

Vaccine Landscape and Hesitancy: An Eerie Challenge for the COVID-19 Immunization Program in Ethiopia

Sileshi Lulseged*

Department of Pediatric and Child Health, Faculty of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

***Corresponding Author:** Sileshi Lulseged, Department of Pediatric and Child Health, Faculty of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia.

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Abstract

Vaccination is a simple, safe, and effective way of protecting susceptible persons by decreasing vaccine-preventable infections. Intervention strategies and programs to promote vaccinations need to consider country and local circumstances as knowledge, attitude, and practices related to vaccination vary by geography, social groups, and across time. Ethiopia has recorded substantial coverage in childhood immunization, however, there is still short of achieving set targets, equity, and quality of services in the country. Much remains to be done in terms of the country's preparedness to be able to systematically and effectively introducing newly developed or improved vaccines. Vaccine hesitancy, a challenge to immunization programs for long, is more pronounced with the COVID-19 vaccine. This will inevitably have major implications for the prevention and control of the epidemic in Ethiopia, a country with a huge population of over 115 million and has limited resources and logistics capacity. The country has instituted COVID-19 mitigations measures and, to date, recorded some 349,231 confirmed cases, and 5,765 deaths from the epidemic. Starting in March 2021, the country has provided at least one dose of COVID-19 vaccine (AstraZeneca, Sinopharm, or J and J/Janssen) to 2.01million (1.8%) and full dose to 819,308 (0.7%) of the population. The pace is apparently slow to achieve the set target of 20% by end of 2021. COVID-19 Vaccine hesitancy, seen in 10% - 70% among population groups, could be a major contributor to the slow progress, and the associated factors include, but are not limited to, myths, misconceptions, fake news, conspiracy theories, older age (≥ 40 years), young age (youth), fears/concerns among healthcare workers, unemployment, and confidence in the healthcare system. As the determinants of vaccine hesitancy vary from one setting to the other, a "one-jacket" approach to mitigate or remove the problem is unlikely to work. Tailored strategies and effective communication, transparency in program development, restoring trust in the health system, and application of a "think - feel - do" client-centered approach are suggested to mitigate COVID-19 vaccine hesitancy and improve uptake. Well-designed epidemiological studies are required to identify the magnitude, determinant, barriers/ enablers of COVID-19 vaccine hesitancy in Ethiopia.

Keywords: COVID-19; Vaccine Hesitancy; Immunization; Awareness; Attitude; Ethiopia

Abbreviations

AIDS: Acquired immunodeficiency syndrome; COVID: Coronavirus disease; EPI: Expanded Program of Immunization; EDHS: Ethiopian Demographist Health Survey; HIV: Human immunodeficiency virus; IDP: Internally displaced people; LMICs: low- and middle-income countries; MDGs: millennium development goals; SAGE: Strategic Advisory Group of Experts on Immunization; VPD: Vaccine-preventable diseases; mWHO: World Health Organization

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Introduction

Vaccines are among the most effective health innovations with substantial benefits in reducing mortality and short and long-term morbidity [1]. Programs introducing and implementing vaccines need to achieve high uptake levels to effectively reduce the magnitude and impact of vaccine-preventable infectious diseases. Owing to the high impact they afford in effectively preventing infectious diseases of public health importance, particularly among the vulnerable population including children, vaccines are highly acclaimed interventions globally [2]. The benefits of vaccination program are, however, offset by vaccine hesitancy which has emerged as a complex and context-specific challenge to immunization programs, varying across time, place, and vaccine types [3].

The Strategic Advisory Group of Experts on Immunization (SAGE) defines vaccine hesitancy as “*Delay in acceptance or refusal of vaccination despite the availability of vaccination services*” [4]. It has been suggested that complacency, convenience, and confidence of clients, among others, constitute factors contributing to vaccine hesitancy [4,5]. Complacency denotes a low perception of disease risk resulting in an attitude that renders vaccination unnecessary, while confidence is associated with the attitude of clients towards the healthcare system and confidence in health care workers’ skills. On the other hand, convenience relates to clients’ access to vaccines and perceptions about the conduciveness of the environment in which the vaccinations are provided [5]. Available evidence indicates that vaccine hesitancy is a frequent occurrence around the world with the underlying associated causes varying by region and socio-economic factors [6].

Studies from different settings have corroborated that the various factors described above also contribute to COVID-19 vaccine hesitancy. For example, clients’ perception regarding the safety of the vaccine substantially reduces their intention to access and receive the vaccine [7]. Other factors negatively and significantly affecting clients’ attitudes related to the COVID-19 vaccine include lack of trust and fear of potential side effects of the vaccine in the long-haul [8], and socio-demographic determinants such as religiosity [9]. Such factors and the associated vaccine hesitancy could undermine the huge efforts made and the success achieved in getting approval for use of the COVID-19 vaccines developed through unprecedented international initiatives and unparalled pace in the history of vaccine development. Indeed, vaccine hesitancy could present a major hindrance in harvesting maximal benefits from the currently available COVID-19 vaccine and impact the approval and use of prospective vaccines [10].

Survey reports suggested that the factors underlying COVID-19 vaccine hesitancy vary and are dynamic. They can also be broad in spectrum ranging from the specific client or individual-level attributes to broad outlooks related to COVID-19 vaccine production and distribution, and institutional orientation, and politically inspired decisions [11]. Research on COVID-19 vaccine hesitancy could, out of necessity, be complex owing to the nature of the epidemic and the diversity and complexity of factors associated with vaccine hesitancy [12], which often constitute intertwined personal and socio-cultural determinants [13]. As indicated by others [11], defining the magnitude of the challenge and unravelling the determinants underlying COVID-19 vaccine hesitancy through penetrating epidemiological studies will have major impacts on the control of the epidemic in the short- and long-term.

Purpose

The promotion of vaccines needs sound evidence-base in terms of the occurrence and epidemiological variations in vaccine hesitancy across countries. The identification of factors specific to a given country or geographic setting is critically important to have an in-depth understanding of the determinants and consequences of vaccine hesitancy, thereby informing policies, strategies, and work planning. As reported by others [12], such country-specific information on vaccine hesitancy can be used as a springboard to work on and achieve clients’ trust in COVID-19 vaccine and vaccination programs. This may be augmented by filling the gaps in surveillance initiatives and measuring changes in awareness, attitude, and practice related to COVID-19 vaccines and programs, particularly in resource-constrained settings.

In sub-Saharan Africa (SSA), despite the slowly increasing access to and the benefits afforded by the COVID-19 vaccine, anecdotal evidence, and some published reports indicated the existence of reluctance to take the vaccine by potential beneficiaries [12]. This could limit the effectiveness of the regional and national response to the epidemic through immunization programs, including the implementation of the interim COVID-19 national program in Ethiopia [14]. Thus, this perspective aims at providing information and reflections on vaccination program and COVID-19 vaccine hesitancy in Ethiopia, which will inform health program managers and may serve as a basis for more rigorous epidemiological studies.

Methods

This is a narrative review describing and synthesizing the available literature on vaccination programs and COVID-19 vaccine hesitancy in Ethiopia providing a broad perspective and conclusions from the evidence. Pub-med, Embase, and Hinari databases were searched using vaccine and vaccine hesitancy-related search terms/keywords including immunization program, introduction of vaccine, vaccine hesitancy, and COVID-19 vaccine, each searched separately with the term Ethiopia added. In addition, relevant reports identified from other sources during the background review, like reports on the country context, were included. The search covered the period 2015 - 2021. A total of 45 reports were selected based on the relevance of the titles, and the abstracts as required. The narrative review is written using the content from these as references, and the perspective organized in sections apprising the country context, COVID epidemiology, national immunization program, COVID-19 vaccines, COVID-19 vaccine hesitancy (potential causes, policies and prospects), and conclusions.

County Context and COVID-19 Epidemiology

Ethiopia is a country with a total surface area of approximately 1.1 million square Kilometres The country is divided into 12 administrative regions and shares a border with six countries (Figure 1). The country has a total population of nearly 120 million, only 15% of which is living in urban areas [15]. Children under 14 years of age constitute 40%, adults 15 - 64 years 56%, and population aged 65 and older 4%. Nearly half of the population lives below the poverty line, but fast economic progress has been recorded in recent years.

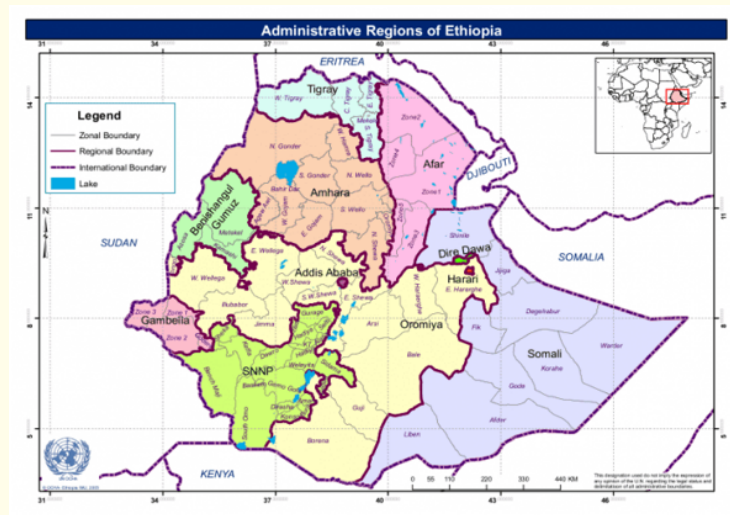


Figure 1: Map of Ethiopia (Source: reliefweb.int).

Ethiopia’s healthcare delivery system is not well developed, even by the standard of others in SSA. Currently, the country is a dual burden from communicable and non-communicable diseases, which are largely associated with poverty, low levels of education, and inadequate health services. The leading causes of morbidity and mortality include malaria, HIV/AIDS, tuberculosis, and maternal and neonatal illnesses, malnutrition, and inadequate access to clean water and poor environmental sanitation. Nonetheless, the country has done well, in terms of progress towards the millennium development goals (MDGs). There has been substantial progress in reducing maternal and childhood mortality, controlling the HIV/AIDS epidemic, and decreasing deaths associated with malaria and tuberculosis [16].

The COVID-19 epidemic was confirmed to have reached Ethiopia on 13 March 2020 [17]. Nearly three-quarters of the epidemic reported in Ethiopia is concentrated in and around Addis Ababa, the capital city with a population of about 5 million people [18]. In the initial months of the epidemic, the driving factors of the epidemic included information gaps concerning protection methods, illness behaviour and access to care, and regional and district variations in the myths around the disease, and false assurances [19]. A recent cross-sectional study on knowledge and practice towards the prevention of COVID-19 showed that the population knew about mitigation measures but had problems in putting these to practice [20].

Ethiopia country is currently having the third wave of the COVID-19 epidemic (Figure 2), which is partly due to the delta variant of the virus. By October 4, 2021, there were, in total, 26,390 active cases, 349,231 confirmed cases, and 5,765 deaths from the disease. Although over three-quarters of the current COVID-19 cases are concentrated in and around Addis Ababa, there are predictions that, over time, the risk of infection will be higher across most other parts of the country and the risk of death will be higher in the regions with low response preparedness, including access and uptake of vaccines [21].

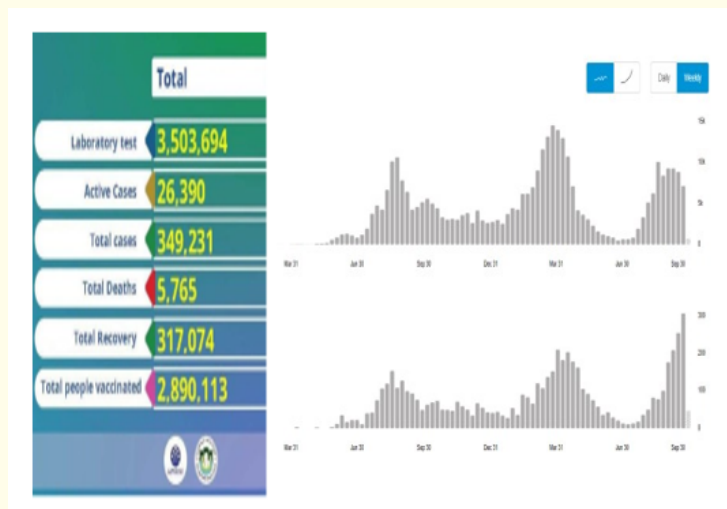


Figure 2: COVID-19 Situation in Ethiopia (EPHI & WHO as of October 4, 2021).
 Source: HO Health Emergency Dashboard. WHO (COVID-19) Homepage.

National immunization program

Ethiopia’s Expanded Program of Immunization (EPI) was introduced in 1980 and recorded major achievements over the subsequent years. However, the planned coverage targets (> 90%) were not achieved and there are still high disparities between regions in terms of coverage (Figure 3). While there are also challenges with the quality of immunization services and equity in accessing vaccines, the coun-

try has managed to introduce 10 priority vaccines and deliver them according to the schedule recommended by the World Health Organization (WHO). Currently, there is more on the list of vaccines for possible introduction in the short-term. The adoption of new vaccines is primarily decided through prioritization by the Ministry of Health (MOH), the type of vaccine, and disease burden. The country needs to guard the health system and vaccination program so that these are not overwhelmed by too ambitious plans for the introduction of new vaccines, technologies and [22]. Similarly, the potential challenges the country will inevitably be facing from vaccine hesitancy need to be systematically tackled to avert loss of efficiency and coverage related to the newly introduced vaccines, including vaccines against COVID-19.

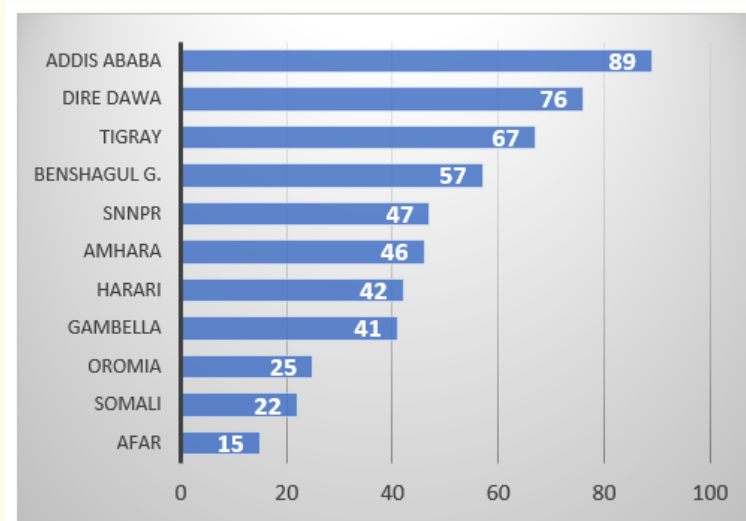


Figure 3: Vaccination coverage by Region: % of children ages 12-23 months. Source: Ethiopian Demographic Health Survey 2016.

COVID-19 vaccination

Ethiopia launched its COVID-19 vaccine program in March 2021 using the first shipment of the AstraZeneca vaccines produced by Serum Institute of India (SII) obtained through the COVAX initiative, adding a vaccine to its portfolio of testing and prevention and mitigation strategies [23]. The MOH developed and employed a prioritization criterion to effectively and efficiently use the few batches of COVID-19 vaccines that have reached the country. The delivery of the vaccines was started with high-risk population groups like the elderly and frontline healthcare workers and those with chronic illnesses. The country has set a COVID-19 target of 20% of its nearly 120 million population by December 31, 2021.

By end of September 2021, Ethiopia received a total of some 5.23 million doses of the vaccine (SII-AstraZeneca/COVISHIELD), AstraZeneca/AZD1222), and J and J/Janssen). Some 2.01million (1.8%) of the population received at least one dose and some 819,308 (0.7%) received the full dose of the COVID-19 vaccine [24] (Figure 4). During the last week’s report, Ethiopia averaged about 54,342 doses administered each day. With this pace, 413 days will be required to provide full doses covering an additional 10% of the country’s population [25]. While access and the logistical challenge are of concern COVID-19 vaccine hesitancy could have a substantial impact on Ethiopia’s apparently slow progress towards the set target of achieving 20% by end of the year.

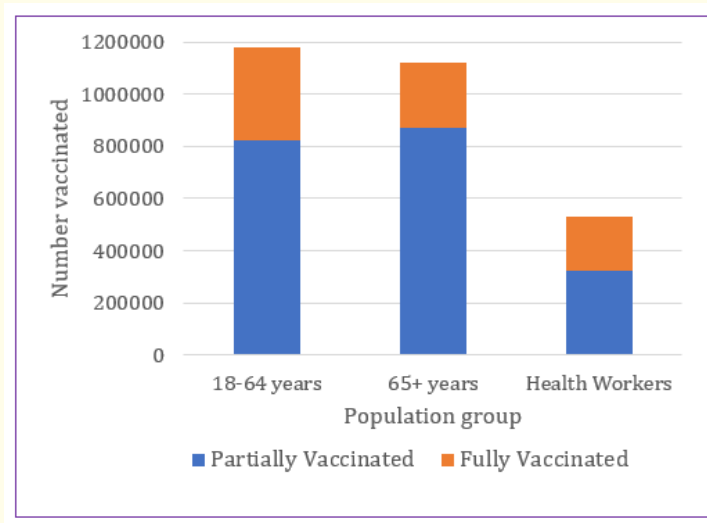


Figure 4: Number vaccine doses administered by population group as of September 29, 2021.
 Source: COVID 19 Pandemic and Preparedness and Response Daily Situation Report, MOH.

COVID-19 vaccine hesitancy

Potential causes

There is a general understanding among the experts that vaccine hesitancy is on the rise globally, but a precise quantification of the magnitude of vaccine-hesitant population has been a daunting challenge. COVID-19 vaccines that have gone through the evaluation and approval process have been millions of people worldwide and there are no serious concerns regarding their safety and effectiveness. As in many other settings, there are insufficient levels of willingness to receive the COVID-19 vaccine, and several factors are associated with vaccine hesitancy in Ethiopia [26].

In surveys that looked at acceptance and vaccine hesitancy among different population groups in the country, though there is a wide variation in the level of hesitancy ranging from 10%-70%, in most settings, less than one-half of the participants would accept COVID-19 vaccines if available [26-28]. This, at least partly, is the effect of disinformation that is spread largely through social media outlets [22]. Other factors that have been reported to have contributed to hesitancy included, misconceptions and conspiracy theories [29], and lack of awareness about the COVID-19 vaccine resulting in negative perceptions and practice [30-32]. The hesitancy associated with these factors also affects those with comorbidities, a high-risk group prioritized for receiving the COVID-19 vaccine [33].

Other surveys in Ethiopia also show that hesitancy to COVID-19 vaccine is associated with older age (≥ 40 years) and have no worries about getting COVID-19 [34], occupation (university instructors, bank employees, and primary and secondary school teachers) [28,35], listening to the mass media, Having received any vaccination during the epidemic, family members or friends having been diagnosed with COVID-19 [36], fears/concerns among healthcare workers (the odds being highest among nurses) about vaccine adverse reaction, and effectiveness and safety of the vaccine [37-40] unemployment, being in the youth age group, engagement with non-farm businesses, and region of residence [41], and experience of taking the first round of the vaccine and confidence with the care system [42]. Moreover, there are indications that a host of other factors contribute positively or negatively to COVID-19 vaccine hesitancy in Ethiopia [26,43].

Policies and Prospects

Since the launching of its COVID-19 response roadmap in March 2020, Ethiopia has worked intensively to implement epidemic mitigation measures coupled with efforts to enhance testing and patient care capacity nationwide, and its collaboration to increase the availability and access to vaccines. Currently, the national working group on epidemic emergency response is working to establish mechanisms to scale up its response to the pandemic systematically and effectively with due attention to vaccination initiatives. Financing and logistics are outstanding challenges and the government is enlisting support through grants to overcome these challenges.

There is a general consensus on applying a “think - feel - do” client-centered approach to the COVID-19 vaccine hesitancy, which could improve efforts at accelerating vaccinations to reach herd immunity [44]. Much focus has unfortunately been given to the “do” stage giving attention only to making the vaccines available through the health care delivery system complemented through mass vaccination campaigns. These arrangements are effective for population groups that are willing to receive the vaccine. For those who are not prepared to receive the vaccine, the due focus should be given to and the intervention allows that clients go through the “think” and “feel” stages. These initial stages are essential, indeed are pre-requisites, for the clients to effectively get to and go through the “do” stage. In the “think” stage, clients need to be asked and encouraged to look into the reasons why they are hesitant to take the vaccines, and this must be followed by the “feel” stage which allows them to explore the emotional aspects associated with their decision.

Vaccine advocacy through optimal and tailored communication strategies and effective vaccination campaigns improve vaccine acceptance, thereby reducing vaccine hesitancy [45]. In the Ethiopian context the “think - feel - do” client-based approach may be facilitated through education at mass gatherings at places of worship and communal traditional ceremonies. The approach can also be employed in education and public awareness activities done through the social and mainstream media as well as through messages sent via phone calls, and print materials. Religious leaders, community elders, and health extension workers have been effective in disseminating such information widely across urban and rural populations of the country. The healthcare delivery system can work with these groups, who in coordination with care providers the informal health sector to avert and overcome the challenges posed by COVID-19 vaccine hesitancy.

The road ahead to scaling up COVID-19 vaccination in Ethiopia will not be easy. There are daunting challenges emanating from the deep-rooted poverty compounded by conflict and population displacement, periodic flooding emergencies, and poor coordination capacity. The country is in the process of strengthening its immunization program and scaling up its response to the COVID-19 epidemic, particularly its initiatives on increasing access to and delivery of the vaccines to immunize the population, starting with most at-risk vulnerable groups. COVID-19 vaccine logistics and deployment in Ethiopia will require a truly monumental effort, but, if done effectively, will have immense economic and health benefits.

Conclusion

Vaccine hesitancy adds to the serious threat posed by the overall socio-economic challenges to the immunization program in Ethiopia. As reflected in this perspective, crafting policies and strategies to facilitate the availability, access, and delivery of COVID-19 vaccines are affected by various political, social-cultural, and economic factors. As a result, and out of necessity, there is no single or simple strategy that can address this multifaceted challenge. Updated policies, tailored strategies and public health messages, effective communication campaigns, transparency in decision making and program development, and restoring trust in health authorities and the health system are instrumental to increasing vaccine uptake and achieving herd immunity in the country. Ethiopia’s Ministry of Health, in collaboration with other stakeholders, needs to address clients’ concerns and fears in order to tackle vaccine hesitancy. Enhancing healthcare workers’ knowledge and attitude towards the COVID-19 vaccine and vaccination program is a critical gap that needs to be addressed as a matter of urgency.

There is insufficient research on what vaccine hesitancy is in the context of SSA in general and Ethiopia in particular, including studies on determinants of vaccine hesitancy. Indeed, the available data on vaccine hesitancy is often incomplete and not informative enough

to guide policy- and decision-making. Well-designed epidemiological studies need to be conducted to identify additional barriers to and enablers of vaccine acceptance among various population groups in general and health care providers in particular.

Conflict of Interest

The author states that there is no financial or conflict of interest to declare.

Bibliography

1. Centers for Disease Control and Prevention. Ten great public health achievements - United States, 1900-1999". *Morbidity and Mortality Weekly Report* 48 (1999): 241-243.
2. Fine P, *et al.* "Herd immunity: a rough guide". *Clinical Infectious Diseases* 52 (2011): 911-916.
3. World Health Organization. Vaccine hesitancy: A growing challenge for immunization WHO (2015).
4. MacDonald ME. "Vaccine hesitancy: Definition, scope and determinants". *Vaccine* (2015).
5. SAGE Working Group on Vaccine Hesitancy. SAGE Working Group on Vaccine Hesitancy". *Report of the SAGE Working Group on Vaccine Hesitancy* (2014).
6. Wagner AL, *et al.* "Comparisons of Vaccine Hesitancy across Five Low- and Middle-Income Countries". *Vaccine* 7.4 (2019): 155.
7. Karlsson LC, *et al.* "Fearing the disease or the vaccine: The case of COVID-19". *Personality and Individual Differences* (2021): 172.
8. Paul E, *et al.* "Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communication". *The Lancet Regional Health* 1 (2021): 100016.
9. Olagoke AA, *et al.* "Intention to Vaccinate Against the Novel 2019 Coronavirus Disease: The Role of Health Locus of Control and Religiosity". *Journal of Religion and Health* 60.1 (2021): 65-80.
10. Harrison EA and Wu JW. "Vaccine confidence in the time of COVID-19". *European Journal of Epidemiology* 35 (2020): 325-330.
11. Lin C, *et al.* "Confidence and Receptivity for COVID-19 Vaccines: A Rapid Systematic Review". *Vaccines* 9.16 (2021).
12. Sallam M. "COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates". *Vaccines* 9.2 (2021): 160.
13. Browne M, *et al.* "Going against the Herd: Psychological and Cultural Factors Underlying the 'Vaccination Confidence Gap". *PLoS One* 10.9 (2015): e0132562.
14. Afolabi A and Ilesanmi O. "Dealing with vaccine hesitancy in Africa: the prospective COVID-19 vaccine context". *The Pan African Medical Journal* 38 (2021): 3.
15. United Nations Population Fund. World Population Dashboard- Ethiopia. UNFPA (2021).
16. United Nations Development Program. Ethiopia: Millennium Development Goals Report 2014 - Assessment of Ethiopia's Progress towards the MDGs. UNDP (2014).
17. World Health Organization-Africa. First Case of COVID-19 confirmed in Rwanda (2020): 1.
18. Alene KA, *et al.* "COVID-19 in Ethiopia: a geospatial analysis of vulnerability to infection, case severity and death". *BMJ Open* (2021): 1.

19. Kebede Y, *et al.* "Myths, beliefs, and perceptions about COVID-19 in Ethiopia: A need to address information gaps and enable combating efforts". *PLoS ONE* 15.11 (2020).
20. Bekele D, *et al.* "The knowledge and practice towards COVID-19 pandemic prevention among residents of Ethiopia. An online cross-sectional study". *PLoS One* 16.1 (2021).
21. Alene KA, *et al.* "COVID-19 in Ethiopia: a geospatial analysis of vulnerability to infection, case severity and death". *BMJ Open* (2021): 11.
22. Ethiopian Academy of Sciences. Establishing a New-Vaccine Introduction Unit in Ethiopia: A Scoping Review (2020).
23. World Health Organization. Ethiopia introduces COVID-19 vaccine in a national launching ceremony WHO (2021).
24. Public Health Emergency Operations Center. COVID 19 Pandemic and Preparedness and Response Daily Situation Report (2021).
25. World in Data. Ethiopia: Coronavirus Pandemic Country Profile (2021).
26. Wake AD. "The willingness to receive covid-19 vaccine and its associated factors: "vaccination refusal could prolong the war of this pandemic": a systematic review". *Risk Management and Healthcare Policy* 14 (2021): 2609-2623.
27. Handebo S., *et al.* "Determinant of intention to receive COVID-19 vaccine among school teachers in Gondar City, Northwest Ethiopia". *PLoS One* (2021).
28. Zewude B and Habtegiorgis T. "Willingness to Take COVID-19 Vaccine Among People Most at Risk of Exposure in Southern Ethiopia". *Pragmatic and Observational Research* 12 (2021): 37-47.
29. Dereje N., *et al.* "COVID-19 Vaccine hesitancy in Addis Ababa, Ethiopia: A mixed-methods study". *Med Rxiv* (2021).
30. Mesele M. "Awareness and Attitude Towards COVID-19 Vaccination and Associated Factors in Ethiopia: Cross-Sectional Study". *Infection and Drug Resistance* 14 (2021): 2193-2199.
31. Wiysonge SC., *et al.* "Vaccine hesitancy in the era of COVID-19: could lessons from the past help in divining the future?" *Human Vaccines and Immunotherapeutics* (2021).
32. Abebe H., *et al.* "Understanding of COVID-19 Vaccine Knowledge, Attitude, Acceptance, and Determinates of COVID-19 Vaccine Acceptance Among Adult Population in Ethiopia". *Infect Drug Resist* 14 (2021): 2015-2025.
33. Berihun G., *et al.* "Acceptance of COVID-19 Vaccine and Determinant Factors Among Patients with Chronic Disease Visiting Dessie Comprehensive Specialized Hospital, Northeastern Ethiopia". *Patient Prefer Adherence* 15 (2021): 1795-1805.
34. Seboka BT, *et al.* "Factors Influencing COVID-19 Vaccination Demand and Intent in Resource-Limited Settings: Based on Health Belief Model". *Apollo Hospitals Risk Management Policy* 14 (2021): 2743-2756.
35. Solomon Y, *et al.* "COVID-19 Vaccine: Side Effects After the First Dose of the Oxford AstraZeneca Vaccine Among Health Professionals in Low-Income Country: Ethiopia". *The Journal of Multidisciplinary Healthcare* 14 (2021): 2577-2585.
36. Mesele M. "Covid-19 vaccination acceptance and its associated factors in sodo town, wolaita zone, southern ethiopia: Cross-sectional study". *Infection and Drug Resistance* 14 (2021): 2361-2367.
37. Guangul BA, *et al.* "Healthcare workers attitude towards SARS-COVID-2 Vaccine, Ethiopia". *Global Journal of Infectious Diseases and Clinical Research* 7.1 (2021): 043-048.
38. Yewlsew O., *et al.* "Attitude and associated factors of COVID-19 vaccine acceptance among health professionals in Debre Tabor Comprehensive Specialized Hospital, North Central Ethiopia; 2021: cross-sectional study". *Virus Disease* 32 (2021): 272-278.

39. Angelo AT, *et al.* "Health care workers intention to accept COVID-19 vaccine and associated factors in southwestern Ethiopia, 2021". *PLoS One* 16.9 (2021): e0257109.
40. Ahmed MH., *et al.* "Intention to receive vaccine against COVID-19 and associated factors among health professionals working at public hospitals in resource limited settings". *PLoS One* 16.7 (2021).
41. Oyekale AS. "Willingness to Take COVID-19 Vaccines in Ethiopia: An Instrumental Variable Probit Approach". *International Journal of Environmental Research and Public Health* 18.17 (2021): 8892.
42. Zewude B and Belachew A. "Intention to Receive the Second Round of COVID-19 Vaccine Among Healthcare Workers in Eastern Ethiopia". *Infection and Drug Resistance* 14 (2021): 3071-3082.
43. Belsti Y., *et al.* "Willingness of Ethiopian Population to Receive COVID-19 Vaccine". *The Journal of Multidisciplinary Healthcare* 14 (2021): 1233-1243.
44. World Economic Forum. "Three tactics to overcome COVID-19 vaccine hesitancy". *WEF* (2021).
45. Yimer DB., *et al.* "Communication Strategies to Combat COVID-19 Vaccines Hesitancy". *Journal of Pharmaceutical Research International* 33.40B (2021): 72-85.

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