors in the governance arena such private and civil actors. With the presence of numerous actors, regulatory modes became shaped by market logics. Contractual arrangements, standards, rankings and monitoring gained higher importance (22).

Development theory is concerned with understanding how to reduce poverty in developing countries through enhancing socioeconomic standards of living. Development theories are entangled with collaborative governance since 2000.

Internal and external stakeholders are involved in producing successful governance (23).

International relations theory is related to the fact that the world is becoming transnational. In this transnational world things happening within a state boarder are not isolated but are often related to in events in places beyond nations. In this world, state is one actor among many others in a complex organizational web resulting in transnational governance. Transnational governance is organized through relations in the international web and results in the "travel of ideas" around the world (24).

Models of Governance

Several governance models were developed over time. Jon and Guy discussed six models of governance in their book (10) these models are: Etatiste Governance, Network and Interactive Governance, Multilevel Governance, Informal Governance, Metagovernance, and Good Governance.

Etatiste Governance model where the government and its institutions have the authority to steer the country and its population. Although the government is the main actor in this model, other institutions and society actors interact with the government. The role of the government is defined by both the government and the society. The government defines its role towards the society while the society have expectations for the government to coordinate the society in a certain manner and pursue collective goals. This model is characterized by the centrality of power which has both a negative and a positive aspect. If the government is an elected government, this entails societal representation, higher accountability and less conflict regarding collective goals.

Network and interactive governance model: In this model a group of actors involved in a collective action following the establishment of a coordination mechanism in the aim of pursuing a common goal. This model is more fluid than the Etatiste model where actors might change overtime entering and exiting the governance arena. It is dependent on interaction between actors rather than on institutional structures and roles as in Etatiste governance model. Although this model is more flexible, many concerns surround it. Coordination between actors is vital for this model to work. Weak coordination might render the system poorly functional. The absence of an upper formal authority might generate legitimacy and accountability problems. The

inclusivity and exclusivity of the network might become an issue of representation of various stakeholders. Heterogeneity of members of the network might lead to difficulty in goal setting. Power gradient between actors, if it is imbalanced, might lead to bias towards resourceful actors namely private actors.

Multilevel governance model: This model is composed of complex system of local, regional, national, and transnational institutions which are required to coordinate their actions to govern. The model is best presented in the European Union model. It is a nonhierarchical model. Exchange does not need to pass by the capital. It has different level actors that interact through both formal authorities along with informal networking. In the absence of hierarchy, multilevel governance is more of an administrative practice than a legal authority. Some refer to this model as the "new intergovernmentalism" where collective solutions are pursued to face shared problems. Nevertheless, this model raises the issue of national sovereignty.

Informal governance This can take place in both democratic settings as well as in failing states leading to hybrid governance (formal alongside informal). In the first case- democratic settings- the formal governance structure delegates some governing power to informal institutions. In the case of failing states, informal governance emerges as the existing formal governance is incapable of governing. One of the threats of informal governance is when the power is transferred to the private sector and to social organizations. Although there are instances where this has proven beneficial, there is a considerable risk of interest bias. At the international level (e.g., Red Cross & Red Crescent, WB), informal governance entities might be of great help in case of crises. However, there may be some tendency to create a parallel governance structure.

Metagovernance refers to the monitoring and controlling of the existing governance (e.g. governing the governance) through some forms of accountability mechanisms. Federal system can be seen as an example of Metagovernance. Four main instruments are needed to perform Metagovernance: information, authority and law, financial resources and organization.

Good governance This model is concerned with assessing existing governance structure performance. The problem with good governance is that it is normative depending on perspective. This model is mainly adopted by international

organizations such as WB and UN Economic and Social Commission for Asia and the Pacific. These organizations listed sets of criteria for good governance. Nevertheless, these criteria are general, open to interpretation and are derived from values of developed countries.

Governance in Heath

Given that health is an important element in the social and the developmental discourses, it would be reasonable that the definition of governance in relation to health has elements from the previous governance definitions and relates to the above-mentioned governance theories. However, governance in health has few specificities. Health is a term that can be used to describe a status that is influenced by many factors and actors and has the health system at the center. This difference in health is mirrored in the way governance in health is defined. If the unit of definition is the health system, then one can consider the World Health Organization (WHO) definition of Health System Governance (HSG). The WHO combines leadership and governance and states that "Leadership and governance involves ensuring that a strategic policy framework exists and is combined with effective oversight, coalition building, regulation, attention to system-design and accountability" (25). This WHO definition lists what is needed in terms of governance system outcomes but does not touch upon aspects such as power or the actors involved. If one is to consider health at a sector level then governance can have defined as "developing and putting in place effective rules in the institutional arenas for policies, programs, and activities related to fulfilling public health functions so as to achieve health sector objectives" (26). By institutional arena, the authors mean: civil society, politics, policy, and public administration. And by rules they mean the roles played by the different actors. Contemplating the two definitions, one can observe that the second definition moved from concentrating on the narrow vision of a system to a wider vision that encompass rules and politics. The broadening in vision originates from the change of the unit of definition (i.e., from system to sector).

These are definitions of governance at relatively limited levels, nevertheless health goes up to the global level where it becomes a global concern with a plethora of actors and therefore an expanded governance system. The global health governance entails a certain level of complexity, novelty, dynamicity that renders it

difficult to define. Fiddler has defined GHG as "the use of formal and informal institutions, rules, and processes by states, intergovernmental organizations, and non-state actors to deal with challenges to health that require cross-border collective action to address effectively"(27). Hills, on the other side, stated that GHG is "complex adaptive system" that changes and evolves constantly to adapt to the globalizations process and its effects (28). Despite the nuance differences, these two definitions, one observes that the concentration of the definition is on the actors present in the GHG system and the complexity of the structure present. Thereafter, to be able to adequately define the GHG and its assumed roles, one ought to understand the structure of GHG.

Global Health Governance Structure

GHG structure has been discussed by several scholars. Kickbusch and Reddy described GHG as a multilateral governance system (29). Frenk and Moon, on the other hand, define GHG as the way the global health system is managed and is the system responsible to respond to health issues and threats that cannot be handled by single states. They describe GHG as a pluralistic system of numerous actors with no hierarchical authority (30). In contrast, Hill, used the complexity theory and explained GHG as a complex adaptive system, where the numerous actors are involved in nonlinear interactions with changing places of dominance and marginality and where the local is framed by the context of the global (28). Fidler described GHG structure as unstructured plurality where many actors and approaches are present in the global health arena without defined architecture to assemble them within the GHG system. He further explains that the unstructured plurality in GHG is a result of an anarchy problem where non-state actors are becoming more powerful in the international arena (31). Van et.al. compares the GHG in its complexity with a beehive. They stated that this complexity needs good connectivity between actors which can be accomplished through network governance with the WHO acting as a meta- governor (32). Lee and Smith, conversely, suggested that the WHO keeps its leadership role while concentrating on enabling consensus, facilitate networks, resources sharing and enabling all actors in decision making. They also suggested that GHG shift into network governance (33). Lastly, Desai and Lang proposed a new global governance mode called global un-governance (GU). GU is proposed for circumstances where aggregate, transnational, universal institutions are formed to govern global initiatives

such as markets. GU is to be applied in cases of closure impossibility which means the impossibility of matching the institutional structure with the outcome. GU distributes commitments equally, competently and evenly. Success is measured by the ability to change and adapt visions according to the market (34).

The way GHG structure is described can be related to the above-mentioned governance models as scholars attempt to describe and analyze GHG in different manners. Each of the above-mentioned governance model can be detected in the GHG described structures except the first one- Etatiste governance- which has a hierarchical governance system and centralized power. The fact that GHG has no hierarchical authority and has non-linear interactions makes it related to the Network and interactive governance model. Since the GHG system is complex composed of actors at local, regional, national, and transnational levels with no clear legal authority, it seems to fit in the Multilevel governance model. The presence of many informal (non-governmental) organizations in the GHG system draws attention to the informal governance model. Metagovernance model is also applicable in the case of GHG system. WHO and other international organizations; to which countries have certain types of obligations; might be considered as the institutions governing the governance. Finally, the good governance model. This model is slightly different as it is concerned with assessing existing governance structure performance and not describing one. Nevertheless, this model measures could be modified to fit the global context. The divergence in definition and proposed structure(s) and governance models suggests the lack of consensus, and why some aspects of implementation may go unaddressed (e.g., equity).

Health equity

Human rights, as being fundamental are constituted as the value basis for many concepts since WWII. Right to health, where "Every human being is entitled to the enjoyment of the highest attainable standard of health conducive to living a life in dignity"(35) is the bedrock for the notion of health equity. "Health equity is defined as the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically or geographically"(7). Thus health inequity would be the existence of unfair differences

in health among population groups(36). These differences are systematic and not individual (37).

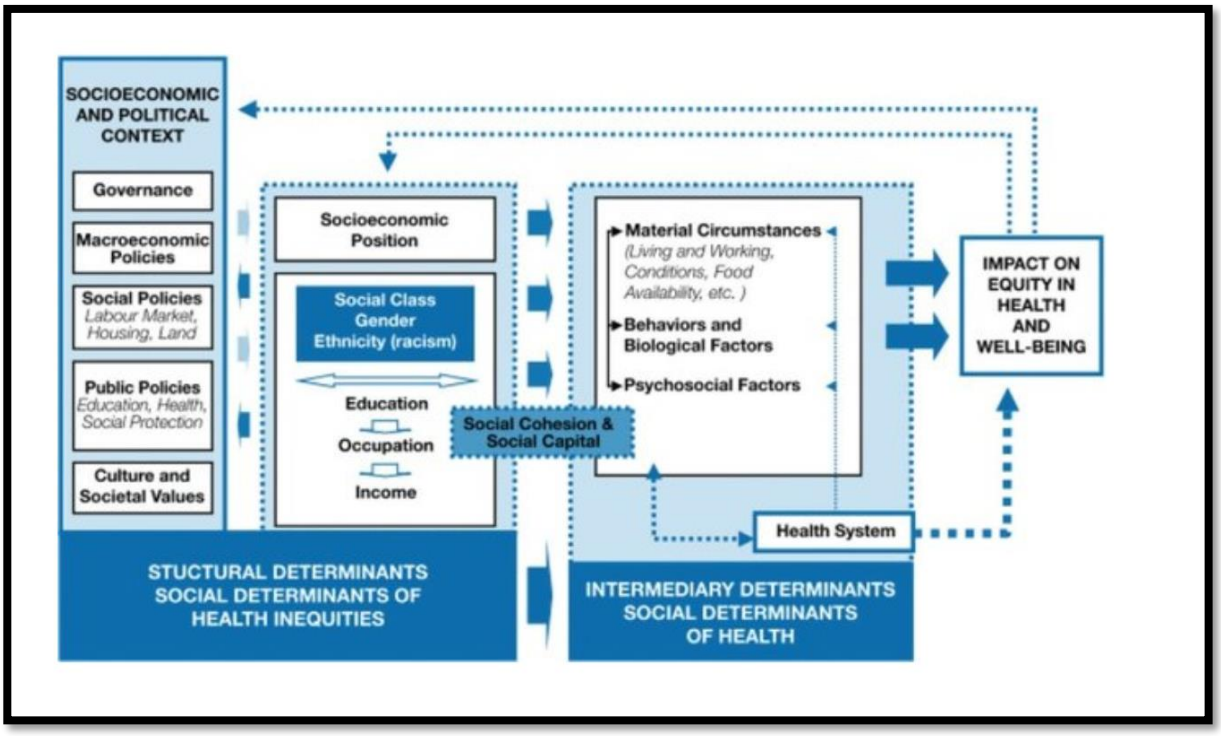

Figure 1 CSDH conceptual framework (38)

This definition of health inequity highlights two pivotal areas of concern: (1) social justice and (2) underlying causes of social injustice. In a just society all people enjoy their rights and are enabled to attain them. For this to happen, underlying causes of differences in health between population groups need to be addressed. The Commission on Social Determinants of Health analyzed the causes underlying health inequities in a society and concluded that they are caused by two sets of determinants (Figure 1): structural and intermediary determinants. Intermediary determinants are mainly our living conditions, behavioral, biological and psychological factors along with the health system. These intermediary factors are affected by our social stratifications: gender, ethnicity, income, education, and occupation which overall decide our socioeconomic position. However, our socioeconomic positioning is influenced or partially determined by the socioeconomic and political context we live

in. Hence governments decisions and policies(38). Thereafter, health inequities are consequences of the practices of a governing system and its implications.

Covid-19 and health equity

In many nations, the current pandemic Covid-19, revealed that health equity proved to be an issue of concern. Different forms of health inequities were shown to either emerge or be exacerbated since the start of the Covid-19. Scholars found that the main causes of these health inequities were disparities in income (32–35), gender (43–49) and ethnicity (50–52)which are all social determinants of health. The disparities in these social determinants is related to increased risk of virus: exposure, vulnerability and consequences (53).

Health equity is also considered a concern at the global level. One of health equity issues at the global level is the Covid-19 vaccine distribution(54,55). The GHG system has the ethical responsibility to promote human rights, ensure equity and promote solidarity (56). Many reports have been produced discussing the reasons underlying the GHG policies and decisions in Covid-19 and the resultant health inequities. Some referred it to political power imbalance(57–59) , others discussed the influence of economic power (60,61), and some cited the laws and regulations such as the International Health Regulations (62,63).

Despite and regardless of stated justifications, it should be recognized that in the face of global challenges, where a significant stratum of global society is disenfranchised, health concerns, particularly with their tie to global governance, can no longer be viewed as being contained by geography.

Chapter 3

Logical and Conceptual Framework

Conceptual framework

The logical framework for this investigation is primarily derived from two key elements, the CSDH conceptual framework and the concept of governance in general and GHG in particular. The CSDH framework relates equity in health outcomes to both intermediary determinants and structural determinants in a country. The intermediary determinants include individual aspect such as behavioral and psychological determinants as well as the health system, while the structural determinants include the socioeconomic position and the socioeconomic and political context. Although the CSDH framework attempts to be comprehensive, it stops at the country level. However, with the globalization and the increased external influence from other countries and supranational entities on internal national matters, this framework can be extended to include these external forces, mainly the GHG.

GHG, as defined in the previous chapter with all its actors, functions and structure, regulatory framework and underlying values, has a major influence on health outcomes and health equity within a country as well as between countries. GHG affects global health through various pathways: agenda setting, financing, political pressure, etc. GHG agenda and priorities highly impact countries' health-related agendas. The priorities set at the global level become priorities at the national level. Countries work hard to achieve goals such as the MDGs and SDGs partly to conform with the global trends but also because once the global agenda and priorities are set major actors in the field start organizing their projects and directing their funds towards these priorities leading countries towards the same ends.

GHG actors' power is also a very important factor in affecting health outcomes and equity. Actors' power emanates from their financial, economic, political, knowledge and technology capacities, etc. Their power enables them to position themselves within the GHG structure. GHG mostly follows a mixture of: the Network

governance model, the interactive governance model, the multilevel governance model and the meta-governance model. GHG is a nonhierarchical system with no defined authority but has some kind of a regulatory framework. Within this GHG system, actors are involved in a collective action to pursue a common goal. Given this type of structure, actors can affect global and local health agenda through any of the above-mentioned sorts of power (Figure 2).

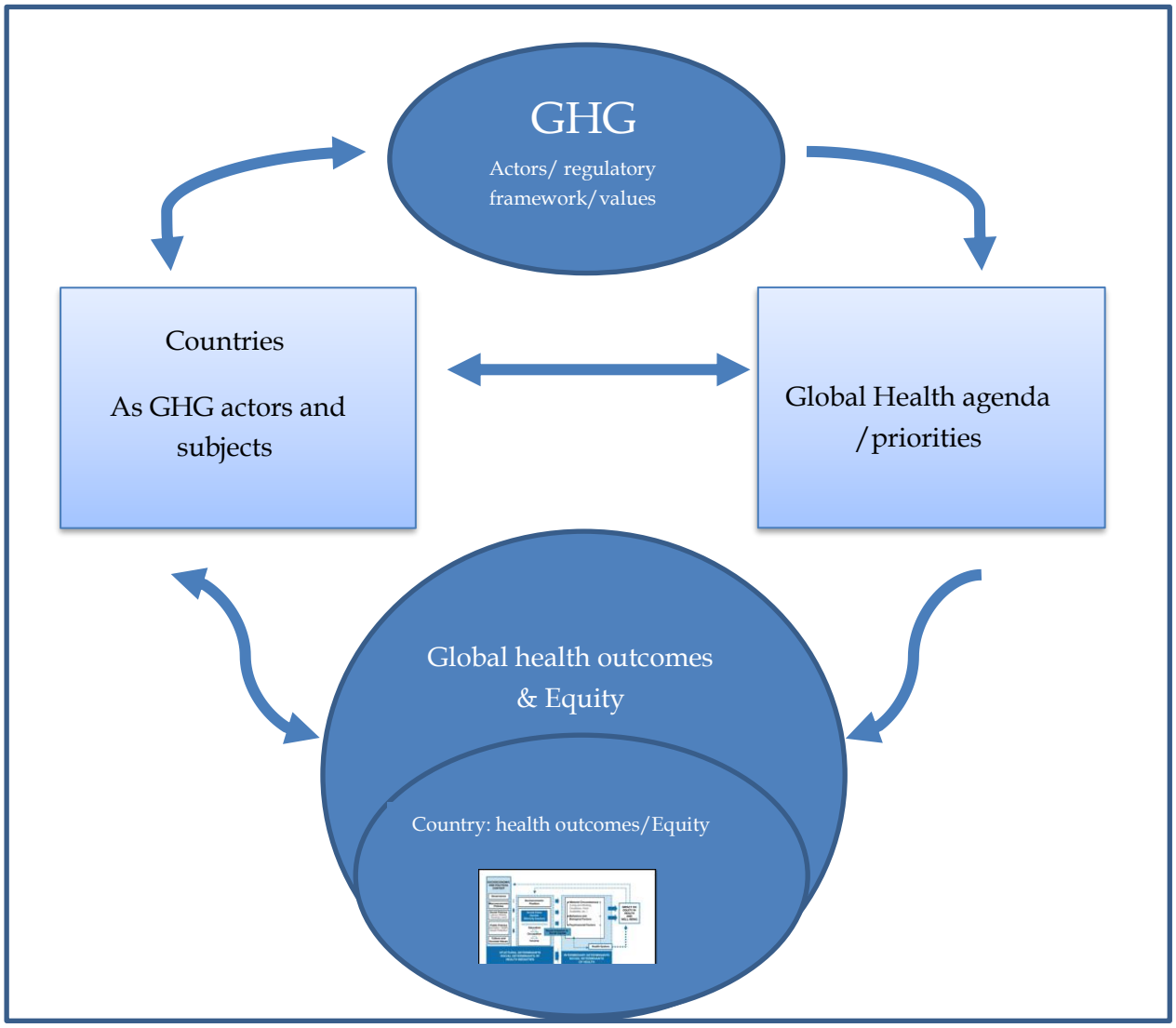

Figure 2 Conceptual framework

Logical framework

This present investigation is conceptualized in accordance with the former logical framework. The thesis structure and the methodology used aim at fulfilling the logic used in connecting GHG to health equity using Covid-19 vaccine as an example to demonstrate the linkage. As mentioned in the introduction, there are five main objectives that serve criteria towards this. To achieve these objectives, the thesis has five key parts. Each part is intended to accomplish one of the objectives of the thesis. Although, each part may stand on its own, they build on each other and complement each other to achieve the overall aim of the research (Table 1).

The first part is a systematic scoping review done to stand upon what has been done in the field on GHG, equity and Covid-19. This part serves as baseline for the other parts of the thesis as a means to back up and justify the need for these parts. The scoping review results are used to: first, provide the idea for the second part (meta-analysis) of the thesis. Second, identify health determinants that can be used in the third part of the thesis (CI analysis). And third, as a reference and source for the Delphi survey statements which are used in part four (consensus analysis) and part five (social network analysis) of this thesis.

The second part is a meta-analysis used to calculate the exact estimate of the proportion of parental acceptance to vaccinate their children against Covid-19 in L&MICs. This meta-analysis considers one intermediary health determinant leading to health equity which is the behavioral determinant. Although this health determinant is not directly related to global determinants, the overall estimate calculated in the meta-analysis of studies done in L&MICs is compared with the global estimates and HICs estimates to demonstrate the differences in behavior towards Covid-19 vaccines.

The third part is a health equity analysis. This part aims at providing evidence of the presence of health inequities in relation to health determinants that extend beyond countries' boundaries to reach a global level. This part uses Covid-19 vaccine distribution among countries and uses determinants such as countries' geopolitical power to show that external factors affect equity at countries' level.

The fourth part is a Delphi consensus study. This takes into consideration the results of part two and three which prove the presence of health inequities and aim to provide a reasoning for these inequities through investigating GHG performance during Covid-19. It also makes use of the results of the scoping review in preparing the components of the Delphi survey. This Delphi study evaluates the performance of GHG during Covid-19 in general and in relation to Covid-19 vaccine equity in particular. Then it identifies the reasons for such performance and finally provides consensus on proposed prospective changes in GHG for better future performance and equity.

The fifth part is a social network analysis. This part takes one of the results of the Delphi survey (i.e., need for structural change in GHG for better future health equity) and explores it further through measuring the centrality (importance) of actors in the current GHG structure and providing future prospect for changes in these centralities following Covid-19.

The table below provides a detailed pathway for the conceptualizing of the thesis structure. It starts with the overall aim, then the objectives, followed by the research questions for each objective. Afterwards, comes the methodology used to achieve each of the objectives. Within the methodology part, the approach, data sources, and data analysis methods are described separately.

Table 1 Logical Framework of the Thesis

Thesis Main Aim	To relate GHG to health inequities while investigating the underlying structural causes of these inequities and forecasting future needed changes to avoid them				
Thesis objectives	1. To establish the backbone for the thesis through acquiring a comprehensive knowledge of what has been published on Global Health Governance (GHG) in relation to health equity in the context of covid-19	2. To demonstrate behavioral difference between L&MICS and HICs towards Covid-19 vaccine as a factor contributing to the differences in acquisition of Covid-19 vaccine between the two categories of countries	3. To demonstrate the presence of health inequities at countries' level and relate these inequities to structural factors at a global level using Covid 19 vaccine distribution to demonstrate these inequities	4. To understand GHG system performance during Covid-19 and the reasons behind this performance and to investigate possible GHG modification to enhance global health equity	5. To model and analyze the current community of GHG actors in the context of Covid-19 and investigate possible future changes in their roles

Research questions	1. What are the findings of other researchers regarding GHG, Health Equity, and Covid-19? 2. What are the research gaps in these areas?	1. What is the precise estimate of the overall proportion of L&MICs parents accepting to vaccinate their children against Covid-19 2. What are the main determinants of their decisions?	1. Are there health inequities in Covid-19 vaccine distribution among countries according to their economy? 2. What are the structural factors contributing to this inequity?	1. How was the performance of GHG during Covid-19 in general and in relation to Covid-19 vaccine equity in particular. 2. What are the reasons behind this performance 3. What prospective changes in GHG are needed for better GHG performance and equity	1. Which actors are central in the current GHG system 2. How are their centralities going to change following Covid-19
Approach	A systematic scoping review	A systematic meta-analysis	A decomposition analysis	A consensus Delphi study	A social network analysis

Data Sources	Literature published and found in 5 databases (PubMed, Scopus, Google Scholar, World cat, and WHO-Global Index Medicus)	Studied found in 3 databases (PubMed, Web of Science, and Cochrane Library)	Secondary data from several websites including Our World in Data, WB, UNICEF, etc.	A Delphi survey with eight questions and a total of 72 statements	Two questions with eight sub questions that were inserted in the Delphi survey

Data analysis methods	1. Open descriptive coding 2. Focused thematic analysis 3. Frequency, commonality and significance analysis.	1. Arcsin proportion method for measuring the effect size	1. Concentration index analysis 2. Decomposition of CI	1. Consensus analysis 2. Performance analysis Correlation analysis	1. Degree centrality analysis 2. Eigenvector centrality analysis

Methodological Framework

Although methods are mentioned in the above conceptual framework, this section is intended to further clarify the flow of methods used in this thesis studies (Figure 3).

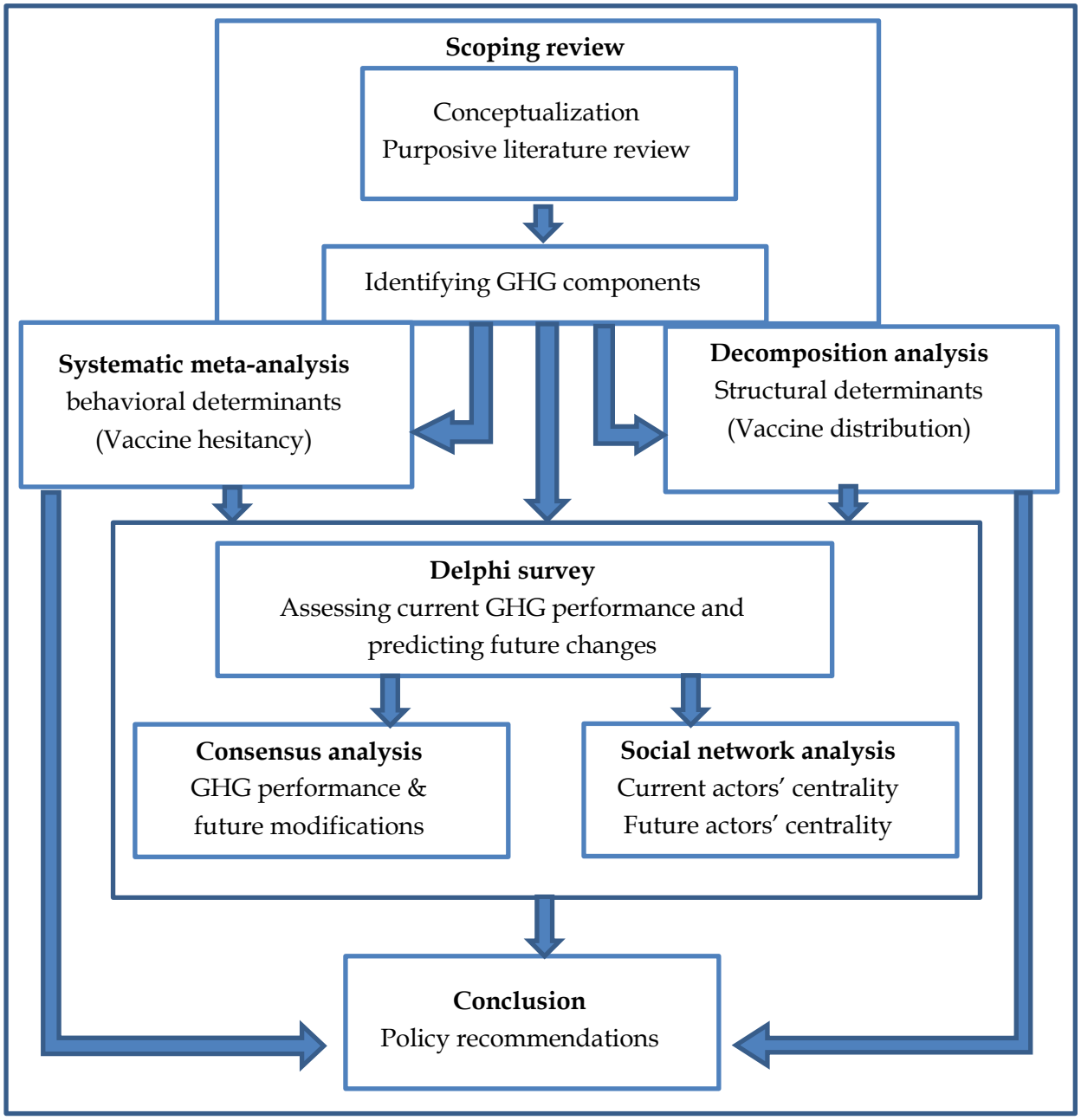

Figure 3 methodological framework

As shown in the figure above each study conducted through this thesis uses a specific methodology that is intended to provide the data and/or inputs to the studies that follow. The first step was the scoping review which is a purposive literature review that concentrated on the three main area of research for this thesis: GHG, health equity, and Covid-19. The scoping review provided the information on structural health determinants as well as on disparities among countries during the Covid-19. The information on disparities among countries provoked the idea of investigating behavioral determinants in L&MICs and compare them to HICs, which was the aim of the meta-analysis study. As for the structural health determinants, they were used in the concentration index analysis and its decomposition in the third study.

The Delphi survey's statements were deducted from the themes resulted in the scoping review study and the results of both the meta-analysis and the concentration index analysis. Using this data, the Delphi survey was composed of ten questions, each with multiple statements. Data collected from eight out of the ten questions was used to conduct the performance analysis as well as the consensus analysis while the data resulting from the two remaining questions was used to perform the SNA analysis. Lastly, the final conclusion and recommendations of the whole thesis was deduced from the results of the five studies.

Chapter 4

Global Health Governance and Health Equity in the Context of COVID-19: A Scoping Review[1]

Introduction

Global Health Governance (GHG) is defined as "the use of formal and informal institutions, rules, and processes by states, intergovernmental organizations, and non-state actors to deal with challenges to health that require cross-border collective action to address effectively" (27). According to Frenk and Moon, GHG has four main functions: First, the production of global goods, guidelines, polices, research and technologies. Second, the management of external threats. Third, the facilitation of global solidarity. Forth, a stewardship function (30). Health equity is defined as "the absence of unfair, avoidable, or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, geographically, or by other stratifiers (e.g., sex, gender, ethnicity, disability, or sexual orientation)" (64). GHG has both a moral and a functional role in achieving health equity (56) so that every human being enjoys his right to health. Considering the above GHG functions, health equity could be addressed through each and every one of them. Health equity can be enhanced through better GHG stewardship, better GHG performance in managing of external threats, stronger global solidarity, and more inclusive guidelines and policies.

Based on the fact that health equity is a moral obligation and is an important aspect of responsible governance, the COVID-19 pandemic has exposed existing

[1] Kheir-Mataria WA, El-Fawal H, Bhuiyan S, Chun S. Global Health Governance and Health Equity in the Context of COVID-19: A Scoping Review. InHealthcare 2022 Mar 15 (Vol. 10, No. 3, p. 540). MDPI.

shortfalls of GHG through the exacerbation of already existing health inequities across countries as well as within the same country (53). Since the start of the pandemic, a considerable amount of literature has been produced discussing COVID-19 and health inequities. Different areas have been explored. Some authors discussed inequities between countries and nations, concentrating on the difference between Low- and Middle-Income Countries (LMICs). LMICs are disproportionality affected by COVID-19 due to their limited capacities and resources and due to High Income Countries (HICs) actions (53). Other authors concentrated on social determinants of health as reference causes of health inequities (65). While several authors discussed GHG in relation to health inequities apparent during the COVID-19 pandemic (5,66,67).

Given the ongoing health inequities during the COVID-19 crisis and the experts' criticism of the current GHG for not ensuring health equity, gathering the knowledge covering these areas and demonstrating the gaps in this knowledge is of high importance to stimulate further research to better understand the status quo and for better future actions. This scoping review aims at mapping the present knowledge and at identifying these gaps. The paper is organized as follows: methodology, detailing the objective and research questions, studies identification, eligibility criteria, and data charting, followed by the results section where results are presented using tables and analyzed thematically. Afterwards, there is a discussion part and finally the conclusion.

Materials and Methods

The methodology used in this scoping review is based upon: first, the guidelines for conducting systematic scoping review developed by the Joanna Briggs Institute (68), and second, the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Review (PRISMA-ScR). PRISMA-ScR contains 20 essential reporting items and 2 optional items to include when completing a scoping review(69). These guidelines were used to ensure the consistency of results and to enhance the utility of the synthesized knowledge. The study was performed in the period between the first of September 2021 up until 25 December 2021.

Objectives and Research Questions

The main objective of the scoping review is to map the body of literature on health equity in relation to GHG in the context of COVID-19. Along with this objective, the scoping review aims at identifying research gaps according to research themes, disciplines, and countries of origin (i.e., authors' affiliations: developed vs. developing countries).

Relevant Studies Identification

Relevant studies were identified through searching electronic databases of both published literature and grey literature. Databases used for the search were: PubMed, Scopus, Google Scholar, World cat, and WHO-Global Index Medicus. Keywords used for the search were: health equity, health inequity, COVID-19, and global governance. In order to obtain focused results, Boolean operators were used as conjunctions to combine these keywords in the search. The used research term is: "health inequity" OR "health equity" AND "Global Governance" AND "COVID 19". Keywords were searched in the title, abstract, or keyword.

Eligibility of Studies

Identified studies to be included were to conform with the following inclusion criteria:

a. Written in English
b. Published starting with the COVID-19 in 2019 up till October 2021
c. The main focus is on global governance aspects that affect health equity
d. Reports on health equity issue in the COVID-19 context

As for the type of the documents to be included, it has not been limited to peer reviewed article for two reasons: First, the topic (COVID-19) is recent, so not limiting the type of documents included widened the base of search to ensure the collection of as much scholars viewpoints as possible, including the ones that were not developed to full research papers. The second reason is that it is recommended to include gray literature and reports while mapping the research because they are considered valuable sources of information.

Identified eligible studies were screened and reviewed by two reviewers. Screening was done through three stages: Stage one, identified studies were screened to ensure the elimination of any duplicates. Identified studies were imported into Zotero, a citation managing software that can identify duplicates and eliminate them. Stage two: title and abstract screening to exclude ineligible studies (i.e., studies that has the keywords but do not conform with other eligibility criteria). Stage three: full text article assessment of remaining studies in order to confirm their eligibility and include them.

Charting of Data

Data were charted in an Excel table. In the table, the extracted results were classified into conceptual categories according to the objectives of the scoping review. The classification criteria were: year of publication, country, field or discipline, type of publication, aim of the study, relevant findings, and main theme.

Analysis and Results Reporting

Thematic analysis of the data was performed so as to map the present literature. Analysis was done on three stages: First, open descriptive coding to generate ideas. These ideas were to be used in the focused thematic analysis. Second, focused thematic analysis to identify patterns and relationships. Third, frequency, commonality, and significance analysis of previously identified categories. Data distribution is presented using tables along with a narrative descriptive format.

Results

The first stage of chosen databases' search resulted in 332 studies. Following examining for duplicates, 50 studies were eliminated and 282 studies remained. The 282 studies were screened against the inclusion criteria. The primary screening of the title, abstract, and keywords of these articles lead to eliminating 180 studies due to the absence of one or more of the keywords, leaving 102 studies. Within the 102 studies, eight of the sources were not accessible, which led to their exclusion. The rest of the studies, a full text screening was applied and 49 studies met the inclusion criteria (Figure 4).

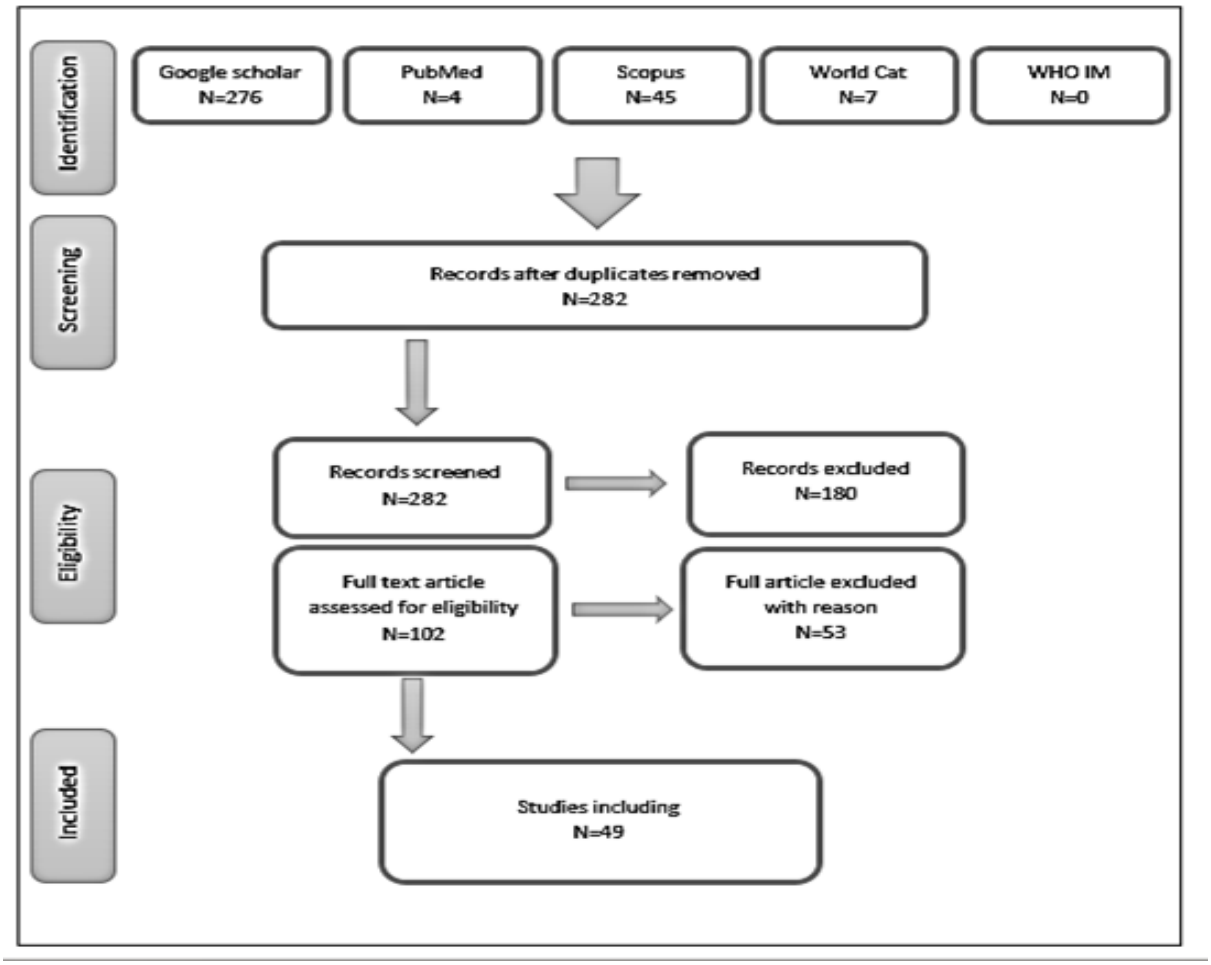

Figure 4 Search Flow Chart

The characteristics of the included studies are presented in Table 2.

Table 2 Included studies characteristics

Study characteristics N=49				Count (%)	
Year of publication				N	%
	2019			3	6.12%
	2020			14	28.57%
	2021			32	65.31%
Type of publication					
	Journal article	Commentary	8	42	85.71%
		Viewpoint	1		
		Perspective	1		

		Analytical	22		
		Essay	3		
		Review	4		
		Systematic review	1		
		Learning module	1		
		Commission report	1		
	Book chapter			3	6.12%
	Background paper			1	2.04%
	PhD Thesis			1	2.04%
	Discussion paper			1	2.04%
	Document			1	2.04%
Discipline					
	Medicine			25	
	Bioethics and humanities			1	
	Social sciences			9	
	Development and Policy			1	
	Law & Policy			6	
	Communication			1	
	Economics and political sciences			2	
	Multidisciplinary			4	
Country					
	Single country			32	65.31%
	UK			4	
	USA			9	
	Australia			3	
	Taiwan			1	
	Germany			1	
	Italy			1	
	Nigeria			1	
	Canada			5	
	Finland			1	
	India			1	
	China			1	
	Netherlands			1	
	Sri Lanka			1	
	Norway			2	
	Two or more countries			13	26.53%
	France, UK			1	
	Norway, UK			1	
	UK, US, Sweden			1	
	Belgium, India, Guinea, Peru			1	
	UK, Rwanda			1	
	UK, USA, Lithuania, Kenya, Switzerland			1	
	USA, Zimbabwe, Mexico, Belgium			1	
	UK, USA, Kenya			1	

	UK, Australia	1	
	Australia, UK, USA	1	
	Bangladesh, Sweden, Uganda, US	1	
	New Zealand, Hong Kong	1	
	US, South Africa, India, Australia	1	
	Unidentified / commission/UN	4	8.16%

Identified Themes

The 49 studies included in this scoping review were found to cover equity in the context of COVID-19 and in relation to GHG in an array of 35 different yet related topic areas. Upon analyzing the different topics, the studies were grouped into seven main proposed themes according to the interconnected areas they cover. The seven themes are: "human rights and inequities", "solidarity, collaboration and partnership", "GHG structure change", "political and economic power and finance", "approaches to address inequity", "law and regulations", and "private investment and PPPs in GHG" (Table 3).

Table 3 Main Themes

Main theme				
1	Human rights and inequities		11	22.49%
	Right to health and human rights	3		
	COVAX as a charitable PPP's model to enhance equity	1		
	Digital technology role in enhancing equity, medical technology	1		
	Decolonizing GHG/ right based approach	1		
	Inequity through different stages of vaccine	1		
	VALUES to consider in governing global vaccine distribution	2		
	Gender mainstreaming in IOs, in policy and response)	2		
2	Solidarity, collaboration and partnership		5	10.20%
	Solidarity through COVAX, technology transfer and voluntary license-sharing	1		
	Weak solidarity as a cause for inequity	1		
	GH partnership	1		
	Capacity bridging, collaboration, population-based health initiatives are needed to face inequity	1		
	Improving capacity in LMICs	1		
3	GHG structure change		9	18.37%
	Structural factors for health inequity	1		
	Many actors, no centralized authority nor binding rules	1		

	Flexible governance, adequate financing, and evidence-based, collaborative	1		
	Justice and equity as the principle for GH practice	1		
	Unequal power relation / move some power to global south	1		
	Power, resources & networks in GHG policy formulation	1		
	WHO –stronger independent structure to ensure equity	2		
	Inclusive multilateralism	1		
4	Political and economic power and finance		9	18.37%
	Political will & pro-equity policies	2		
	Centrality of power in GHG	1		
	Power and political economy/ Power as an Access Determinant to the vaccine	4		
	Quitting a one-size-fits-all approach in equity, tends to prioritize the interests of HICs	2		
5	Approach to address inequity		4	8.16%
	Multi-disciplinary effort is needed	1		
	Public health centrality in decision making	1		
	Global system approach	1		
	Mutual collective accountability	1		
6	Law and regulations		8	16.33%
	Health security & IHR to enhance equity	1		
	Role of law	1		
	Global intellectual property rules modification	1		
	Inequitable information sharing IS /international law for IS	1		
	Law capacity to advance GH justice	1		
	GH law reform	3		
7	Private investment and PPPs in GHG		3	6.12%
	Financial instrument for GHG- private investors render GHG more secretive	1		
	Less PPP in GHG PPP causes inequity	2		

The human rights and inequities theme (theme 1) is the most frequent theme among the included studies. Eleven papers were categorized as part of this theme. The studies highlight the fact that equity is embedded in the essence of human rights in general and in the right to health more specifically. The fact that -the responses to COVID-19 were inequitable- was referred to the values underlying the responses. There proved to be an under-reliance on the human rights as a base in constructing these responses (60,70–72). COVID-19 vaccines are an obvious example of this conduct. Distribution of the vaccine proved to be inequitable (73) as well as other

stages of the vaccine production, procurement, and distribution (55). Not centralizing the COVID-19 responses around human rights could be related to the failure to operationalize human rights in institutions and mode of action of the numerous actors in GHG (74). Gender mainstreaming in institutions working in the field of GHG especially in emergency response, is required so as to promote equity both at the decision-making level as well as at the outcome level (75,76). Different views and actions on techniques to address equity on the bases of human rights were presented in the studies. COVID-19 Vaccines Global Access (COVAX) as a global initiative is regarded as "the only global solution" to vaccine inequity (77), nevertheless other suggestions emerged such as using digital and medical technology to enhance equity (78).

The "structure of GHG and the need for change" theme (theme 3) comprises nine studies out of the 49 studies included. Different authors indicated that the current GHG structure is no longer adequate for facing the present challenges associated with global health and their consequences. Some scholars concentrated on the structural factors that lead to the current health inequities and proposed pro-equity laws and policies (79). Others indicated that COVID-19 is a turning point that should be used to perform fundamental changes in GHG structure in order to eliminate any barriers to achieve equity (80). Changes proposed included supporting centralized authority in GHG and binding state rules (81), stronger role for the WHO (82) while concentrating on its professional independent role as global health authority (59), voicing of those that are disproportionately affected (83), inclusive multilateralism and networking in order to leave no one behind (84), flexible collaborative governance to ensure equitable global distribution (85), and creating governance structures with higher representation of the global south (58).

Solidarity, collaboration, and partnership theme has five studies out of the 49 included studies. The authors of these studies discussed the need for global solidarity to mitigate COVID-19 effects and consequences through global partnerships, preparedness, and multi-sectoral governance (86). Others specified the need for global solidarity and collaboration to facilitate capacity bridging between LMICs and HICs (87,88), while some concentrated on solidarity to assure equitable access to COVID-19 vaccines through global initiatives such as COVAX (89,90).

Political and economic power and finance is the fourth theme with nine studies. The majority of these studies discussed economic and political power role in GHG and equity. The authors described power as an access determinant to the COVID-19 vaccine (57) and emphasized the importance of political will for achieving equity (91). Decisions are shaped by powerful nations, multilateral organizations, and private sectors (54), while other key-group actors have weak participation in decision making (92). Moreover, the authors emphasized that power through knowledge monopoly—where new methodologies are developed by the Global North and not shared with the South (93)—makes it harder for weaker actors to influence the GHG in the aim of enhancing equity (61). This leads to prioritizing the wealthier and concentrating on economic recovery rather than on human health and well-being and on inclusive development (65,94). Lastly, the authors stated that the main causes of inequity were: the presence of unequal power relations (61), the centrality of powerful donors in GHG (95), and market-oriented health norms.

The fifth theme "approaches to address inequity" contains four studies. The first study proposes a new approach to address inequity in COVID-19 and its consequences. The approach is basically a global multi-disciplinary human-centered approach aiming at coordinated research, technology development, and health trade facilitation (96). The second study discusses the use of public health as a base for approaching the current pandemic. The authors argue that public health could support social movements that concentrate on social determinants of health for radical changes. They also state that public health —as a discipline—provides arguments about conditions and decisions that might jeopardize health (97). The third study proposes a system approach. This approach recognizes the relation between human health, animal health, and environment. It proposes that future interventions need to take these three areas into consideration through a system thinking including all the involved sectors (98). Lastly, the mutual collective accountability approach, which entails having a shared global governance with a common goal and measurable indicators (67).

The sixth theme "law and regulations" explores the role of law and regulations in GHG as a way to advance global justice and enhance equity (99,100), especially vaccine accessibility (101). Laws offer legal instruments such as mechanisms, frameworks, and accountability measures to ensure safety and compliance to public

health measures (63) as well as laying the foundation to achieve Universal Health coverage, health equity (102), and ensuring timely sharing of information (103). Intellectual property rights are another topic discussed in this theme. COVID-19 proved that the current intellectual property rights need modification to allow faster manufacturing and distribution of the vaccine (104). Lastly, global Public Private Partnerships (PPPs) is another domain where laws need modification or reform. The current global PPPs are not supported by a legal accountability backbone to guarantee: collaboration, benefit sharing (101), and global action rather than nationalistic ones (62).

The last theme is "private investment and PPPs in GHG". The studies in this theme tackle the topic of prioritizing public interests over economic interests and financial gains. The authors argue that private investors' and pharmaceutical companies' main interest is financial gain, which makes PPPs less desirable in GHG as they might lead to inequities (105,106). Finding financing instruments for GHG to ensure equity can reduce the effects of the private actors and improves equity. COVAX provides a good example on the matter. It enhances accessibility to the vaccine, while considering pharmaceutical companies' concerns (107).

Discussion

The scoping review ended with 49 studies. One would assume that—with COVID-19 being the topic of interest of the moment—an enormous number of research papers would be included in this scoping review. However, only 49 studies were eligible to be included. This result might be attributed to the strict methodology used or to the fact that there is a lack of published studies tackling the three areas (GHG, health equity, and COVID-19) at once.

Considering the studies' characteristics, it is evident that the amount of research increases with time. Most of the research is published in 2021, which is logical given that COVID-19 was detected in the end of 2019 and time is needed to produce data and research. Therefore, as the COVID-19 pandemic continues to exist and time passes, research will accumulate. Looking at the type of publication, most of the included studies are peer-reviewed articles that concentrate on analyzing different aspects combining the three areas. Nevertheless, the results show that around 20% of the included publications are opinion-based pieces such as commentaries, viewpoint,

or perspective, which indicate that authors are in the phase of formulating their ideas; however, these ideas did not reach the stage of fully designed research or that there is lack of data and evidence. Discipline wise, most of the studies pertain to the medical field insinuating that certain disciplines are more productive in the area of GHG, equity, and COVID-19 than others. It also indicates that GHG is still thought of as a medical field and not as a multidisciplinary field. As for authors' countries affiliations, most of the articles with one author originate from developed countries, while multiple authors' studies have a fairly higher contribution from authors affiliated to developing countries. This can be attributed to: the higher research capacity in developed countries, the need for collaboration and capacity building in developing countries, or the concentration of developing countries' researchers on the local level research more than the global level research.

As for the research themes, the authors discuss the values underlying COVID-19 responses, the need for GHG reform, solidarity, and change in GHG power gradient. They deliberate on the role of law and propose new approaches to promote equity. Some also discussed the measures that were taken by the current GHG system to ensure health equity, such as the COVAX initiative. Although each included study has a main theme, many of the articles touch upon other themes showing several points of intersection between the themes. This became apparent following the analysis of the assembled seven themes, it appears that although they concentrate on different domains, they are interrelated. The human rights and inequities theme, the largest theme with 24.49% of the included studies appears to be central to the other themes (Figure 5). Papers discussing GHG structure change in theme 3 debate that the need for structure change emanates from the fact that present inequities are a result from structural factors in GHG that undermine human rights [23] and stressed on the need for building a new GHG structure that promotes equity and human right [29]. In theme 4, the authors touched upon human rights in a different way. They stated that political actors in power need a shift in norms towards human rights and equity so as to produce pro-equity policies [38]. Authors in theme 7 argue that GHG ought to give up the neoliberal values and move towards human rights and equity [56]. Theme 5 calls on multidisciplinary approach founded on the right to health and equity values in order to minimize the protectionism in responses to COVID-19 [45]. In theme 6, the authors urge for a global health law reform to support human rights and equity

taking the case of COVID-19 [50]. Finally, theme 2 builds on human rights as a base for global solidarity to ensure equity in response and preparedness to the pandemic [36].

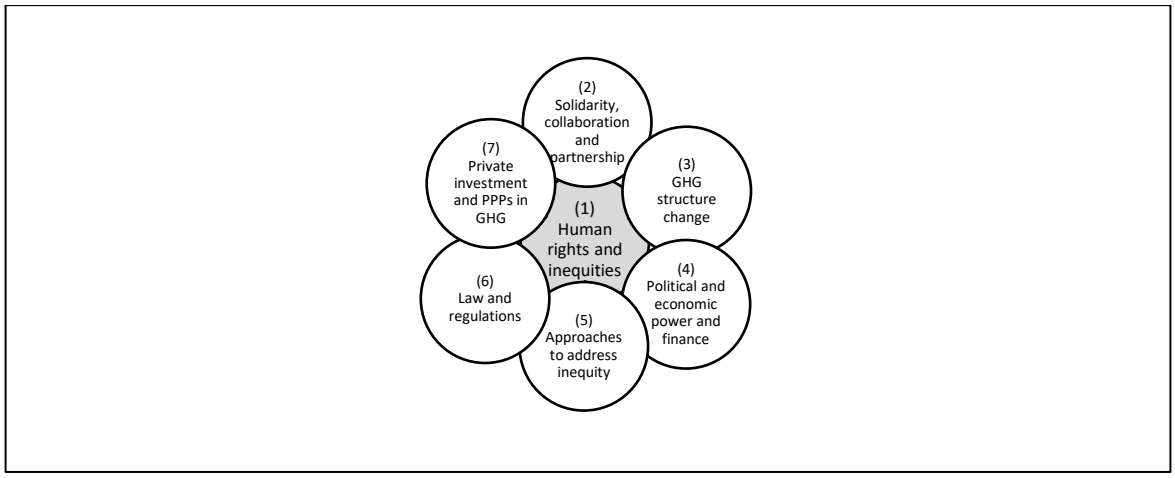

Figure 5 The interlinkages between themes discussing GHG, equity, and COVID-19

Additionally, several studies across the seven themes seemed to touch on areas in the other themes making the themes interrelated. Articles on solidarity and collaboration (theme 2) called for: multi-sectorality in GHG structure (theme 3) [32], population-based health initiatives approach to enhance equity (theme 5) [33], overcoming geopolitical power and LMICs in capacity building (theme 4) [34]. Articles on GHG structure change (theme 3) discusses power and hierarchy in decision making (theme 4) [28], collective action (theme 2) [29], and partnership (theme 7) [31]. Articles in theme 7 proposes GHG structure change (theme 3) [56]. Articles in theme 5 relate to theme 2 through discussing research and technology coordination [45].

The interrelation between themes points out that GHG, equity, and COVID-19 are multidimensional and they cannot be limited to one area of analysis, but require a broader thinking approach that builds on different expertise and knowledge from various disciplines.

The themes and the number of articles in each theme is an indication of what the research community is focused on. The focus is on the values underlying the GHG system decisions. Researchers care to emphasize the need to remind the world that the essence of having GHG is to protect humans and their rights, including the right

to health without any type of discrimination, thus relating GHG to health equity. The authors go further to discuss the causes of the inequities, they refer to the present structure of GHG and the power imbalance in this system. They propose several structural changes, higher degree of solidarity and collaboration, and new approaches in GHG to achieve global health equity. However, most of the studies focused on the connection between GHG and health equity through one or two dimensions (i.e., power, authority, law, needed reform, etc.). A holistic approach to equity through GHG should be considered. GHG needs to be considered as a process, starting from inputs to implementation, then outputs, and finally impact. Although health equity comes at the end of the GHG process, health equity needs to be taken into consideration throughout the whole process: from the beginning of the process, the decision-making step (who is participating in the decision-making, their power gradient, resources to be employed, presence of regulating laws), to the ways of implementation (production, allocation and procurement), then outcomes (accessibility), and finally the impact (populations health). This holistic approach of streaming equity into the whole process facilitates achieving global solidarity and collaboration to enhance equitable accessibility at the end. Thus, the notion of equity needs to be cultivated in the structure as well as processes of GHG. Only one study mentioned the need to consider the equity aspect at all stages of the vaccine, from production till access.

Study Limitations

The main limitation of the study is the timeframe. Since COVID-19 is an ongoing pandemic, the research on the topic is still ongoing, which means that more studies will be produced, but not included in this scoping review.

The second limitation is that only English publications were included in the literature search, therefore there is a risk of a language bias.

Lastly, the developed protocol for this scoping review has not been registered.

Conclusions

The research connecting GHG and health equity in the context of COVID-19 was mapped and grouped into seven main themes: “human rights and inequities”, “solidarity, collaboration and partnership”, “GHG structure change”, “political and

economic power and finance", "approaches to address inequity", "law and regulations", and "private investment and PPPs in GHG." However, it appeared that the themes are interrelated and articles touched on more than one theme. The highest number of papers were in the "human rights and inequities" theme. More research on smaller themes such as the one on solidarity and collaboration is required.

As for research production, the authors contributed to research connecting GHG and health equity in the context of COVID-19 as mostly affiliated to developed countries, indicating a gap in knowledge and expertise in developing countries. This entails the need for information sharing between countries as well as capacity building in developing countries.

Research concerning GHG and equity is multidimensional, which requires a wide range of expertise. There are few multidisciplinary studies in this domain indicating the need for multidisciplinary collaborative research in this area.

Chapter 5

Covid-19 vaccine hesitancy among parents in Low- and Middle-Income Countries: a meta-analysis[2]

Introduction

Vaccination is one of the most important achievements in medical and public health history. It has proved to be the most effective method to prevent the spread of infectious diseases (108). Nevertheless, vaccine hesitancy has been an issue for a while now. Some people are reluctant to be vaccinated, which increases their risk for diseases and increases the risk of public threat through diminishing the ability to achieve and sustain "herd immunity" (109). Vaccine hesitancy is defined as the "delay in acceptance or refusal of vaccination despite availability of vaccination services" (110). People's acceptance of a vaccine is known to be influenced by several factors related to the people themselves (e.g., education level, complacency, convenience), to the vaccine (e.g., safety and efficacy) and to external factors (e.g., policies, media, confidence) (111,112).

People opposing vaccines are called "anti-vaxxers". Studies have found that anti-vaxxers are mostly mothers who are older in age with higher education and socioeconomic status (113). Since children are normally the largest vaccine recipient group, parental hesitancy towards vaccines is a major part of the problem of stopping the spread of infectious diseases.

Covid-19 is no different case from other infectious diseases when it comes to vaccines. Although Covid-19 has resulted in millions of deaths and the count is still going on. Covid-19 vaccine acceptance proves to pose another challenge in facing the

[2] El Kheir-Mataria WA, Saleh BM, El-Fawal H, Chun S. COVID-19 vaccine hesitancy among parents in Low-and Middle-Income Countries: A meta-analysis. Frontiers in Public Health. 2023;11.

pandemic (114). Covid-19 vaccine acceptance is a worldwide issue (115). However, L&MICs seem to have a special context where certain L&MICs have a higher acceptance rate than some High-Income Countries (HICs) (116). A number of studies address COVID-19 vaccines acceptance in L&MICs (116–118). These studies concluded different acceptance proportions and different factors influencing vaccine acceptance decisions. As for the parents' population, many studies were performed to study parents' acceptance of Covid-19 vaccines and the determinants of their behavior. However, many of these studies were conducted in HICs (119–121).

Given the difference in the Covid-19 vaccine acceptance rate between L&MICs countries and HICs and the fact that fewer studies are addressing parental vaccination hesitancy and the factors underlying the parents' decisions, and the urgency of research in L&MICs countries, we set our research questions as follows. "What proportion of the parents' population is willing to give the Covid-19 vaccine to their children in L&MICs?" And "what are the factors influencing their decision?". Thereafter, this meta-analysis study aims at assessing the published literature on parents' acceptance in L&MICs in order to provide a more credible estimate of the proportion of parents accepting to vaccinate their children against Covid-19 as well as to identify determinants of Covid-19 vaccine parents' acceptance to vaccinate their children in L&MICs.

Methods

Design

This meta-analysis followed the PIO framework (Population, Intervention, and Outcome)used in the Evidence Based Medicine EBM (122) and the PRISMA 2020 statement on updated guidelines and the checklist for reporting systematic reviews (123). The target population (P) was the L&MICS population, including parents, caregivers, and guardians; intervention (I) was COVID-19 vaccination intention, and outcome (O) was COVID-19 vaccine hesitancy or acceptance among the target population.

Inclusion and exclusion criteria

Studies included in this meta-analysis needed to confirm with the following criteria: published between December 2021 (first vaccine approval) till February 2022, use either quantitative or mixed methodology, express COVID-19 acceptance or hesitancy using proportions or absolute numbers, target L&MICs' population (parents, caregivers, and guardians) with accessibility to the Covid-19 vaccine, and finally, original peer-reviewed studies published in English.

On the other hand, exclusion criteria were: studies targeting populations other than parents, caregivers, or guardians; written in languages other than English; targeting HICs countries; using a qualitative approach.

Search strategy

The search for the peer-reviewed studies was performed in three main databases: PubMed, Web of Science, and Cochrane Library. The following keywords – COVID-19, vaccine, hesitancy, and acceptance – were searched in the three databases using Boolean operators, truncation, and wildcard, where appropriate. The search term differed according to each database recommended search mechanism. Accordingly, the exact used search terms were:

PubMed

("COVID-19"[MeSH Terms] OR "COVID-19 Vaccines"[MeSH Terms]) AND ("vaccine*"[Text Word] OR "Vaccines"[MeSH Terms]) AND ("vaccine acceptance"[Text Word] OR "Vaccination Hesitancy"[MeSH Terms]) AND (english[Filter])

Cochrane

#1 MeSH descriptor: [Vaccination Hesitancy] explode all trees

#2 (vaccin* NEXT(hisitanc* or acceptanc*)):ti,ab,kw (Word variations have been searched)

#3 #1 Or #2

#4 MeSH descriptor: [COVID-19 Vaccines] explode all trees

#5 (covid* NEXT (Vaccin*)):ti,ab,kw (Word variations have been searched)

#6 #4 OR #5

#7#3 AND #6

Web of science

(((AB=(vaccin* acceptance)) OR AB=(vaccin* hesitancy)) AND AB=(covid 19)) AND ((LA==("ENGLISH") NOT CU==("USA" OR "ENGLAND" OR "ITALY" OR "CANADA" OR "FRANCE" OR "DENMARK" OR "KUWAIT" OR "PEOPLES R CHINA" OR "GERMANY" OR "AUSTRALIA" OR "SAUDI ARABIA" OR "CROATIA" OR "VENEZUELA" OR "U ARAB EMIRATES" OR "NEW ZEALAND" OR "ROMANIA" OR "CYPRUS" OR "HUNGARY" OR "LUXEMBOURG" OR "URUGUAY" OR "TRINIDAD TOBAGO" OR "SWITZERLAND" OR "SWEDEN" OR "SOUTH KOREA" OR "SINGAPORE" OR "QATAR" OR "PORTUGAL" OR "POLAND" OR "PANAMA" OR "OMAN" OR "NORWAY" OR "NETHERLANDS" OR "MALTA" OR "LITHUANIA" OR "JAPAN" OR "ISRAEL" OR "IRELAND" OR "GREECE" OR "FINLAND" OR "CZECH REPUBLIC" OR "CHILE" OR "BELGIUM" OR "BARBADOS" OR "BAHRAIN" OR "AUSTRIA")) NOT (SE==("LECTURE NOTES IN COMPUTER SCIENCE" OR "LECTURE NOTES IN OPERATIONS RESEARCH SPRINGER") OR CF==("16TH INTERNATIONAL CONFERENCE ON AVAILABILITY RELIABILITY AND SECURITY ARES" OR "EASTERN ALLERGY CONFERENCE")))

The databases' search was done in the title and abstract.

Data extraction and synthesis

Two authors (W.A.E.K.-M. and B.M.S.) independently identified and extracted the studies from the databases. The identified studies were imported into Zotero, a citation managing software that can locate duplicates and eliminate them. After removing the duplicates, the remaining studies were screened independently by both reviewers for eligibility. The screening was done in two steps. The first screening was included title and abstract screening. Studies that passed the first screening went into the second step of screening where a full text article assessment was performed to confirm eligibility.

Studies which passed the two steps of screening were imported to an excel sheet table. The following information was extracted and entered to the excel sheet for each study: title, author, year of publication, sample size, proportions of the population

that accepted/hesitated/refused the vaccine, and factors underlying parents' decisions.

Critical appraisal

The chosen studies were evaluated by two independent reviewers. The studies were evaluated based on the five Cochrane criteria: bias resulting from deviations from intended interventions, bias resulting from missing outcome data, bias in measuring the outcome, bias resulting from the randomization process, and bias resulting from the selection of reported results. The studies met four of the criteria for validation. The randomization criterion was not used since the studies are not randomized control studies. The two reviewers discussed their findings and came to an agreement on the included ones.

Meta-analysis

Data analysis was done in two steps. First, a descriptive analysis of the studies was performed including distribution of the studies among countries and among country classification, sample size, type of study, and data collected in each study. Second, a meta-analysis using R program. Meta-analysis was first done using the observed proportion method. This method assumes that parents' acceptance proportions follow a normal or binomial distribution (bell-shaped, centered around 0.5) with minimal variance which is seldom the case. Then second, using the Arcsine proportion model. The Arcsin proportion model is one of the statistical models used to transform proportions (i.e., the data used in this study) so that their distribution be more approximate to a normal distribution which is an assumption required by meta-analysis models (124). The Arcsin model acknowledges that proportional data derived from real studies are mostly not normally distributed (skewed) and that there is variance among different studies measures (e.g., proportion). Thus, accounting for skewness and stabilizing the variance among studies making it more constant. Both the observed proportions analysis and the Arcsine proportion analysis were done using: first, fixed effect model which assumes homogeneity of studies, and second, a random effect model. The random effect model is used due to the fact that the include studies are heterogeneous as proved in the fixed effect model. Finally, a brief analysis of the major factors underlying parents' Covid-19 vaccine acceptance was done.

Results

The primary database search resulted in 806 studies. The number of studies was reduced to 742 after the first stage of screening and elimination of duplicates. Checking the title and abstract against the eligibility criteria, 712 studies were eliminated for one of the following reasons: being a qualitative study, not done in L&MICs, and the population used in the study is not parents. The remaining 30 studies passed through a full-text screening.

From the remaining 30 studies, seventeen studies were eliminated for combining both HICs and L&MICs in the same study calculations or for not collecting the same data as required by the methodology (Figure 6).

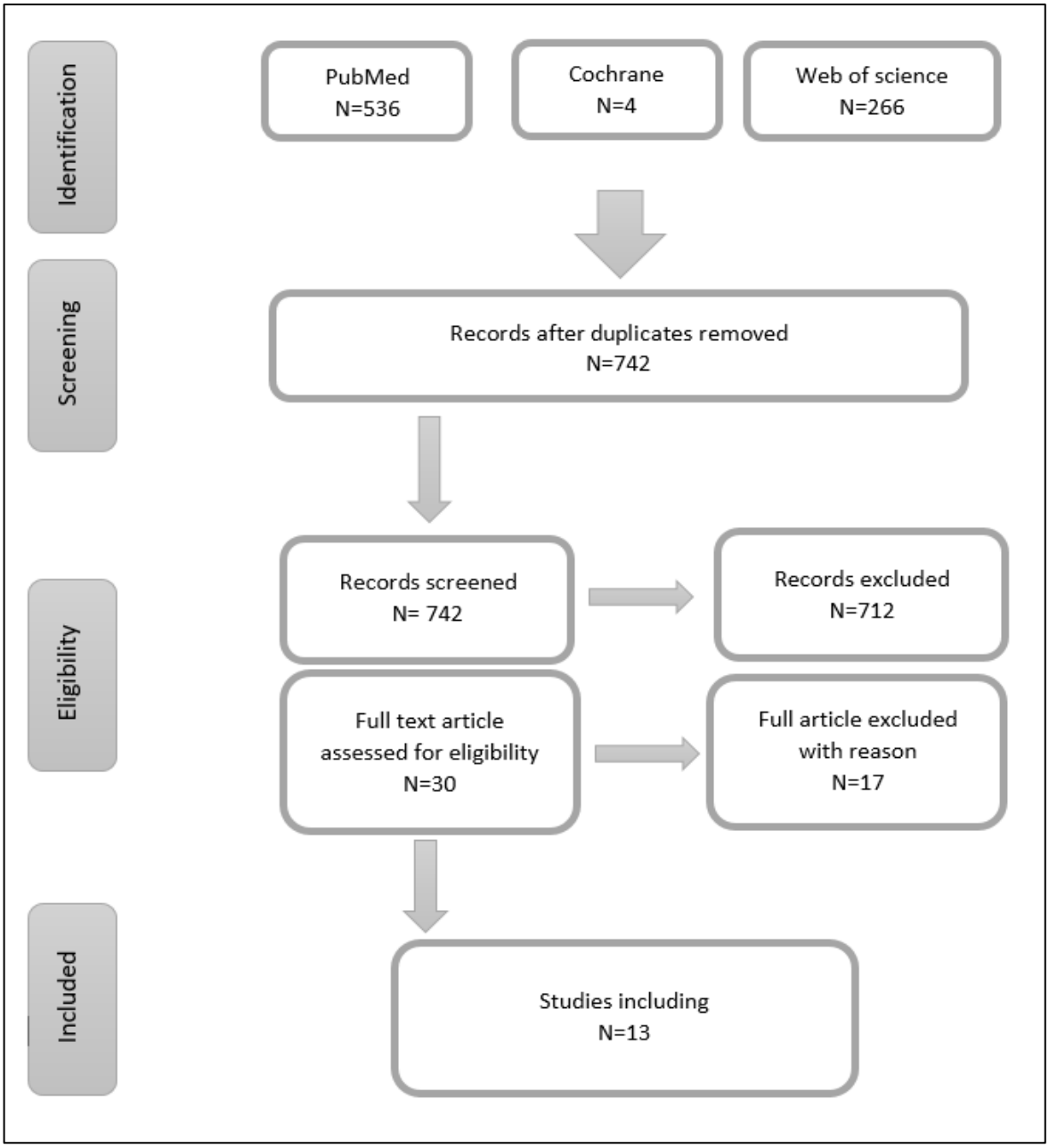

Figure 6 Search flow chart

Thirteen studies were finally included in the meta-analysis. The studies included were cross-sectional type of studies. Only ten out of thirteen studies clearly stated the type of study in the text (Table 4). Two studies declared using a validated data collection tool (125,126), while three provided the sources upon which their questionnaires were based (127–129). Certain variations were noticed among the

studies: first, the study population. Seven out of thirteen studies did not have any specifications on the parents nor the children population in their sample, while two studies specified the age of participants as a criterion to choose participants (125,130), one study specified that the participants were mothers (131), and two studies defined the parents' population to have children with specific medical conditions (129,132). Second, the sample size, which ranged between 201 participants and 3079 participants among the studies. Third, the measurement term used within the study. Three main terms were used (acceptance, hesitancy, and refusal). Three out of thirteen studies used and provided data for all three terms (125,132–134), while five studies used hesitancy only (111,127,130,135,136), and four used acceptances only (126,128,131,137).

As for the country where studies were performed, one can notice that 69% of the studies took place in Upper Middle-Income Countries UMICs (six in Turkey, two in China, and one in Brazil), while three studies were done in Lower Middle-Income Countries LMICs (two in Bangladesh and one in Vietnam) and one study in Nigeria, which is a Low-Income Country LIC (Table 4).

Looking at the required statistic (acceptance proportion) -which is either directly provided by the study or calculated through using other terms (e.g., hesitancy and refusal)- and the sample size, one can observe that it ranges between 4.9% and 91%, indicating huge variation among included studies (Table 4).

Table 4 Included articles' data and characteristics

Article	Type of study*	Population	Country	Data collection tool	Sample size N	Acceptance %	Hesitancy %	Refusal %
Huynh G. et al. 2022 (127)	Cross sectional	General parents, children population	Vietnam	Questionnaire based on "health belief model"	1015		26.2	
Yılmaz, M., & Sahin, M.	Cross sectional	General parents, children population	Turkey	Not based on a specific model	1135	36.3	35.6	28.1

K. , 2021 (133)								
Akgün, O. et al. 2022 (132)	Cross sectional	Children with rheumatoid disease	Turkey	Not based on a specific model	201	41.8	45.8	12.4
Ali, M. et al. 2022 (138)	Cross sectional	General parents, children population	Bangladesh	Not based on a specific model	2633		42.8	
Chinawa, A. et al. 2021 (131)	Cross sectional	Mothers	Nigeria	Not based on a specific model	577	4.9		
Gönüllü, E., et al. 2021 (137)	Cross sectional	Pediatricians	Turkey	Not based on a specific model	506	75		
Soysal, G., et al. 2021 (125)	Not specified	Age 18-25 Not specified as parents	Turkey	Questionnaire based on "vaccine hesitancy questionnaire" by WHO	1033	68.8	11.4	3.1
İkiışık, H., et al. 2021 (130)	Cross sectional	Age 20-85 Not specified as parents	Turkey	Not based on a specific model	384		89.6	
Bagateli, L. et al. 2011 (128)	Not specified	General parents, children population	Brazil	Questionnaire based on" parents' attitude about childhood vaccine"	501	91		
Wang, Q. et al. 2021 (126)	Cross sectional	General parents, children population	China	Questionnaire based on "vaccine hesitancy questionnaire" by WHO	3079	52.4		
Zhang, M. X. et al. 2021 (135)	Cross sectional	General parents, children population	China	Not based on a specific model	1788		52.5	
Ali, M. et al. 2022 (129)	Cross sectional	Children with neurodevelopmental disorders	Bangladesh	Based on a questionnaire used in a published study	396		42.7	

Yigit, M. el al. 2021	Not specified	General parents, children population	Turkey	Not based on a specific model	428	28.9	71.1	

Although the thirteen included studies have a wide range of sample sizes and resulted in different Covid-19 vaccine acceptance among parents, they are all significant. None of the studies crosses the vertical null effect line (Figure 7).

Table 5 Arcsine proportions of parents accepting to vaccinate their children against Covid-19 in L&MICs and effect sizes

Author (s) and year	Number of parents accepting the vaccine	Sample size	Weighted proportion	Variance	Standard error	Z statistics	P-value	CI Lower limit	CI Upper limit
Huynh G et al, 2022	749	1,015	1.0334	0.0002	0.0157	65.8444	<.0001	1.0026	1.0641
Yilmaz M, Sahin M K, 2021	412	1,135	0.6466	0.0002	0.0148	43.5689	<.0001	0.6175	0.6757
Akqün O et al, 2022	84	201	0.7029	0.0012	0.0353	19.9317	<.0001	0.6338	0.7721
Ali M et al, 2022	1,506	2,633	0.8576	0.0001	0.0097	88.0137	<.0001	0.8385	0.8767
Chinawa A et al, 2021	28	577	0.2221	0.0004	0.0208	10.6705	<.0001	0.1813	0.2629
Gönüllü E et al, 2021	380	506	1.0483	0.0005	0.0222	47.1636	<.0001	1.0048	1.0919
Soysal G et al, 2021	711	1,033	0.9784	0.0002	0.0156	62.8951	<.0001	0.9480	1.0089
İkiışık H et al, 2021	40	384	0.3286	0.0007	0.0255	12.8797	<.0001	0.2786	0.3786
Bagateli L et al, 2021	456	501	1.2664	0.0005	0.0223	56.6925	<.0001	1.2226	1.3102
Wang Q et al, 2021	1,613	3,079	0.8093	0.0001	0.0090	89.8117	<.0001	0.7916	0.8269
Zhang MX et al, 2021	849	1,788	0.7602	0.0001	0.0118	64.2914	<.0001	0.7370	0.7834

Ali M et al, 2022	227	396	0.8589	0.0006	0.0251	34.1836	<.0001	0.8096	0.9081
Yigit M et al, 2021	124	428	0.5684	0.0006	0.0242	23.5169	<.0001	0.5210	0.6157
Arcsin proportion model results									
			estimate		Standard error	Z statistics	P-value	CI Lower limit	CI Upper limit
Fixed-Effects Model			0.8077		0.0042	188.9211	<.0001	0.7994	0.8161
Random-Effects Model			0.7758		0.0608	12.7515	<.0001	0.6566	0.8951
Test for Heterogeneity: Q (degree of freedom = 12) = 2281.3290									

However, knowing that using the observed proportions method entails assuming that the proportions identified across the collection of studies follow a normal or binomial distribution with minimal variance, the Arcsine proportions method - which acknowledges that proportional data derived from real studies is mostly skewed and that there is variance among different studies measures- was used. The meta-analysis (Table 5) using the arcsine proportion models shows high heterogeneity among studies and the random effect model indicates the model is effective (p<.0001).

When the results of arcsine proportions are transferred to normal proportions, the final effect size for these studies becomes 49.0% which happens to be significant with confidence limits of 37.3% and 60.9% within a confidence interval of 95%. Moreover, the studies have narrow confidence limits resulting in minimal differences in weights assigned to the different studies (Figure 7).

Concerning the factors affecting parents' decisions regarding the Covid-19 vaccination of their children, they are numerous and vary among studies (Annex 1). The most common factor for parents' hesitancy to vaccinate their children against Covid-19 is their concerns about vaccine efficacy, safety, and possible side effects. This factor was mentioned in eleven studies out of thirteen. On the other hand, the most common factor for parents' acceptance to vaccinate their children is their conviction that the vaccine is needed to control Covid-19 and end the pandemic. Lastly, parents refused to vaccinate their children due to distrust of vaccine manufacturing companies and vaccine safety and efficacy.

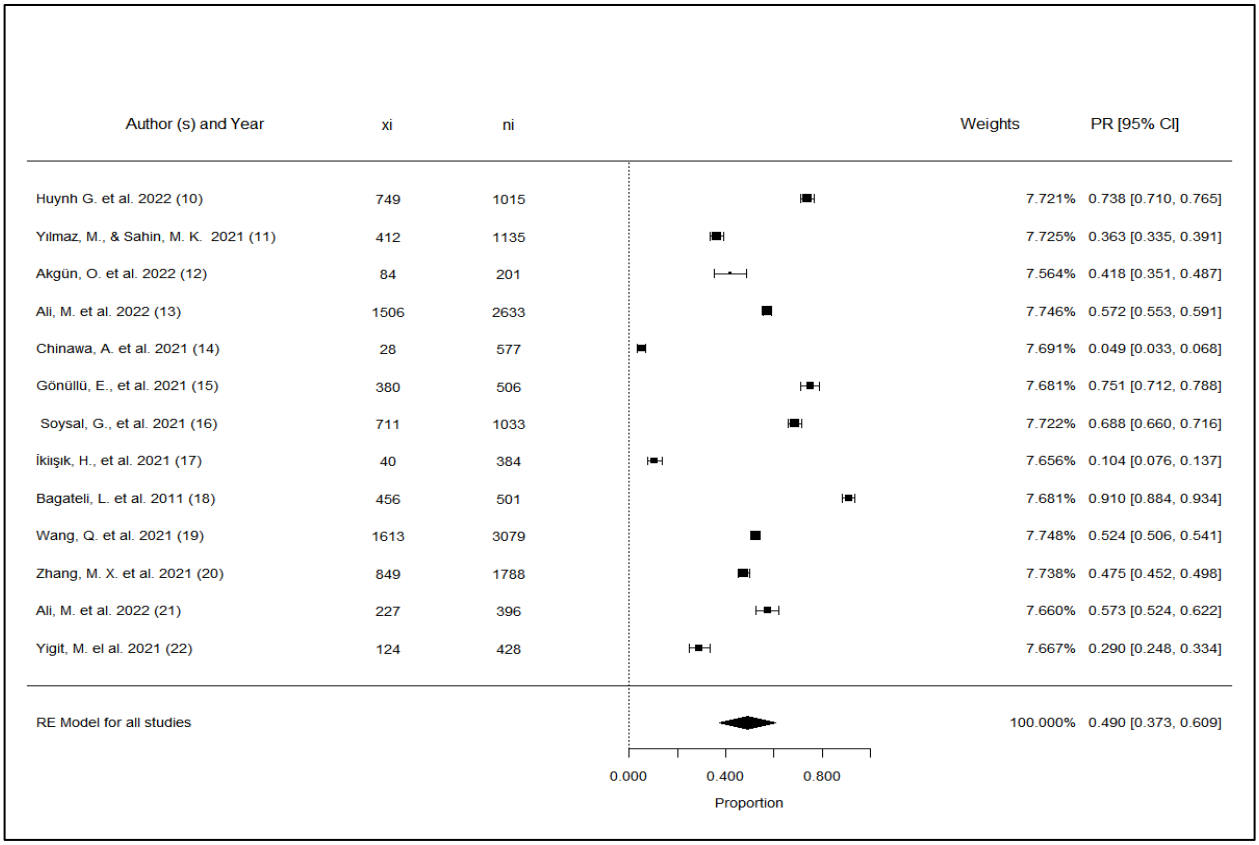

Figure 7 Forest Plot: proportion of parents accepting to vaccinate their children against Covid-19 in L&MICs

Discussion

Given the Covid-19 gravity, assessing vaccine hesitancy has become very crucial for governments and policymakers. Persuading people to be vaccinated is essential to protect themselves and others by limiting the global spread. An important category regarding vaccine hesitancy is the parents or caregivers who influence the vaccination process of their children. The number of studies included in this meta-analysis, and their distribution indicates the weak attention given to parents' behavior against Covid-19 vaccine in L&MICs especially in LICs (131). Taking into account the higher fertility rate and higher proportion of children in L&MICs, concentrating on parents' behavior might be a key factor in fighting against the Covid-19 pandemic.

It is worth noting that the most common announced factor for parents' acceptance to vaccinate their children is that the vaccine is needed to control Covid-19 and end the pandemic which indicates a certain level of these parents' awareness regarding Covid-19 and the vaccine (130,132,133,137). Other acceptance factors mentioned in the studies are equally important (Annex 1). Parents accepting to vaccinate their children are found to be the parents who accept the notion of vaccines in general, they believe that the benefit of vaccination outweighs its harm. These are parents who are vaccinated yearly against influenza and who follow vaccination regimes for their children (125,137). This signifies that parents' acceptance to vaccinate their children against Covid-19 is more related to the fact that they believe in the benefit of vaccine rather than the fear of Covid-19 itself.

As for factors related to Covid-19 vaccine hesitancy and refusal, the most commonly identified factor is the uncertainty about Covid-19 vaccine efficacy, safety and possible side effects (125–129,133,134,136). This factor highlights the lack of trust that the parents have in their governments as well as vaccine manufacturers (134,136). This factor can be related to the final proportion of parents accepting to vaccinate their children against Covid-19, which is around 49% (Figure 7).

The above proportion is lower than the worldwide estimated proportion. According to a similar meta-analysis done on a global level (i.e., HICS, MICs and LICs are included), parents' willingness to vaccinate their children ranges between 25.6% and 92.2% worldwide; and the overall proportion of parents intending to vaccinate their children against COVID-19 is 60.1% (139). This may be related to various reasons. In African countries, the demand for vaccine decreased due to public concerns about the possibility of COVID-19 exposure when receiving vaccination. This concern has equally affected parental health-seeking behavior resulting in lower parental acceptance (140). Other reasons for the lower parental acceptance in L&MICs might be related to factors such as trust in authorities and subsequently trust in the type of vaccine provided by the country. Also, some L&MICs might concentrate less on health promotion strategies and the availability of data on COVID-19 vaccines' safety and efficacy compared to HICs. Finally, the economic status and the educational background may play a role in the reduced parental acceptance. People in some of these countries are extremely poor with low education hence might be

ignorant of the benefits of the vaccine. Others might trust traditional medical practice over conventional medicine resulting in lower acceptance rate.

Given that educational background, economic status, and available health promotion strategies all influence individual perceptions of vaccines, addressing the fears of anti-vaxxers is of great importance, especially in the presence of inconsistent information regarding vaccine safety and efficacy that may be present on different live or online networks. Healthcare providers can help parents overcome their fears about vaccinating themselves and their children. Healthcare providers need to have the proper knowledge and the essential skills to address these fears correctly.

The fact that there are different terms used to address parents' behavior concerning vaccinating their children against covid-19 indicates that researchers ought to consider adding a clear definition of the terms they use in their studies to avoid confusions, especially that the terms acceptance and refusal are present in the definition of vaccine hesitancy. Moreover, not all studies use a validated data collection tool, resulting in variation in the data collected, especially the factors underlying parents' decisions, which in turn renders comparing between the studies and stating unified factors for the L&MICs parents' decisions more difficult.

This study has its limitations such as language bias. Only English studies were eligible to be included, which means that many non-English studies are missing. Also, the timeframe for the study. Although it is necessary to set a timeframe for the study as the pandemic is still ongoing and more studies will come out, setting a timeframe here limits the number of studies included. These limitations call for further research that can include other languages published studies over a longer period of time.

Conclusion

This meta-analysis concludes that the proportion of parents in L&MICs accepting to vaccinate their children against Covid-19 is 49%, and the major reason for their acceptance is that they believe that Covid-19 vaccine is fundamental to the fight against the pandemic. To increase parental acceptance, responsible authorities should concentrate on increasing their population trust in the government as well as in the vaccine manufacturers. In addition, authorities ought to concentrate on increasing acceptance of the vaccine idea in general through highlighting the need for the

vaccine to end the pandemic and assuring the efficacy and safety of the vaccine. Further research on parental behavior concerning vaccinating of their children is needed in L&MICs especially in LICs.

Chapter 6

Inter-country Covid-19 vaccine inequities: A Decomposition analysis

Introduction

During the Covid-19 pandemic, health equity proves to be a major issue of concern at both the national and international levels. At the national level, researchers have been concerned with disparities in the level of infection, consequences and vaccination among different social groups with their countries (39–51,53). On the international arena, similar concerns with the level of infections, consequences and vaccinations are commonly investigated among the different countries. However, at the international level, relatively little research has attempted to quantify the disparities among different countries in these issues. One of the major health inequality concerns at the global level was the unequal access to Covid-19 vaccine. According to the Our World in Data website on the 7th of April 2022, in High Income countries (HICs) and in Upper Middle-Income Countries (UMICs), the share of fully vaccinated people reached 74.1% and 76.68%, respectively, and the share of the partially vaccinated people mounted to 5.05% and 4.77%, respectively (141). On contrast, in Lower Middle-Income Countries (LMICs) and Low-Income countries (LICs), the share of fully vaccinated people reached 50.51% and 11.51% respectively and 9.17% and 3.26% were partially vaccinated. The mere comparison between these figures clearly shows that there a direct relationship between the country's income and their accessibility to the vaccine across these country groups. Sell (2020) argues that this strong effect of the economic power in securing the vaccine, and influencing and controlling its distribution across the different countries can be attributed to the power of high economics to produce, trade and control the value chain of Covid-19 vaccines (142) Their financing capacity enables the production as well as the purchase of needed vaccines and their purchasing power appeared to be determinative in the accessibility to the vaccine (143). Many HICs rushed to purchase Covid-

19 vaccine for their population even before its final approval (144) which affected the availability of the vaccine for the other countries.

Political power and its imbalance among the different countries was also postulated to actively affect the vaccine accessibility. Political power has a dual role in Covid-19 vaccine accessibility, it acts as a determinant as well as a consequence. Power has been detrimental in vaccine accessibility Covid-19 vaccines (145). Powerful countries compete to settle their ideological perspectives in the global health arena and use their power to influence less powerful countries accessibility to the vaccine (146). Countries' responses to the pandemic were influenced by their power resulting in vaccine nationalism (147). Western countries (e.g., USA) intentionally hoarded the vaccine for itself and its allies ignoring other countries needs (148). On the other hand, countries aimed at gaining power through higher accessibility to the vaccine. Fiddler stated that Covid-19 related decisions are influenced by geopolitical calculations. Covid-19 vaccine access is considered a source of political power (149). Countries with higher vaccine coverage are expected to have better chances for rapid economic recovery (150,151). Also, countries' ability to manufacture the vaccine and decide on its distribution project soft power and demonstrate their ambition for geopolitical opportunities (152,153).

On another front, several published studies discuss the reasons underlying inequalities in Covid-19 vaccine distribution related to health system. These studies highlighted the limited countries capacities, poor infrastructure, inadequate supply chain capability, and limited technical expertise as main barriers to manufacturing of Covid-19 vaccine in these countries, which in turn limited their access to the vaccine doses (154–158).

The current study has two main objectives. The first objective is to quantify the inequality in accessibility to Covid-19 vaccine among countries according to their economic power. The second objective is decomposing the observed economic inequality in accessing the vaccine by its determinants. The decomposition exercise aims to quantify the role played by economic inequalities in the political power, knowledge and technology, and health system strength in explaining economic inequality in access to Covid-19 vaccine.

Data and methods

Data sources and study variables

In assessing the economic inequality in vaccine accessibility among the different countries, and its decomposition, the current study relied on the published data from

reliable sources. Two indicators were implemented to measure the country accessibility to Covid-19 vaccine.

The first indicator is Total Vaccinations per Hundred (TVH). TVH is the number of vaccine doses administered per 100 people within a given population, including booster doses. All doses are counted individually. This indicator was downloaded from Our World in Data website (141). Our World in Data is a project by the Global Change Data Lab based at the University of Oxford. The Covid-19 dataset for this website is obtained from official numbers provided by governments and health ministries around the world and is updated daily. As for population estimates for per-capita metrics they are based on the United Nations World Population data (. The TVH data for the current study was extracted on 17/5/2022. The indicator was extracted for 203 data points that ranged between 0.1 and 355.75 per hundred with an average of 129.54 per hundred.

The second indicator is Vaccine courses delivered as a proportion of country population (VPP). VPP is the number of vaccine doses delivered in a full course for a given vaccine and as a proportion of country population. This indicator data was obtained from the UNICEF COVID-19 Vaccine Market Dashboard (159). The website vaccine data is compiled from public sources and complemented with relevant information from Airfinity intelligence platform. Vaccine data does not consider countries' vaccination strategies whether the country prioritize vaccine use for first dose or for full dose vaccination. As for population estimates, they are obtained from UN population division 2019 revision. Dashboard data is updated weekly. Data for this study was extracted on the 25 of February 2022 and included 175 data points that ranges between 2.04 and 181.67 per 100 persons with an average of 75.91 per 100 persons.

Gross Domestic product (GDP)per capita was used as a measure of the economic power of the countries. It is measured in terms of the share of the country individual in the gross domestic product, which is "the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products" (160). GDP per capita data for this study is of year 2019 and was obtained from the World bank data website: (https://data.worldbank.org/indicator/NY.GDP.PCAP.CD). A total of 205 data points were extracted with a range between 228.21 and 189487.15 and an average of

18605.51. In addition, the categorical classification of the World Bank for the countries around the world into four economic categories, namely Low-Income countries (LICs), Lower Middle-Income Countries (LMICs), Upper Middle-Income Countries (UMICs), and High-Income Countries (HICs) was implemented in the analysis.

To assess the political power of the countries two indicators were implemented. The first is the world power index (WPI). WPI is a composite index of three subindexes that reflect the multi-dimensionality of the concept of state power. The three indexes are: Material capacities index (MCI), Semi-material capacities index (SMCI), and Immaterial capacities index (IMCI). Each of the indexes is a composite index of a set of essential variables. MCI represent the economic-military power of the state and is composed of six essential variables: national production (gross national income, Atlas method current US$), territorial area (Km2), defense (military expenditure, % of gross domestic product), international commerce (trade, % of gross domestic product), finance (total reserves including gold, current US$), and research and development expenditure (% of gross domestic product). SMCI reflects the socio-institutional power of the state and is composed of six variables: production per capita (gross national income per capita, Atlas method current US$), Population (total), consumption (Household final consumption expenditure per capita US$), energy (Electric power consumption, kilowatt hour per capita), education (Spending on education, total as percent of gross domestic product), and health (Health expenditure as percent of gross domestic product). IMCI measures the cultural-communicative power of the state and includes the following variables: government expenditure (General government final consumption expenditure, current US$), tourism appeal (International tourism, revenues, current US$), international aid (Net official development assistance (ODA) received per capita, current US$), media (Telephone lines), academic influence (Scientific and technical journal articles), and cosmopolitism (International migrant stock, total). Data used in the calculation of the WPI were obtained from DataBank-World Development Indicators. The latest available WPI data were for the year 2017 and were implemented in the current study. The data were extracted from the WPI website (161) with a total 176 points with range of 0.136 and 0.954 and an average of 0.465. however, the values obtained for this indicator was multiplied by 100 to scale it with the other variables.

The second indicator of political power is the Political Stability and Absence of Violence/Terrorism (PS). PS is one of the six world governance indicators created by the World Bank. PS measures the likelihood of violence and terrorism that can lead to government destabilization or being overthrown. It is a standardized aggregate indicator reported in percentile ranking from 0 to 100, where higher ranking corresponds to better outcomes. The indicator is based on data that assess the following areas: Orderly transfers, Armed conflict, Violent demonstrations, Social unrest, International tensions / terrorist threat, Political terror scale, Security risk rating, Intensity of internal conflicts, Intensity of violent activities, Intensity of social conflicts, Government stability, Internal conflict, External conflict, Ethnic tensions, Protests and riots, terrorism, interstate war, civil war, Right to Freedom from Disappearance, Right to Freedom from Extrajudicial Execution, Right to Freedom from Arbitrary Political Arrest, Right to Freedom from Torture and Ill-Treatment, The risk of political instability is very low, Civil conflict is effectively limited. These data are rescaled and combined using the unobserved components statistical technique. PS data used for this study is of year 2020 and is obtained from the World Bank Governance Indicators website (162). A total of 206 data points were extracted available is 206 points with an average of 48.94 and ranges between 0 and 100.

To assess the health system performance, the Universal Health Coverage index (UHC) was implemented. The UHC is an index that measures the essential health services average coverage. UHC measure the average coverage of 14 tracer indicators in four main areas: *first*, reproductive, maternal, newborn, and child health. *Second*, infectious diseases. *Third*, Non-communicable diseases. And finally, service capacity and access. The index is computed using geometric means of the 14 tracer indicators and reports on a unitless scale of 0 to 100. Data for the tracer indicators is taken from the most recent data from WHO or other international agencies. Data on UHC for this study is of year 2019 and is obtained from the UHC Global Monitoring Report . A total of 192 data points were extracted with a range between 27 and 89 and an average of 64.53.

One of the major factors that can secure access to vaccine is the country's ability to produce the vaccine. vaccine manufacturing countries usually made sure to cover its population needs before opening their production to the world. To account for this ability, the analysis included the Vaccine Manufacturing indicator which is a

binary variable with the value of 1 assigned for countries that manufacture Covid-19 vaccine and a value of 0 assigned for countries that do not manufacture the vaccine. information for this variable is obtained from Knowledge Portal on Innovation and Access to Medicines which is a part of a project of the Global Health Centre at the Graduate Institute, Geneva (164). Data used from the website is based on arrangements between Covid-19 vaccine developers and manufacturers. A total of 170 arrangements between 23 vaccine developers and 132 identified manufacturers based in 47 countries were extracted. These arrangements were then used to classify the countries into manufacturers with a value of 1 for the VM indicators and non-manufacturers with a value of 0 on the VM indicator. A total of 195 data points were extracted on 25/2/2022.

In preparing the data for the analysis, all the indicators have been matched across the countries. Due to missing information on some indicators, the final analytical dataset included 163 countries with the full array of the indicators.

Statistical analysis

Concentration index (CI)

To assess the level of inequality in vaccine accessibility indicators, the current study uses the concentration index. The CI is a measure of inequality in health (i.e., vaccine accessibility indicators in the current study) which is associated systematically with quantitative stratifier (i.e., the GDP per capita in the current study). The CI is the mathematical value associated with the concentration curve. The concentration curve is plotted as follows: on the X-axis is the cumulative proportion of countries ranked according to GDP/capita, starting from the least advantaged to the most advantaged. On the Y-axis is the cumulative proportion of health (i.e., vaccine accessibility indicators in the current study). The CI is twice the area between the concentration curve and the diagonal (line of equality). Inequality is observed when the concentration curve is not aligned with the line of equality. The more convex the concentration curve the higher the inequality (165,166). In mathematical form, CI is calculated as follows:

$$CI = \frac{2}{N\mu}\sum_{i=1}^{N} h_i\, r_i - 1 - \frac{1}{N}$$

N = the number of countries

hi = the health variable (vaccine accessibility indicator) for the country i

μ = the mean of the health variable

ri = is the fractional rank of country i across the health stratifier (GDP/ capita)

Calculating the CI demonstrate the presence or absence of inequity in distribution of a health indicator among different population groups. Knowing that there are inequities is important, however knowing the reasons for these inequities is equally important as they stem from inequalities in the other underlying determinants. Decomposing the CI following Wagstaff et al. allows the calculation of the relative contribution of the inequalities in each of these determinants to the observed inequality(167) in vaccine accessibility indicators (167). Assuming that the used health indicator(y) which in this case is Covid-19 vaccine distribution has a number of determinants (k) then the relation between the health indicator and these determinants can be written using a linear regression model:

$$y_i = \alpha + \sum_k \beta_k \mathcal{X}_{k_i} + \varepsilon_i$$

β_k are coefficients and ε_i is an error term. Thus, the CI for y would be written as:

$$CI = \sum_k \left(\frac{\beta_k \tilde{x}_k}{\mu}\right) CI_k + \frac{GCI_\varepsilon}{\mu},$$

μ is the mean of y, $\tilde{x}_k$ is the mean of X_k, and CI_k is the concentration index for X_k. Given the above equation CI is composed of two elements: first element $\left(\frac{\beta_k \tilde{x}_k}{\mu}\right) CI_k$ which is the elasticity multiplied by the CI of each determinant. Elasticity is the change in the dependent variable associated with one unit change in the independent variable. Second element $\frac{GCI_\varepsilon}{\mu}$ which is the part of inequality that is not explained by the proposed determinants. In the last term, $\frac{GCI_\varepsilon}{\mu}$ is a generalized concentration index for ε_i, calculated as

$$GCI_{\varepsilon} = 2/n\sum_{i=1}^{n}\varepsilon_i R_i,$$

Therefore, to decompose the CI for the economic inequality in vaccine accessibility indicators, a linear regression was calculated to estimate the regression coefficient for the main determinants of the vaccine accessibility indicators, namely WPI, PS, UHC, VM. This is followed by a decomposition analysis. All analysis were carried out using STATA 15.

Results

Inequality in vaccine accessibility and its determinants

To assess the inequality in vaccine accessibility indicators and their determinants, (Table 6) presents the mean of the indicators across the four income categories of the GDP according to the World Bank categories. It clearly shows a significant positive relationship between the income categories and the vaccine accessibility indicators and its proposed determinants. For example, for the vaccine accessibility the average vaccine doses per 100 persons increased from 31.9 per hundred among the LICs to 195.2 in HICs. Similarly, the average vaccine courses increased from 25.3 per hundred in LICs to 122.3 per hundred HICs.

For the world power index, the index almost doubled moving from LICs to HICs (28.02 to 63.84) and the political stability also increased three time between the same two groups of countries. For the UHC, the index almost doubled between the same two groups of countries from 41.76 in LICs to 80.21 for HICs. Finally, while none of the LICs participated in the manufacturing of the Covid-19 Vaccine, more than one third of the HICs participated in manufacturing the vaccine.

Table 6 The average of the vaccine accessibility indicators and their determinants across the World Bank four income categories

	GDP				CI
	LICs	LMICs	UMICs	HICs	
Total vaccinations per hundred TVH* **	31.94	98.31	125.82	195.23	0.26

Vaccine courses delivered as a proportion of country population VPP* **	25.30	59.41	70.40	122.29	0.25
World power index WPI* **	28.02	39.28	48.38	63.84	0.16
Political Stability and Absence of Violence/Terrorism (PS)* **	19.00	35.22	42.99	70.28	0.23
UHC service coverage index 2019 (UHC)* **	41.76	57.06	68.36	80.21	0.12
Vaccine manufacturing capacity VM **	0.00	0.24	0.31	0.35	0.25

***<0.001 **<0.01

These large disparities in the indicators across the four income categories have proved their high-level inequality. Table 6 shows that the CI for these indicators exceeded 0.10 which is an indication of high levels of inequality. Both indicators for vaccine accessibility showed a CI of 0.26 for TVH and 0.25 for VPP. The positive values of the CI and its high magnitude indicate substantial high levels of inequality which deny countries in the low-income category equal accessibility similar to that in high income countries (Figure 8).

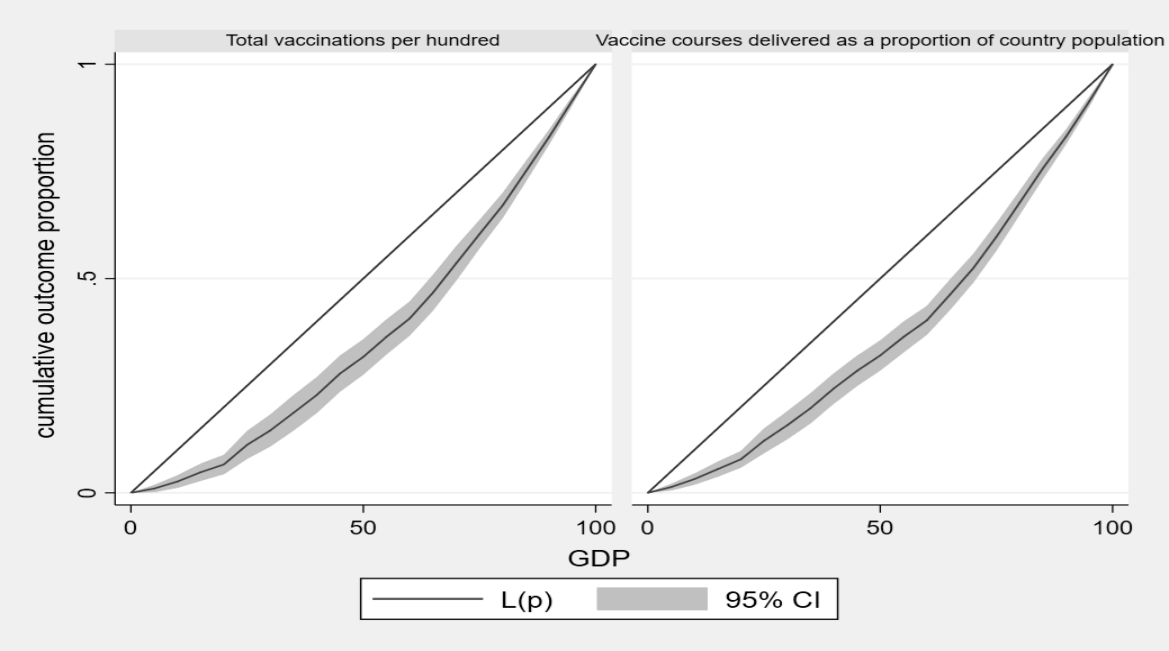

Figure 8 The concentration curve for vaccine accessibility indicators

For the determinants, the concentration index for the four indicators were positive and large in magnitude as it ranges from 0.12 for UHC to 0.25 for the VM indicating high levels of inequality with share of the low-income countries for each indicator is far less than the share for the high-income countries.

Decomposing the economic inequality in vaccine accessibility.

As we alluded previously, in addition to the economic power, other determinants have been proposed to be strongly related to vaccine accessibility for the different countries. These determinants include the country's political power, political stability, health system infrastructure and vaccine production. To test the relationship between the inequality in vaccine accessibility to inequality in these indicators, a decomposition of the CI for the vaccine accessibility was carried out. Table 7 shows the results of the decomposition of the CI for both TVH and VPP. It shows that all the independent indicators were highly significantly related to both vaccine accessibility indicators. The only two exceptions are the marginally significant relationship between VM and TVH and the insignificant relationship between VM and VPP. Both regression models were able to explain 69% of the variability in the accessibility indicators.

Table 7 Decomposition of the economic inequality in vaccine accessibility indicators by their determinants

	Coefficient	Mean	Elasticity	CI	Contribution	Relative contribution%
TVH						
WPI	0.66*	47.57	0.25	0.16	0.04	14.79
PS	0.87***	45.60	0.32	0.23	0.07	27.13
UHC	2.38***	65.02	1.23	0.12	0.14	54.43
VM	18.2†	0.26	0.04	0.25	0.01	3.64
Total					0.26	100
VPP						
WPI	0.60***	47.57	0.38	0.16	0.06	23.66
PS	0.54***	45.60	0.32	0.23	0.07	29.31
UHC	1.14***	65.02	0.97	0.12	0.11	45.48
VM	4.44ns	0.26	0.02	0.25	0.00	1.54
Total					0.24	100

*** significant at 0.001, * significant at 0.05, † significant at 0.1, ns not significant

The decomposition of the inequality in TVH and VPP revealed that the inequality in UHC accounts for 54.4 % and 45.5%, respectively. Inequality in the indicator of Political stability was the second in explaining the inequality in vaccine accessibility indicators and account for 27.1% in TVH and 29.3% in VPP. WPI was third in place and accounted for 14.8% in TVH and 23.7% in VPP.

Discussion

The literature on Covid-19 vaccine and its distribution among the different countries has strongly highlighted the unequal access to the vaccine. Some research has related the inequality to factors that pertain to the country itself, namely its human and technological capacities, while others discuss the external factors such as power imbalance in the global health arena, global solidarity and health security.

Almost all of these studies are propositional and of qualitative nature. To our current knowledge, there are no studies that was able to quantify the level of inequality in Covid-19 vaccines distribution and relates it to its underlying inter and intra countries determinants that go beyond countries level into a global level. The current study attempted to fill this void by assessing the level of inequality in Covid-19 accessibility according to countries' economic power and assessing the relationship between the proposed determinants. To gain a deeper understanding of the inter and intra countries' factors (i.e., state power, political stability, strength of health system and technological capacity) that affect the vaccine accessibility and its inequality, the current study went into decomposing the economic inequalities in vaccine accessibility by the economic inequalities in their determinants.

The current study implemented two different Covid-19 vaccines distribution indicators (TVH, VPP). The two indicators were used to ascertain the credibility of the results regardless of the indicator used and its underlying meaning. TVH is more related to country's adopted policies for vaccination, VPP is not related to these policies. This can be interpreted that TVH is more related to the country level, while VPP is more related to external forces and actors. The results have proved that for both VPP and TVH were highly unequal by the economic power of the countries. However, the differences among the four income categories of countries (I.e., LICs, LMICs, HMICs, HICs) is not consistent. The gap between the four income categories decrease as one moves from LICs to HICs. The largest observed gap in vaccine accessibility is between LICs and LMICs and the smallest gap is between HMICs and HICs. Another indication of the high inequality in vaccine accessibility is the values and signs of the concentration indexes for TVH and VPP (CI= 0.25, 0.26 respectively). The sign and the magnitude of the concentration index for both indicators indicate that countries with high GDP/capita have higher accessibility to the vaccine. These two results suggest that countries in the LICs are highly denied access to vaccine and the need for global health governance policies to pay significant attention to these countries and attempt to secure and satisfy their needs for vaccine.

In addition to the role played by the economic power in determining inequality in vaccine accessibility, the regression proved that both TVH and VPP are significantly associated with other determinants (i.e., PS, UHC). WPI was found to be significantly associated with VPP (P value= 0.001) but not TVH (P value = 0.051), probably this can

be explained by the difference between the two variables where TVH is more concentrated on internal country policies. As for VM, although the regression showed that it is not association with TVH and VPP (e.g., P value above 0.05), which counteract the literature that indicates that manufacturing countries made sure to cover their populations needs of the vaccine before exporting it to other countries(reference).

The decomposition of the CI for both VPP and TVH indicated that the four predictor variables contribute to the inequality in TVH and VPP and in the same order of contribution. UHC had the highest share of contribution in the inequality of vaccine distribution with a share of 54.4% for TVH and 45.5% for VPP. UHC is an indicator used as a proxy for the strength of the health system in a country. A country providing a decent level of UHC needs to have a relatively strong health system that is able to provide services and cover the population. As for the Covid-19 vaccines, having a strong health system would facilitate the management of the vaccines from procurement to distribution and finally administration. Strong health system means having the financial and human resources to accomplish adequate Covid-19 vaccine coverage for their population. This justifies the high percentage contribution of the UHC to the inequality in both TVH and VPP.

The second most important predictor variable is the PS in a country. PS reflects the country context in terms of its ability to put Covid-19 a primary concern, ability to import or manufacture the vaccine, raise people awareness enough to accept the vaccine, the ability if the health system to function efficiently to administer the vaccine. No doubt that the populations of politically unstable countries (e.g., Yemen, Syria, Ukraine) suffer horrendous health consequences even before the Covid-19. Government or responsible parties do not have the required financial resources to acquire the vaccine, but they also do not consider health as a priority on their agendas. Covid-19 has exacerbated the existing health inequities in these countries as well as add new ones such as the inequity in the accessibility to Covid-19 vaccine. This inequity is not limited to socioeconomic determinants in that country, where there are avoidable unfair discrepancies in the distribution of the vaccine with the country, but extend to the national level where the whole nation is discriminated against by the global society in the amount of vaccine allocated for at especially in the presence of weak global solidarity.

The third predictor variable contributing for the inequity in TVH, VPP is WPI. The power of a state can stems from several attributes: economy, political, military, cultural, technology, etc. These attributes enable the state to make decisions and execute measures that it redeems necessary to preserve its sovereignty. Covid-19 pandemic threatens states at multiple level: population health, economy, political stability and even its sovereignty. In the presence of power imbalance among states and the absence of a GHG structure with the power to lead all state for a unified response against the pandemic, these powerful states prioritized their populations and interest regardless of the consequences of their decisions on other nations. Powerful states were capable of securing Covid -19 vaccines to their populations. Some of these powerful states secured more than double their need while weak nations struggled to secure the minimum amount of vaccine to cover the most vulnerable segment of their populations.

The last predictor variable contributing for the inequity in TVH, VPP is VM. Although VM association with TVH and VPP is insignificant, the events during Covid-19 suggest that countries that produce the vaccines -which are mostly powerful countries- have the power to decide how to distribute it. Although producing countries agreed on the COVAX, these countries prioritized their nations first. Moreover, manufacturing companies in these countries stroked deals with other powerful state to cover these states needs of the vaccines. Given that the vaccine production was limited and slow at the beginning, the drill down of the vaccine to the COVAX and weaker states was far from adequate.

These results prove that determinants of health inequity go beyond the structural determinants (i.e., governance, macroeconomic policies, social policies, public policies and culture and societal values) which are illustrated in the last column in the CSDH conceptual framework. These structural determinants are country bound factors that are decided upon by national governing bodies. Covid-19 pandemic and the challenges arose with it such as the vaccines accessibility demonstrates that health inequities within a country have determinants that exceeds its boarders and reaches the level of global policies.

The results also reveal that health inequities are also present at countries' level. Pre the Covid-19, the health inequity discussions were mostly limited to comparing between group of people in a community. With the Covid-19, it became evident that

there are "unfair and avoidable or remediable differences in health" among countries according to their economic and political powers. These differences are magnified by the absence of will defined Global Health Governance structure with human rights as its core value and is capable of promoting solidarity and equity.

Inequity in Covid-19 vaccine accessibility can be reduced through acting on minimizing the contribution of each of the four determinants to the inequality. The contribution of each determinant is a result of multiplying the elasticity by the CI for each determinant. The CI for each determinant is related to the GDP of the country, thus equality among countries can be improved through enhancing their economies. The elasticity, on the other hand, signify the direct relationship between the dependent (i.e., TVH, VPP) and independent variable (i.e., WPI, PS, UHC, VM). Thus, improving the equality can be done through eliminating the effect of economic power on these determinants and working on the determinants themselves. Meaning that: attaining UHC, having political power and the ability to manufacture the vaccine should not be related/ dependent on the economic power of a country. Rather, each country should be enabled to attain decent levels of these determinants in order to improve global equity in Covid-19 vaccine accessibility. GHG strategies and decisions need to support countries by catering their needs to achieve equity.

Conclusion

The distribution of Covid-19 vaccine among countries is inequitable. Rich, powerful and politically stable countries were able to secure their needs of the vaccine while poor, weak and unstable countries were less fortunate in securing the vaccine.

The inequity in Covid-19 vaccines distribution originates from two types of determinants. Ones that are country related such as PS and UHC while others that are related to global factors such as the power imbalance and the sub-functional GHG system. GHG strategies and decisions need to support countries by catering their needs to achieve equity.

Moreover, health equity goes beyond country level to global level. Rethinking the social determinants of health and expand them to include international and global ones might be the next step to achieve health equity globally.

Chapter 7

Global health governance performance during Covid-19, what needs to be changed? A Delphi survey study[3]

Introduction

Right from the start of the Covid-19 pandemic, scientists recognized the zoonotic nature of the disease, as caused by a virus transmitted from animals to humans (168), and the risk of its global spread. Equally, many suspected that with the climate and environmental changes that the world is living through, humans would continue to encounter other zoonotic infectious diseases (169) threatening their lives and livelihoods. Assessing how Covid-19 is being handled globally provides lessons for ensuring better performance in facing upcoming outbreaks. Deficits such as poor coordination and regulatory overlapping (170), a fragile system of global health governance (171), and vaccine inequity(172) in the current GHG system resurfaced during the current Covid 19. These deficits intrigued researchers and policymakers to search for underlying reasons and propose changes for better outcomes in the future.

The response to the Covid-19 pandemic is a cumulative result of all policies and actions of different governments and agencies active in global health. These actors fall, by various scholars' definitions, under the umbrella of the Global Health Governance (GHG) system (27,173–175). Thus, the performance in the Covid-19 response ought to be assessed at a global level including the actors and the factors affecting their performance, such as their interests and capacities, as well as the various components of the GHG system, such as the legal framework.

[3] Abu El Kheir-Mataria W, El-Fawal H, Chun S. Global health governance performance during Covid-19, what needs to be changed? a delphi survey study. Globalization and Health. 2023 Dec;19(1):1-3.

Covid-19 is not the first pandemic to challenge GHG. Preceding outbreaks and epidemics were sources of continuous debate on GHG leadership and structure. They made politicians recognize the global health danger they face, shifting global health from low politics to high politics (29). This resulted in the current structures and finance system of GHG the way we know it today. Nevertheless, COVID-19 is placing tremendous pressure on GHG leaders like never before. It provided a test of the effectiveness of the current GHG in performing its role. From ordinary people to heads of States, all are questioning the structure, functions, power, and ability of the existing GHG to ensure global health security by protecting populations' health

Certain speculations are made regarding upcoming changes following Covid-19 (176). Many of the GHG challenges and recommendations raised during the COVID-19 period were raised through reviews and openings (170–172), and there were not many analytical studies by systematic and designed collective opinions by experts. Delphi surveys is a valuable method to collect diverse experts' opinions and viewpoints on core areas of challenges and prospective modifications in GHG. The main use of the Delphi method is to reach a consensus on debatable issues (177–179). The Delphi method allows for reaching a consensus on the most important points while avoiding group dynamics where some participants dominate the discussions (180). The Delphi method can also be used to predict future events or changes. It is used when experts' opinions are the only source of information (181). Thus, since the Delphi method was introduced by RAND Corporation in the 1950s (182), it has been used in various disciplines, such as social sciences (183) and health sciences (184–187), especially in case of planning and structuring for expert discussions to generate insights on debatable issues with little information (188).

This study has three main objectives: first, to evaluate the performance of GHG during Covid-19 in general and in relation to Covid-19 vaccine equity in particular. Second, to identify the reasons behind this performance; and third, to propose prospective changes in GHG for better performance.

Methods

Research Design and Questionnaire

This study is a cross-sectional research design using the Delphi method. Data was collected using the three-round Delphi surveys.

The Delphi survey questionnaire was composed of eight main questions, each question has a set of statements. The total number of statements in the study was 72 statements. The questions were based on eight previously identified core areas extracted from a systematic review of the literature produced on global governance and health equity in the context of Covid 19 (189) as well as on a literature review of models and theories on governance in general and global health governance in particular. The eight core areas are: GHG performance in the current Covid-19 pandemic focusing on Covid 19 vaccines, Covid-19 vaccine equity as handled by the GHG, factors affecting countries' ability to acquire Covid-19 vaccines, GHG current structure as the main factor contributing to Covid-19 vaccine equity, GHG regulatory framework in relation to global justice and equity, GHG actors' underlying values and priorities in managing Covid-19 vaccines, decision-makers, their interest and the power they use in the GHG arena, and finally characteristics for future changes in GHG. The questionnaire was pilot tested on three experts to assess survey conditions and the questions' validity.

Recruitment and Participants

Purposeful sampling was used to recruit experts to participate in the study at a primary stage. The rest of the Delphi panel members were selected through a snowballing technique where the primary participants were solicited to recommend other experts' names to be part of the study. The panel members were selected based on their expertise and experience in the field, considering the proportion of the representatives of international organizations, governments, NGOs, and Academia by continent. Sixty Delphi panel members were invited to participate in the study. An introductory email was sent to a total of 60 experts. The email thoroughly explained the study in hand: its aim, objectives, mode (via email), timeline, ethical considerations, and voting principles (the vote on each statement should be based on either the participants' own opinion or the organization they represent). The Delphi questionnaires were administered using e-mail. Regular reminder emails were sent to assure survey completion.

According to the recommendations for the Delphi surveys, the target number of participants in the study should be around 18 and the minimum accepted number of participants is 10 (190). For the current study, the final number of participants was 30. Recruited participants presented four main groups of stakeholders: academia, governments, international non-governmental organizations, and United Nations agencies, with years of experience in the field of GHG that ranges between 7 and 50 years (Table 8).

Table 8 Experts panel demographics

	Group	No.		%
Age	30-40	3		10
	41-50	4		13.3
	51-60	12		40
	>60	8		26.7
Organization type	UN system	5		16.7
	Government	6		20
	International organization	2		6.7
	Non-governmental organization	2		6.7
	Academia	USA	5	16.7
		Europe	3	10
		East Asia	1	3.3
		East Mediterranean	6	20

Years of experience	≤ 10	2	6.7
	11-20	5	16.7
	21-30	10	33.3
	31-40	7	23.3
	>40	4	13.3

Delphi consensus process

The Delphi survey was done in three rounds. All statements were included in each round. Participants were to vote on the Delphi survey statement. A 7-point Likert Scale was used, with one as the lowest score possible and seven as the highest available score. 7-point Likert scale was used because it has been demonstrated that seven-point Likert scale more accurate, easier to use, and a better reflection of a respondent's true evaluation (191).Following each round, the average and the standard deviation of participants' scores on each statement were calculated. The values were then made available to the participants anonymously. They were included in the following round's questionnaire allowing participants to provide comments and suggestions. In the second and third rounds, the participants were notified to consider the average score and the standard deviation of the previous round before deciding if they were to keep their original scores or they will change them. The difference in the average and standard deviation between the first and second round was minimal while following the second round all participants maintained their scores except for one who changed a few scores. This indicated that experts were confident of their scores and would not change them signaling that the panel members had reached consensus (192). The response rate in the 2nd round was 96.7% while in the 3rd round it reached 83.3%.

Data analysis

4.1 Consensus criteria and calculations

The standard deviation served as a measure of reaching an agreement point or consensus in the current study. According to the literature, the mean and standard

deviation can be used as measures of consensus (192,193). The breakpoint for agreement using the mean and standard deviation from a 7-point Likert scale is not common, it is more common for a 5-point Likert scale. In a 5-point Likert scale the cutting point is when the mean equals or is greater than 3.25 and the standard deviation is equal to one or less than one (194). Since this study uses a 7-point Likert scale, the values for the means and standard deviations as breaking points of agreements were recalculated.

The mean for our 7-point Likert scale was calculated as follows (195), giving the value of 4.38:

$$x_7 = (x_5 - 1)\ (6/4) + 1$$

$x_{7:}$ Mean for the 7-point Likert scale

$x_{5:}$ Mean for the 5-point Likert scale

As for the standard deviation, it was calculated using the coefficient of variance concept. Assuming that the coefficient of variance for the given scores on the two scales is equal then the standard deviation for the 7-point Likert scale would be 1.35.

Given the manner in which this survey was conducted – where the participants were asked if they agree with the mean score of the previous round's score – the mean cannot be used as measure of consensuses. Only the standard deviation can be used as a measure of consensus as it measures the dispersion of the scores from the mean score. If the dispersion is high (SD> 1.35) that means that the participants did not have consensus on this score.

4.2 Assessing the performance of GHG

Out of the eight questions of the survey, two questions with 16 statements were allocated to assess GHG performance. These statements were scored, and each statement's mean and standard deviation were calculated. The mean score for each statement was the measure used to assess GHG performance. In this study the value of the mean is not a measure of consensus but rather a measure of agreement with the statement, the higher the score the stronger the agreement, also the higher the mean the better the performance of GHG in that certain point.

4.3 Future changes in GHG structure and the underlying factors

In the survey one question with five statements was dedicated for depicting areas of future change in GHG structure. These statements were scored and the mean and standard deviation for each statement was calculated to have consensus on the proposed changes and to figure the scores given by the panel which would serve as an indicator of the importance of the proposed change. A correlation analysis was also performed between the proposed areas of change in GHG and the presumed underlying causes of GHG malperformance. The correlation analysis results were used to explain the future changes.

Results

The Delphi survey included seventy-two statements within which fifty-seven statements gained consensus by the expert panel while the remaining fifteen statements did not gain consensus (Table 9).

Table 9 Consensus and correlation values

			8. Characteristics for future changes in GHG				
			8.1 Clear stewardship M=6.1 SD=1	8.2 Enhanced accountability M=6.1 SD= 0.9	8.3 Centralized authority M=4.6 SD=1.3	8.4 More equitable representation of actors M=6.2 SD=1	8.5 Better legal framework to ensure accountability, information and technology sharing. M=5.9 SD=1.1
1. GHG performance in the current Covid-19 pandemic focusing on Covid 19 vaccines	M=	SD =					
Generate a collective response to meet the need for the Covid-19 vaccine	3.9	1.2	-.344	-.421*	-.163	-.569**	-.359
Manage Covid-19 vaccine production	3.8	1.3	-.123	-.294	-.169	-.491	-.052
Manage Covid-19 vaccine procurement	3.7	1.0	-.523**	-.433*	-.260	-.587**	-.371

Manage Covid-19 vaccine distribution	3.4	1.2	-.364	-.279	-.123	-.559**	-.397*
Produce inclusive decisions and guidelines for Covid-19 vaccines	4.9	1.0	.028	-.161	-.083	-.434*	-.063
Produce clear policies and guidelines for countries	4.6	1.1	.011	.030	-.201	-.029	.073
Produce feasible policies and guidelines for every nation	3.8	1.2	-.202	-.110	-.110	-.221	-.118
Facilitate global solidarity through managing Covid-19 vaccine (production, procurement and distribution)	3.3	1.2	-.053	-.245	-.149	-.451*	-.003
GHG overall performance	3.6	0.9	-.180	-.314	-.143	-.589**	-.164
2. GHG performance in Covid-19 Vaccine Equity							
Covid-19 vaccine production (manufacturing) ensured equity across nations in securing the vaccine for their populations	2.5	1.3	-.352	-.414*	-.097	-.605**	-.341
There is an equal opportunity for every nation to procure the needed amount of Covid-19 vaccines to cover its population	2.2	1.3	-.368	-.460*	-.051	-.663**	-.327
The Covid-19 vaccine is equitably distributed among nations	2.1	0.9	-.483*	-.354	-.132	-.583**	-.422*
Using digital and medical technology can enhance Covid-19 vaccine equity	4.4	1.2	.139	.059	.064	-.282	.048
COVAX initiative enhances Covid-19 vaccine equity	4.4	1.2	-.018	-.126	-.213	-.307	-.093
Actors bared in mind the collective benefit of their actions	3.0	0.9	.039	.088	.254	-.306	-.033
Actors showed solidarity actions in their decisions regarding the Covid-19 vaccine	3.0	1.0	-.036	.007	.077	-.360	-.227
3. Factors affecting countries' ability to acquire Covid-19 vaccines							
Having the knowledge and technology to develop or produce the vaccine	5.0	1.1	.180	.327	-.148	.065	.144
Level of economic and political power a country holds	6.0	0.8	-.201	-.113	.075	.255	.046
The country's health system's capacity to handle the Covid-19 vaccine	5.1	1.1	-.225	.138	.276	.013	-.112
Bilateral deals to acquire Covid-19 vaccine	4.9	1.2	-.060	.045	.347	-.057	-.156
The COVAX initiative	4.1	1.1	.093	-.101	.200	-.313	.017
Pharmaceutical companies' interest in financial gain	6.2	1.1	.156	.088	.117	.611**	.124
Laws on intellectual property rights	4.5	1.5	-.267	.019	.164	-.109	-.141
Country's representation and influence in GHG	4.8	1.4	-.100	.020	.295	.018	.200
4. GHG structure and the achievement of Covid-19 equity							
It is not clear which GHG actor holds the stewardship position (setting priorities, building consensus, setting rules, and evaluating members)	4.6	1.1	.078	-.055	.029	.037	-.053
The GHG structure is loose with no specified roles and accountability measures	5.1	1.2	.334	.318	-.094	.596**	.385*
Authority is better to be centralized in GHG to ensure the better authority	4.3	1.3	.093	-.175	.776**	-.245	-.197
Better representation of countries from the global south in GHG to ensure equity	6.2	0.9	.148	.206	-.025	.524**	.186
Develop a mechanism to monitor the influence of private actors and non-governmental financing organizations in policymaking	6.0	0.9	.313	.354	-.113	.542**	.276

The World Health Organization should have more authority	4.9	1.5	.122	-.068	.075	-.165	-.018
WHO should focus on its technical role of providing guidelines	4.8	1.5	-.173	-.222	.197	.022	-.291
The role of the World Health Organization should change	5.4	1.2	.116	.150	-.039	.089	.196
United Nations headquarter should hold the stewardship position in GHG	3.6	1.5	-.058	-.142	.483*	-.012	.026
Global NGOs should have authority in GHG	3.9	1.5	-.127	.014	-.052	.262	.081
5. Laws and regulations of GHG							
The legal instruments in GHG assure legal accountability of actors	3.3	1.1	-.398*	-.535**	-.208	-.447*	-.355
The legal instruments in GHG ensure health equity	3.1	1.2	-.303	-.431*	-.202	-.429*	-.337
International Health Regulations (IHRs) need to be updated	6.1	0.8	.354	.439*	-.089	.199	.484*
IHRs need better enforcement	6.4	0.7	.446*	.367	.153	.054	.264
More laws and regulations are needed to regulate actors, their contributions and their interaction	5.5	1.2	.066	.048	.396*	.168	.191
6. Underlying values and priorities in managing Covid-19 vaccines							
Human rights and the right to health are the main values considered by GHG actors concerning the Covid-19 vaccine	3.9	1.2	-.089	-.016	.006	-.150	-.242
Market-oriented health norms are affecting GHG decisions and actions concerning Covid-19 vaccines	5.6	1.0	.201	.021	-.159	.233	.162
Health as a common good. This concept is being considered in decisions concerning Covid-19 vaccine distribution	3.7	1.0	-.196	-.122	-.101	-.563**	-.392*
The vulnerability of countries is considered in Covid-19 vaccine distribution to limit the spread of the disease.	2.8	1.0	-.124	-.085	-.089	-.457*	-.214
7.1 Who makes / influences decisions regarding the Covid-19 vaccine?							
WHO - World Health organization	4.2	1.1	.199	.327	.399*	-.056	.187
UNICEF - United Nations International Children's Emergency Fund	3.2	1.2	-.012	.221	.113	.016	.111
GAVI - Global Alliance for Vaccines and Immunization	4.2	1.4	.120	.285	.199	.137	.200
CEPI - Coalition for Epidemic Preparedness Innovations	3.7	1.1	-.031	.473*	-.085	.413	.262
Bill & Melinda Gates Foundation	4.4	1.1	.034	.170	-.138	.074	.019
The World Bank	4.2	1.3	.263	.360	.274	.028	.315
Research agencies	3.4	1.1	.134	.175	-.167	-.064	.204
Vaccine manufacturers	5.7	1.2	.217	.502**	.092	.618**	.417*
Governments	5.5	1.1	-.081	-.149	-.111	-.260	-.246
Non-governmental Organizations	2.8	0.7	-.094	-.089	.055	-.127	-.130
7.2 What forms of power do they invoke?							
Political influence	5.7	1.1	.478*	.221	.082	.136	.494**
Economic power (market and trade relations, material capital)	6.1	0.8	.033	.031	-.134	.372	.291
Technical expertise (Knowledge and technology)	4.9	0.8	-.132	-.139	-.079	-.116	-.081
Cultural capital	3.0	1.2	-.302	.125	-.498*	-.055	-.102

7.3Whose interests are at stake?							
WHO - World Health organization	5.5	1.3	.512**	.513**	-.019	.334	.467*
UNICEF - United Nations International Children's Emergency Fund	4.6	1.8	.340	.617**	.084	.435*	.401
GAVI - Global Alliance for Vaccines and Immunization	4.5	1.8	.435*	.602**	.044	.120	.464*
CEPI - Coalition for Epidemic Preparedness Innovations	3.8	1.6	.187	.457*	-.015	.224	.285
Bill & Melinda Gates Foundation	4.2	1.5	.232	.359	.508**	.032	.213
The World Bank	4.0	1.5	.130	.299	.437*	.059	.167
Research agencies	4.4	1.5	.396*	.577**	-.092	.348	.494*
Vaccine manufacturers	5.2	1.9	-.051	.226	.214	-.025	.125
Governments	5.7	1.3	.129	.291	.170	-.046	-.072
Non-governmental Organizations	3.7	1.5	.332	.394	.461*	.236	.276

GHG performance

The panel had consensus on all the scores given for the performance of GHG in managing the Covid-19 vaccines during the pandemic as well as on the GHG performance in achieving equity concerning Covid-19 vaccine (Table 9). GHG performance during the Covid-19 in general and in relation to Covid-19 vaccine was assessed using nine statements. The participants' scores indicated that GHG performance was "disappointing", the mean scores for the ten statements did not reach five at the 7-point Likert. GHG overall performance mean score (M) was 3.6. Within this generally deficient performance, GHG best performance was in producing *inclusive* decisions and guidelines for Covid-19 vaccines (M=4.9) followed by the production of *clear* guidelines to countries (M=4.6), while the worst performance was in facilitating global solidarity (M=3.3) and in managing vaccine distribution (M=3.4). GHG ability to manage Covid-19 vaccine production and procurement as well as its ability to generate a collective response and feasible policies was average compared to its performance in other aspects (Figure 9)

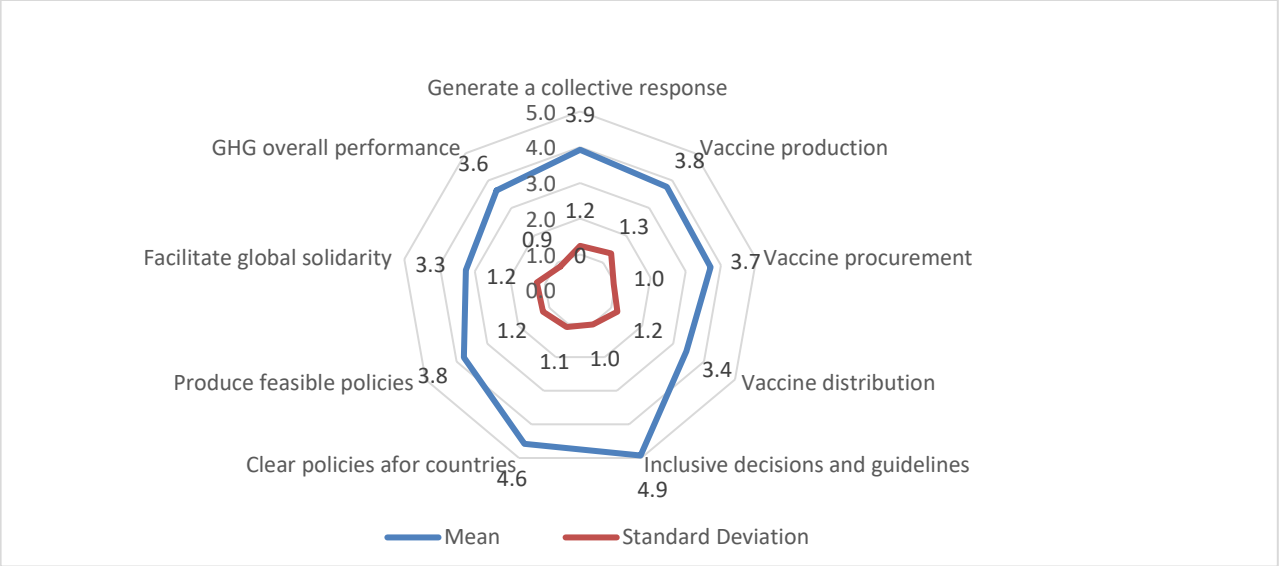

Figure 9 GHG performance in the current Covid-19 pandemic focusing on Covid 19 vaccines

As for GHG performance in achieving equity regarding Covid-19 vaccines and how it can be enhanced, it was similarly "inadequate". Panel experts decided that Covid-19 production, distribution and procurement were highly inequitable among countries (M= 2.5, 2.1, 2.2 consecutively). They also scored low on the two statements related to GHG actors' considerations of their actions. Actors poorly considered their solidarity actions (M=3.0) as well as the collective consequences of their actions (M=3.0). On the other hand, the panel experts gave slightly higher scores for the COVAX initiative and digital and medical technology as a tool to achieve equity (M=4.4 for both statements) (Figure 10).

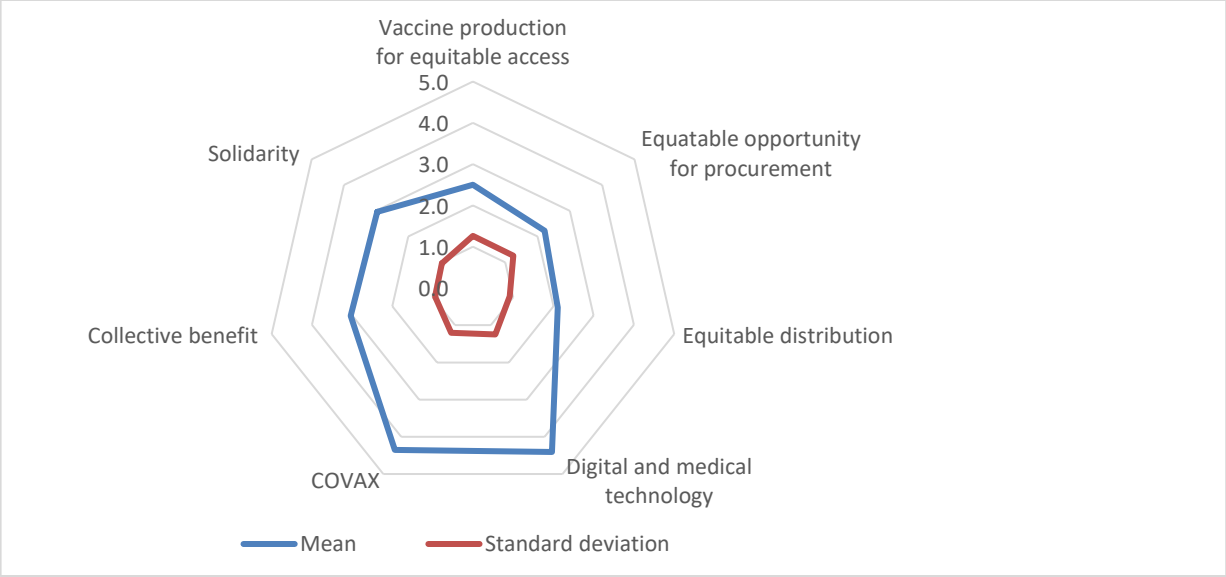

Figure 10 GHG performance in Covid-19 Vaccine Equity

Factors affecting countries' ability to acquire Covid-19 vaccines

Regarding the factors affecting countries' ability to acquire Covid-19 vaccines, the panel had a consensus on six out of eight statements. The panel had a consensus that the two most important factor that enable countries to acquire the vaccine are pharmaceutical companies' interest in financial gain (M=6.2) and the level of economic and political power a country holds (M=6). The other important factors that the panel had consensus on were the country's health system's capacity to handle the Covid-19 vaccine (M= 5.1), having the knowledge and technology to develop or produce the vaccine (M=5), the bilateral deals to acquire Covid-19 vaccine (M=4.9), and the COVAX initiative (M=4.1). The panel did not have a consensus on the scoring of two factors affecting countries to acquire the vaccine, these factors are: the laws on intellectual property rights and the country's representation and influence in GHG.

GHG structure and the achievement of Covid-19 equity

On the role of GHG structure in the achievement of Covid-19 equity, the panel had a consensus on six out of ten statements. The panel had a consensus that for GHG structure to support equity has to (from the highest to the lowest important): have a better representation of countries from the global south (M=6.2), develop a mechanism to monitor the influence of private actors and non-governmental

financing organizations in policymaking (M=6), change the role of the World Health Organization (M=5.4), have a more controlled GHG structure with specified roles and accountability measures (M=5.1), clarify which GHG actor holds the stewardship position (M= 4.6), and centralize authority in GHG (M=4.3). The panel did not have a consensus on the scoring of the following statement: The World Health Organization should have more authority, WHO should focus on its technical role of providing guidelines, United Nations headquarter should hold the stewardship position in GHG, and Global NGOs should have authority in GHG.

Laws and regulations of GHG

The legal framework of the GHG statements harnessed a full consensus of the panel. They agreed that (from highest to lowest score): the International Health Regulations (IHRs) need better enforcement (M=6.4), IHRs need to be updated (M=6.1), more laws and regulations are needed to regulate actors' contributions and interactions (M=5.5), the legal instruments in GHG assure legal accountability of actors (M=3.1), and that the legal instruments in GHG ensure health equity (M=3.1).

Underlying values and priorities in managing Covid-19 vaccines

The panel had full consensus on the scoring of the underlying values and priorities in managing Covid-19 vaccines. They scored the following values and priorities used in GHG in decreasing order: market-oriented health norms (M=5.6), human rights and the right to health (M=3.9), health as a common good (M=3.7), and countries' vulnerability (M=2.8).

Who makes/influences decisions regarding the Covid-19 vaccine?

In the area of who influences decisions regarding the Covid-19 vaccine, the panel had a consensus on scores given to all the proposed actors except GAVI (Global Alliance for Vaccines and Immunization). The scores given to the actors influence were in the following order: vaccine manufacturers (M=5.7), governments (M=5.5), Bill & Melinda Gates Foundation (M=4.4), WHO - World Health Organization (M=4.2), The World Bank (M=4.2), CEPI - Coalition for Epidemic Preparedness Innovations (M=3.7), research agencies (M=3.4), UNICEF - United Nations International Children's Emergency Fund (M=3.2), and finally Non-governmental Organizations (M=2.8).

Forms of power invoked and whose interest at stake

The panel had also a consensus on the type of power used by these actors. They gave the highest score for economic power (M=6.1), then political power (M=5.7), followed by technical expertise (M=4.9) and lastly cultural capital (M=3). Coming to whose actor's interests are at stake, the panel had only consensus for the WHO (M=5.5) and Governments (M=5.7).

Characteristics for future changes in GHG

The final set of findings focuses on the characteristics of future changes in GHG and how they relate to other survey-listed factors that affect GHG performance. The panel had a consensus on all the GHG structural change statements, the highest score was for changing the GHG structure to have a more equitable actors' representation (M=6.2), then to clear stewardship (M=6.1) and enhanced accountability (M=6.1), followed by having a better legal framework to ensure accountability, information and technology sharing (M=5.9), and finally centralized authority (M=4.6).

The five prospective GHG changes were found to correlate with different factors. For GHG to have clearer stewardship was negatively correlated with: GHG performance in Covid-19 vaccine procurement, GHG performance in equitably distributing Covid-19 vaccines, and GHG legal instruments' ability to hold GHG actors accountable. And positively correlated with: the need for better enforcement of IHRs, the political power used by actors in GHG, and the WHO interest in influencing decision-making in GHG.

The need for enhanced accountability in future GHG structure was negatively correlated with: GHG ability to generate a collective response, GHG performance in managing Covid-19 vaccine procurement, GHG performance in ensuring equity through vaccine production and providing an environment where every nation can procure the needed number of Covid-19 vaccines, the ability of GHG legal framework to hold actors accountable and to ensure equity. On the other hand, it was positively correlated with: the fact that IHRs need to be updated, that CEPI and Vaccine manufacturers are decision-makers in GHG, and that WHO interests in policymaking are at stake.

For future centralization of GHG's authority, this aspect was negatively correlated with: the use of cultural capital as a form of power in GHG. And positively correlated

with: achieving better equity due to GHG centralized authority, having the United Nations headquarter to hold the stewardship position in GHG, the need for more laws to regulate actors and their contributions and interactions, and the fact that WHO is a decision maker in GHG.

For GHG to have a more equitable actors' representation, this perspective was negatively correlated with: GHG overall performance, GHG performance in generating a collective response to meet the need for the Covid-19 vaccine, managing Covid-19 vaccine procurement and distribution, producing inclusive decisions and guidelines for Covid-19 vaccines, and facilitating global solidarity through managing Covid-19 vaccine. It is also negatively correlated with GHG performance in achieving equity through vaccine manufacturing, procurement and distribution. The GHG legal instruments' ability to assure legal accountability of actors and equity, the value of health as a common good and the vulnerability of countries as a priority in GHG decisions were also negatively correlated. On the other hand, pharmaceutical companies' interest in financial gain, the looseness of GHG structure, the need for better representation of countries and for developing a mechanism to monitor the influence of private actors and non-governmental financing organizations in policymaking, the role of vaccine manufacturers in decision-making were all positively correlated.

Lastly, future GHG structure with a better framework was negatively correlated with: GHG performance in managing Covid-19 vaccine distribution in general and in an equitable manner, and health as a common good for GHG actors. And positively correlated with: the GHG current structure being loose, the need for better enforcement of IHRs, the role of vaccine manufacturers in decision-making, the use of political power in GHG decision-making, and finally, WHO interests in decision-making.

Discussion

Covid-19 pandemic was described as a catastrophe hitting humanity (196–199). It was large in scale that it brought all actors in the global health arena into action. Actors by nature had different domains of action and different functions in the global health field. In face of the pandemic, each actor hasted to act to its best ability to face the ramifications of the pandemic. All these actors are considered part of the GHG

system present today for that GHG is defined as "the use of formal and informal institutions, rules, and processes by states, intergovernmental organizations, and nonstate actors to deal with challenges to health that require cross-border collective action to address effectively" (27). Governance, on the other hand is described in the literature as the process of exercising authority with the aim of guidance and regulation of the governed so as to achieve common interests. Authority in governance is founded on collaboration, negotiation, and partnership amongst many actors thus distrusting the power between actors (13).

Thereafter, the authority as well as the responsibility is distributed among actors based on the concept of partnership and collaboration. Consequently, the performance of GHG is the accumulative results of all actors' decisions and actions that are influenced by their interests, priorities, values, and power. These actors are not present in the void, they are present in the GHG system. The structure, dynamic and regulatory framework of this system affect the actors conduct. Assessing the performance of GHG entails assessing all the above: the actors' actions, the influencing factors, as well as, the structure of the GHG system and its regulatory framework. In the current study, GHG governance performance in managing Covid-19 vaccines and in achieving equity in this area is assessed using experts in the field of global health. The expert panel were engaged in three rounds Delphi survey to reach a consensus on these areas of assessment.

The panel had a consensus that GHG had performed poorly. GHG decisions and actions toward handling the vaccines whether it was in their production, distribution and procurement or in the guidelines and policies, did not manage to satisfy many nations' needs of the vaccine or reach out for an adequate level of solidarity to help these nations. Having this weak performance has led to apparent worldwide inequities regarding the Covid-19 vaccines. However, the Covid-19 vaccines inequity is directly related to the current structure of GHG. According to the panelists, the inequity is due to the loose structure of GHG and the absence or an unclear stewardship. For improved equity, the role of WHO needs to change, authority needs to be more centralized and monitoring mechanisms to hold actors accountable are in need. Moreover, the global south ought to be better presented in the GHG system.

Actors in the GHG can be roughly organized into five groups: the UN agencies with the WHO as the main one, governments, non-governmental organizations,

vaccine manufacturers, and the international organizations which can be further divided into funding agencies and research and service agencies. The panel had a consensus that, of these actors, the government and vaccine producers have the greatest influence over choices with Covid-19 vaccinations followed by funding agencies.

Vaccine manufacturers are pharmaceutical companies. Pharmaceutical companies are for-profit, market-driven businesses that place little value on the concept that health should be regarded as a common good. Thereafter when economically well-off countries proposed deals to reserve a large number of doses of upcoming vaccines, pharmaceutical businesses concurred and struck agreements with these countries.

Countries' governments are important actors in GHG, their performance in acquiring and handling Covid-19 vaccine and the policies and measures they adopted contributed to the final GHG performance. Countries' performance is tied to a number of factors. The panel had consensus that countries' economic, political and technical power as well as a country's representation in GHG are determinants in acquiring the vaccines. Technological powers enabled some countries to manufacture the vaccines while economic and political power allowed countries to procure the vaccine and influence decisions regarding the vaccines distribution and affect other countries' ability to acquire the vaccine. Certain countries used their power to strike bilateral deals to secure their needs of the vaccine regardless of the consequences of these deals on other countries' ability to acquire the vaccine (200). Also, capacity of the countries' health systems in terms of facilities, human and financial capacity are detrimental for procuring, storing and administering the vaccines. Certain African countries did not have the facilities nor the capacities to store and administer the vaccines resulting in low vaccine accessibility.

Funding agencies namely GAVI, Bill and Melinda gates and the World Bank are major actors in GHG and according to the panel have moderate influence on decisions regarding the vaccines. the financial support that they can provide is the source of their power. Gavi is a key partner in the COVAX initiative which is considered an enabler to acquire the vaccine. With the funds, Gavi provides many poor countries were able to acquire the vaccine despite their weak economic, technological and political powers.

According to the panel scoring, WHO which is recognized as one of the most important GHG actor did not have the upper hand in decision making regarding the vaccine. WHO had a score similar to the one of funding agencies. On contrast, WHO got the highest score as the actors with interest at stake. WHO is the organization that most look at as a leader in GHG. Its main domain is providing policies and guideline. WHO has very limited power over other actors in the GHG field, thus in the decisions regarding the vaccines it scored lower than the governments and the vaccine manufacturers. WHO's low level of authority over other actors contributes to the inadequate GHG performance.

Within the GHG system, the panel has scored two other important areas that affects the performance, the regulatory framework and the underlying values and priorities. As for the regulatory framework, the panel had the highest consensus on two aspects: the need for better enforcement of the IHRs, and the need for updating the IHRs and have more laws and regulations to regulate GHG actors, their contributions and interaction. IHRs are laws to control infectious disease, they are concerned with global surveillance and reporting system and set national minimum mandatory controls to prevent disease. In Covid -19, there were many violations of the IHRs highlighting their weaknesses (201). As for values and priorities, the panel agreed that market-oriented health norms are the norms affecting GHG decisions and actions concerning Covid-19 vaccines. Covid-19 is a global threat that affect all nations, to survive such a threat, health ought to be considered a global public good (202). Perceiving health as a global public good entails that health resides beyond the authority of any one country and that people cannot be excluded from consuming such goods, nor does one person's consumption of such goods should preclude consumption by another (203).

Inadequate performance and the underlying issues raise the question of what might be altered to improve future GHG performance. Clarifying who is the steward in GHG is one of the agreed upon future modifications to GHG. A steward is the actor responsible for setting priorities, building consensus, setting rules, and evaluating members and promote solidarity. WHO is considered the steward in GHG (204). According to the analysis, it appears that this demand for clear stewardship is related to what took place during the pandemic such as the inadequacy in managing Covid-19 vaccine procurement, their inequitable distribution, use of political power to

influence decisions concerning Covid-19 vaccines, and having a legal instrument to assure accountability leading to the call for better IHRs enforcement.

Accountability is another area that needs modification in GHG. Following the ineffective response to Covid-19, there is a call for "collective responsibility and mutual accountability"(5). The findings of this study suggest that enhanced future accountability is related to transforming the GHG system to create a collective response to the pandemic, improving the inadequate management of vaccine avoiding unequal opportunities of procurement, accompanied by reviewing the absence of legal instrument to ensure equity.

Another area that needs improvement in GHG is authority. There were no clear calls for centralized authority in GHG raised in the pandemic. Some called for centralized Covid-19 data collection where data is to be merged under a centralized authority (205). However, there was consensus from the panel that authority is better centered in GHG; this notion of centralization was found related to the need for more laws to regulate the actors and the fact that WHO can influence Covid-19 vaccines decisions and the use of cultural capital as form of power in GHG. This indicate that the type of centralized authority needed is to be expressed through laws and cultural capital managed by a neutral actor (e.g., WHO).

Equitable representation of actors had consensus as the most import GHG structural change to take place in the future. The worse the capacity of GHG to produce a collective response to Covid-19: inclusive decisions, facilitated solidarity, taking into consideration certain countries' vulnerability, promoting health as a global public good and manage Covid-19 in a manner to achieve equity, the higher the demand for better representation of the global south in GHG. Also, the need for more equitable representation stems from the fact that GHG structure is loose with no legal instrument to ensure equity and accountability allowing vaccine manufacturers to influence decisions regarding Covid-19 vaccines knowing that pharmaceutical companies main interest is financial gain.

Similarly, to the previously mentioned modification – better representation of the global south in GHG – the need for a better legal framework is correlated negatively with Covid-19 vaccine production and equitable distribution and with the fact that health is not treated as a global public good. The worse the vaccines are managed and

the less the reliance on global public good concept in dealing with health matters the more the demand for a better legal framework. On the other hand, the need for a better legal framework is positively correlated with the fact that GHG structure is loose with outdated IHRs and where vaccine manufacturers are decision makers regarding the Covid-19 vaccines and political power is used to influence these decisions.

Study Limitations

Despite being a reliable method to evaluate degrees of consensus on particular issues, the Delphi method has its limitations. Among the primary issues is gathering a panel of experts that is truly representative. For the current study, the panel experts were chosen carefully to have a certain level of expertise in the field and to represent the whole range of actors in GHG. Another issue is the choice of the Delphi survey statements. Identification of areas of concern representing the main problem and the construction of statements for these areas is a challenge in a Delphi survey. In the present study, statements were based on the results of a peer reviewed published systematic scoping review (189) which aimed at identifying areas of concern in GHG, equity and Covid-19. As for the statements, they were pilot tested for language, structure and comprehensibility.

Conclusion

The GHG general performance as well as its performance in managing Covid-19 vaccine from its production to its distribution and procurement was not adequate. GHG performance limited the achievement of Covid-19 vaccines global equity. GHG performance is a product of the existing GHG system, its actors and legal framework. It is a collective result of individual GHG actors' performance. The most influential actors in decision making regarding Covid-19 vaccine are the vaccine manufacturers and governments. While the most invoked power to influence decision are economic and political powers. Covid-19 decisions underlying value, although had human right to health at base, overlooked the concept of health as a global public good and were skewed towards market-oriented values. GHG malperformance along for its underlying factors calls for four main changes in GHG structure: assigning a clear

steward for GHG, enhanced accountability, centralized authority, more equitable representation of actors, and better legal framework.

Chapter 8

Global Health Governance: Changes of actors' roles following Covid-19: A social network analysis

Introduction

Global Health Governance (GHG) is criticized for its performance during the current Covid-19 pandemic in general and in vaccine management in particular. Issues including inequity in distribution (56), actors' engagement (206), solidarity promotion (207), policy formulation (94), response inclusivity (64), and rules and regulations were discussed by scholars revealing the existence of various GHG performance limitations.

These limitations are not restricted to the formal structures of power or to the existing laws and regulations. They are heavily influenced by the identity of the main actors, their interactions, and the flow of resources like information, technology, and finance between these actors. The networks of relationships among actors active in GHG influence how policy decisions are made and implemented. These networks can be of high importance in the functionality and performance of GHG.

Fundamentally, health is a component of social systems where actors, relationships and values influence policies immensely (208). The GHG system is similar, actors and relationships are decisive. GHG is crowded with numerous actors (209). These actors form a governing network where they interact. Nevertheless, their interactions vary; they frequently collaborate while other times they compete (210). GHG serves four primary purposes – e.g., production of global guidelines and policies, management of external threats, facilitation of global solidarity, and stewardship (30) – which GHG actors interact to perform. However, actors differ in their resources, influence and interests, as they hold different levels of importance in

the network, influencing its outcomes and performance. The number of connections an actor has, with whom, its position, and whether this position allows it to control the flow of resources in the network, are all important factors.

Social Network Analysis (SNA) is the investigation of a network structure using graph theory (211). It allows for the modelling and analysis of a community of agents utilizing a network structure (212). SNA is a useful tool to study governance, it takes into account the complexity of multi-layered relationships (213). The power of SNA is that it can determine the real position of actors in the network and their importance using different measures; and permits investigating the magnitude and direction of relationships between actors (214). Several scholars used SNA in analyzing networks in governance structures (215).

In the current study, SNA is used as a tool for analyzing the roles of different actors (nodes) in GHG during Covid-19. Given the importance of networks and actor's status within GHG and the influence these networks have on GHG performance, this study aims at investigating experts' perceived weighted roles of different actors in the GHG network during and after the Covid-19.

Methods

Target organizations (actors)

GHG actors included in this study were selected based on partners/organizations indicated in COVAX and GAVI websites (216), and the results of a mapping study of global health actors (209). These included are: World Health Organization (WHO), United Nations Children's Fund (UNICEF), Global Alliance for Vaccines and Immunization (GAVI), Coalition for Epidemic Preparedness Innovations (CEPI), Bill & Melinda Gates Foundation (GF), World Bank (WB), Research Agencies (RA), Vaccine Manufacturers (VM), Governments (GO), United Nations Development Program (UNDP), The Global Fund to Fight AIDS, Tuberculosis and Malaria (TGF), Stop TB Partnership (STP), Population Council – New York (PCN), Population Action International (PAI), Malaria Foundation International (MFI), Médecins Sans Frontières (MSF), Global Health Council (GHC), Centre for Disease Control and Prevention (CDC), and Family Health International (FHI).

Data collection method

Data was obtained from the third round of a Delphi survey, conducted with the participation of thirty global health experts. Experts' opinion is widely used as a source of data in research. It has been applied across a variety of fields, including medicine and economics (217), and through different methodologies including Delphi surveys (218).

The Delphi survey took place between May 2022 and December 2022. The participants represent different types of organizations including governments, United Nations organizations, international organizations and academia. Within the Delphi survey, eight series questions were inserted to collect data on the roles of nineteen prominent organizations in the field of Global Health. Four of the eight series questions concentrated on actors' roles in the current GHG structure in relation to Covid-19 vaccine and the other four questions concentrated on participants' perspectives of actors' centrality in future GHG structure. The four main roles of GHG actors that were investigated were: 'stewardship', 'production of guidelines and policies', 'promotion of solidarity and collaboration', and 'management of global health challenges' (30). Each Delphi panel member was asked to score each organization's weight in the four functions. Scores were from 1 to 7 where 1 indicates the lowest weight and 7 indicates the highest. The panel of experts rated the roles of each actor in the GHG arena in the current period (i.e., Covid-19). Additionally, they offered rankings of these actors predicted future roles. The rating was later used to calculate current and future actors' centrality in GHG.

Ethical consideration

The survey was approved by the Institutional Research Board at the American University in Cairo (Case# 2021-2022-145). A consent form was developed and sent to the participants along with the invitation letter in the study's introductory correspondence.

Data analysis

Actors' governance network analysis was conducted using SNA method. In SNA there are two important components: nodes and edges. For the purpose of this study the nodes represent the actors while the edges represent the relationship between

actors. The main measures used in SNA are the measures of centrality. Two centrality measures are calculated: degree centrality and eigenvector centrality. Degree centrality is a simple centrality measure, calculated by counting the total number of edges linked to a node. Degree centrality reflects the node's (i.e., actor) importance depending on how connected it is. However, degree centrality does not consider with whom this node is connected and its position in the network, this is captured using another centrality measure: eigenvector centrality. Eigenvector centrality measures the node's influence in a network: the more a node is connected to important other nodes, the higher the eigenvector centrality (219).

The data were converted into eight matrices of scores given by the experts/participants (30 rows) to the GHG actors (19 columns). The scores were converted into binary scores where values from 1 to 3 were given 0 while those from 4 to 7 were given 1. The data collected was a 2-mode data with two sets of entities (participants IDs and GHG actors). Since the study concentrates on the role of GHG actors and not the participants, the data obtained was converted from a 2-mode network to one mode network to be analysed (220). In the 1-mode network analysis, the precedent centrality measures were calculated using UCINET 6.757 and Netdraw modelling program.

Results

Degree centrality and eigenvector centrality for the nineteen GHG actors in each of the four functions of GHG showed distinct variations both among the GHG functions and between the current period and the future. Nevertheless, there proves to be a pattern in the distribution of actors among functions and time. Among the nineteen actors, only two (WHO and UNICEF) preserved their places in the top five most central actors. GO, WB, RA, CDC and GAVI also had centralities ranked among the top ten. The other actors were less central.

To facilitate the comparison between actors and between the current period and the future, the actors were ranked. For each actor, the degree centrality and the eigenvector centrality moved in the same direction between the current period and the future. However, in some cases, the amount of change was not the same, resulting in differences if we are to rank the actors according to their degree centrality or

eigenvector centrality. The ranking was based on the eigenvector centrality as it is a more indicative measure (Table 10).

Table 10 Current and Future Centrality measures for GHG Actors in the four functions of GHG

Stewardship						
	Current			Future		
GHG actor	Degree centrality	Eigenvector centrality (EC)	Rank according to EC	Degree centrality	Eigenvector centrality	Rank according to EC
WHO	193	0.393	1	248	0.342	1
GO	188	0.379	2	242	0.33	2
WB	154	0.311	3	210	0.284	3
GAVI	156	0.3	4	200	0.264	6 ↓
UNICEF	158	0.298	5	203	0.272	5
CDC	143	0.266	6	184	0.236	8 ↓
GF	125	0.243	7	189	0.249	7
VM	113	0.23	8	152	0.205	12 ↓
RA	119	0.222	9	210	0.275	4 ↑
CEPI	114	0.219	10	171	0.223	10
TGF	109	0.192	11	164	0.206	11
UNDP	104	0.187	12	180	0.231	9 ↑
GHC	105	0.185	13	150	0.187	14 ↓
STP	65	0.106	14	157	0.196	13 ↑
MSF	56	0.101	15	123	0.153	16 ↓
PCN	56	0.089	16	108	0.13	17 ↓
MFI	43	0.069	17	134	0.165	15 ↑
FHI	42	0.067	18	98	0.117	19 ↓
PAI	31	0.047	19	101	0.12	18 ↑
Production of guidelines & policies						
GHG actor	Current			Future		
	Degree centrality	Eigenvector centrality	Rank according to EC	Degree centrality	Eigenvector centrality	Rank according to EC
WHO	206	0.405	1	232	0.363	1
CDC	188	0.356	2	199	0.3	4 ↓
RA	176	0.334	3	209	0.316	3
GO	153	0.292	4	207	0.32	2 ↑
UNICEF	147	0.27	5	186	0.281	5
GAVI	148	0.269	6	170	0.255	6
VM	136	0.256	7	138	0.206	9 ↓
CEPI	137	0.252	8	145	0.212	8
WB	120	0.22	9	155	0.232	7 ↑
TGF	101	0.167	10	144	0.201	10
GF	95	0.163	11	134	0.196	11
GHC	98	0.163	12	127	0.179	13 ↓
UNDP	98	0.161	13	122	0.171	15 ↓

STP	90	0.148	14	135	0.187	12 ↑
MSF	80	0.133	15	122	0.169	16 ↓
PCN	76	0.119	16	85	0.114	19 ↓
MFI	71	0.109	17	129	0.177	14 ↑
FHI	63	0.099	18	120	0.165	17 ↑
PAI	59	0.088	19	95	0.126	18 ↑
Promotion of solidarity & collaboration						
GHG actor	Current			Future		
	Degree centrality	Eigenvector centrality	Rank according to EC	Degree centrality	Eigenvector centrality	Rank according to EC
WHO	256	0.349	1	303	0.31	1
UNICEF	241	0.322	2	280	0.282	5 ↓
GO	219	0.299	3	294	0.298	2 ↑
GAVI	216	0.29	4	279	0.284	4
GF	215	0.284	5	261	0.265	7 ↓
WB	210	0.279	6	285	0.289	3 ↑
RA	178	0.239	7	269	0.268	6 ↑
CDC	183	0.237	8	228	0.226	10 ↓
UNDP	185	0.236	9	239	0.232	9
CEPI	171	0.224	10	212	0.208	12 ↓
TGF	177	0.222	11	219	0.21	11
VM	140	0.179	12	243	0.243	8 ↑
STP	144	0.177	13	210	0.2	14 ↓
MSF	135	0.169	14	215	0.207	13 ↑
GHC	135	0.166	15	191	0.182	15
PCN	114	0.136	16	143	0.133	18 ↓
MFI	95	0.111	17	171	0.161	16 ↑
PAI	93	0.108	18	147	0.136	17 ↑
FHI	89	0.105	19	17	0.015	19
Management of global health challenges						
GHG actor	Current			Future		
	Degree centrality	Eigenvector centrality	Rank according to EC	Degree centrality	Eigenvector centrality	Rank according to EC
WHO	212	0.378	1	251	0.317	2 ↓
UNICEF	179	0.306	2	266	0.331	1 ↑
GAVI	153	0.256	3	224	0.276	4 ↓
CEPI	122	0.201	4	195	0.24	7 ↓
GF	169	0.296	5	162	0.192	13 ↓
WB	179	0.304	6	202	0.248	6
RA	113	0.189	7	214	0.265	5 ↑
VM	89	0.15	8	175	0.212	11 ↓
GO	193	0.339	9	169	0.202	12 ↓
UNDP	150	0.242	10	246	0.301	3 ↑
TGF	137	0.216	11	198	0.23	9 ↑
STP	98	0.148	12	190	0.219	10 ↑

PCN	70	0.102	13	156	0.178	15 ↓
PAI	47	0.065	14	108	0.119	19 ↓
MFI	59	0.085	15	123	0.136	18 ↓
MSF	114	0.184	16	149	0.167	17 ↓
GHC	100	0.156	17	164	0.187	14 ↑
CDC	180	0.303	18	152	0.172	16 ↑
FHI	52	0.077	19	198	0.232	8 ↑

Considering the 'stewardship' function, WHO, GO and WB are found to have higher degree and eigenvector centralities both in the current period and in the future (Figure 11). On the other hand, GAVI, CDC and VM, although were considered central as stewards in GHG during Covid-19, their eigenvector centrality was estimated to decrease in the future. Moreover, actors such as RA, UNDP, and STP are estimated to have higher future eigenvector centralities than their current ones.

As for the 'production of guidelines & policies' function, WHO maintained the highest eigenvector centralities currently and for the future (Figure 12). Also, RA, UNICEF and GAVI upheld their eigenvector centrality measure. GO and WB, on the other hand, were found to have higher future eigenvector centrality measures than the current period. Contrary to GO and WB, CDC and VM were to have lower future eigenvector centrality than the current.

Regarding the 'promotion of solidarity & collaboration function', WHO again scored the highest centrality measures currently and, in the future, followed by UNICEF, GO and GAVI (Figure 13). However, UNICEF as well as RA and CDC scored lower future eigenvector centralities than their current ones, while GO, WB and RA are to have higher central roles in promoting solidarity and collaboration in the future.

Finally, as for 'management of global health challenges', this function demonstrated major changes in centrality. WHO lost its position as the most central to UNICEF, which became the most central (Figure 14). Also, UNDP, FHI and RA were predicted to have a much more central role in health challenges management in the future than currently while GF seemed to lose a lot of significance in this function in the future.

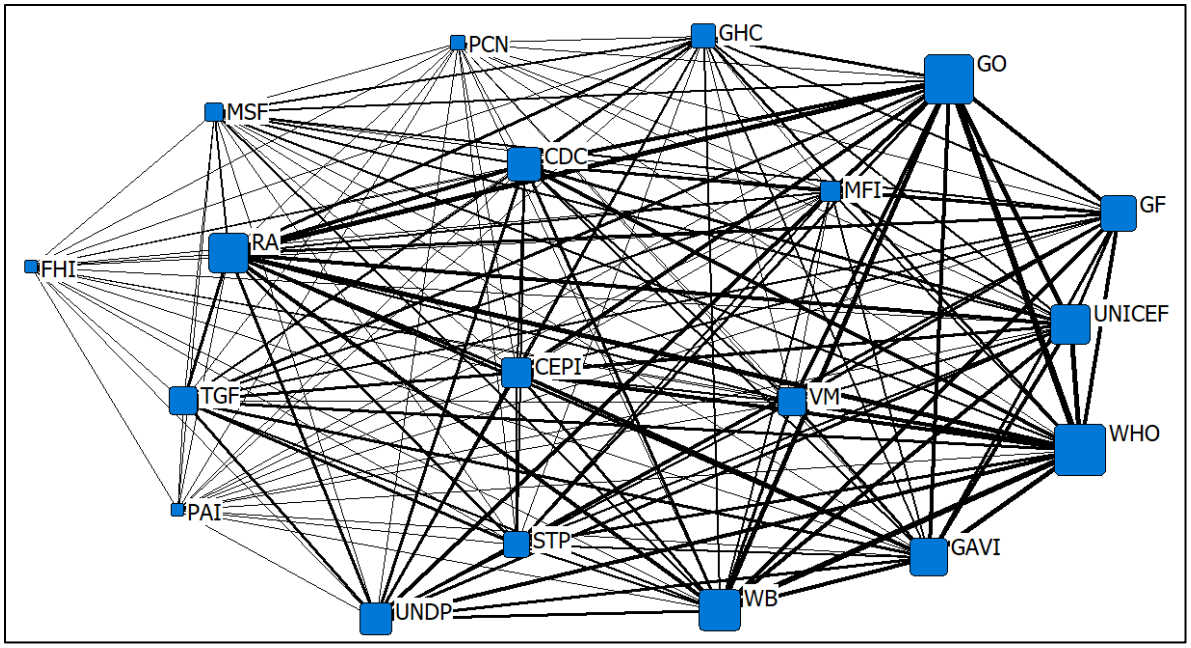

Figure 11 Stewardship

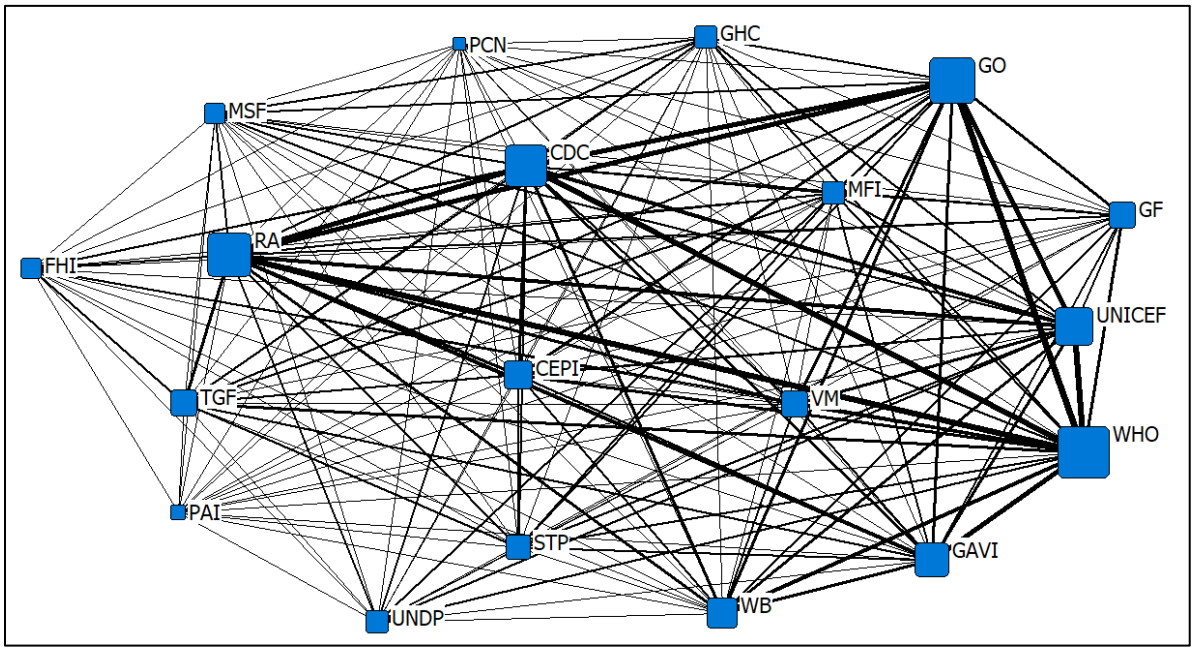

Figure 12 Production of guidelines & policies

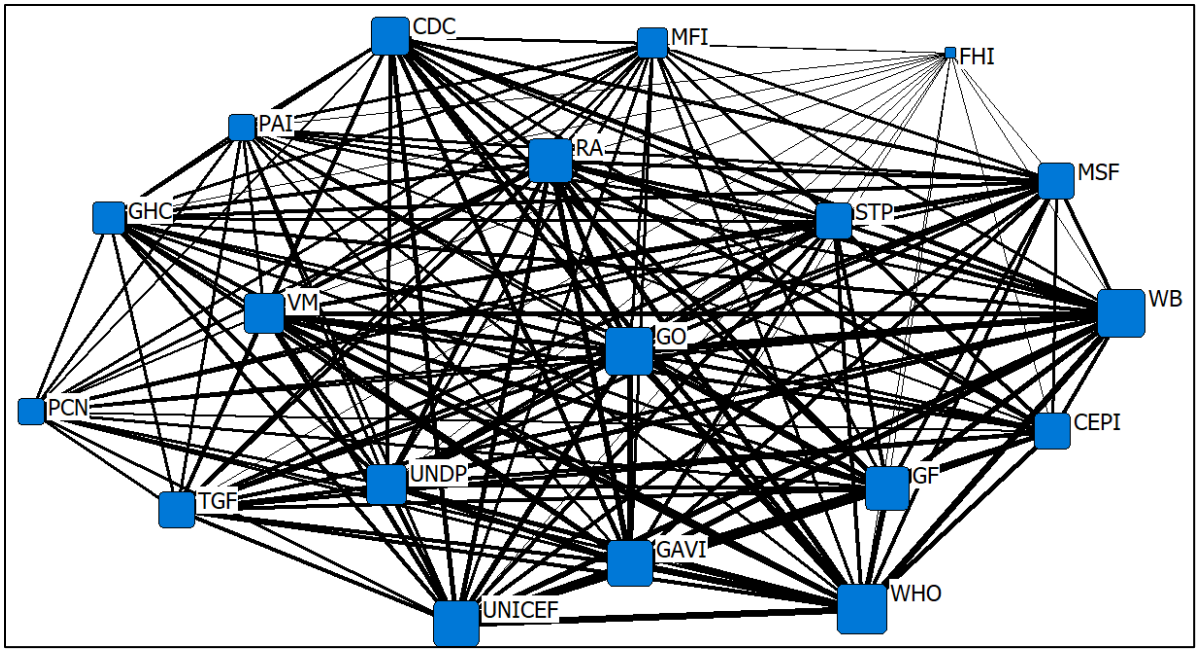

Figure 13 Promotion of solidarity & collaboration

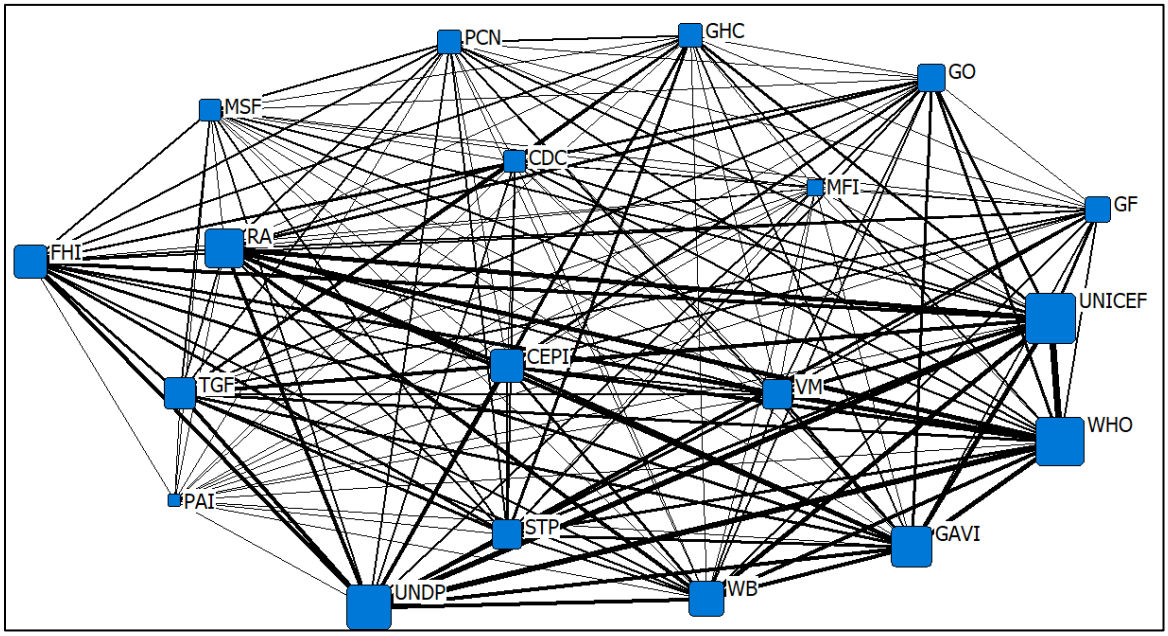

Figure 14 Management of global health challenges

Discussion

Covid-19 pandemic has shed the light on GHG, mainly criticizing how it handled the crisis. There were debates on potential structure changes as previous outbreaks and pandemics have resulted in changes in global health (29). Many scholars addressed how national reactions overrode global rules and how GHG failed to unify national efforts during the pandemic. They referred to how national governments developed their own strategies independent of the global standards set forth (221). Others discussed the need for change in GHG structure (59), the role of WHO in GHG (82), and the importance of inclusive multilateralism and networking (84). As far as we are aware, no research used SNA to compare the roles of GHG actors during Covid-19 with potential change of their roles post pandemic. The network analysis used in the current study addressed this gap.

The results show that some GHG actors are regarded as being of more significant than others and so hold on a high degree of centrality within the various GHG roles. These actors are: WHO, UNICEF, GO, RA, WB, GAVI, CEPI, GF, VM, UNDP, CDC, and TGF. Alternatively, other actors even though significant, they did not hold any of the top ten higher centrality places.

According to the findings, WHO was the highest central actor in the current period and the future among three GHG functions ('stewardship', 'production of guidelines & policies' and 'promotion of solidarity & collaboration') and exchanged the position of highest centrality with UNICEF for the fourth function ('management of global health challenges'). WHO is the most renowned organization in global health. WHO was established following WWII, at the start of the globalization era, to be the UN agency concerned with health at global level. WHO is a member-states entity; it has 194 member states. Being a member states organization indicates the high representation of nations in WHO and that it is governed by the nations. This in turn gives WHO the legitimacy to be in a leading position in GHG and have its stewardship which in turn explains the previous results. Coming to the guidelines, policies, and solidarity, these are the main functions of WHO according to its constitution. The WHO constitution states that the WHO main tasks are: coordinating efforts of different stakeholders influencing the health sector; supporting member states to enhance the health conditions in their societies; providing leadership and technical support; setting norms and standards; monitoring the health status; defining research topics; and providing sound health policies (1). In Covid-19, WHO

performed these functions through the guidelines it formulated and through the Access to COVID-19 Tools (ACT) Accelerator and the COVAX (COVID-19 Vaccines Global Access) initiative (222). Finally, 'management of global health challenges' function is problematic. WHO, although supported by the International Health Regulations (IHR) for the management of threats, lacks the authority and resources to force countries to oblige to its guidelines and policies (223), which might be the reason why participants thought that UNICEF should be the most significant actor in this function. Being WHO, UNICEF or UNDP, the findings of the study show that the United Nations agencies are central to GHG. Given the UN agencies' "neutrality", mandates, outreach through member states, legitimacy, and the involvement in health-related activities, this qualifies them to have this central role in GHG (224).

Besides the above UN agencies, another type of agencies was found to be central to GHG functioning, these can be grouped under "funding actors". These agencies include GF, WB, GAVI, CEPI and TGF. These actors scored relatively high in centrality in the four GHG functions indicating their perceived importance in the GHG arena both currently and in the future. Their importance emerges from the resources they control and pledge to different health domains. These organizations have the financial resources that they use in specific projects and programs according to either their agenda or mandates in accordance with global trends. However, the health domains they choose to fund become priority areas for receiving countries and organizations thus funding actors greatly affect the GHG agenda (225). It is understandable that having the resources is key to promote solidarity and ensure challenges management, which is not the case for the 'stewardship' and 'production of guidelines and policies' functions. Having high centrality in these two latter functions insinuates that having resources enables actors to obtain more central roles and be more influential in GHG (226).

Governments hold comparatively significant positions in GHG. GO obtained high centrality in all functions except for the management of global health challenges, where it obtained a much lower centrality. GO represent the nations upon which these functions are performed but GO also takes part in performing these functions which makes them central. GO are part of the stewardship function as they are member states in WHO which is presumed to hold this function. As for guidelines and policies, although GOs are supposed to follow guidelines at the global level, they

are to be part of their formulation as these guidelines will be imposed on their nations and in these countries' special contexts. Solidarity is a collective action where more fortunate countries help less fortunate ones – few solidarity actions can take place without the consensus of GO. Concerning managing the global health challenges, due to the way several GOs behaved during the Covid-19 – favoring their interests and countries over the overall welfare of the world – they received a lower centrality score. This was evident in the way certain countries took drastic closure measures (227) and in their ways of securing the Covid-19 vaccines (228).

In terms of centrality, research agencies scored quite high, reflecting their relevance in GHG. The higher future centrality emphasized the necessity to increase RA's influence in GHG. RA would play a larger role in the future in fostering solidarity and addressing health challenges. They would also occupy a more central steward position. RA centrality in the 'development of guidelines & policies' function was the greatest among functions and stayed constant between the current time and the future, demonstrating that experts value RA involvement in the worldwide production of guidelines and policies. This highlights the importance of evidence-based policies and guidelines. Evidence-based policies can enhance health equity, especially between rich and poor countries (229). Effectiveness studies of global health interventions provide proof of failure or improvement of health in developing world populations (230).

International non-governmental organizations are the final category of participants in this study. They include PAI, FHI, MFI, PCN, MSF and GHC. Despite being one of the 19 GHG actors in the study, these actors' centralities in GHG functions were lower than those of other actors, indicating a lesser impact on GHGs. These international NGOs play a major role in service delivery, advocacy and some role in research in global health, nevertheless they have limited voice as they have limited implementation capability, and do not have the capacity of GO or UN agencies. Moreover, they are dependent on other actors for funding which might affect their agenda and outreach (203).

Study limitations

This study has potential limitations. The current study determined the centrality of GHG actors in the global health arena depending on the perspectives of a panel of

experts in the field which might be encompass a degree of bias. Moreover, the study determines the centrality of actors but not the relationships between actors and their directions. The GHG actors included in the study do not represent the whole array of actors present on the ground which might result in some bias. However, the included actors were selected based on two criteria: their importance in global health during the pandemic and being included in a previously published study that mapped the most important actors in global health. Another potential limitation is the composition of the panel of experts, as they represent a limited number of global health organizations. Nonetheless, the number of panelists included in the study is within what is indicated in the literature and covers the most essential categories of organizations.

Conclusion

Our governance network research revealed that, despite the large number of actors in the GHG space, a subset of actors proved to be more crucial than others. The findings position WHO as the most central actor in 'stewardship', 'production of guidelines and policies', and 'promoting solidarity and collaboration', while UNICEF is the upcoming most central actor in managing global health challenges. Governments are major actors in GHG, however, they are less significant in 'managing global health challenges. Funding actors are central in all functions of GHG, indicating financial resources importance in obtaining central roles in GHG. Research organizations received a high centrality rating, indicating their importance in GHG. International non-governmental organizations have lower centralities than other actors, which suggests a less significant impact on GHGs.

Chapter 9

Conclusion and future recommendations

Following the five studies performed through this thesis and their results, *it became obvious that GHG has not reached maturity in achieving Health Equity per the tenets of Human Rights.* The thesis concludes that health inequities are present at global level and that GHG is instrumental in achieving health equity. However, GHG performance during Covid-19 demonstrated several flows in the current GHG system that requires future adjustments. Although this thesis addresses structural and intermediate determinants of health equity at the global level and provide quantitative evidence regarding these two aspects, its main contributions are: first, the quantitative measurement of the GHG performance in Covid-19 and the determinants for this performance. And second, quantitatively suggesting future prospective changes in GHG and its actors for better health equity.

The literature on GHG and health equity in connection to Covid-19, although limited, has discussed the presence of Covid-19 vaccines inequities at a global level. Different studies have related these inequities to various root factors. The fact that values underlying GHG were more oriented towards market values rather than human rights was one of the underlying factors for inequity. Market oriented values have indirectly led to the strong influence of vaccine manufacturers and economically well-off countries which often possess the political power to divert global decisions into specific direction leaving the weaker under-presented nations to struggle. These underlying values and differential economic and political power were aided by the current complex structure of GHG with its unclear stewardship and weak legal framework and accountability system. Although the literature provided all these information regarding GHG and Covid-19 vaccines inequity up till the time limit used in collecting the literature no quantitative evidence on the presence of Covid-19 vaccines inequities among countries was present.

The concentration index analysis used in this thesis has proved quantitatively the presence of health inequity at countries' level concerning the Covid-19 vaccine distribution, confirming what was found in the literature. Several factors were found to contribute to this inequity, including economic and political power of countries, knowledge and technological capacities of countries, and health system capacity of countries. The contribution of these factors to Covid-19 vaccines inequities was calculated through decomposing the calculated concentration index. Along with these structural determinants of Covid-19 vaccines inequities, behavioral determinants were also investigated in one of the studies of this thesis through measuring vaccine hesitancy. Although Covid-19 vaccines were primarily directed towards adults, as the pandemic progressed, children above 12 years old were added to the population categories to be vaccinated. Since the decision of the children's vaccination is in the hands of their parents, vaccine hesitancy was measured among parents regarding their children and used as an indicator of behavioral differences between L&MICs and HICs which might affect equity in Covid-19 accessibility. It was proven that L&MICs' parents' behavior towards Covid-19 vaccines differs from that of HICs' parents. L&MICs' parents' acceptance is lower than that of HICs' parents. It also showed that L&MICs' parents' behavior is related to their weak trust in vaccine manufacturers and in their governments' decisions.

However, since GHG has a complex structure, countries and their governments were not the only agent contributing to health inequities. Thereafter, GHG was assessed as a system through its performance in Covid-19. Its performance was found to be less than satisfactory in achieving health equity in general and Covid-19 vaccines distribution equity in particular. Several factors were identified as contributors to this result. The values underlying the decision making in Covid-19 were more tilted towards market- oriented values rather than human rights values which are the underlying values for health equity. Different power types were used to influence decision making during Covid-19. The most invoked powers were economic and political powers which are not pro-equity as there is huge economic and political power differences among countries. The current GHG structure with no clear stewardship and authority, feeble accountability measures, outdated legal framework, and unequitable representation of actors are all factor that contributed in

the observed health inequity. As could be noticed these factors confirm with what has been discussed in the literature.

GHG actors seemed to be a common element among all the reasons for GHG inadequate performance. They are the control knob which can be used to manipulate the other factors. Actors decide which values and power to be used, they can invoke legal reform, etc. However, not all actors are of the same importance. Actors such as the UN agencies, funding agencies, private manufacturers, governments, and research agencies were found to be the most central in the GHG structure. However, given Covid-19 flow of events it is forecasted that certain actors' centralities would change following the pandemic. The two UN agencies, WHO and UNICEF would continue to be the most central GHG actors, while others would change in terms of centrality ranking. Research agencies, for example, would become more central in development of guidelines & policies.

GHG and health equity are important domains in the current health paradigm. This thesis provided humble evidence of their connectivity and explored the factors affecting this connection. Certain changes in GHG are recommended. GHG structure needs to be strengthened. A solid stewardship is needed. Given the status quo, strengthening the WHO to assume the role of a steward would enhance equity in GHG. A clear description of the roles of different GHG actors and a more equitable representation of GHG actors regardless of their power are also required. And finally, a reinforced legal and accountability framework is fundamental to achieve global health equity.

This research, although answered the research question under its five declared objectives, gave rise to many questions regarding GHG, equity and the underlying factors. Further research is required. Some of the points that require research are: what determines the structure and functionality of GHG – the actors or the events? How to achieve better/more equitable actors' representation in GHG? How to concentrate on human rights as the main value for GHG decisions? What legal reforms and accountability measures are needed and how could they be enforced? The power dynamics in decision-making in GHG and its consequences.

Finally, the findings of this thesis should be considered by both powerful actors as well as weaker GHG actors in the GHG arena to work together for a healthier

equitable future in the face of global health challenges and for the coming generations. Powerful actors need to keep checking that their decisions are in accordance with human rights while marginalized actors need to work on enhancing their capacities and presence at the global level

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Annexes

Annex 1: Chapter 5 – Factors table

Table 11 factor affecting parents' decision regarding vaccinating their children against Covid 19

Article	Factors
Huynh G. et al. 2022 [18]	Reasons for parent' hesitancy 1. concerns about side effects 2. vaccine safety
Yılmaz, M., & Sahin, M. K. 2021[24]	factors for parents' willingness to allow vaccination: ● need for COVID-19 control ● benefits of the COVID-19 vaccine outweighing its potential harm ● to protect not only their own families but also others factors for reluctance to allow vaccination: ● lack of sufficient scientific studies ● concern about safety and side effects ● potential inefficacy of the vaccine due to mutations
Akgün, O. et al. 2022 [23]	factors affecting parents' acceptance of vaccines for their children were as follows: ● "Receiving anti-rheumatic medications regularly ● previous history of getting special recommended vaccines ● relying on vaccines for ending pandemic complying with the pandemic measures entirely
Ali, M. et al. 2022 [27]	Hesitancy factors: ● parents of 0–4-year-old children's parents of girls ● young parents ● Muslims parents who received college education ● unemployed parents

	● parents with a household income of <৳15 000 those who lived in their own house ● came from a village lived in the north zone ● tobacco users' parents politically affiliated with opposition parties ● participants who did/will not vaccinate their child with regular vaccines (other than COVID-19) available under government programs ● those who did not believe in the effectiveness of the COVID-19 vaccine for Bangladeshi children ● those who did not/will not receive the COVID-19 vaccine for themselves Parents who were not likely to believe that their children or a family member could be infected with COVID-19 in the next year those not concerned about their children or a family member getting COVID-19 in the next year
Chinawa, A. et al. 2021 [22]	● believed they could be infected with the COVID-19 or are aware of someone that died from COVID-19
Gönüllü, E., et al. 2021 [28]	Acceptance factors: ● believe that effective vaccine will be developed ● accepted to be enrolled as a subject in phase 2 clinical COVID-19 vaccine trial ● thought that COVID-19 vaccine should be mandatory ● thought that COVID-19 vaccine passport should be used in entrance to school and travel ● were vaccinated with influenza vaccine in year 2019 ● who wanted to get influenza vaccine shot in year 2020
Soysal, G., et al. 2021 [16]	Hesitancy factors ● age ● advanced and negative information was received on childhood vaccines Acceptance factors

	● thought that childhood vaccines could protect against severe diseases than those who had no idea about this subject
İkiışık, H., et al. 2021[21]	Factors affecting vaccine acceptance ● the perception of risk ● age
Bagateli, L. et al. 2011 [19]	Hesitancy factors ● the caregivers were concerned about serious side effects of the vaccines ● had some concerns about their safety
Wang, Q. et al. 2021 [17]	● willing: to "protecting the people around" ● unwillingness: "concern about side effects"
Zhang, M. X. et al. 2021 [26]	Hesitancy factors: ● parents with children under 18 years of age ● lower knowledge scores about COVID-19 vaccination ● lower awareness of the permission of vaccinating children ● hesitancy to inoculate themselves
Ali, M. et al. 2022[20]	Hesitancy factors: ● parents who lived in the northern zone ● those who thought vaccines would not be safe and effective for Bangladeshi children ● those who were either not vaccinated or did not receive the COVID-19 vaccine themselves ● those who said that they or their family members had not tested positive for COVID-19 ● those who did not lose a family member to COVID-19 ● parents who were not likely to believe that their children or a family member could be infected with COVID-19 the following ● who were not concerned at all about their children, or a family member being infected the following year

Yigit, M. el al. 2021 [25]	Refusal factors: ● avoiding possible vaccine side effects ● not knowing the precise effectiveness of the vaccine ● distrust in vaccines from abroad ● concerns about excipients in the vaccine ● not believing in the effectiveness of vaccines ● not being afraid or anxiety about COVID-19 infection ● distrust in domestic vaccines ● thinking he will not have COVID-19 again ● religious reasons ● believing the virus will mutate so that the vaccine will be ineffective ● distrust in companies developing vaccines ● thinking that the vaccines might contain microchips

Annex 2: Chapter 5 Meta-analysis R calculations

Observed proportions

	Article	xi	ni	yi	vi	sei	zi	pval	ci.lb	ci.ub
1	Huynh G. et al. 2022 (10)	749	1015	0.7379	0.0002	0.0138	53.4605	<.0001	0.7109	0.7650
2	Yılmaz, M., & Sahin, M. K. 2021 (11)	412	1135	0.3630	0.0002	0.0143	25.4318	<.0001	0.3350	0.3910
3	Akgün, O. et al. 2022 (12)	84	201	0.4179	0.0012	0.0348	12.0128	<.0001	0.3497	0.4861
4	Ali, M. et al. 2022 (13)	1506	2633	0.5720	0.0001	0.0096	59.3166	<.0001	0.5531	0.5909
5	Chinawa, A. et al. 2021 (14)	28	577	0.0485	0.0001	0.0089	5.4248	<.0001	0.0310	0.0661
6	Gönüllü, E., et al. 2021 (15)	380	506	0.7510	0.0004	0.0192	39.0645	<.0001	0.7133	0.7887
7	Soysal, G., et al. 2021 (16)	711	1033	0.6883	0.0002	0.0144	47.7592	<.0001	0.6600	0.7165
8	İkişık, H., et al. 2021 (17)	40	384	0.1042	0.0002	0.0156	6.6822	<.0001	0.0736	0.1347
9	Bagateli, L. et al. 2011 (18)	456	501	0.9102	0.0002	0.0128	71.2517	<.0001	0.8851	0.9352
10	Wang, Q. et al. 2021 (19)	1613	3079	0.5239	0.0001	0.0090	58.2043	<.0001	0.5062	0.5415
11	Zhang, M. X. et al. 2021 (20)	849	1788	0.4748	0.0001	0.0118	40.2073	<.0001	0.4517	0.4980
12	Ali, M. et al. 2022 (21)	227	396	0.5732	0.0006	0.0249	23.0631	<.0001	0.5245	0.6219
13	Yigit, M. el al. 2021 (22)	124	428	0.2897	0.0005	0.0219	13.2128	<.0001	0.2467	0.3327

'

Fixed effect model

```
> rma(yi,vi, data=dat_PR, measure = "PR", method = "FE")

Fixed-Effects Model (k = 13)

I^2 (total heterogeneity / total variability):   99.76%
H^2 (total variability / sampling variability):  422.39

Test for Heterogeneity:
Q(df = 12) = 5068.6384, p-val < .0001

Model Results:

estimate      se      zval    pval   ci.lb   ci.ub
  0.4722  0.0036  129.4899  <.0001  0.4650  0.4793  ***

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Random effect model

```
> rma(yi, vi, data = dat_PR, measure = "PR", method = "DL")

Random-Effects Model (k = 13; tau^2 estimator: DL)

tau^2 (estimated amount of total heterogeneity): 0.0755 (SE = 0.0366)
tau (square root of estimated tau^2 value):      0.2748
I^2 (total heterogeneity / total variability):   99.76%
H^2 (total variability / sampling variability):  422.39

Test for Heterogeneity:
Q(df = 12) = 5068.6384, p-val < .0001

Model Results:

estimate      se    zval    pval   ci.lb   ci.ub
  0.4966  0.0764  6.5021  <.0001  0.3469  0.6462  ***

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
```

Arcsin proportion

```
> dat_PAS <- escalc(measure = "PAS",xi=xi,ni=ni,data = PHRR)
> summary.escalc(dat_PAS)

                              Article   xi   ni     yi     vi    sei      zi   pval  ci.lb  ci.ub
1              Huynh G. et al. 2022 (10)  749 1015 1.0334 0.0002 0.0157 65.8444 <.0001 1.0026 1.0641
2  Yılmaz, M., & Sahin, M. K.  2021 (11)  412 1135 0.6466 0.0002 0.0148 43.5689 <.0001 0.6175 0.6757
3             Akgün, O. et al. 2022 (12)   84  201 0.7029 0.0012 0.0353 19.9317 <.0001 0.6338 0.7721
4               Ali, M. et al. 2022 (13) 1506 2633 0.8576 0.0001 0.0097 88.0137 <.0001 0.8385 0.8767
5           Chinawa, A. et al. 2021 (14)   28  577 0.2221 0.0004 0.0208 10.6705 <.0001 0.1813 0.2629
6          Gönüllü, E., et al. 2021 (15)  380  506 1.0483 0.0005 0.0222 47.1636 <.0001 1.0048 1.0919
7           Soysal, G., et al. 2021 (16)  711 1033 0.9784 0.0002 0.0156 62.8951 <.0001 0.9480 1.0089
8          İkiışık, H., et al. 2021 (17)   40  384 0.3286 0.0007 0.0255 12.8797 <.0001 0.2786 0.3786
9          Bagateli, L. et al. 2011 (18)  456  501 1.2664 0.0005 0.0223 56.6925 <.0001 1.2226 1.3102
10             Wang, Q. et al. 2021 (19) 1613 3079 0.8093 0.0001 0.0090 89.8117 <.0001 0.7916 0.8269
11         Zhang, M. X. et al. 2021 (20)  849 1788 0.7602 0.0001 0.0118 64.2914 <.0001 0.7370 0.7834
12              Ali, M. et al. 2022 (21)  227  396 0.8589 0.0006 0.0251 34.1836 <.0001 0.8096 0.9081
13            Yigit, M. el al. 2021 (22)  124  428 0.5684 0.0006 0.0242 23.5169 <.0001 0.5210 0.6157

>
```

Fixed effect model

```
> rma(yi,vi,data = dat_PAS, measure = "PAS",method = "FE")

Fixed-Effects Model (k = 13)

I^2 (total heterogeneity / total variability):   99.47%
H^2 (total variability / sampling variability):  190.11

Test for Heterogeneity:
Q(df = 12) = 2281.3290, p-val < .0001

Model Results:

estimate      se      zval    pval   ci.lb   ci.ub
  0.8077  0.0043  188.9211  <.0001  0.7994  0.8161  ***

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
  .
```

Random effect model

```
> rma(yi,vi,data = dat_PAS, measure = "PAS",method = "DL")

Random-Effects Model (k = 13; tau^2 estimator: DL)

tau^2 (estimated amount of total heterogeneity): 0.0477 (SE = 0.0249)
tau (square root of estimated tau^2 value):      0.2184
I^2 (total heterogeneity / total variability):   99.47%
H^2 (total variability / sampling variability):  190.11

Test for Heterogeneity:
Q(df = 12) = 2281.3290, p-val < .0001

Model Results:

estimate      se     zval    pval   ci.lb   ci.ub
  0.7758  0.0608  12.7515  <.0001  0.6566  0.8951  ***

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Converting Arcsin proportion to normal proportion

```
>
> transf.iarcsin(0.7758)
[1] 0.4904024
> transf.iarcsin(0.6566)
[1] 0.3726215
> transf.iarcsin(0.8951)
[1] 0.6088238
>
```

Annex 3: Chapter 6, statistical calculations

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Vaccine courses delivered as a proportion of country population	163	2.040	181.670	76.56423	44.017381
Total vaccinations per hundred	163	.100	321.320	125.89264	77.891263
GDP per capita 2019	163	228.214	113218.713	14666.98773	20205.355394
WPI scaled	163	13.60	95.40	47.5742	18.10328
Political Stability and Absence of Violence/Terrorism	163	0	98	45.60	26.815
UHC service coverage index 2019	163	28	89	65.02	15.470
Vaccine manufacturing capacity	163	0	1	.26	.442
Valid N (listwise)	163				

Report

GDP per capita catorical		Vaccine courses delivered as a proportion of country population	Total vaccinations per hundred	WPI scaled	Political Stability and Absence of Violence/Terrorism	UHC service coverage index 2019	Vaccine manufacturing capacity
1	Mean	25.29619	31.93524	28.0238	19.00	41.76	.00
	N	21	21	21	21	21	21
	Std. Deviation	19.308037	34.379664	7.49045	16.393	7.028	.000
2	Mean	59.40735	98.30857	39.2776	35.22	57.06	.24
	N	49	49	49	49	49	49
	Std. Deviation	33.242915	67.855138	13.09881	22.164	11.595	.434
3	Mean	70.39844	125.81778	48.3778	42.99	68.36	.31
	N	45	45	45	45	45	45
	Std. Deviation	32.734747	67.462415	14.75635	21.817	8.957	.468
4	Mean	122.28875	195.22792	63.8438	70.28	80.21	.35
	N	48	48	48	48	48	48
	Std. Deviation	27.110702	42.410854	14.60044	18.963	6.126	.483
Total	Mean	76.56423	125.89264	47.5742	45.60	65.02	.26
	N	163	163	163	163	163	163
	Std. Deviation	44.017381	77.891263	18.10328	26.815	15.470	.442

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Vaccine courses delivered as a proportion of country population * GDP per capita catorical	Between Groups	(Combined)	171686.107	3	57228.702	63.993	.000
	Within Groups		142193.730	159	894.300		
	Total		313879.837	162			
Total vaccinations per hundred * GDP per capita catorical	Between Groups	(Combined)	453425.542	3	151141.847	45.391	.000
	Within Groups		529436.366	159	3329.788		
	Total		982861.909	162			
WPI scaled * GDP per capita catorical	Between Groups	(Combined)	24134.032	3	8044.677	44.171	.000
	Within Groups		28958.039	159	182.126		
	Total		53092.072	162			
Political Stability and Absence of Violence/Terrorism * GDP per capita catorical	Between Groups	(Combined)	49683.051	3	16561.017	39.420	.000
	Within Groups		66799.186	159	420.121		
	Total		116482.238	162			
UHC service coverage index 2019 * GDP per capita catorical	Between Groups	(Combined)	26037.048	3	8679.016	108.361	.000
	Within Groups		12734.854	159	80.093		
	Total		38771.902	162			
Vaccine manufacturing capacity * GDP per capita catorical	Between Groups	(Combined)	1.972	3	.657	3.520	.017
	Within Groups		29.685	159	.187		
	Total		31.656	162			

VPP's CI and its decomposition using stata 15

TVH's CI and its decomposition using stata 15

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
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       Serial number:  401506255171
         Licensed to:  Dabdo
                       ISSR

Notes:
      1.  Unicode is supported; see help unicode_advice.
      2.  Maximum number of variables is set to 5000; see help set_maxvar.

. use "C:\Users\DR\Desktop\PhD\Thesis\equity\equitydata 9-10-2022.dta"

. concindc VPP, welf(GDP)
Concentration Index (CI) using grouped approach
as in Kakwani, Wagstaff & van Doorslaer (1997)
  Concentration Index       0.24767798
  Std. Error of CI          0.01990379

. do "C:\Users\DR\Desktop\PhD\Thesis\equity\trial2 (1).do"

. concindc VPP , welf(GDP)
Concentration Index (CI) using grouped approach
as in Kakwani, Wagstaff & van Doorslaer (1997)
  Concentration Index       0.24767798
  Std. Error of CI          0.01990379

. sca CI = r(concindex)

.
. global X WPI PS UHC VM
```

```
.
. reg VPP $X

      Source |       SS       df       MS      Number of obs   =       163
-------------+------------------------------   F(4, 158)       =     88.96
       Model |   217364.8         4  54341.2001   Prob > F        =    0.0000
    Residual |  96515.0365       158  610.854661   R-squared       =    0.6925
-------------+------------------------------   Adj R-squared   =    0.6847
       Total |  313879.837       162  1937.52986   Root MSE        =    24.715

------------------------------------------------------------------------------
         VPP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         WPI |   .6037513   .1862333     3.24   0.001     .2359233    .9715794
          PS |   .5441047   .0944682     5.76   0.000     .3575214    .7306881
         UHC |   1.144276   .2319784     4.93   0.000     .6860974    1.602455
          VM |   4.443835   5.674609     0.78   0.435    -6.764041    15.65171
       _cons |  -52.54901   9.087813    -5.78   0.000    -70.49828   -34.59975
------------------------------------------------------------------------------

. predict dd
(option xb assumed; fitted values)

. mat coeff = e(b)

. concindc dd  , welf(GDP)
Concentration Index (CI) using grouped approach
as in Kakwani, Wagstaff & van Doorslaer (1997)
  Concentration Index       0.24984727
  Std. Error of CI          0.01637629

. sca CI_y = r(concindex)

.
.
. sum dd

    Variable |       Obs       Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
          dd |       163    76.56423    36.63002  -4.007734   151.0563

.
. sca m_y=r(mean)

. gen scon=0
```

```
. foreach x of varlist $X {
  2. qui {
  3. mat b_`x' = coeff[1,"`x'"]
  4. sca b_`x' = b_`x'[1,1]
  5.
. sum `x'
  6.
. concindc `x'  , welf(GDP)
  7.
. sca CI_`x' = r(concindex)
  8.
. sum `x'
  9.
. sca elas_`x' = (b_`x' * r(mean))/m_y
 10.
. sca con_`x' = elas_`x' * CI_`x'
 11. replace scon= scon+ con_`x'
 12. }
 13.
. }

. foreach x of varlist $X {
  2. {
  3. sca prcnt_`x'=con_`x'/scon
  4. di "`x' elasticity:", elas_`x'
  5. di "`x' concentration index:", CI_`x'
  6. di "`x' contribution:", con_`x'
  7. di "`x' percentage contribution:", prcnt_`x'
  8. }
  9. }
WPI elasticity: .37514916
WPI concentration index: .15758025
WPI contribution: .0591161
WPI percentage contribution: .23660894
PS elasticity: .32406655
PS concentration index: .22600888
PS contribution: .07324192
PS percentage contribution: .29314676
UHC elasticity: .97181191
UHC concentration index: .11692734
UHC contribution: .11363138
UHC percentage contribution: .45480339
VM elasticity: .01531133
VM concentration index: .25196176
```

```
VM contribution: .00385787
VM percentage contribution: .01544091

.
. drop dd

.
end of do-file

. drop scon

. concindc TVH, welf(GDP)
Concentration Index (CI) using grouped approach
as in Kakwani, Wagstaff & van Doorslaer (1997)
  Concentration Index       0.25437368
  Std. Error of CI          0.02329784

. do "C:\Users\DR\Desktop\PhD\Thesis\equity\trial 9-10-2022.do"

. concindc TVH , welf(GDP)
Concentration Index (CI) using grouped approach
as in Kakwani, Wagstaff & van Doorslaer (1997)
  Concentration Index       0.25437368
  Std. Error of CI          0.02329784

. sca CI = r(concindex)

.
. global X WPI PS UHC VM

.
. reg TVH $X

    Source |       SS         df       MS      Number of obs   =       163
-------------+------------------------------   F(4, 158)       =     86.20
     Model |  674009.396         4  168502.349   Prob > F        =    0.0000
  Residual |  308852.513       158  1954.76274   R-squared       =    0.6858
-------------+------------------------------   Adj R-squared   =    0.6778
     Total |  982861.909       162  6067.04882   Root MSE        =    44.213

------------------------------------------------------------------------------
       TVH |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       WPI |   .6550292   .3331467     1.97   0.051    -.0029663    1.313025
        PS |   .8741105    .168991     5.17   0.000     .5403376    1.207883
```

```
       UHC |   2.376874   .4149786     5.73   0.000     1.557253    3.196495
        VM |   18.19731   10.15112     1.79   0.075    -1.852088    38.24671
     _cons |  -104.4862   16.25689    -6.43   0.000     -136.595    -72.3773
------------------------------------------------------------------------------

. predict dd
(option xb assumed; fitted values)

. mat coeff = e(b)

. concindc dd  , welf(GDP)
Concentration Index (CI) using grouped approach
as in Kakwani, Wagstaff & van Doorslaer (1997)
  Concentration Index       0.26372248
  Std. Error of CI          0.01867738

. sca CI_y = r(concindex)

.
.
. sum dd

    Variable |       Obs       Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
          dd |       163    125.8926    64.50234  -14.68578   256.4077

.
. sca m_y=r(mean)

. gen scon=0

. foreach x of varlist $X {
  2. qui {
  3. mat b_`x' = coeff[1,"`x'"]
  4. sca b_`x' = b_`x'[1,1]
  5.
. sum `x'
  6.
. concindc `x'  , welf(GDP)
  7.
. sca CI_`x' = r(concindex)
  8.
. sum `x'
  9.
. sca elas_`x' = (b_`x' * r(mean))/m_y
```

```
 10.
. sca con_`x' = elas_`x' * CI_`x'
 11. replace scon= scon+ con_`x'
 12. }
 13.
. }

. foreach x of varlist $X {
  2. {
  3. sca prcnt_`x'=con_`x'/scon
  4. di "`x' elasticity:", elas_`x'
  5. di "`x' concentration index:", CI_`x'
  6. di "`x' contribution:", con_`x'
  7. di "`x' percentage contribution:", prcnt_`x'
  8. }
  9. }
WPI elasticity: .24753242
WPI concentration index: .15758025
WPI contribution: .03900622
WPI percentage contribution: .14790632
PS elasticity: .31662384
PS concentration index: .22600888
PS contribution: .0715598
PS percentage contribution: .27134508
UHC elasticity: 1.2276743
UHC concentration index: .11692734
UHC contribution: .14354869
UHC percentage contribution: .54431722
VM elasticity: .03813184
VM concentration index: .25196176
VM contribution: .00960777
VM percentage contribution: .03643135

.
. drop dd

.
end of do-file

. save "C:\Users\DR\Desktop\PhD\Thesis\equity\equity 9-10-2022.dta"
file C:\Users\DR\Desktop\PhD\Thesis\equity\equity 9-10-2022.dta saved
```

Annex 4: IRB Approval Letter for Delphi study

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

Case# 2021-2022-145

To: **Wafa Mataria**
Sungsoo Chun
Sherihan Hassan

From: **Heba Kotb Chair of the IRB**
Date: **15th April 2022**

Re: IRB approval

This is to inform you that I reviewed your revised research proposal entitled

"GLOBAL HEALTH GOVERNANCE AND ITS ROLE IN HEALTH EQUITY: THE CASE OF COVID-19"

It required consultation with the IRB under the "expedited" category. As you are aware, there were minor revisions to the original proposal, but your new version addresses these concerns successfully. Your proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participants in any published record. I believe you will also make adequate provision for obtaining informed consent of the participants.
This approval letter was issued under the assumption that you have not started data collection for your research project. Any data collected before receiving this letter could not be used since this is a violation of the IRB policy.

Please note that IRB approval does not automatically ensure approval by CAPMAS, an Egyptian government agency responsible for approving some types of off-campus research. CAPMAS issues are handled at AUC by the office of the University Counsellor. The IRB is not in a position to offer any opinion on CAPMAS issues, and takes no responsibility for obtaining CAPMAS approval.
This approval is valid for only one year. In case you have not finished data collection within a year, you need to apply for an extension.

Thank you and good luck.

H. Kotb

Heba Kotb
IRB chair, The American University in Cairo
2078 HUSS Building
T: 02-26151857
Email: hebakotb@aucegypt.edu

Institutional Review Board
The American University in Cairo
AUC Avenue, P.O. Box 74
New Cairo 11835, Egypt.
tel 20.2.2615.1000
fax 20.2.27957565
Email: irb@aucegypt.edu

Annex 5: Consent form

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

Documentation of Informed Consent for Participation in Research Study

Project Title:

Global Health Governance and its Impact on Health Equity: The Case of COVID-19

Principal Investigator:

Wafa Abu-El-Kheir-Mataria

Tel:01276757819

Email: wafamataria@aucegypt.edu

*You are being asked to participate in a research study. The purpose of the research is to understand the role of Global Health Governance in achieving health equity and to identify priorities and future policies, taking the Covid 19 as a case study. The findings may be *presented and published.*

The procedures of the research will be as follows: a three round online survey will be conducted. The 1st round will be based on a group of open-ended questions to stand upon your perception of the role of GHG in health equity. The 2nd and 3rd rounds will be based on a group of close-ended questions with space for comments and remarks. The estimated time for answering each round is half an hour. Finally, you will be invited to an online consensus meeting with at least 30% of the participants to ratify the results.

*There will not be certain risks or discomforts associated with this research.

*There will not be benefits to you from this research.

*The information you provide for purposes of this research is anonymous and confidential except for the final meeting if you decide to attend. Identities for the meeting participants would not be confidential however all their previous answers will be.

* Questions about the research, my rights, or research-related injuries should be directed to Wafa Mataria at (01276757819).

*Participation in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or the loss of benefits to which you are otherwise entitled.

Signature _____

Printed Name _____

Date _____

Annex 6: Delphi study protocol

Introduction

GHG is responsible for: the formulation of global health goals, strategies to reach them and policies and guidelines to achieve these goals. Thereafter, GHG can be assumed to have major effects on health outcomes around the world and at country level. Many factors contribute to the way GHG affects health outcomes: i.e. political power, economic power, national vs. global interests, and coalitions. These factors are translated in the differential in decision influencing power, financing capacity, ability to enforce policies and goals, etc. among different GHG actors.

Given the above, global health equity could be considered as a byproduct of GHG. The differential distribution of health among nations and social groups of people resulting in variation in health outcomes level and distribution can be seen as influenced by GHG. Health outcomes can be looked at through difference in certain health indicators between different groups of countries (e.g. low and high income countries) while the health outcome distribution can be looked at from an equality and equity point of view.

The current Covid 19 pandemic exposed and exacerbated already present health inequities around the world. Age, gender, and ethnic, among other, inequities that are related to structural, political and economic conditions become more pronounced during the pandemic. These health inequities indicate, in a way, that policies and actions taken were a continuation of the present practices that leads to the systematic, avoidable and unfair health differences. Further research is needed to understand the relation between GHG and health inequity, the factors influencing GHG and leading to the status quo, and to propose modifications that enhance GHG performance and consequently ameliorate heath equity levels.

Aim of the study

To understand strengths and weaknesses in the current GHG system and investigate possible modification to enhance global health equity.

Objectives

1. Investigate the role of global health governance in affecting health outcomes (levels and distribution) at both global and national policies.

2. Evaluation of global health governance performance during the Covid 19 regarding health outcomes and the resulting health inequities.
3. Identify reasons underlying the current GHG response
4. Probing prospective directions for changes in GHG as a proactive action to face similar upcoming global health challenges.

Research question

1. How does global health governance affect health outcomes?
2. What were the positives and negatives in the GHG response to the current Covid 19?
3. What were the reasons behind these responses?
4. What changes/ modifications in GHG are needed to assure better responses, health outcomes to achieve higher level of health equities?

Methods

Approach

Deficits in the current GHG system resurfaced during the current Covid 19. These deficits intrigued researchers as well as policy makers to search for the reasons behind theses deficits and to propose changes for better outcomes in the future. Delphi surveys could be a useful method to collect different stakeholders' opinions and viewpoints on core areas of challenge and prospective modifications in GHG. Delphi method allows for reaching a consensus on the most important points while avoiding group dynamics where some participants dominate the discussions (180).

Participants

According to the recommendations for the Delphi surveys, the target number of participants in the study should is 18 and the minimum accepted number of participants is 10 (190). Purposeful sampling will be used to recruit experts to participate in the study. The rest of the participants would be selected through snowballing technique where the primary participants are solicited to recommend other stakeholders names to be part of the study. Selection of the participants will be passed on their expertise and experience in the field. Participants would be presenting four main groups of stakeholders: academics, government, NGOs, international organizations.

Recruitment

Participants will be invited to participate in the study. An introductory email will be send to each participant. The email will thoroughly explain the study in hand: its aim, objectives, mode (online), timeline, ethical considerations, and voting principles (the vote on each statement should be based on either the participants own opinion or the organization they represent). The Delphi questionnaires will be administered using e-mail. Regular reminder emails will be sent to assure survey completion.

Ethical considerations

The survey will be administered to the AUC IRB for approval. A consent form will be developed and sent to the participants along with the questionnaire in the first round of the survey.

Information sources

The initial list of statements for the Delphi survey are based on a systematic review of the literature produced on global governance and health equity in the context of Covid 19 as well as on literature review of models and theories on governance in general and global health governance in particular. This initial list can be expanded through open ended question according to panel recommendations following the first round. This expansion would serve the purpose of widening the understanding of the topic and covering under-looked areas.

Delphi consensus process

Previously identified core areas will be incorporated as statements in the Delphi survey. Participants are to vote on each statement. Likert scale will be used. The scale will be a typical five-level Likert item (Strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). The Delphi survey will have three rounds of voting. Statements that met >=70% consensus will be considered included. However, the statements that did not reach the consensus benchmark will still be considered and not eliminated to avoid participants' dropout if they feel their responses are not being acknowledged.

Round 1 will: collect demographic information on the participants, administering the Likert scale questions, and allow participants to provide additional comments and suggestions for consideration. Round 2: scores feedback will be available for the participants anonymously. Participants will have the chance to refine each idea, comment and suggest. Participants with answers falling outside of interquartile zone established in round 1 will be requested for justification of their answers. Round 3 will be similar to round 2 with the aim of reaching

an end point with consensus between the participants on the proposed statements. Finally, a consensus meeting will be held with at least 30% of the participants to ratify the results.

Data Analysis

1. Simple frequency analysis of participants' demographics and characteristics
2. Response, completion, and dropout rate analysis
3. Descriptive statistics (measures of central tendency and measures of variability)

Annex 7: Delphi survey, Invitation letter

Subject:

Invitation to Participate in a Delphi Forum

Topic:

Global Health Governance and its Impact on Health Equity: The Case of COVID-19

Dear Dr. _____

This is an invitation email for you to be part of an experts' panel in a Delphi survey. The aim of the panel is to reach consensus on the role of Global Health Governance (GHG) in achieving health equity, and to define priorities and formulate future policies.

The role of GHG in the current pandemic and the exacerbating health inequities are at the center of debates nowadays. Different scholars from various disciplines tackled the topic from diverse angles, concentrating on certain aspects. Some discussed the manifesting inequities and raised a red flag pointing to health inequities at both global and national levels, including inequities in Covid 19 vaccine distribution. While others deliberated on the underlying reasons for the GHG responses and the resulting inequities.

The results of a thorough scoping review of the literature on GHG, health equity and Covid 19, demonstrated that the research produced, following the start of the pandemic, concentrated on eight main areas: "Human rights and inequities"; "Solidarity, collaboration and partnership"; "GHG structure change"; "Political and economic power and finance"; "Approach to address inequity"; "Law and regulations"; and "Private investment and public-private partnerships (PPPs) in GHG".

The discussions on the reasons of *status quo* and what needs to be modified in GHG continue to take place and no consensus is reached. Reaching consensus on underlying reasons of the

current status, identifying priorities, and forecasting about the future are of high concern at the time being. Consensus can be attained using Delphi survey method.

This research uses the Delphi survey to reach consensus of a group of experts on: the role of GHG in achieving health equity, underlying causes of the GHG response to Covid 19, identifying priorities, and forecasting future changes in GHG to ameliorate health equity. This Delphi survey will be administered through an online questionnaire using SurveyMonkey software. The survey would be in three rounds. The first round will be a set of five open ended questions aiming at collecting your view-points on the topics based on your knowledge and expertise. Round two and three questions will be based on the answers to round one as well as on rigorous literature review. Round two and three are mainly composed of multiple-choice questions with space to provide your own remarks and comments. Scores of responses from the 2nd round will be calculated. Scores from the 2nd round along with questions that did not reach consensus will be resent to you in the third round to reevaluate and reach consensus. The end step would be an online consensus meeting with at least 30% of the participants to ratify the results.

The study is part of a PhD thesis conducted by Wafa Abu El Kheir-Mataria, A PhD candidate in the Global Public Health: Health Policy and Management Program in the American University in Cairo, under the supervision of Dr. Sungsoo Chun, Dr. Hassan El Fawal and Dr. Shahjahan Bhuiyan. The results will be disseminated in a peer reviewed journal.

Annex 8: Delphi survey

A. Demographics

1. Name: _____
2. Age: _____
3. Discipline/specialty: _____
4. Current position: _____
5. Years in current position: _____
6. Institution: _____
7. Total years of experience: _____

B. Survey statements

1. GHG Performance		
Global Health Governance (GHG) has 4 main functions: stewardship; facilitation of global solidarity; management of external threats; and production of global goods guidelines, polices, research and technologies. **Please rate GHG performance in the current Covid-19 pandemic focusing on Covid 19 vaccines.** **A score between one and seven is to be given, with one as the worst possible performance and 7 as the best possible performance.**		
GHG functions and activities concerning Covid-19 vaccine	**Score**	**Comments**
Generate a collective response to meet the need for Covid-19 vaccine		
Manage Covid-19 vaccine production		
Manage Covid-19 vaccine procurement		
Manage Covid-19 vaccine distribution		
Produce inclusive decisions and guidelines for Covid-19 vaccines		
Produce clear policies and guidelines for countries		
Produce feasible policies and guidelines for every nation		
Facilitate global solidarity through managing Covid-19 vaccine (production, procurement and distribution)		
GHG overall performance		

2. Covid-19 Vaccine Equity		
Health equity is a moral obligation and is an important aspect of any responsible governance. Equity in Covid-19 vaccine is the responsibility of GHG. **Please rate the following statements regarding Covid-19 vaccine equity as handled by the GHG using a score from 1 to 7 with 1 indicating total disagreement with the statement and 7 indicating the highest agreement.**		
	Score	**Comments**
Covid-19 vaccine production (manufacturing) ensured equity across nations in securing the vaccine to their populations		

There is an equal opportunity for every nation to procure the needed amount of Covid-19 vaccines to cover its population		
The Covid-19 vaccine is equitably distributed among nations		
Using digital and medical technology can enhance Covid-19 vaccine equity		
COVAX initiative enhances Covid-19 vaccine equity		
Actors bared in mind the collective benefit of their actions		
Actors showed solidarity actions in their decisions regarding the Covid-19 vaccine		

3. Factors affecting countries ability to acquire Covid-19 vaccines

The ability to acquire Covid-19 vaccines varies between countries.

Please rate the following factors influencing countries' ability to acquire Covid-19 vaccines using a score from 1 to 7 with 1 being the lowest score and 7 the highest score.

	Score	Comment
Having the knowledge and technology to develop or produce the vaccine		
Level of economic and political power a country holds		
The country's health system capacity to handle Covid-19 vaccine		
Bilateral deals to acquire Covid-19 vaccine		
The COVAX initiative		
Pharmaceutical companies' interest in financial gain		
Laws on intellectual property rights		
Country's representation and influence in GHG		

If you have any other suggested factors affecting countries ability to acquire Covid-19 vaccines, please add them here:

4. GHG structure and the achievement of Covid-19 equity

GHG current structure is a main factor contributing in Covid-19 vaccine equity.

Several scholars have indicated the need for change in GHG structure in order to enhance health equity.

Please rate the following statements regarding GHG structure and proposed changes using a score from 1 to seven. A score of 1 stands for the lowest level of agreement with the statement while a score of 7 stands for the highest level of agreement with the statement.

	Score	Comment
It is not clear which GHG actor holds the stewardship position (setting priorities, building consensus, setting rules, and evaluating members)		
The GHG structure is loose with no specified roles and accountability measures		
Authority is better to be centralized in GHG to ensure better authority		
Better representation of countries from the global south in GHG to ensure equity		
Develop a mechanism to monitor the influence of private actors and non-governmental financing organizations in policy making		
The World Health Organization should have more authority		
WHO should focus on its technical role of providing guidelines		
The role of the World Health Organization should change		
United Nations headquarter should hold the stewardship position in GHG		
Global NGOs should have authority in GHG		

If have any suggestion regarding changes in GHG to enhance health equity, please add them here:

5. GHG regulatory framework

Laws offers legal instruments to regulates GHG arena and advance global justice and enhance equity.

Please rate the following statements regarding laws and regulations of GHG. Use a score from 1 to 7 with 1 indicating total disagreement with the statement and 7 indicating the highest agreement.		
	Score	**Comment**
The legal instruments in GHG assure legal accountability of actors		
The legal instruments in GHG ensures health equity		
International Health Regulations (IHRs) need to be updated		
IHRs need better enforcement		
More laws and regulations are needed to regulate actors, their contributions and interaction		
If you any suggestion regarding laws and regulation in GHG, please add them here:		

6. Underlying values and priorities in managing Covid-19 vaccines		
GHG actors' response are based on underlying values and preset priorities. **Please rate the following statements regarding values and priorities underlying the way GHG actors are handling Covid-19 vaccines. A score of 1 stands for the lowest level of agreement with the statement while a score of 7 stands for the highest level of agreement with the statement.**		
	Score	**Comment**
Human rights and right to health are the main values considered by GHG actors concerning Covid-19 vaccine		
Market-oriented health norms are affecting GHG decisions and actions concerning Covid-19 vaccines		
Health as a common good. This concept is being considered in decisions concerning Covid-19 vaccine distribution.		
Vulnerability of countries is considered in Covid-19 vaccine distribution to limit the spread of the disease.		
If you think of any other values or priorities, please add them here:		

7. Decision making power in GHG		
Health policies and decisions at the global are influenced by the power gradient between actors. Please rate the following statements regarding power used in GHG using a score from 1 to 7 with 1 as the lowest score and 7 as the highest score.		
	Score	**Comments**
Who makes / influence decisions regarding Covid-19 vaccine		
WHO - World Health organization		
UNICEF - United Nations International Children's Emergency Fund		
GAVI - Global Alliance for Vaccines and Immunization		
CEPI - Coalition for Epidemic Preparedness Innovations		
Bill & Melinda Gates Foundation		
The World Bank		
Research agencies		
Vaccine manufacturers		
Governments		
Non-governmental Organizations		
What forms of power do they invoke?		
Political influence		
Economic power (market and trade relations, material capital)		
Technical expertise (Knowledge and technology)		
Cultural capital		
Whose interests are at stake?		
WHO - World Health organization		
UNICEF - United Nations International Children's Emergency Fund		
GAVI - Global Alliance for Vaccines and Immunization		
CEPI - Coalition for Epidemic Preparedness Innovations		
Bill & Melinda Gates Foundation		
The World Bank		
Research agencies		
Vaccine manufacturers		
Governments		
Non-governmental Organizations		
If you think of any other forms of power evoked by actors, please add these power forms here:		

8. Future prospects		
Please rate the importance of these characteristics for future changes in GHG. Use a score from 1 to 7 with 1 as the least important and 7 as the most important		
	Score	**Comment**
Clear stewardship		

Enhanced accountability		
Centralized authority		
More equitable actors' representation		
Better legal framework to ensure accountability, information and technology sharing.		

9. Actors centrality in the *Current* GHG structure in relation to vaccine				
Among these GHG most prominent actors, please rate their importance according to each of the following roles. Use a score from 1 to 7 with 1 as the least important and 7 as the most important[4]				
Actor	**Stewardship**	**Production of guidelines and policies**	**Promotion of solidarity and collaboration**	**Management of global health challenges**
WHO - World Health organization				
UNICEF - United Nations Children's Fund				
GAVI - Global Alliance for Vaccines and Immunization				
CEPI - Coalition for Epidemic Preparedness Innovations				
Bill & Melinda Gates Foundation				
The World Bank				
Research agencies				
Vaccine manufacturers				
Governments				
UNDP - United Nations Development Program				
TGF - The Global Fund to Fight AIDS, Tuberculosis and Malaria				
STP- Stop TB Partnership				
Population Council- New York				

[4] Actors included in this questions were selected based on the partners mentioned in the COVAX and GAVI website (colored in black) and on the results of a published study: Hoffman, S. J., & Cole, C. B. (2018). Defining the global health system and systematically mapping its network of actors. *Globalization and health*, *14*(1), 1-19.

Population Action International				
Malaria Foundation International				
Médecins Sans Frontières				
Global Health Council				
Centers for Disease Control and Prevention				
FHI 360 (formerly Family Health International)				
If you think of any other important GHG actor, please add it here and the rating of its functions.				

10. Actors centrality in the *future* GHG structure in relation to vaccine

Among these GHG most prominent actors, please rate their importance according to each of the following roles. Use a score from 1 to 7 with 1 as the least important and 7 as the most important[5]

Actor	Stewardship	Production of guidelines and policies	Promotion of solidarity and collaboration	Management of global health challenges
WHO - World Health organization				
UNICEF - United Nations Children's Fund				
GAVI - Global Alliance for Vaccines and Immunization				
CEPI - Coalition for Epidemic Preparedness Innovations				
Bill & Melinda Gates Foundation				
The World Bank				
Research agencies				
Vaccine manufacturers				
Governments				
UNDP - United Nations Development Program				
TGF - The Global Fund to Fight AIDS, Tuberculosis and Malaria				
STP- Stop TB Partnership				
Population Council- New York				

[55] Actors included in this questions were selected based on the partners mentioned in the COVAX and GAVI website (colored in black) and on the results of a published study: Hoffman, S. J., & Cole, C. B. (2018). Defining the global health system and systematically mapping its network of actors. *Globalization and health*, *14*(1), 1-19.

Population Action International				
Malaria Foundation International				
Médecins Sans Frontières				
Global Health Council				
Centers for Disease Control and Prevention				
FHI 360 (formerly Family Health International)				
If you think of any other important GHG actor, please add it here and the rating of its functions.				

Annex 9 Reprints of the peer-reviewed published studies

9.1 Global Health Governance and Health Equity in the Context of COVID-19: A Scoping Review

Global Health Governance and He

9.2 Covid-19 vaccine hesitancy among parents in Low- and Middle-Income Countries: a meta-analysis

Meta-analysis Final published.pdf

9.3 Global health governance performance during Covid-19, what needs to be changed? A Delphi survey study

Delphi survey published paper.pd