

Research Article

Health Policy Lessons from First Wave of Coronavirus (COVID-19) to Reduce Economic and Health Impacts from Anticipated Future Waves

Mende Mensa Sorato^{1*}, Majid Davari² and Abbas Kebriaeezadeh²

¹Department of Pharmacy, College of Medicine and Health Sciences, Arba Minch University, Ethiopia

²Department of Pharmacoeconomics and pharmaceutical Administration, Faculty of Pharmacy, Tehran University of Medical Sciences, Iran

Abstract

Background: Coronavirus (COVID-19) pandemic has caused extraordinary shocks across all sectors of society. The pandemic highlighted three important policy issues (i.e. healthcare spending, social determinants of health, and health equity). It is also projected that recurrent wintertime outbreaks of COVID-19 will likely occur after this initial wave in the next few years.

Methods: Descriptive review was conducted to provide information on the important lessons learned from the first wave of COVID-19 to improve the wellbeing of society in light of predicted future waves. We searched articles from PubMed/Medline, Scopus, Embase, and Google Scholar with systematic search inquiry.

Results: We included 96 articles in this descriptive review. Health is the ultimate goal of the healthcare sector and an important prerequisite for achieving other societal goals. The first wave of the COVID-19 pandemic showed that countries that have given less attention to Social Determinants of Health (SDH), health equity, and marginalized vulnerable populations faced the greatest burden of disease morbidity and mortality. Spending on healthcare or other developmental sectors should be based country's health production function status (i.e. understanding the marginal return of healthcare). Health and wellbeing are indivisible from other societal goals and should be addressed with due consideration of their interconnectedness. A comprehensive multi-disciplinary approach involving health in all policies, which integrates SDH and health equity into modeling with the principle of leaving no one behind, will have a critical impact on improving economic and health outcomes during future anticipated COVID-19 Waves.

Conclusion: In general, improving and adopting novel strategies, confronting the multiple facets of the public health mitigation measures, facilitation, and stimulation of interdisciplinary public health interventions are important to reduce the health and economic impacts of anticipated future COVID-19 waves. Developing countries could benefit from increasing public expenditure on health with due consideration of SDH. For developed countries like the United States, it is imperative to shift health policy focus from illness-oriented healthcare towards policies that affect the social determinants of health.

Keywords: Coronavirus; Anticipated future waves; Health in all policies; Disease based policy; Social determinants of health; Health equity

Introduction

A novel Coronavirus disease (COVID-19) is a global pandemic which claimed millions of deaths so far. It is caused by the zoonotic SARS-CoV2 virus [1,2]. The structure of the receptor-binding gene region is very similar to that of the SARS Coronavirus, and the virus uses Angiotensin-Converting Enzyme 2 (ACE2), for cell entry. There are two different types of SARS-CoV-2, type L (accounting for 70% of the strains) and type S (accounting for 30%) of strains identified in Wuhan, China [3-5].

Infection is transmitted through large droplets generated during

coughing and sneezing by symptomatic patients but can also occurs from asymptomatic people and before the onset of symptoms. These infected droplets can spread one to two meters. The virus can remain viable on surfaces for days in favorable atmospheric conditions but is destroyed in less than a minute by common disinfectants. Infection is acquired either by inhalation of these droplets or touching surfaces contaminated by them or then touching the nose, mouth, and eyes. Other means of transmission include feco-oral and post-natal transmission. The incubation period varies from 2 to 14 days (median 5 days) [4,5].

Elderly and patients with neutrophilia, diabetes, chronic lung disease, cardiovascular disease, and coagulation dysfunction are at higher risk for severe COVID-19 associated disease [6,7]. In adults, COVID-19 can be grouped into five categories based on the severity of illness: asymptomatic infection; mild illness; moderate illness; severe illness, and critical illness [8,9]. A confirmatory test should be done by using specific molecular tests (e.g. polymerase chain reaction or antigen tests) on respiratory samples (throat/nasopharyngeal swab/sputum/endotracheal aspirate) [5,10,11]. Unique properties of this virus make prevention difficult namely, non-specific features of the disease, the infectivity even before the onset of symptoms in the incubation period, transmission from asymptomatic people, long incubation period, tropism for mucosal surfaces, prolonged duration

Citation: Sorato MM, Davari M, Kebriaeezadeh A. Health Policy Lessons from First Wave of Coronavirus (COVID-19) to Reduce Economic and Health Impacts from Anticipated Future Waves. *J Med Public Health*. 2022;3(3):1035.

Copyright: © 2022 Mende Mensa Sorato

Publisher Name: Medtext Publications LLC

Manuscript compiled: Aug 03rd, 2022

***Corresponding author:** Mende Mensa Sorato, Department of Pharmacy, College of Medicine and Health Sciences, Arba Minch University, Ethiopia, Tel: +251-937-170-976; E-mail: mendemensa@gmail.com

of the illness, and transmission even after clinical recovery [5].

The COVID-19 pandemic has caused a significant challenge for healthcare systems globally including the risk of healthcare workers [12], high healthcare costs; shortages of protective equipment including N95 face masks, low numbers of ICU beds and ventilators; increased investment in disease prevention infrastructure including vaccine trials, accelerated digital transformation of healthcare delivery; disruptions of provision of HIV, tuberculosis and malaria services in developing countries [13]. Prevalence and mortality rates are currently lower in Africa than among several Western countries and the USA, maybe due to early initiation of lockdown and border closures, the younger age of the population, lack of robust reporting systems, and as yet unidentified genetic and other factors [14]. Social inequalities in health significantly to COVID-19 morbidity and mortality [15]. The fact that both the global north with better expertise and the global south with serious economic and capacity limitations face a similar burden with the highest infection and fatality rates recorded in the global economic powers suggests the need for transforming the healthcare system [16].

A modeling study showed that in high-burden settings, deaths due to HIV, tuberculosis, and malaria over 5 years could increase by up to 10%, 20%, and 36%, respectively. The greatest impact on HIV, TB, and malaria was estimated to be from interruption to antiretroviral therapy, reductions in timely diagnosis and treatment of new cases, and interruption of planned net campaigns [17,18]. It is anticipated that recurrent wintertime outbreaks of COVID-19 will likely occur after this initial wave in the next few years [19,20]. The pandemic thought as the role of SDH, equity, and protection of vulnerable groups for population health outcomes [19,21]. Therefore, this descriptive review was conducted to provide information on the important lessons learned from the first wave of COVID-19 to improve the wellbeing of society in light of predicted future waves.

Materials and Methods

Search strategy and information source

We searched articles written in the English language since August 28, 2020, from PubMed/Medline, Scopus, Embase, and Google Scholar with the following search query: Coronavirus AND Health in all policies AND Social determinants of health AND Health equity AND Strategies for controlling epidemics. We found 252 articles with the above search strategy. Forty-five articles are removed because of duplication. We screened 207 articles by reading title and abstracts and excluded 111 articles due to lack of relevant information on COVID-19, social determinants health, and health equity. Finally, 96 articles were included in this descriptive review (Figure 1).

Study types

Systematic reviews, clinical trials, cohort studies, observational and cross-sectional studies related to 1st wave of COVID-19 pandemic

Inclusion and exclusion criteria

- Systematic reviews, clinical trials, cohort studies, observational and cross-sectional studies related to 1st wave of COVID-19 pandemic (health and economic impacts) are included.
- Articles not related to 1st wave of COVID-19 pandemic (health and economic impacts) are excluded.

Study selection

From a total of 252 articles identified by literature search, 207

potentially relevant articles were selected, after applying the inclusion-exclusion criteria listed above 96 articles were found to be relevant (Figure 1). Two investigators (MM, MD) independently reviewed each study's abstract against prespecified inclusion and exclusion criteria. A second investigator checked these data for accuracy. In case of disagreement on the quality of the article two authors discussed in front of a table in presence of the third author (AK).

Data synthesis and analysis

We qualitatively described and summarized the evidence on the impact of COVID-19 on society wellbeing, health policy directions, and the importance of reforming health systems to address SDH and equity. We stratified results by types of SDH: education, income and development, environment, energy, and food security. We also addressed the impact of social disparities on COVID-19 related morbidity and mortality. Finally, the importance of restructuring the health systems to address SDH to reduce economic and health impacts of projected recurrent wintertime outbreaks of COVID-19, which is likely to occur after this initial wave were discussed.

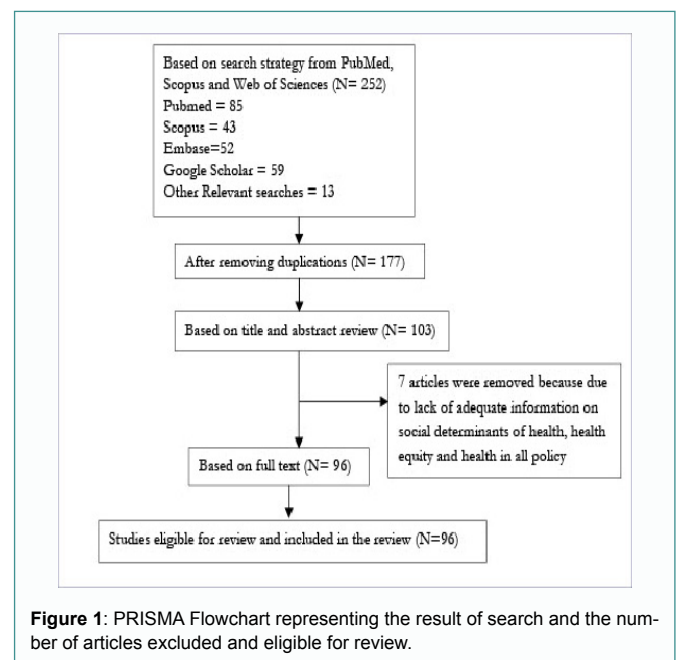


Figure 1: PRISMA Flowchart representing the result of search and the number of articles excluded and eligible for review.

Results

Impact of the first wave of COVID-19

The COVID-19 pandemic had a significant impact on economic activities and the health of individuals and society [22]. A study conducted to evaluate the economic impact of the first wave of the COVID-19 pandemic on acute care hospitals in Japan showed that during 1st wave of COVID-19, total claimed hospital charges decreased by 5% to 14% compared to the same months before COVID-19 in 2019 [23]. The cross-sectional survey was conducted to investigate maternal mental health under COVID-19 pandemic lockdown in Thailand showed that COVID-19 lockdown had a perceived impact on household's ability to pay for rent, to make mortgage payments, the household's ability to pay for other essentials (utilities and medication), household crowding after lockdown, and not going outside or doing outdoor activities [24].

Concerning health impact, a longitudinal household survey conducted in the United Kingdom (UK) to evaluate the first wave of

the COVID-19 pandemic and its impact on socioeconomic inequality in psychological distress showed that the prevalence of psychological distress increased from 18.5% to 27.7% due to COVID-19. The main contributors of increased distress and socioeconomic inequality were chronic health conditions, housing conditions, and neighborhood characteristics [25]. A similar cross-sectional electronic survey conducted to quantify psychological distress experienced by the emergency, anesthetic, and intensive care doctors during the acceleration phase of COVID-19 in the UK and Ireland showed that about 50% of frontline doctors reported psychological distress [26]. A quasi-natural experiment done in England and Scotland showed that imposition of containment policies had a higher impact on mental health than the evolution of the pandemic itself [27].

Health and disease-based health policy

Globally today’s healthcare system is spending more on medical care. However, the health outcomes are not changing in the same rate as the rise of millions of dollars being spent on medical care [28-33]. For example, the U.K. spending per capita (\$3,235) in 2013 as 37.1% of the U.S. level (\$8,713), or when expressed as a ratio of GDP (8.5% as opposed to 16.4%) has better coverage, easy access to primary care and higher life expectancy. Due to this, most health economists suggested the need for US healthcare system in the following five areas: health “safety net” for all residents, irrespective of age, health, or employment status; mechanisms that promote cost containment; mechanisms that promote quality and high-value care; choice for patients and providers and ease in administration [34]. This is supported by evidence from the economics of health production, after the threshold limit of input the production function curve becomes flat (i.e. law of diminishing marginal return) [35].

Health cannot be viewed as a single business because it is the ultimate goal of the healthcare sector and, an important prerequisite for achieving other societal goals. Many of the SDH have social, environmental, and economic origins that extend beyond the direct influence of the health sector and health policies [36,37]. For example, health-related Sustainable Development Goal (SDG 3) which is good health and wellbeing is interconnected with, SDG 1 (poverty), SDG 2 (zero hunger), SDG 4 (quality education), SDG 5 (gender equality), SDG 6 (clean water and sanitation), SDG 13 (climate action), SDG 14 (life underwater), SDG 15 (life on land) and SDG 17 (partnerships for goals) [38]. The Health in All Policies (HiAP) approach is necessary to protect and promote health and health equity, particularly where there are competing interests [39-45]. Implementation of HiAP involves the following interrelated strategies: developing and structuring cross-sector relationships; incorporating health into decision-making; enhancing workforce capacity; coordinating funding and investments; integrating research, evaluation, and data systems; synchronizing communications; and implementing accountability [46,47].

SDH are the primary factors influencing population health and health equity. Health policy must shift its focus from illness-oriented healthcare towards sectors whose policies affect SDH [48]. Investing in SDH contributed to 50% of under-5 mortality reduction (between 1990 and 2010). About 50% of inequalities in major NCDs are accounted for by social inequalities in risk factors. Integration of social and medical services reduced child mortality by 10-fold. Addressing social determinants requires coordination and alignment among different sectors and different stakeholders at international, national, and local levels. An interrelationship between health and other societal goals, as reflected in various sectors

including; economy and employment, security and justice, education and elderly life, agriculture and food, infrastructure planning and transport, environment and sustainability, housing and community services, and land and culture [49,50]. Therefore, understanding the interconnectedness of SDH and health, and addressing SDH are critical for achieving SDGs (Figure 2) [51].

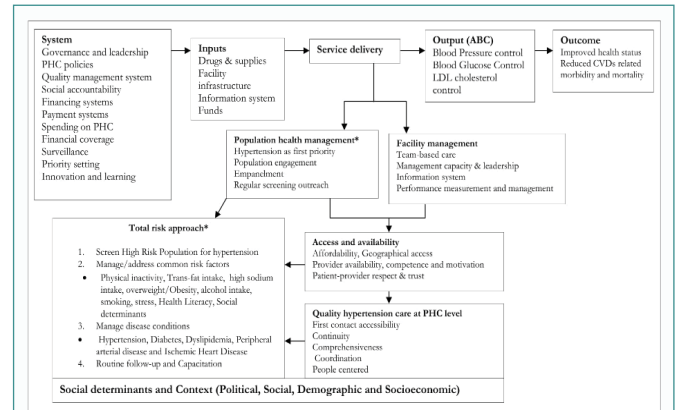


Figure 2: Social determinants of Health conceptual Framework. Adopted from: Solar O, Irwin A. A conceptual framework for action on the social determinants of health. Geneva, World Health Organization, 2010.

Despite this, health outcomes have only responded marginally, raising concerns on the significance of health expenditure in improving health outcomes. Different studies from an African region showed that both government and private spending on health care significantly improve infant, under-five, maternal mortality, life expectancy in the region [52,53]. A study from 40 Sub-Saharan African countries showed that health expenditure has a significant but inelastic effect on health outcomes in SSA, reducing mortality rates and improving life expectancy at birth [54]. Increasing health expenditure (public expenditure through health insurance schemes) is important to improve health outcomes in the African region [54]. This should be done with due consideration on contributors of population health outcomes socioeconomic, individual behavior, medical and clinical and living environment accounts 40%, 30%, 20% and 10% respectively [55]. Currently, the average sub-Saharan African country spends approximately 5.5% of GDP on healthcare, of which perhaps half has been spent on hospital care [28] (Figure 3).

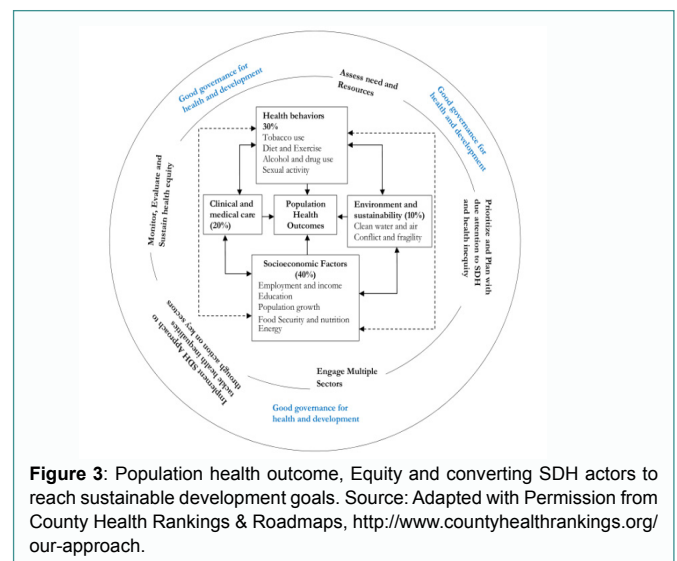


Figure 3: Population health outcome, Equity and converting SDH actors to reach sustainable development goals. Source: Adapted with Permission from County Health Rankings & Roadmaps, <http://www.countyhealthrankings.org/our-approach>.

COVID-19 have heightened fears of increasing levels of domestic violence, which include physical, emotional, and sexual abuse [13]. Conflict and violence are higher in the African region. For example, 37% of global physical and/or sexual intimate partner violence among women is in the WHO African Region this figure could be further aggravated by the COVID-19 pandemic [81,82].

A study that evaluated conflict during COVID-19 in Africa showed that the probability of experiencing riots, violence against civilians, food-related conflicts, and food looting has increased since lockdowns. An increase in the local food price index is associated with an increased percentage of violence against civilians and anti-poverty measures reduced it [83]. Addressing food insecurity, Future planning for providing incentives for employers to preserve employee jobs can help to maintain family income and can reduce family, domestic and intimate partner violence [84].

The concept of equity is simple to understand, but difficult to put into practice. This is because equitable distribution depends on economic and political factors. Choice of distribution methods also needs critical evaluation of available options including; accepting market outcomes; accepting market outcomes but ensuring equity of opportunity; reducing inequalities with progressive taxation and transfers; accepting market outcomes but providing a safety net for those who cannot earn, and creating complete equality [34]. In response to this practical difficulty, currently, 36 sets of core indicators suitable existing indicators, which were often, SDG indicators, were selected for government action on the social determinants of health to improve health equity. The indicators address five domains including national governance, participation, health sector reorientation, global governance, and monitoring and accountability [85]. To promote health equity, it is important to have a national monitoring system for SHD. SDH is a concern of every healthcare system, including countries with extensive national health systems [86]. This is because of the interconnectedness of population health outcomes with SDG 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 16. Therefore, monitoring health systems for SDH is important to assess inequalities in coverage and health outcomes (Figure 5) [87].

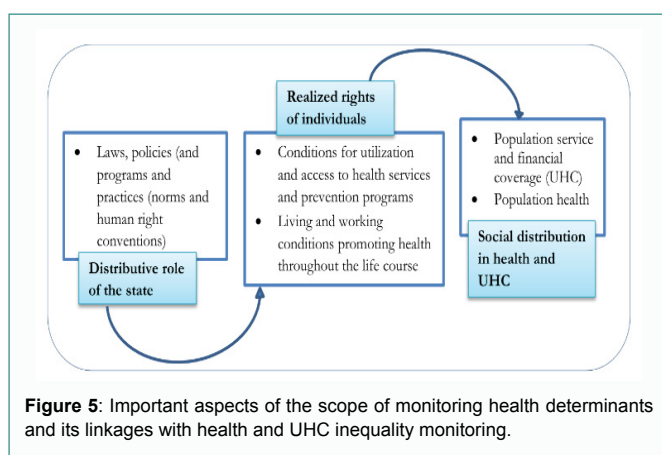


Figure 5: Important aspects of the scope of monitoring health determinants and its linkages with health and UHC inequality monitoring.

Discussion

We reviewed available documents related to Coronavirus (COVID-19), health in all policies, social determinants of health, and health equity to provide important information on lessons learned from the first wave of COVID-19 in light of the anticipated future waves. Health cannot be viewed as a single business because it is the

ultimate goal of the healthcare sector and, an important prerequisite for achieving many other societal goals. Many of the determinants of health have social, environmental, and economic origins that extend beyond the direct influence of the health sector and health policies [36-38]. This indicates the need for multi-sectoral collaboration to address these interrelated sectors. Therefore, public health policymakers should give due attention to the interconnectedness of health outcomes with other sectors to improve health outcomes [39-45,51].

The novel COVID-19 pandemic revealed that the highest burden of the disease is recorded in the global north which had better expertise and well-equipped health facilities [20]. Health policy must shift its focus from illness-oriented healthcare toward sectors whose policies affect the social environments of daily living [48]. In explaining the dilemma faced by the modern physician and criticizing disease-based health policy, Irving Zola wrote the following beautiful story. "You know, sometimes it feels like this: There I am standing by the shore of a swiftly flowing river and I hear the cry of a drowning man. So I jump into the river, put my arms around him, pull him to shore, and apply artificial respiration. Just when he begins to breathe, there is another cry for help. So I jump in the river, reach him, pull him to shore, apply artificial respiration, and just as he begins to breathe, there is another cry for help. So back in the river again, reaching, pulling, applying for breathing support, and then another yell. Again and again, without end, goes the sequence. You know, I am so busy jumping in, pulling them to shore and applying respiration that I have no time to see who in the hell is upstream pushing them all in" [88]. This is supported by higher dollars spent on curative, medical care and less on the social drivers of health, which has contributed to the lowest health outcome of the US population [65].

Health is interrelated with other societal goals and should be addressed by multi-sectoral collaboration [39,89-92]. Linking SDH and health equity requires delivering quality health services for all; ensuring compulsory insurance to decrease out-of-pocket expenses; establishing innovative and effective policy frameworks that allow coordination across sectors, enabling and sustaining equitable health system development, and engaging civil society in healthcare decision-making [93,94], ensuring universal to access health, providing specifically designed health services and social protection measures for socially disadvantaged groups, improving the capacity of the health sector to identify and contribute to addressing SDH [28,51,87,95-99]. Specific action areas to address SDH include: adopting better governance for health and development; promoting participation in policy-making and implementation; reorienting the health sector towards reducing health inequities; strengthening global governance and collaboration; and monitoring progress and increasing accountability [100].

Reforming health systems to address SDH and health equity concerns involves the following components: strengthening capacity of essential public health services; clarifying first-point-of contact strategy for possible cases; improving accessibility health facilities; ensuring availability basic emergency service supplies; training the health workforce; protecting the physical and mental health of frontline health workers; ensuring access to essential medicines and health technologies; mobilizing financial support and easing logistical and operational barriers; assessing and mitigating potential financial and physical barriers to accessing care for vulnerable groups of people; optimizing social protection to mitigate the impact of public

health measures on household financial security; ensuring clarity in roles, relationships and coordination mechanisms in health system governance; expanding capacity for communication and health information dissemination and ensuring that no one is left behind from accessing essential healthcare [68-70].

Lessons from public health revealed that Mitigating SDH such as improved housing, reduced overcrowding, and improved nutrition reduces the effect of infectious diseases, such as tuberculosis, even before the advent of effective medications [101,102]. A multi-disciplinary approach involving HiAP, which integrates the SDH and health equity into modeling with the principle to leave no one behind (i.e. whole population including disadvantaged), will have an impact on population wellbeing [103]. Implementation of HiAP involves the following interrelated strategies: developing and structuring cross-sector relationships; incorporating health into decision-making; enhancing workforce capacity; coordinating funding and investments; integrating research, evaluation, and data systems; synchronizing communications; and implementing accountability structures [46,47].

The COVID-19 pandemic significantly affected the global economy and all SDH [104-109]. Education is one SDH that has a critical role in improving health outcomes and reducing health inequities. Spending on education, with expanded coverage, is believed to improve life expectancy on average by 1.19 years [97,110]. Quality education promotes employment, health, poverty reduction, increases innovation and social welfare [104-109]. The COVID-19 pandemic has affected all levels of the education system, from pre-school to tertiary education. Both teaching learning and assessment methods are affected, which in turn could affect the quality of learners [13]. Countries with better access to digital technology shifted teaching, learning to online classes. However, those with poor access to digital technology used watchful waiting and home take assignments. This will contribute to future increased inequality in career status and job opportunity and income [72]. Therefore, it is important to address issues related to digital technology utilization (knowledge, availability, accessibility of technology, internet access, and power supply) to reduce the inequality that could be caused by the anticipated future COVID-19 wave [72].

The emergence of COVID-19 affected food distribution and retailing [13]. Food can be a source or vector of disease for society (i.e. malnutrition and food-borne disease due to poor food handling). Food security is a key precondition for a healthy life, better cognitive abilities especially in early childhood (i.e. the first 1000 days of its life). A study conducted in the United States showed that food-insecure children are at least twice as likely to report being in fair or poor health and at least 1.4 times more likely to have asthma, compared to food-secure children [111]. The recent meta-analysis of child malnutrition in sub-Saharan Africa showed the highest prevalence of child malnutrition (stunting, wasting, and underweight) in Africa [112]. Malnutrition causes a substantial risk to both the physical and mental health of children, including lowering immune response and lowering school performance [113,114]. In addition, more than 200 known diseases can be transmitted by food, which can reduce labor productivity, increase health care costs, impose substantial stress on the health care system and reduce economic output [98,115-118].

Similarly, healthy eating and regular physical activity play a substantial role in preventing heart disease, cancer, and stroke among adults aged >18 years [119,120]. It is estimated that roughly 1 in seven and one in 12 cardiovascular deaths could be attributed to

not eating enough fruits and vegetables respectively [121]. A recent meta-analysis showed that the risk of heart disease, strokes, and premature death can be decreased by 10.8% for each 200 gm increase in consumption of fruit or vegetables up to an intake of 800 gm [122]. This could have a direct impact on COVID-19 disease severity and associated mortality because the elderly, patients with neutrophilia, diabetes, chronic lung disease, cardiovascular disease, and coagulation dysfunction are at higher risk for severe COVID-19 associated disease [Acute Respiratory Distress Syndrome (ARDS) and progression from ARDS to death] [6,7].

Addressing COVID-19 pandemic added nutrition needs public health activities and improving the efficiency of resource utilization. Optimal nutrition and dietary intake require individual, community involvement, national commitment, and global cooperation [73,74]. The triple epidemics of obesity, malnutrition, and food safety are increasing in many low and middle-income countries, requiring action at the local, regional, and national levels to address determinants of food insecurity to tackle the anticipated health and economic impact. The national Nutrition Assistance Program (NAP) substantially reduces the prevalence of under nutrition and thus is critical to reducing negative health outcomes. The issue of globalization of unhealthy lifestyles (smoking, high-fat diets, salt consumption, and alcohol use) is a political and trade issue. Therefore, enacting strong policies with priority to the health of citizens, re-evaluating trade policies, and agreements, and collaborating and controlling industries working in this area is critical. It is also equally important to ensure transparency of strategies and actions to control the big hands of business owners in the area, as it is a source of billion dollars investment [123].

COVID-19 pandemic has also affected the energy sector [75]. Improving the availability of energy alleviates poverty and has a positive impact on health. There is severe socioeconomic inequality to access household energy in developing countries. It is anticipated that household air pollution would lead to over 1.5 million premature deaths per year by 2030. This is greater than similar projections for infectious diseases, including malaria, tuberculosis, or HIV/AIDS [124]. The recent review revealed that most financial and short-term interventions were made by governments in Africa [75]. To address social disparity concerning energy utilization, it is important to; monitor trends and outcomes for populations and specific groups using disaggregated data that uncover the impact of equity on energy policies, and advocate energy sustainability and health; encourage needs-based assessment for disadvantaged populations and specific groups to better design actions that increase access to energy, develop guidelines, standards, and recommendations on energy-related risk factors, and disseminate technical guidance in the spirit of shared responsibility for both health and energy actors.

COVID-19 has inadvertently affected the financial markets and the global economy due to lockdowns which led to a disruption in the supply chain (reduced production of goods), while quarantine and self-isolation policies decreased consumption, demand, and utilization of products and services [13]. The Health crisis caused by COVID-19 changed the history of global poverty [77]. Estimates of the impact of COVID-19 on global poverty showed that COVID-19 poses a real challenge to the UN SDG of ending poverty by 2030 because global poverty could increase for the first time since 1990 [78]. Africa bears a disproportionate burden of poverty [almost half-world poor (earning below 1.90 USD/day) living in the region] and disease, which could be

exacerbated by the COVID-19 pandemic [79,125-127].

The study that analyzed the COVID-19 situation in Africa showed that many African countries had taken bold quarantine and lockdown measures to control the spread of COVID-19 although this has come at a cost such as the collapse of health systems and a painful economic crisis or recession [80]. Africa has the highest unemployment rate in the world and the unemployment is further aggravated by a poor education system and weak technological integration, which is yielding an unskilled graduate [126,128,129]. The working poor constitute around 25% of the employed labor force in all developing countries. In addition, workers in the informal economy are less likely to be covered by social insurance schemes and thus lack access to health care. Fair employment relations and decent work, including employment and working conditions and reasonable wages contributing to income security, are key social determinants of workers' health [130-132]. Addressing poverty alone can improve life expectancy by (2.4-5.4 years) [133-135]. Addressing poverty in pandemic situations requires national commitment to; provide public funds to improve the capacity of health systems; provide financial support to individuals to help them cope with financial and economic crises associated with the pandemic; provide incentives for employers to preserve employment; provide liquidity and credit support to protect local markets from liquidity crash; ensure access to effective communication systems to enhance social interaction between community, families, and friends [79,80].

COVID-19 caused difficulties in tackling climate change [16]. Out of the 133 diseases or disease groups listed in the global health observatory, 101 (76%) had significant links with the environment. A study conducted on preventing disease by healthy environment by WHO in 2012 showed that 12.6 million (23%) deaths globally and 26% of deaths among children under five were due to modifiable environmental factors [136-138]. Children, the elderly, and people with heart disease, lung disease, diabetes, minority, and low-income communities are particularly vulnerable to adverse health outcomes from exposure to air pollution [136]. This has direct implications for the anticipated future wave of COVID-19 since most of these populations are at greater risk for disease severity and mortality. This could be due to differential levels of ACE2 in the cardiac and pulmonary tissues of younger versus older adults; aging-associated immune deterioration; increased number of commodities in the aging population, SDH, and potential unexplained factors that could be illustrated in the future [139]. Effectively addressing environmental root causes like (e.g., energy, hygiene, housing, and transport) will have the greatest impact on improving health. For example, energy policies that facilitate or scale-up household access to clean fuels for cooking, heating, and lighting in LMICs will help avert the 3.5 million deaths per year [140-142].

Air pollution can be addressed by a comprehensive mix of policies and measures including fiscal policies to reduce different forms of pollution cost-effectively and accelerating efforts towards a pollution-free planet; taxes on polluting activities and substances to discourage the use of harmful pollutants while raising public revenues; providing subsidies can encourage the use of alternatives to pollutants by reducing their prices [143]. Actions required to reduce inequities in health should include assessment of the current health system for inclusion of SDH [85], developing strategies for improving equity in health care with the principle of leaving no one behind [71], and monitoring of health system for SDH and equity) [87].

Inequities are driven by inequities in money, resource, and power. Therefore, decisions made outside the health sector such as political, economic, and resource distribution decisions should consider health as an outcome across the social distribution as opposed to a focus exclusively on increasing productivity. Implementation of health in all policies approach can help to address some of these components [87].

Conclusion

The first wave of the COVID-19 pandemic showed that countries that have given less attention to SDH, health equity, and marginalized vulnerable populations faced the greatest burden of disease morbidity and mortality. In general, improving and adopting novel strategies, confronting the multiple facets of the public health mitigation measures, facilitation, and stimulation of interdisciplinary public health interventions are important to reduce the health and economic impacts of anticipated future COVID-19 waves. Developing countries could benefit from increasing public expenditure on health with due consideration of SDH. For developed countries like the United States, it is imperative to shift health policy focus from illness-oriented healthcare towards policies that affect the social determinants of health.

References

1. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *J Autoimmun.* 2020;109:102433.
2. Yuki K, Fujiogi M, Koutsogiannaki S. COVID-19 pathophysiology: A review. *Clin Immunol.* 2020;215:108427.
3. McIntosh K, Hirsch M, Bloom A. Coronavirus disease 2019 (COVID-19): epidemiology, virology, and prevention. Waltham (MA): UpToDate; 2022.
4. Cheng J, Wang X, Nie T, Yin L, Wang S, Zhao Y, et al. A novel electrochemical sensing platform for detection of dopamine based on gold nanobipyramid/multi-walled carbon nanotube hybrids. *Anal Bioanal Chem.* 2020;412(11):2433-41.
5. Singhal T. A Review of Coronavirus Disease-2019 (COVID-19). *Indian J Pediatr.* 2020;87(4):281-6.
6. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. *JAMA Int Med.* 2020;180(7):934-43.
7. CDC COVID-19 Response Team. Preliminary Estimates of the Prevalence of Selected Underlying Health Conditions Among Patients with Coronavirus Disease 2019 - United States, February 12-March 28, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69(13):382-6.
8. Alhazzani W, Møller MH, Arabi YM, Loeb M, Gong MN, Fan E, et al. Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19). *Intensive Care Med.* 2020;46(5):854-87.
9. Phua J, Weng L, Ling L, Egi M, Lim CM, Divatia JV, et al. Intensive care management of Coronavirus disease 2019 (COVID-19): challenges and recommendations. *Lancet Respir Med.* 2020;8(5):506-17.
10. Jin YH, Cai L, Cheng ZS, Cheng H, Deng T, Fan YP, et al. A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version). *Mil Med Res.* 2020;7(1):4.
11. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. First case of 2019 novel coronavirus in the United States. *N Engl J Med.* 2020;382(10):929-36.
12. Tanne JH, Hayasaki E, Zastrow M, Pulla P, Smith P, Rada AG. Covid-19: how doctors and healthcare systems are tackling coronavirus worldwide. *BMJ.* 2020;368:m1090.
13. Nicola M, Alsaifi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, et al. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *Int J Surg.* 2020;78:185-93.
14. Ogunleye OO, Basu D, Mueller D, Sneddon J, Seaton RA, Yinka-Ogunleye AF, et al. Response to the novel corona virus (COVID-19) pandemic across Africa: successes,

- challenges and implications for the future. *Front Pharmacol.* 2020;11:1205.
15. Yancy CW. COVID-19 and African Americans. *JAMA.* 2020;323(19):1891-2.
 16. Oldekop JA, Horner R, Hulme D, Adhikari R, Agarwal B, Alford M, et al. COVID-19 and the case for global development. *World Dev.* 2020;134:105044.
 17. Jewell BL, Mudimu E, Stover J, Brink Dt, Phillips AN, Smith JA, et al. Potential effects of disruption to HIV programmes in sub-Saharan Africa caused by COVID-19: results from multiple mathematical models. *Lancet HIV.* 2020;7(9):E629-40.
 18. Hogan AB, Jewell BL, Sherrard-Smith E, Vesga JF, Watson OJ, Whittaker C, et al. Potential impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income and middle-income countries: a modelling study. *Lancet Global Health.* 2020;8(9):e1132-41.
 19. Zhao Z, Li X, Liu F, Zhu G, Ma C, Wang L. Prediction of the COVID-19 spread in African countries and implications for prevention and control: A case study in South Africa, Egypt, Algeria, Nigeria, Senegal and Kenya. *Sci Total Environ.* 2020;729:138959.
 20. Abrams EM, Szefer SJ. COVID-19 and the impact of social determinants of health. *Lancet Respir Med.* 2020;8(7):659-61.
 21. Kanu IA. COVID-19 and the economy: an African perspective. *J Afr Stud Sustain Dev.* 2020;3(2).
 22. Panneer S, Kantamaneni K, Akkayasamy VS, Susairaj AX, Panda PK, Acharya SS, et al. The Great Lockdown in the Wake of COVID-19 and Its Implications: Lessons for Low and Middle-Income Countries. *Int J Environ Res Public Health.* 2022;19(1):610.
 23. Shin JH, Takada D, Morishita T, Lin H, Bun S, Teraoka E, et al. Economic impact of the first wave of the COVID-19 pandemic on acute care hospitals in Japan. *PLoS One.* 2020;15(12):e0244852.
 24. Sirikul W, Ongpraserat K, Piankusol C, Siviroj P. Maternal Mental Health under COVID-19 Pandemic in Thailand. *Int J Environ Res Public Health.* 2021;19(1):347.
 25. Davillas A, Jones AM. The first wave of the COVID-19 pandemic and its impact on socioeconomic inequality in psychological distress in the UK. *Health Econ.* 2021;30(7):1668-83.
 26. Roberts T, Daniels J, Hulme W, Hirst R, Horner D, Lyttle MD, et al. Psychological distress during the acceleration phase of the COVID-19 pandemic: a survey of doctors practising in emergency medicine, anaesthesia and intensive care medicine in the UK and Ireland. *Emerg Med J.* 2021;38(6):450-9.
 27. Serrano-Alarcón M, Kentikelenis A, McKee M, Stuckler D. Impact of COVID-19 lockdowns on mental health: Evidence from a quasi-natural experiment in England and Scotland. *Health Econ.* 2022;31(2):284-96.
 28. Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB. Disease control priorities in developing countries: General primary care. Washington (DC): International Bank for Reconstruction and Development and the World Bank; 2006.
 29. WHO. A heavy burden: the productivity cost of illness in Africa. 2019.
 30. Priorities CoBP. The number of uninsured Americans is at an all-time high. 2014.
 31. Centers for Medicare & Medicaid Services (CMS). National health expenditures fact sheet. 2020.
 32. Hood CM, Gennuso KP, Swain GR, Catlin BB. County health rankings: Relationships between determinant factors and health outcomes. *Am J Prev Med.* 2016;50(2):129-35.
 33. Ampadu HH, Hoekman J, de Bruin ML, Pal SN, Olsson S, Sartori D, et al. Adverse Drug Reaction Reporting in Africa and a Comparison of Individual Case Safety Report Characteristics Between Africa and the Rest of the World: Analyses of Spontaneous Reports in VigiBase*. *Drug Saf.* 2016;39(4):335-45.
 34. Folland S, Goodman AC, Stano M. *The Economics of Health and Health Care*: Pearson New International Edition. United Kingdom: Routledge; 2016.
 35. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *The Health Consequences of Smoking-50 Years of Progress. A Report of the Surgeon General.* Atlanta (GA): Centers for Disease Control and Prevention (US); 2014.
 36. WHO. World Health Organization, Regional Office for South-East Asia. Meeting Report: Reaching those who are left behind. For: Regional Consultation on Health, the SDGs and the role of Universal Health Coverage: next steps in South-East Asia Region. New Delhi. 2016.
 37. WHO. World Health Statistics 2016: Monitoring health for SDGs, sustainable development goals. 2016.
 38. Khetrpal S, Bhatia R. Impact of COVID-19 pandemic on health system & sustainable development goal 3. *Indian J Med Res.* 2020;151(5):395-9.
 39. WHO. Health in all policies: Helsinki statement. Framework for country action. 2014.
 40. Shankardass K, Muntaner C, Kokkinen L, Shahidi FV, Freiler A, Oneka G, et al. The implementation of Health in All Policies initiatives: a systems framework for government action. *Health Res Policy Syst.* 2018;16(1):26.
 41. Buss PM, Fonseca LE, Galvão LAC, Fortune K, Cook C. Health in all policies in the partnership for sustainable development. *Rev Panam Salud Pública.* 2016;40(3):186-91.
 42. De Leeuw E, Peters D. Nine questions to guide development and implementation of Health in All Policies. *Health Promot Int.* 2015;30(4):987-97.
 43. Howard R, Gunther S. Health in All Policies: An EU literature review 2006-2011 and interview with key stakeholders. *Equity Action.* 2012.
 44. McQueen D, Wismar M, Lin V, Jones CM, Davies M. Intersectoral governance for health in all policies. *Eurohealth.* 2012;18(4):3-7.
 45. WHO. Demonstrating a health in all policies analytic framework for learning from experiences: based on literature reviews from Africa, South-East Asia and the Western Pacific. 2013.
 46. Begashaw B. African Focus: Africa and the Sustainable Development Goals: A long way to go. 2019.
 47. United Nations. *Transforming our World: The 2030 Agenda for Sustainable Development.*
 48. Guglielmin M, Muntaner C, O'Campo P, Shankardass K. A scoping review of the implementation of health in all policies at the local level. *Health Policy.* 2018;122(3):284-92.
 49. WHO. Closing the gap: policy into practice on social determinants of health: discussion paper. 2011.
 50. de Andrade LOM, Pellegrini Filho A, Solar O, Rigoli F, de Salazar LM, Serrate PCF, et al. Social determinants of health, universal health coverage, and sustainable development: case studies from Latin American countries. *Lancet.* 2015;385(9975):1343-51.
 51. WHO. Rio political declaration on social determinants of health. World Conference on Social Determinants of Health; 2011.
 52. Akinci F, Hamidi S, Suvankulov F, Akhmedjonov A. Examining the impact of health care expenditures on health outcomes in the middle East and N. Africa. *J Health Care Finance.* 2014;41(1).
 53. Gallet CA, Doucouliagos H. The impact of healthcare spending on health outcomes: A meta-regression analysis. *Soc Sci Med.* 2017;179:9-17.
 54. Arthur E, Oaikhenan HE. The effects of health expenditure on health outcomes in Sub-Saharan Africa (SSA). *Afr Dev Rev.* 2017;29(3):524-36.
 55. Alper J, Martinez RM, National Academies of Sciences, Engineering, and Medicine. *Investing in Interventions That Address Non-Medical, Health-Related Social Needs: Proceedings of a Workshop.* Washington (DC): National Academies Press; 2019.
 56. WHO Regional office for Africa. Improving health through inter-sectorial actions: lessons from health financing in Rwanda. 2013(WA 540):1-16.
 57. Njui HW. Enhancing learner transformation through holistic quality education by integrating emotional intelligence in curriculum in learning institutions in Kenya. *Eur J Edu Stud.* 2018;4(9).
 58. WHO (Regional office for Africa). Microfinance as a vehicle for promoting health and intersectoral action on health: a case from Ghana. 2013.
 59. WHO (Regional office for Africa) . Integrating social determinants of health in all

- public policies: The case of health development in Botswana. 2013;WA 525.
60. WHO. Improved school-based deworming coverage through intersectoral coordination: the Kenya experience. 2013.
 61. Brocklehurst C, Malik M, Sebunya K, Salama P. Engineering in the time of cholera: overcoming institutional and political challenges to rebuild Zimbabwe's water and sanitation infrastructure in the aftermath of the 2008 cholera epidemic. *J Water Sanitation Hygiene Dev.* 2013;3(2):222-9.
 62. Alberti PM, Lantz PM, Wilkins CH. Equitable Pandemic Preparedness and Rapid Response: Lessons from COVID-19 for Pandemic Health Equity. *J Health Polit Policy Law.* 2020;45(6):921-35.
 63. Shadmi E, Chen Y, Dourado I, Faran-Perach I, Furler J, Hangoma P, et al. Health equity and COVID-19: global perspectives. *Int J Equity Health.* 2020;19(1):104.
 64. Tai DBG, Shah A, Doubeni CA, Sia IG, Wieland ML. The Disproportionate Impact of COVID-19 on Racial and Ethnic Minorities in the United States. *Clin Infect Dis.* 2020;72(4):703-6.
 65. Rollston R, Galea S. COVID-19 and the Social Determinants of Health. *Am J Health Promot.* 2020;34(6):687-9.
 66. Vardavas CI, Nikitara K. COVID-19 and smoking: A systematic review of the evidence. *Tob Induc Dis.* 2020;18:20.
 67. Millett GA, Jones AT, Benkeser D, Baral S, Mercer L, Beyrer C, et al. Assessing differential impacts of COVID-19 on black communities. *Ann Epidemiol.* 2020;47:37-44.
 68. WHO. Strengthening the health system response to COVID-19 in the WHO transmission scenarios: action points: action points for the WHO European Region (1 April 2020) . World Health Organization Regional Office for Europe; 2020.
 69. Chattu VK, Adisesh A, Yaya S. Canada's role in strengthening global health security during the COVID-19 pandemic. *Global Health Res Policy.* 2020;5(1):1-3.
 70. Nepomnyashchiy L, Dahn B, Saykpah R, Raghavan M. COVID-19: Africa needs unprecedented attention to strengthen community health systems. *Lancet.* 2020;396(10245):150-2.
 71. WHO. Innov8 approach for reviewing national health programmes to leave no one behind: technical handbook: World Health Organization; 2016.
 72. Ahmed H, Allaf M, Elghazaly H. COVID-19 and medical education. *Lancet Infect Dis.* 2020;20(7):777-8.
 73. Bogoch II, Watts A, Thomas-Bachli A, Huber C, Kraemer MU, Khan K. Pneumonia of unknown aetiology in Wuhan, China: potential for international spread via commercial air travel. *J Travel Med.* 2020;27(2):taaa008.
 74. Naja F, Hamadeh R. Nutrition amid the COVID-19 pandemic: a multi-level framework for action. *European Journal of Clinical Nutrition.* 2020;74(8):1117-21.
 75. Akrofi MM, Antwi SH. COVID-19 energy sector responses in Africa: A review of preliminary government interventions. *Energy Res Soc Sci.* 2020;68:101681.
 76. Burlinson A, Giulietti M, Law C, Liu HH. Fuel poverty and financial distress. *Energy Econ.* 2021;102:105464.
 77. Ozili PK, Arun T. Spillover of COVID-19: impact on the Global Economy. *SSRN Electronic J.* 2020.
 78. Sumner A, Hoy C, Ortiz-Juarez E. Estimates of the Impact of COVID-19 on Global Poverty. *UNU-WIDER.* 2020:800-9.
 79. Ataguba JE. COVID-19 pandemic, a war to be won: understanding its economic implications for Africa. *Appl Health Econ Health Policy.* 2020;18(3):325-8.
 80. Ozili PK. COVID-19 in Africa: socioeconomic impact, policy response and opportunities. *Policy Response Opportunities.* 2020.
 81. WHO. Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence. 2013.
 82. Tharp AT, DeGue S, Valle LA, Brookmeyer KA, Massetti GM, Matjasko JL. A systematic qualitative review of risk and protective factors for sexual violence perpetration. *Trauma Violence Abuse.* 2013;14(2):133-67.
 83. Gutierrez-Romero R. Conflict in Africa during COVID-19: Social Distancing, Food Vulnerability and Welfare Response. *Food Vulnerability and Welfare Response* (may 28, 2020). 2020.
 84. Piquero AR, Riddell JR, Bishopp SA, Narvey C, Reid JA, Piquero NL. Staying Home, Staying Safe? A Short-Term Analysis of COVID-19 on Dallas Domestic Violence. *Am J Crim Justice.* 2020;45(4):601-35.
 85. Working Group for Monitoring Action on the Social Determinants of Health. Towards a global monitoring system for implementing the Rio Political Declaration on Social Determinants of Health: developing a core set of indicators for government action on the social determinants of health to improve health equity. *Int J Equity Health.* 2018;17(1):136.
 86. WHO. Commission on Social Determinants of Health CSDH: Closing the gap in a generation: health equity through action on the social determinants of health. 2008.
 87. Carey G, Crammond B. Systems change for the social determinants of health. *BMC Public Health.* 2015;15:662.
 88. Association EN. Stand strong for life: Fall prevention program. 2006:1-42.
 89. Williams C, Galicki C. Health in All Policies in South Australia: lessons from 10 years of practice. Progressing the Sustainable Development Goals through Health in All Policies: Case studies from around the world. 2017:25.
 90. Srivastava A, Sharma RK, Suresh A. Impact of Covid-19 on Sustainable Development Goals. *Int J Adv Sci Technol.* 2020;29(9s):2020.
 91. WHO. Key learning on Health in All Policies implementation from around the world: information brochure. World Health Organization; 2018.
 92. Kanie N, Biermann F. The United Nations and the Governance of Sustainable Development Goals. *Governing through goals: Sustainable Development Goals as governance innovation.* 2017:213-40.
 93. Gilson L, Doherty J, Loewenson R, Francis V. Knowledge network on health systems. Final report Geneva: World Health Organization. 2007.
 94. WHO. Delivering quality health services: a global imperative for universal health coverage: World Health Organization; 2018.
 95. WHO. Designing health financing systems to reduce catastrophic health expenditure. World Health Organization; 2005.
 96. Brinda EM, Kowal P, Attermann J, Enemark U. Health service use, out-of-pocket payments and catastrophic health expenditure among older people in India: The WHO Study on global AGEing and adult health (SAGE). *J Epidemiol Community Health.* 2015;69(5):489-94.
 97. Cockerham W, Hamby CBW, Oates GR. The social determinants of chronic disease. *American Journal of Preventive Medicine.* 2017;52(1S1):S5-12.
 98. Akinyelure OP, Sakhuja S, Colvin CL, Clark D, Jaeger BC, Hardy ST, et al. Cardiovascular Health and Transition From Controlled Blood Pressure to Apparent Treatment Resistant Hypertension: The Jackson Heart Study and the REGARDS Study. *Hypertension.* 2020;76(6):1953-61.
 99. Bradley EH, Canavan M, Rogan E, Talbert-Slagle K, Ndumele C, Taylor L, et al. Variation in health outcomes: The role of spending on social services, public health, and health care, 2000-09. *Health Aff (Millwood).* 2016;35(5):760-8.
 100. Pega F, Valentine NB, Rasanathan K, Hosseinpoor AR, Torgersen TP, Ramanathan V, et al. The need to monitor actions on the social determinants of health. *Bull World Health Organ.* 2017;95(11):784-7.
 101. Ahmed F, Ahmed N, Pissarides C, Stiglitz J. Why inequality could spread COVID-19. *Lancet Public Health.* 2020;5(5):e240.
 102. Butler-Jones D, Wong T. Infectious disease and social determinants. *Can Commun Dis Rep.* 2016;42(Suppl 1):18-20.
 103. Rangel JC, Ranade S, Sutcliffe P, Mykhalovskiy E, Gastaldo D, Eakin J. COVID-19 policy measures-Advocating for the inclusion of the social determinants of health in modelling and decision making. *J Eval Clin Pract.* 2020;26(4):1078-80.
 104. Abadzi H. Instructional Time Loss in Developing Countries: Concepts, Measurement, and Implications. *World Bank Research Observer.* 2009;24(2):267-90.

105. Helen A, Llabiri S. Selective Teacher Attention in Lower-Income Countries: A Phenomenon Linked to Dropout and Illiteracy? *Prospects*. 2011;41(4):491-506.
106. Harold A, Orazem PF, Paterno EM. School Quality, School Cost, and the Public/Private School Choices of Low-Income Households in Pakistan. *J Hum Resour*. 2001;36(2):304-26.
107. Andrabi T, Das J, Khwaja AI. A Dime a Day: The Possibilities and Limits of Private Schooling in Pakistan. *Comp Educ Rev*. 2008;52(3):329-55.
108. World Bank. Learning to realize education promise. World develop report; 2018.
109. Ethiopia Federal Ministry of Education. Education Sector Development Programme V(ESDP V) 2008-2012 E.C. 2015/16 - 2019/20 GC: Programme action plan. UNESCO: Education Plans and Policies; 2015.
110. WHO. Education: shared interests in well-being and development. 2011.
111. Gundersen C, Ziliak JP. Food insecurity and health outcomes. *Health Aff*. 2015;34(11):1830-9.
112. Akombi BJ, Agho KE, Merom D, Renzaho AM, Hall JJ. Child malnutrition in sub-Saharan Africa: A meta-analysis of demographic and health surveys (2006-2016). *PLoS One*. 2017;12(5):e0177338.
113. Dunn CG, Kenney E, Fleischhacker SE, Bleich SN. Feeding low-income children during the Covid-19 pandemic. *N Engl J Med*. 2020;382(18):e40.
114. Centers for Disease control and Prevention (CDC). School Health Guidelines to Promote Healthy Eating and Physical Activity. *Morbidity and Mortality Weekly Report*. 2011;60(5):1-71.
115. McGuire S. WHO, World Food Programme, and International Fund for Agricultural Development. 2012. The State of Food Insecurity in the World 2012. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. Rome, FAO. *Adv Nutr*. 2013;14(1):126-7.
116. FAO, IFAD, WFP. The State of Food Insecurity in the World 2012: Economic Growth is Necessary but not Sufficient to Accelerate Reduction of Hunger and Malnutrition. Food and Agriculture Organization of the United Nations, Rome, Italy; 2015.
117. Blas E, Kurup AS. Equity, social determinants and public health programmes. World Health Organization; 2010.
118. Kendig H, Loh V, Loughlin K, Byles J, Nazroo JY. Pathways to Well-Being in Later Life: Socioeconomic and Health Determinants Across the Life Course of Australian Baby Boomers. *J Popul Ageing*. 2016;9:49-67.
119. Hu CS, Han YL, Ge JB, Wu QH, Liu YN, Ma CS. A novel management program for hypertension. *Cardiovasc Diagn Ther*. 2015;5(4):316-22.
120. Grundy SM, Pasternak R, Greenland P, Smith S, Fuster V. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations A Statement for Healthcare Professionals From the American Heart Association and the American College of Cardiology. *Circulation*. 1999;100(13):1481-92.
121. Kontis V, Cobb LK, Mathers CD, Frieden TR, Ezzati M, Danaei G. Three Public health interventions could save 94 million lives in 25 years. *Circulation*. 2019;140(9):715-25.
122. Aune D, Giovannucci E, Boffetta P, Fadnes LT, Keum N, Norat T, et al. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality- a systematic review and dose-response meta-analysis of prospective studies. *Int J Epidemiol*. 2017;46(3):1029-56.
123. Schram A, Labonté R, Sanders D. Urbanization and International Trade and Investment Policies as Determinants of Noncommunicable Diseases in Sub-Saharan Africa. *Prog Cardiovasc Dis*. 2013;56(3):281-301.
124. WHO. Energy: shared interests in sustainable development and energy services. 2013.
125. Moyo D. *Dead Aid: Why Aid Is Not Working and How There Is Another Way for Africa*. London: Penguin Books; 2010.
126. Yoon S, Stefan K, Milasi S, Home R, International Labour Office. *World Employment and Social Outlook 2016: Trends for Youth: Youth Unemployment Challenge Worsening in Africa*: 2016.
127. World Bank. Econ Stats: Population ages 0-14 (% of total population) data catalog. World Bank Population Indicators. 2019.
128. Flack JM, Adekola B. Blood pressure and the new ACC/AHA hypertension guidelines. *Trends Cardiovasc Med*. 2020;30(3):160-4.
129. Zhang X, Perez-Stable EJ, Bourne PE, Peprah E, Duru OK, Breen N, et al. Big Data Science: Opportunities and Challenges to Address Minority Health and Health Disparities in the 21st Century. *Ethn Dis*. 2017;27(2):95-106.
130. Gareis SB. The united nations: Macmillan International Higher Education; 2012.
131. International Labour Office. *Global employment trends for youth 2012*. Geneva: ILO Publications; 2012.
132. International Institute for Labour Studies (IILS). *World of work report 2012: Better jobs for a better economy*. International Labour Organisation; 2012.
133. Folland S, Goodman A, Stano M. *The Economics of Health and Healthcare*. USA: Pearson; 2013.
134. Goldman LR, Benjamin GC, Hernández SR, Kindig DA, Kumanyika SK, Nevarez CR, et al. *Advancing the Health of Communities and Populations: A Vital Direction for Health and Health Care*. NAM Perspectives. NAM Perspectives. 2016.
135. Fox AM. The HIV-poverty thesis re-examined: Poverty, wealth or inequality as a social determinant of HIV infection in sub-Saharan Africa? *J Biosoc Sci*. 2012;44(4):459-80.
136. Prüss-Ustün A, Wolf J, Corvalán C, Bos R, Neira M. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. World Health Organization; 2016.
137. Gordon S, Mortimer K, Grigg J, Balmes J. In control of ambient and household air pollution how low should we go? *Lancet Respir Med*. 2017;5(12):912-20.
138. Landrigan PJ, Fuller R, Acosta NJR, Adeyi O, Arnold R, Basu NN, et al. The Lancet Commission on pollution and health. *Lancet*. 2018;391(10119):462-512.
139. Koff WC, Williams MA. Covid-19 and immunity in aging populations-a new research agenda. *N Engl J Med*. 2020;383(9):804-5.
140. Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, de Souza Dias B, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation-Lancet Commission on planetary health. *Lancet*. 2015;386(10007):1973-2028.
141. GBD 2016 Risk factors Collaborators. Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1345-422.
142. WHO. *Burning opportunity: clean household energy for health, sustainable development, and wellbeing of women and children*. 2016.
143. United Nations Environment Programme. *Reducing pollution and health impacts through fiscal policies - A selection of good practices*. 2019.