University of Montréal

Ethical Governance in Healthcare and Health Inequalities: The Case of Antimalarial Intervention in sub-Saharan Africa

Par
Charles Biradzem, DINE

Sciences humaines appliquées, Faculté des arts et des sciences

Thèse présentée en vue de l'obtention du grade de doctorat en sciences humaines appliquées, programme d'études interdisciplinaires

Janvier 2023

University of Montréal

Programme interdisciplinaire : sciences humaines appliquées, Faculté des arts et des sciences

---

This thesis titled

Ethical Governance in Healthcare and Health Inequalities: The Case of Antimalarial Intervention in sub-Saharan Africa

presented by

Charles Biradzem, DINE

was evaluated by a jury made up of

Solène Lardoux
President

Dany Rondeau
Research director

Bob White
Codirector

Gilles Bibeau
Member

Paul Mkandawire
External Examiner

Résumé

Contexte and problématique : Une des raisons pour la création du concept de santé mondiale était de lutter contre l'ensemble des inégalités de santé à travers les populations mondiales. Cette mission sera à nouveau soulignée le 12 décembre 2012 par le groupe de travail mondial sur les soins de santé, et sera encore soulignée en 2017. Malgré tous ces efforts, elle reste toujours une raison forte pour le renforcement stratégique des interventions de la santé à l'échelle mondiale vers la réalisation homogène de la santé universelle. En effet, cette recherche était instiguée par le fait qu'au XXIe siècle, l'Afrique subsaharienne est toujours l'épicentre mondial du paludisme (la malaria), malgré les décennies d'engagements pour la libérer de cette maladie. Par conséquent, les enfants en Afrique subsaharienne sont encore 15 fois plus susceptibles de mourir avant leur cinquième anniversaire que les enfants du même âge dans le monde occidental.

Pire encore, j'ai également observé ces inégalités entre les pays de l'Afrique subsaharienne, et que cet écart augmente à mesure que de nombreux pays où le paludisme est endémique deviennent holoendémiques. Par exemple, entre 2000 et 2016, l'époque des *objectifs du Millénaire pour le développement,* de nombreux pays de la partie Ouest de l'Afrique subsaharienne (qui est généralement plus endémique du paludisme), ont enregistré une augmentation drastique des calamités liées au paludisme contre toutes attentes. Donc, où est le problème ? Autrement dit, quelle est la cause principale de cet échec ? Comment améliore-t-on la situation, compte tenu des ressources disponibles ?

Objectif : Ces déséquilibres remettent en cause la recommandation de l'éthique du *care* et des droits humains à la santé selon laquelle personne ne devrait être désavantagé d'avoir ce qu'il faut pour réaliser ses droits à la santé. Surtout, cette recommandation a été soutenue par l'OMS avec son appel du millénaire en faveur de la *santé pour tous,* en ne *laissant personne de côté.* Sur cette note, l'objectif principal de cette recherche est de proposer une stratégie de recherche qui guidera les interventions antipaludiques en Afrique subsaharienne afin de produire les résultats les plus équitables et impacter la vie de populations vulnérables durement touchées par cette maladie.

De ce fait, son objectif procédural vise à investiguer de manière systématique les racines des perturbations qui freinent les diverses initiatives antipaludéennes en Afrique subsaharienne à réaliser un déclin équitablement égal du paludisme entre les pays afin de donner aux populations la possibilité équitable aux droits de santé. Il est aussi de déterminer un mécanisme qui pourrait amener toutes les initiatives antipaludéennes au-delà de ces difficultés. Il est enfin de proposer et de démontrer une nouvelle stratégie d'intervention efficace pour l'Afrique subsaharienne.

Méthodes et Résultats : De la littérature scientifique, appuyées sur des évaluations organisationnelles et gouvernementales, j'ai obtenu les données statistiques sur l'état du paludisme en Afrique subsaharienne de 2000 à 2016. Selon les analyses qualitatives et quantitatives de ces données, il existe des inégalités évidentes du paludisme en Afrique subsaharienne de l'Est à l'Ouest, et le côté Ouest est le plus touché. Malgré la certitude de ces inégalités, les recherches antipaludiques, bien que l'ensemble de ces dernières soit le fondement des interventions efficaces, se focalisent loin de la concentration de cette maladie. Alors que 58,45% des calamités du paludisme se concentrent dans l'Ouest de l'Afrique subsaharienne, 61,07% des recherches antipaludéennes se concentrent à l'Est. Malheureusement, ces recherches non-stratégiques désorientent l'intervention avec des résultats non représentatifs.

En général, les diverses activités d'interventions antipaludéennes sont calibrées, réglementées et modelées selon les données présentées par les recherches. Cette désorientation défavorise le côté Ouest qui est généralement le plus endémique. Par conséquent, ses citoyens sont devenus complètement submergés par une multitude de marasmes de santé liés au paludisme, et ils meurent de façon vulnérable dans leur misère. Par exemple, entre 1990 et 2016, l'Afrique subsaharienne a enregistré un nombre cumulé de décès dus au paludisme de 19.136503, et le côté Ouest avait 11.184418, devant le côté Est avec 4.768660, et le Centre avec 3.183425. Mais à la fin de l'ère des *objectifs du Millénaire pour le développement*, 7 des 14 pays d'Ouest ont enregistré des augmentations drastiques des décès dus au paludisme, contre seulement 2 sur 17 à l'Est.

Analyse critique : De façon générale, lorsque l'on fait face aux inégalités en matière de santé, et que l'on envisage plutôt les résultats en termes d'équité (égalité équitable), celle-ci devient centrale dans le processus d'intervention, ce qui permet d'impacter les populations selon leur

besoin. Dans cette optique, la théorie de la gouvernance éthique dans le domaine des soins de santé devient la théorie d'opération par excellence pour maîtriser les inégalités, et parvenir à l'égalité équitable comme un aspect de justice sociale. La gouvernance éthique est une théorie pragmatique de l'éthique appliquée qui valorise la « contextualisation » et qui associe *care* et justice au « besoin » comme facteur principal des opérations.

Insérant cette notion dans la situation du paludisme en Afrique subsaharienne comme soulignée ci-dessus, je présente la *greatest-need target antimalarial intervention strategy,* une nouvelle stratégie d'intervention antipaludique que j'ai façonnée pour Afrique subsaharienne. La démonstration probante de cette stratégie avec les statistiques réelles sur le paludisme provenant de l'Afrique subsaharienne indique la probabilité de changements positifs dans les résultats antipaludiques en Afrique subsaharienne.

Évaluation et Conclusion: Cette thèse exhume les problèmes socio-épidémiologiques qui occupent depuis plus de cinquante ans les experts de la santé mondiale dans le cadre de la lutte contre le paludisme dans les pays d'Afrique sub-saharienne. Fondamentalement intéressée à établir les mesures correctives qui pouvaient y apporter des changements positifs, elle a démontré l'hétérogénéité de l'endémicité du paludisme dans l'ensemble de l'Afrique subsaharienne. Si nous adoptons l'angle de l'éthique appliquée, les diverses activités de lutte contre le paludisme devraient être localisées en fonction de cette hétérogénéité, c'est-à-dire de manière proportionnelle l'une à l'autre. Dès lors, elles produiront des résultats suffisamment représentatifs pour guider un calibrage plus juste et équitable des ressources, et bien orienter le processus d'intervention en fonction des besoins.

Cela conduira facilement à l'atteinte d'un déclin équitable du paludisme entre les pays subsahariens. Par conséquence, les inégalités diminueraient, donnant ainsi l'opportunité égale aux populations durement touchées par le paludisme de voir réalisés aussi leurs droits à la santé. Mais pour que ce processus réussisse, il faut une collaboration interdisciplinaire inclusive dans la conception des interventions, une contextualisation impartiale dans la mise en œuvre et une intégrité éthique élargie.

Récapitulation : Dans cette recherche, j'ai 1/ diagnostiqué une relation inverse entre les engagements de FAMR en Afrique subsaharienne et l'intensité du paludisme, 2/ démontré de

manière illustrative le mécanisme d'intervention de soins de santé proprement nécessaire pour maîtriser les inégalités de santé, et 3/ utilisé les connaissances issues de la démonstration au point 2 pour concevoir et proposer un modèle innovant d'intervention qui pourrait modifier les dynamiques négatives causées par le diagnostic du point 1.

NOTE : Étant donné que cette thèse est écrite en anglais, le résumé en français a été adapté de la version anglaise. Ainsi, je conseillerais fortement aux lecteurs de lire au moins la version anglaise de ces résumés.

Mots-clés : Inégalités en santé ; Iniquités en matière de santé ; Disparités en matière santé ; Paludisme en Afrique subsaharienne ; Éthique en soins de santé ; Égalité équitable en matière santé ; Contextualisation ; Justice sociale ; Recherche interdisciplinaire ; Éthique du *care*.

Abstract

Background and Problem Statement: The main reason for establishing the concept of *global health* was to fight health inequalities among and across the populations of the world, and, even more importantly, to enforce global healthcare interventions towards attaining Universal Health Coverage. This mission will again be emphasized on 12 December 2012 by the global healthcare taskforce, and reemphasized anew in 2017. I was inspired to conceive this research project by the discovery that in the 21st century, in spite of these emphases, sub-Saharan Africa (SSA) still is carrying the brunt of the global malaria burden. As consequence, children in SSA are 15 times more likely to die before their fifth birthday as compared to children of a similar age bracket in the Western world. This reality challenges the decades of antimalarial engagement to liberate this part of world from the grip of this health hazard.

Worst of all, I also witnessed serious malaria inequalities across countries within SSA, and how the inequality-gap increases as many malaria-endemic countries become holoendemic. For example, between 2000 and 2016, the era of *Millennium Development Goals* (MDGs), many countries in the malaria endemic western part of SSA recorded drastic increases in malaria calamities. Given that before the institution of MDGs, the western part of SSA already was declared malaria endemic, and considering that MDG #3 emphasized the fight against health inequalities to ensure health for all in all parts of world, I am challenged by 3-in-2 questions. What or where is the main cause of the antimalarial failure leading to these imbalances? Or at what stage of the intervention process does this failure originate? How can this outcome be reversed?

Aim and Objective: These imbalances challenge the admonitions of the ethics of care and of human rights to health, which caution that no one should be disadvantaged from having what it takes to achieve full health potentiality. Above all, the World Health Organization (WHO) has supported this call with its millennium advocacy of *health for all* which they emphasized that it is *leaving no one behind.* Thus, the aim of the present study is to contribute towards the mitigation and alleviation of the health vulnerability of the malaria hard-hit citizens in malaria-endemic countries in SSA and minimize malaria calamities. To that effect, my main objective is to design

and propose a prospective antimalarial research strategy that would guide antimalarial intervention in SSA to produce fairer results that could impact the lives of vulnerable malaria hard-hit populations.

Therefore, the procedural objectives of the present study are to investigate the source of the main hurdles that have disturbed various antimalarial endeavours in SSA, and to establish how all the populations in SSA can secure equal opportunity to regain their human rights to health. That is, to determine a pathfinding mechanism through which various antimalarial endeavours could achieve equality in malaria decline across SSA, and then propose and demonstrate an innovative model to guide antimalarial intervention in SSA.

Methods and Findings: I systematically extracted malaria data for SSA from the scientific literature, and complemented them with information from organizational and governmental (grey) publications. My results from the qualitative and quantitative analyses of malaria statistics for SSA between 2000 and 2016 show conspicuous inequalities in malaria endemicity across countries in SSA from east to west. These results also show that antimalarial funding and research in SSA—the bedrock of an efficient antimalarial intervention process—have been concentrated away from areas where malaria is most intense. For example, 58.45% of malaria calamities are recorded in the western part of SSA, whereas 61.07% of antimalarial funding and research is directed to the eastern part.

Consequently, this inverse relationship provides unrepresentative data, thereby misguiding the antimalarial intervention process in the part of the world at the greatest disadvantage for the malaria endemic countries in the western part. Thus, the citizens of many of those countries become completely vulnerable to various malaria comorbidities and calamities, and die in squalor. For example, between 1990 and 2017, the whole of SSA had a cumulated malaria death toll of 19,136,503: 11,184,418 in western SSA, 4,768,660 in eastern SSA, and 3,183,425 in central SSA. Between 2000 and 2016, 7 of 14 countries in western SSA recorded drastic increases in malaria deaths as compared to only 2 of 17 in eastern SSA. In other words, only 7 of 14 countries in western SSA recorded positive changes in malaria deaths as against 15 of 17 in eastern SSA.

Discursive Analysis: From a general perspective, antimalarial resources, services, and intervention processes are calibrated, regulated, and modelled based on research results. When confronting health inequalities, healthcare equity becomes the central concept that guides the intervention process. Since healthcare equity helps professionals avert the possibility of health inequities, they must have adequate dispositions to judge where and how to direct their resources and services. Thus, I have established the theory of ethical governance in healthcare as the main theory *par excellence* to help them with their rationale of social justice to overcome health inequalities and achieve equitable health equality. This impetus indicates the contribution of the insight from the ethics of care in developing this research from its conception to its objective.

The theory of ethical governance in healthcare is a pragmatic interdisciplinary theory of applied ethics that valorizes contextualization, and brings care and justice together while using the *need* of the populations as the main factor of operation. After analysing the malaria situation in SSA in light of this philosophy, I have designed and proposed the *greatest-need target antimalarial intervention strategy* as a novel intervention model to fight malaria in SSA. This is a prospective strategy into which is endowed the potential to enhance an efficient antimalarial intervention process in SSA from funding through research to intervention. I formulated it to be pragmatic in process, interdisciplinary in content, and context-sensitive in approach. Although this model is still in the form of a theory, my probability demonstration with real malaria statistics from SSA indicate that it could bring encouraging positive change to antimalarial outcomes in SSA.

Evaluation and Conclusion: This thesis refreshed the socio-epidemiological problems that have puzzled global health experts for more than fifty years in relation to the fight against malaria in SSA. Fundamentally interested in establishing corrective measures that could bring about positive changes to this effect, it has clearly demonstrated the heterogeneity of malaria endemicity throughout sub-Saharan Africa. From the perspective of applied ethics, it specifies that the modelling of various activities in the chain of antimalarial intervention process in that part of world must be proportional to the heterogeneity of malaria endemicity. This insight is of paramount importance at the level of funding and research, since it is the bedrock of efficient antimalarial intervention process in that part of the world. Proportional funded antimalarial

research (FAMR)[1] is capable of producing representative and reliable data to provide a fairer calibration of the available resources, and to facilitate an equitable orientation of the intervention process.

With respect to malaria in SSA, only a proportional antimalarial intervention process has the potential to attain equality in malaria decline across countries so to minimize the inequality-gap. A proportional antimalarial intervention process would give hard-hit populations in malaria endemic countries the opportunity to enjoy their rights to health, even at a minimum. But the successful execution of the proposed antimalarial intervention process in SSA needs an inclusive interdisciplinary collaboration in content building, an unbiased contextualization in implementation, and an open-ended ethical integrity in its frameworks. With these qualities, it will be productive, effective, and efficient in managing variations that characterize the diverse malaria vector factors in that part of the world.

Recapitulation: In this research, I have 1/ diagnosed an inverse relationship between FAMR engagements in SSA and the malaria endemicity, 2/ illustratively demonstrated the appropriate healthcare intervention mechanism necessary to subdue health inequalities, and 3/ used the insight from the demonstrations in point 2 to design and propose an innovative intervention model that could reverse the negative dynamics caused by the diagnoses in point 1.

Keywords: Health inequalities; Health inequities; Health disparities; Malaria in sub-Saharan Africa; Ethical governance in healthcare; Equitable health equality; Contextualization; Ethics of care; Social justice; Interdisciplinary research.

[1] I consider in this research that wherever FAMR activities take place as the bedrock of efficient the fight against malaria in SSA, the antimalarial intervention process has already begun from there.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

SSA = sub-Saharan Africa

WHO = World Health Organization

UNO = United Nations Organization

GHO = Global Health Observatory

MIR = Malaria Infection Rate

MIR/^{000} = Malaria Infection Rate per 1000 people

FAMR = Funded Antimalarial Research

OHCHR = Office of the High Commissioner of Human Rights

DALYs = Disease/Disability Adjusted Life Years

QALYs = Quality Adjusted Life Years

NHS = National Health System

PRISMA = Preferred Reporting Items in Systematic and Meta-Analysis

ER = Efficiency Ratio

IA = Intervention Average

n = Total

MD = Malaria Deaths

TMD = Total Malaria Deaths

PMUFDs = Percentage of Malaria Under Five Deaths

C16yrs = Change in Malaria-Caused Deaths for 16 Years

GDP = Gross Domestic Product

LMIC = Low- and Middle-Income Countries

CMD2000-2016 = Change Malaria Deaths between 2000 and 2016

Dedication

This work is dedicated to my late mother Beatrice Ghaife who died in 2021.

Once I sat watching the horizon daydreaming, these words echoed in me:

> You are getting on, I said to myself, and are becoming an old man without being anything, and without really taking on anything. Wherever you look about you on the other hand, in literature or in life, you see the names and figures of the celebrities, the prized and acclaimed making their appearances or being talked about, the many benefactors of the age who know how to do favours to mankind by making life more and more easy, some with railways, others with omnibuses and steamships, others with the telegraph … Then suddenly this thought flashed through my mind: You must do something, but since with your limited abilities it will be impossible to make anything easier than it has become, you must, with the same humanitarian enthusiasm as the others, take it upon yourself to make something more difficult. This notion pleased me immensely … [and I engaged in this work].
>
> (Soren Kierkegaard, Trans. Alastair Hannay, 2009, 156–157).

In this work, I neither claim perfection nor attest to have exhausted the information bank. All I acknowledge is that through the vehicle of a policy-driven health impact assessment, I have exploited a range of different points of view regarding malaria in sub-Saharan Africa, and have tried to construct an analysis proficient enough to help alleviate the malaria-inflicted health vulnerability of the populations in that part of the world.

Acknowledgements

I want to extend my thanks to a long list of all the people who supported me—morally, economically, socially, and intellectually—during this long and exhaustive period of concentration. Great thanks go to all the members of *sciences humaines appliquées* – University of Montréal. No words are enough to thank my supervisors—Professor Dany Rondeau, and Professor Bob White—who drilled me to higher heights, and supported me in all circumstances and in diverse ways. While their efforts enlarged and reformed my reasoning and intellectual capacities, they also helped me to receive financial motivation from left and right. To that effect, I wish to extend my thanks to CELAT-ULaval, LABRRI-UdeM, ETHOS-UQAR, and CRIDAQ-UQAM.

I owe immeasurable gratitude to My family—immediate and extended—for their patience and encouragement.

To everyone I say:

Hold Your Key to Your Future

- Do not allow another person to hold the key to your future, otherwise your life will be a "push-and-pull," and you will become a blindfolded slave.
- Your key to your future is a tool to your future.
- Hold your key to your future, choose your future, and use your key to open the door into your future.
- Your future is next to your now, but do not put a date or time on your future.
- Dates and times have no future, they are static instruments of your ambitions, and potential hurdles of your future.
- Your efforts are the push forces of your now, not the pull forces of your future, which are your ambitions.
- But ambition without effort is slavery, and effort without ambition makes you a slave, and only the master holds the keys to the benefits of each.
- So, be the master of your now and hold your key to your future.
- Put your efforts at the service of your ambitions and tally your efforts to your ambitions.
- Let your now be the door into your future, and your future be the resting place of your now.

Never too late

Charles Dine

PART ONE: GENERAL INTRODUCTION, FRAMEWORK, and METHODOLOGY

Chapter 1: General Introduction

1.1. Preamble

The destructive effects of malaria in sub-Saharan Africa (SSA)[2] have stood the test of time against wide-ranging antimalarial efforts. Worst of all, the situation has progressively deteriorated on some people—as countries or citizens—creating extreme multidimensional difficulties for the infected and affected populations. In addition, various antimalarial endeavours in that part of the world have grown into a wide fragmented collection of views, theories, models, and concepts. This situation has further complicated the fight against malaria in SSA, and sympathizers and researchers are randomly searching for a way forward. Amid these ups-and-downs, new studies related to malaria in SSA, including the present one, have been difficult, especially considering the vast geographical variations in malaria vector factors.

Thus, while the aim of this chapter is to present the subject matter of this research—the problem addressed—various difficulties faced in defining the research orientation towards establishing a proficient solution pathfinding mechanism in the fight against malaria in SSA are highlighted. That is, the difficulties I encountered in striving to obtain and present coherent and representative information on the malaria situation in SSA. Among many, difficulties related to researching across a broad range of varied ideas and concepts to detect gaps and find their resolution; those related to determining a pathfinding mechanism to fight against malaria in SSA; and those related to defining and presenting the way forward. In other words, this chapter is a brief preview of the

[2] This is all of Africa South of the Sahara from west to east excluding Southern Africa.

research procedure that underlies this thesis[3] because it provides a descriptive analogy of the evolutionary aspect of this research process.

To begin, the general understanding of the word *malaria* has been evolving over time. According to its etymology, *malaria* originated from the ancient Italian *mala aria* with Roman roots *mal Aire,* which means *bad air* (Najera, 2019). As the history of healthcare indicates, symptoms of a certain unknown disease started to appear and cause heavy human calamities and casualties in some parts of the world including Africa, especially among Western explorers. Health stakeholders and professionals immediately associated this disease with *bad air* from swampy/marshy areas, and simply referred to it as either *swamp fever* because of its cause or as *death fever* because of its eminent consequence (Benelli & Beier, 2017; Heggenhougen, Hackethal, & Vivek, 2003).

It was only in the last quarter of the nineteenth century that two independent studies in India and Italy described the life cycle of what we know today as malaria disease (Heggenhougen et al., 2003). Today, we know malaria is a "vector-borne" communicable disease transmitted by female anopheline mosquitoes. About 40 different species of *Anopheles* contribute to the wide variations of plasmodium parasites affecting humans in different parts of the world (Najera, 2019; WHO, 2016b). These mosquitoes bite and inject plasmodium parasites in the form of sporozoite that further develop in the blood system (WHO, 2018c; Zhang et al., 2018).

The deadliest of these plasmodium parasites is the plasmodium falciparum found principally in SSA. In other words, while SSA is the epicentre of global malaria, it also is the centre of the malaria type falciparum (WHO, 2016a; Zhang et al., 2018). Efforts to dislodge SSA from this leading position had been going on for decades. That notwithstanding, SSA still carries more than

[3] The phrases *this thesis* and *this research project* are used interchangeably throughout this work.

or equal to 90% of global malaria cases and deaths, as per the assessments made at the end of the era of the *Millennium Development Goals* (Liow, Kassam, & Sekiwunga, 2017; WHO, 2017c). Precisely, more than 90% of the 216 million malaria cases and 445,000 malaria deaths reported in the world in 2016 occurred in SSA (Liow et al., 2017; WHO, 2017a). Thus, one in every 40 women of childbearing age in SSA has a lifetime risk of dying of malaria or its comorbidities during pregnancy or childbirth (GHO, 2017).

In addition to this general malaria situation in the whole of SSA, variations in non-biological malaria vector factors have rendered malaria disease acute and chronic in some regions or countries (See Annex 1) (Heggenhougen et al., 2003; Snow, Craig, & le Sueur, 1999). Although these variations generate or intensify malaria inequalities across SSA, most antimalarial methods that have been employed to fight malaria in this part of the world are not yet sensitive to these inequalities. Many aspects of the fight against malaria in SSA are not strategic enough to control malaria disease and avert its morbidity/mortality inequalities (Benelli & Beier, 2017). After serious analysis, I have diagnosed two consequences of this failure: 1) the malaria hard-hit populations in malaria-endemic countries have become more vulnerable to malaria calamities; and 2) the already wide malaria morbidity/mortality inequality-gap across countries in SSA continue widening. The procedural objectives of this research project are to provide a critical analysis of the shortcomings of the current fight against malaria in SSA, and determine a corrective way forward.

First, I question why many malaria-endemic countries in SSA are becoming more endemic and the malaria mortality/mortality inequality-gap across countries is increasing, despite decades of efforts to curb the situation. Second, I question/examine what healthcare intervention theories can ameliorate the deteriorating situation of health inequalities of this magnitude. Third, I determine

what antimalarial intervention strategies can reverse the malaria situation in SSA to alleviate the vulnerability of malaria hard-hit populations and protect their right to health. I was motivated to carry out this research by some significant ethical concerns: 1) by the call of the ethics of care and of human rights to enforce the global justice of health for all, and help vulnerable people to gain what is necessary to be healthy (Brannigan, 2012; Rondeau, 2019); and 2) by the call of the social sciences to enhance or ameliorate antimalarial intervention surveillance and evaluation (Benelli & Beier, 2017).

The results of my research show that funded antimalarial research in SSA, the bedrock of efficient antimalarial intervention, inversely relate to malaria endemicity. This relationship suggests that stakeholders and their partners tend to direct more antimalarial funding and research to areas of scanty malaria endemicity, and by doing so invest less in areas of dense malaria endemicity. Since this inverse relationship misdirects antimalarial intervention process in SSA, it disfavours the malaria hard-hit populations in malaria-endemic countries, even as they record increasing malaria calamities. However, given that the microbiological knowledge of plasmodium falciparum still has some gaps due to its parasitic changes over time and space, the fight against malaria in SSA remains complicated (Zhang et al., 2018).

In addition to the microbiological uncertainties about plasmodium falciparum, various socio-contextual malaria vector factors in SSA are unpredictable and uneven, and thus, difficult to detect and target. From the socio-epidemiological perspective, this disposition complicates the prevalence pattern of plasmodium parasites across SSA, and frustrates the intervention process. From a socio-ethical perspective, they intensify the risk of increasing inequalities through an inequitable distribution of the available resources and services (Jasso, 2015). This risk level will

increase in case the fight against malaria in SSA is calibrated based on generalized vulnerability (Mackenzie, Rogers, & Dodds, 2014) for all of SSA.

Thus, to avert such a globalizing intervention mechanism that could disfavour the malaria hard-hit populations in SSA, I believe in the view of Bob White that we need to be informed by the insight from ethnography so as to learn, understand, and inculcate the contextual social, cultural, and economic determinants of the health and wellbeing of the people in different parts of SSA (White, 2011; White, Gratton, & Agbobli, 2017). This socio-anthropological impetus of healthcare is significantly important in this case: 1/given that malaria often manifests as an opportunistic disease (Recht et al., 2017; Tompkins & Thomson, 2018); and 2/that SSA is overcrowded with opportunities like poor hosing facilities (Arku, Luginaah, Mkandawire, Baiden, & Asiedu, 2011), many disguised and untreated health cases like hepatitis B (Mkandawire, Richmond, Dixon, Luginaah, & Tobias, 2013), unidentified cases of HIV and AIDS (Yé et al., 2018), many aspects of social vulnerability (Mkandawire, Luginaah, & Baxter, 2014).

To this effect, the place of the ethics of care, a pragmatic facet of applied ethics, in the fight against malaria in SSA cannot be overlooked. From this impetus, the antimalarial stakeholders and partners in SSA must strive to detect and target what Dany Rondeau called situational (induced) vulnerability because it either leads to or results from inequalities, rather than basing their interventions on ontological vulnerability (Rondeau, 2019) with the believe that everyone everywhere in SSA has the degree of vulnerability to malaria. However, they need to be conscientized to develop a high ethical degree of autoregulation in the interpretation of theories rather than operate solely on hetero-regulation (Rondeau, 2007).

Notwithstanding these complications, our ethical responsibility is to endeavour to provide everyone with the opportunity to enjoy their rights to health whenever possible, even at a minimum (WHO & OHCHR, 2008). When we activate this ethical responsibility, we strive to detect and subdue various complications to provide relief to the disadvantaged. This ethical responsibility, emphasized by the socio-anthropological and the socio-ethical views mentioned above, was the impetus that enticed me to study and document various contextual malaria uncertainties to obtain representative information that could provide a closer-to-reality look at malaria in SSA. From the analysis of these data, I will provide a potential useful orientation for efficient antimalarial intervention processes in SSA. I want to underscore here that a proactive foundation for an efficient antimalarial intervention process in SSA can only be achieved by carrying out strategic antimalarial research that will obtain representative data to facilitate efficient intervention processes.

Therefore, I focused this research project at the level of antimalarial research, the bedrock of efficient antimalarial intervention in SSA (Hammer et al., 2006). In the course of this work, I have established the indispensable need for two main categories of input to render antimalarial research in SSA strategic enough to enhance antimalarial efficiency. First, researchers need funding because strategic antimalarial research can be long and costly (Head et al., 2017). That is why I am treating malaria funded and antimalarial research together in this work as FAMR. Second, researchers need ethical consciousness to abide by all necessary contextual ethical exigencies and minimize any possibilities of exploiting vulnerability (Resnik, 2004). The latter is significantly important in this case because the autoregulation contextualization emphasis of applied ethics, as (Rondeau, 2007) highlights, is still timid and less exploited in SSA. Thus, I

have developed this research using insights from the theory of ethical governance in healthcare (see Section 2.3), the pragmatic interdisciplinary perspective of applied ethics.

As my findings and results will show, even though the actual FAMR positioning in SSA does not target malaria density, strategic FAMR remains necessary to realize an efficient antimalarial intervention. Whether rampant negative malaria dynamics across SSA occur because of the ignorance of the right procedure, or because some professional negligence, or as signs of the conflict of interest, an innovative antimalarial intervention strategy for SSA is crucial. Given the intensive inequalities that define the malaria situation in SSA, an efficient antimalarial intervention strategy for that part of the world must be equitable. Thus, I have designed the *greatest-need target antimalarial intervention strategy* as the innovative and equitable antimalarial intervention model suitable for SSA. The rationale supporting this strategy is empowered by the insights from the theory of ethical governance in healthcare which can minimize malaria inequalities and maximize chances for the equitable equality in malaria decline across SSA.

With directives from the exigencies of ethical governance in healthcare, I have designed this strategy to demonstrate how equitable antimalarial intervention processes at the level of FAMR can favour the malaria hard-hit populations. At the level of FAMR, this intervention strategy can register the proportion of the asymptomatic populations and record non-biological factors that influence malaria burden. Also, this method brings in the impetus of the ethics of care and moderates the deontology of healthcare professions with empathy. Antimalarial researchers in SSA need empathy because malaria, the main health threat in that part of the world, is more of a social problem with many social factors than it is a biomedical or microbiological problem.

Thus, I will highlight the view that in managing the fight against malaria in SSA, both domestic stakeholders, governments, and their foreign partners need to convert rules into desires, exercise duties as responsibilities, assume professional activities as vocations, and harmonize egoism with altruism (IHP, 2012). I acknowledge that human beings (as moral or individual persons) often need an external ethical push or pull out form some egocentric tendencies into altruistic or public consciousness (Hobbes, 1651). Thus, I will show that such an ethical disposition does not exist in the realm of global healthcare research to either enforce public consciousness in local governments or entice partners into altruism, although many of them claim philanthropy. Therefore, I will be inviting global health stakeholders to establish a specific ethical framework to guide and maintain the integrity of global healthcare research towards the vulnerable, such as the malarial hard-hit populations in SSA.

I am convinced that such an ethical framework will facilitate the connection between credibility and validity, transferability and generalizability, confirmability and objectivity, and dependability and reliability (Kivunja, 2018). The inspiration provided by these ideals of global healthcare research have helped me to establish the findings, results, and proposals of the present study. Thus, beneath the socio-epidemiological aim of the present research to inform the fight against malaria in SSA and relieve the vulnerable malaria hard-hit populations in malaria endemic countries, there also exists its socio-ethical aim. The socio-ethical aim or purpose of this present research is to use the example of malaria in SSA and demonstrate how healthcare inequities cause or intensify health inequalities while healthcare equity does the opposite to attain equitable health equality as a prelude to satisfying human rights to health for all.

Though this preamble already has provided a foretaste of this research project, I still will, in the next section, recapitulate its evolutionary development from the conception of its problem to

determining its question and defining its objective. I describe the initial conception of the original background knowledge of my research to the impasse that has made this work daring. That impasse is a steppingstone from which I developed the subject of this research, and *how* and *why* I formulated its central problem. I also present various themes and procedural objectives that I explore in the following chapters, and the structural layout of the whole document.

1.2. The Origin of this Research Project

This present study neither considers the microbiological characteristics of malaria disease nor discredits various biomedical antimalarial efforts invested in SSA. Rather, it analyzes and questions the statistical disequilibrium in the malaria data obtained across countries in SSA amid decades of efforts (GHO, 2017). What disturbed me initially was the rampant negative dynamics in malaria morbidity and mortality across SSA where, in the 21st century, many malaria-endemic countries still are becoming holoendemic with enormous calamities. Worst of all, as the situation becomes unbearable in the malaria hard-hit endemic countries, their vulnerable citizens surrender to various malaria hazards and die in great numbers.

As this situation helps to ensure the permanence of malaria parasites in SSA, it also infringes the health rights of the malaria hard-hit populations as they die in misery. In turn, these imbalances help to increase the malaria morbidity/mortality inequality-gap across countries and communities, even as the ethical call for human rights to *health for all* grows louder. In light of these uncertainties, it will be difficult to realize the objective of the present research, which is to diagnose the causes of these weaknesses, determine the pattern of inequalities, and design a corrective measure to target and minimize these inequalities. Therefore, as a nod to prudence, I have adopted a *step-by-step* investigative research approach to access and obtain accurate findings and results concerning the malaria situation in SSA.

This approach is the impetus for the research procedure I have used in the present study, which also is informed by insights from the theory of ethical governance in healthcare (see Section 2.3) (Ritvo, Ohlsen, & Holland, 2004). I have applied this step-by-step investigative research procedure from data mining to data curation, and from the analysis of findings to the discussion of results. This procedure helped me to establish a chronological list of common factors that have determined the orientation of the antimalarial intervention processes in SSA, and also helped me to diagnose the plausible causes of these negative antimalarial dynamics in SSA.

Basing my judgment on this information, I have strived to propose an equitable/fairer antimalarial intervention strategy for SSA. As per my malaria findings and results, efficient antimalarial intervention process in SSA requires adequate funding from partners (WHO, 2019) and strategic antimalarial research to produce reliable data (Hammer et al., 2006; Head et al., 2017). Also, efficient intervention process needs inclusive interdisciplinary engagements to detect and confront the wide variations in non-biological malaria vector factors (Benelli & Beier, 2017; Hay, Omumbo, Craig, & Snow, 2000).

Therefore, I have established the research question and objective of the present study by posing and answering a series of context-sensitive questions about these necessary inputs. First, do we have sufficient antimalarial funding in SSA to sustain feasible antimalarial endeavours in that part of the world? Second, do we have a good number of antimalarial research activities in SSA—the bedrock of an efficient antimalarial intervention process—to provide representative malaria data (Bhutta, 2002; Hammer et al., 2006)? Third, in addition to the various microbiological characteristics of malaria disease, does the strategy of antimalarial intervention processes in SSA consider the wide variation in the non-biological determinants of malaria prevalence in that part of the world (Hay et al., 2000; Heggenhougen et al., 2003)?

This questioning was fastened with the tenets of the socio-anthropological the socio-ethical clarifications made above. Although I question these factors individually, it is difficult and useless to treat them individually, since they are necessary complements with respect to enhancing antimalarial efficiency in SSA. For example, funders need research and other intervention activities to obtain their rewards. Researchers need funding to cover costs and undertake extensive and sustainable research that traces variables to obtain reliable data. Therefore, obtaining sequential answers to context-sensitive questions is also obtaining representative and reliable context-sensitive information to guide a context-sensitive intervention process. This is the procedural inspiration I have extracted from the theory of ethical governance in healthcare (Ritvo et al., 2004).

Regarding the research process—see Chapter 3, Methodology Section—my findings will show sequential increases in antimalarial funding in SSA that accumulated to US$ 3.1 billion by 2017[4]. I had to answer the second and third questions—described above—before I could judge whether antimalarial funding is "enough" to sustain a feasible antimalarial intervention in SSA. Also, as previously described, I have taken for granted that antimalarial research is more productive when funded, thus, as mentioned above, I will only be working research activities that are funded by malaria partners. That notwithstanding, I will not be assessing their monetary values. As per my findings in Chapter 3, I have a record of 1,061 FAMR conducted in 38 countries across SSA between 2000 and 2016 (GHO, 2017; Head et al., 2017).

Like any healthcare intervention process, we need to consider various activities and stages of an efficient antimalarial intervention process in SSA. The appropriate research practice is as important in any intervention process as is the availability of necessary resources. Inappropriate

[4] See http://www.who.int/news-room/fact-sheets/detail/malaria. For various updates on malaria, see http://www.who.int/malaria/en/ (Accessed 21/05/2018).

research leads to inappropriate interventions, which can lead to inappropriate results that increase or complicate health inequalities (Jasso, 2015). Thus, a clarification as to whether these inputs (funding and research) are enough to sustain feasible antimalarial intervention in SSA is as important as is the clarification as to whether the allocations of funding and research were strategic. In this situation, clarification is possible only through an evaluation of the interaction between these inputs because they function as complements.

To begin, if the US$ 3.1 billion funded 1,061 FAMR in 38 countries across SSA, then an average of +/- 27 possible antimalarial research activities could be carried out in each of these countries during this 16-year period. On average, without stepping outside of the realm of this research, it is common that researchers conduct antimalarial research in three sites to obtain findings that are rated comparative. Each antimalarial research cohort takes three phases (Phase I to Phase III), and sites increase as phases increase because of verifications and readjustments (Najera, 2019). I am only bringing up these details to demonstrate that within the 16 years included in these studies, each of the 38 countries studied could host up to 9 antimalarial FAMR cohorts, if they were administered on a rotation basis. Although FAMR in SSA are not carried out on a rotation basis, I consider that these inputs (research and funding) could sustain feasible antimalarial intervention processes in SSA, while accepting that more antimalarial funding is still needed.

This analytical evaluation assured me that the available antimalarial resources, as much as my findings provided, could enable fairer antimalarial intervention in SSA than recorded. However, I only can get clarification on whether the allocation process of these resources was equitable from the answer to question three: In addition to the various microbiological characteristics of malaria disease, does the strategy of antimalarial intervention processes in SSA consider the wide variation in the non-biological determinants of malaria prevalence in that part of the world? To be

sure, I need to 1/undertake an interdisciplinary analysis of both statistical and narrative malarial data from SSA, and 2/use a step-by-step sequential approach as mentioned previously. My objective is to design and demonstrate an innovative context-sensitive antimalarial intervention strategy for SSA with aid from the answer to question three. That is, from the established relationship between the allocation of resources and the execution of the intervention *vis-à-vis* malaria variations. As mentioned previously, my first procedural objective of the present research is to establish the main cause of the various negative malarial dynamics in SSA.

1.3. The Evolution of this Thesis

During the preliminary stages of my research project, my primary findings convinced me that there was adequate antimalarial input (funding and research) in SSA that could assure an efficient antimalarial intervention in SSA. However, at variance with this conviction is the number of malaria-endemic countries in SSA that continue to experience increases in malaria deaths. In light of this input-output imbalance, I considered the following: either they (individuals or moral persons) were doing something within the antimalarial intervention process in SSA that they should not do, or they need to do the interventions differently, or they are not doing something that they need to do. Whatever the case, this research aims at diagnosing where the problem lies so as to propose the possible solution pathfinding mechanism.

As mentioned previously, the efficient antimalarial intervention process in SSA is a chain of successive or sequential stages. If any stage in this chain is not executed correctly or adequately, subsequent stages will have a high potentiality to be less scientific or to miss the target, and the final results of the whole intervention process will be unreliable. Therefore, in addition to taking account of the microbiological characteristics of malaria disease, the antimalarial intervention process in SSA should also consider the contextual variations in the non-biological malaria

determinants (Hay et al., 2000; Heggenhougen et al., 2003). This is a two-part question: 1) do the antimalarial intervention processes in SSA take into account the microbiological records of malaria in SSA? and 2) does this intervention target the variations in other vector factors?

In conformity with the exigencies of the insights from the theory of ethical governance in healthcare, I administered an investigative research methodology to answer these questions. Thus, I used my results to answer the first question, which was the basis for answering the second, and not vice versa. I wanted to have clear answers to the questions of *how, where, why,* and *for whom* before proposing a novel antimalarial intervention strategy for SSA. As my bottom line, I wanted to have representative findings from which to propose an intervention strategy that gives attention to contextual sociocultural malaria vector factors to make that intervention process more efficient to produce fairer outcomes. As mentioned above, this objective was informed by the socio-anthropological and socio-ethical views highlighted above (Rondeau, 2007; White, 2011).

My findings on FAMR already provided a satisfactory answer to the question of *how* simply because we need enough funding and research to establish efficient antimalarial intervention in SSA. However, the answer to the question of *where* was more complicated because it needs to combine the socio-epidemiological, the socio-anthropological, and the socio-ethical perspectives of the fight against malaria in SSA. However, since the socio-anthropological characteristics of malaria prevalence are already inferred in the socio-epidemiological and the socio-ethical perspectives, two substantially related opinions have to guide me through this analytical process. First, the intervention process must be equitable to confront and minimize inequalities and attain equitable equality in outcomes (Jasso, 2015). Second, the distribution of FAMR activities in SSA

must consider the heterogeneity of malaria endemicity to produce representative data and facilitate equitable intervention process (Head et al., 2017).

Therefore, by combining the two perspectives, FAMR in SSA should track the heterogeneity of the malaria endemicity to produce representative data and facilitate equitable intervention. Although I know that the heterogeneous pattern of malaria endemicity in SSA follows the pattern of contextual malaria vector factors, not all of these factors determine inequalities in the same way. Thus, I began by tracking the heterogeneity of malaria endemicity before making any necessary adjustments to trace the variations of social determinants in which is embedded the socio-anthropological perspective of malaria prevalence. So, I had to determine whether FAMR activities in SSA were equitable *vis-à-vis* the heterogeneity of malaria endemicity to produce representative data and guarantee equitable antimalarial intervention process.

If my results were in the affirmative, I proceeded to the question of *why* so to explain that it is equitable to the heterogeneity of malaria endemicity to capture the variations in the contextual malaria vector factors. From this point, I would work on developing an efficient intervention strategy to detect and target various socio-contextual malaria vector factors. According to my findings and results (see Chapter 3), while 58.45% of calamitous malaria endemicity was concentrated in the western part of SSA, 61.07% of FAMR activities were concentrated in the eastern part. This inverse relationship may seem trivial, but it indicates research inequities with the potential of misleading the antimalarial intervention process in SSA with unrepresentative data. Thus, I will need to show the significance of the practical/physical consequences of this relationship, since they lead to unfavourable outcomes on the malaria hard-hit populations (details and graphical illustrations in Chapter 4).

Contrary to my expectations, these negative results marked the turning point in the orientation and dimension of my research, since I was not able to continue beyond this point. These results indicated that the first or main cause of the negative antimalarial dynamics in SSA is associated with the question of *where* the antimalarial stakeholders and partners direct FAMR activities. In other words, FAMR initiatives in SSA, the bedrock of an efficient antimalarial intervention process, do not target the heterogeneity of malaria endemicity. By extension in Chapter 4, I demonstrate the extent to which these nonstrategic FAMR initiatives are responsible for the negative malaria dynamics in SSA since they are unable to produce representative malaria data that assures equitable antimalarial intervention processes in that part of the world. This is the conclusive assertion on which I established the actual object of my research project with the objective to design a corrective measure.

1.4. The Concept, the Object, and the Theory of this Research

Initially, I conceived this research around the observation that despite decades of various endeavours to fight malaria in SSA, positive malaria changes have been too slow to benefit all the populations in need. Malaria not only has remained the main killer disease in that part of the world, but also that part of the world has remained the global epicentre of malaria, and vulnerability to this disease skyrockets. As per my findings and results presented in the following chapters, I have diagnosed that the inter-country malaria inequalities in SSA are increasing, and malaria-endemic countries are recording increases in malaria calamities and deaths.

These inequalities have exposed the health destitution of the malaria hard-hit populations, and have inspired my empathetic emotion towards their health vulnerability and rights to health. Thus, I have constructed the conceptual framework of this research based on real malaria morbidity and mortality statistics from SSA that depict real global health inequalities. First, these

statistics ensure that my research is semi-empirical because it is based on facts that pave the way forward for practical applications. Second, these statistics provide a basis for establishing the purposeful research of applied ethics aimed at contributing to the mitigation and alleviation of the health vulnerability of the malaria hard-hit citizens in malaria-endemic countries in SSA. This approach is my contribution towards rejuvenating the rights to *health for all* and helping the malaria vulnerable populations in obtaining and enjoying these rights.

While the conceptual framework of this research brings together FAMR, malaria morbidity, and malaria mortality in SSA, its object is the alleviation of the health vulnerability of the malaria hard-hit populations in SSA. I postulate this object as a dependent variable of the efficient union between malaria inequalities (morbidity/mortality) in SSA and the antimalarial intervention strategy (FAMR), which I consider to be independent variables. In other words, this object only can be realized through an equitable orientation of the antimalarial intervention process in SSA *vis-à-vis* the heterogeneity of malaria endemicity. The application of such an intervention process will relieve the malaria hard-hit populations as it attains equitable equality in malaria decline across countries in SSA, thereby assuring human rights to *health for all*.

The main question or concern is how to bring these two independent variables together while avoiding all possibilities of confronting the same difficulties and obtaining the same results, or even aggravating the situation. To overcome this concern, I have designed the theoretical framework of my research with the aid of insights from the theory of ethical governance in healthcare. As previously mentioned, I developed this theory (Section 2.3) to facilitate the coherent extraction of health data through a step-by-step research methodology, which sets the stage for posing successive context-sensitive questions and obtaining sequential answers to balance findings and results to reality.

With these insights in mind, healthcare justice can be adjusted with care ethics, and applied as social justice in healthcare where *need* is the guiding factor. This approach of applied ethics (Rondeau, 2019) can be used to detect or discover the contextual peculiarities of the malaria hard-hit populations and target them in their real settings. Although this vulnerable group makes up the larger fraction of the populations of SSA, and their contextual conditions put them in the position of the greatest need of antimalarial assistance, they often are forgotten, and they suffer and die in squalor. More than 50% of the populations of SSA live on farming and animal rearing as their economic activities, which are the main non-microbiological factors favouring a dense malaria parasitic prevalence.

On the one hand, the rural environmental conditions that favour these activities also favour mosquito development. On the other, crop growing and animal rearing that favour mosquito breeding are main rural activities (Hay et al., 2000; Snow et al., 1999). These facts position rural areas as the main malaria infested regions, the antimalarial intervention strategies in SSA seldom target rural populations. For example, the rural agricultural Great Lake Region of Tanzania continued to face serious malaria calamities while other parts of Tanzania were close to zero malaria incidence (Mboera, Mazigo, Rumisha, & Kramer, 2013). Similar imbalances have been observed in the Nouna Health District in rural Burkina Faso, a malaria-endemic district that has been forgotten/abandoned (Kouyate, Sie, Ye, De Allegri, & Muller, 2007; Muller, Ye, Louis, & Sie, 2009; Paul, 2011).

As I will highlight in my data curation and analysis, I substantiate these imbalances with my diagnoses that FAMR in SSA inversely relates to malaria endemicity. In other words, more FAMR activities occur in regions that have relatively lesser malaria prevalence, and less FAMR activities take place in regions that have more dense malaria prevalence. As I mentioned

previously, this inverse relationship undermines the recommended equitable intervention to relieve inequalities (Head et al., 2017) and also challenges the importance of FAMR as the bedrock of efficient antimalarial intervention process in SSA (Hammer et al., 2006).

Also, this inverse relationship misdirects both the production and distribution of antimalarial products and services, thereby facilitating the rampant malaria drug resistance in malaria-endemic regions or countries (Kouyate et al., 2007). By extension, it also aggravates the circulation of counterfeit antimalarial drugs across Africa (Arora & Sharma, 2019). These highlights entice curiosity because malaria stakeholders and partner would have known that the intensity of the inequalities in malaria prevalence across SSA impose equitable intervention in that part of the world. However, I am not able to 100% certify a *cause-effect* relationship between these two phenomena because many factors influence malaria changes, and many factors also influence the fight against malaria in SSA. This notwithstanding, I do certify the probability that the inverse relationship between FAMR and malaria endemicity in SSA helps to increase malaria inequalities across countries. I will substantiate my conviction with a series of corelated facts about malaria in that part of the world.

As per my findings, fewer FAMR activities occur in the western part of SSA, despite its dense malaria endemicity, and these activities are instead concentrated in the eastern part. First, based on these findings, malaria drug resistance continues to increase across countries in the western part of SSA (Dambach et al., 2016; Kouyate et al., 2007). Second, a larger fraction of complicated malaria comorbidities and other related health complications are rampant across countries in western SSA (Papaioannou, Utzinger, & Vounatsou, 2019). Third, the malaria morbidity and mortality rates across countries in the eastern part of SSA—where FAMR activities are concentrated—have reduced drastically since the year 2000. Within this same

period, malaria mortality across many countries in the western part of SSA drastically increased (GHO, 2017). I use these facts to confirm these outcomes as the dependent variable of the relationship between FAMR and malaria endemicity, which are independent variables.

1.5. The Question and the Objective of this Thesis

I want to underscore that my main objective in this research project is not only to signal the problem of malaria in SSA, but also to present a pathfinding mechanism towards a solution to that problem. Thus, I have framed this research project with three main pillars. First, I have used the malaria morbidity/mortality inequalities across countries in SSA as the basis of the problem to be solved. Second, I present the theory of ethical governance in healthcare (see Section 2.3) as its operational tool to unite elements for the plausible solution. Third, I have designed an innovative antimalarial intervention strategy for SSA as the pathway to the solution. Therefore, the obvious question and concern at this point are on how to bring these pillars together and establish a convincing way forward towards a solution to this problem.

Despite the evolutionary changes that have altered some aspects of this thesis in the course of its development, as mentioned previously, its ambitious subject matter has remained—to use the insights from the theory of ethical governance in healthcare and unite the two independent variables of the fight against malaria in SSA to obtain the needed dependent variable. I acknowledge the challenges inherent in fighting against a communicable vector borne disease like malaria in an environment like SSA with unpredictable, undefined, and complicated non-biological conditions. That notwithstanding, I am moved by empathy for the health destitution of their malaria hard-hit populations to take the responsibility for developing a strategic mechanism to address various antimalarial hurdles in SSA and relieve their suffering. However, the procedural modalities for the realization of this responsibility are complicated.

From the perspective of applied ethics, I know that when aiming at excellence in population-based healthcare activity, like antimalarial intervention in SSA, it is not enough to only abide by various conventional laws guiding the healthcare professions. We need to fashion an operational *ethos* with context-sensitive values, principles, and virtues to produce a context-sensitive intervention process (A. Cortina, García-Marzá, & Conill, 2017). Therefore, the process of antimalarial intervention in SSA must be investigative in process, interdisciplinary in content, and context-sensitive in practice to move beyond various non-biological antimalarial complications. Moreover, this context-sensitive antimalarial intervention process must be innovative to avert the old pitfalls of the fight against malaria in SSA.

Thus, I use the insights from the theory of ethical governance in healthcare to demonstrate how to establish an innovative intervention strategy to enhance efficient antimalarial intervention processes in SSA. These insights can facilitate the collection of novel interdisciplinary findings to facilitate equitable intervention process that tackles the heterogeneity of malaria endemicity to attain equitable equality in malaria decline across countries. For example, when questions are posed and answered in sequence, this approach can generate novel interdisciplinary information and knowledge that facilitates equitable intervention and equitable equality in decline. If malaria decline is equitable across countries, it will relieve the malaria hard-hit populations. But which innovative intervention strategy can enhance the equitable antimalarial interventions processes in SSA to attain equitable equality in malaria decline across countries and relieve the malaria hard-hit populations?

Initially, this research question mainly focused on the socio-anthropological perspective of the fight against malaria in SSA, that is, how to target the contextual social determinants/vector factors of malaria disease with various antimalarial initiatives in SSA. Over the course of my

research and its findings, the main focus of this question shifted to the socio-ethical perspective of the fight against malaria in SSA, that is, how to target the heterogeneity of malaria endemicity. Nevertheless, this shift does not undermine the importance of considering the contextual social determinants of malaria disease when designing a proactive antimalarial intervention strategy for SSA. As mentioned previously, those contextual non-biological vector factors are already inferred in malaria endemicity.

In conformity with this shift, I also shifted the objective of this thesis. Initially, I intended to establish an innovative antimalarial intervention strategy to include the contextual determinants of malaria and attain equitable equality in malaria decline to relieve vulnerable malaria hard-hit populations. Due to this shift, my objective has become the design of an innovative antimalarial intervention strategy to target malaria endemicity in SSA and attain equitable equality in malaria decline to relieve vulnerable hard-hit populations. Thus, I have designed the intervention strategy which I call the *greatest-need target antimalarial intervention strategy* for SSA. This strategy will enhance antimalarial intervention efficiency by assuring equity in FAMR allocation and, consequently, in the distribution of antimalarial resources and services. Since it is designed to operate through sequential verification and acquisition of context-sensitive facts, it has the potential to minimize knowledge gaps and avert the infiltration of biased information. Thus, I will use my research findings and results as prior evidence of the evolution of malaria disease and antimalarial intervention in SSA to demonstrate the operationalization of the strategy.

The characteristics of this prior-evidence information will help me to validate the *why* (the necessity) and *how* (the realization process) of this objective. From a socio-epidemiological perspective, I use the inverse relationship between FAMR and malaria endemicity to demonstrate how antimalarial initiatives in SSA do not favour the malaria hard-hit populations. From a socio-

ethical perspective, I show how the situation undermines human rights to health of these populations, and plunges them into a desperate health vulnerability. As an aspect of care and social justice in healthcare, I emphasize our ethical responsibility to relieve the malaria hard-hit populations and restore their rights to health for all. But how can this objective be realized?

First, I illustrate the operational capacity or ability of the theory of ethical governance in healthcare to overcome health inequalities and attain equitable health equality. This strategy is the overriding intervention mechanism to enforce a successful and ethical antimalarial intervention process in SSA by minimizing inequalities and attaining equitable health equality. Then, I use my *greatest-need target antimalarial intervention strategy* to show how the insights from the theory of ethical governance in healthcare can help to make the fight against malaria in SSA equitable and of benefit to the vulnerable.

1.6. Discussion

This research specifically challenges the antimalarial intervention strategies in SSA using the malaria infection rate per 1000 people as the measuring tool and the dynamics of malarial deaths as the evaluation measure of the intervention efficiency. While talking of antimalarial intervention here refers to the ensemble of all acts and gestures aimed at reliving the intensity of malaria as plasmodium and as diseases and moving towards elimination, this research capitalizes on antimalarial funding and research (FAMR) from partners to SSA. Since these interwoven inputs provide the means and data for the efficient antimalarial intervention and effective malarial treatment processes, they are jointly considered the bedrock of the fight against malaria in SSA (Druetz et al., 2020; Hammer et al., 2006; Head et al., 2017).

While antimalarial effectiveness may mean the active presence of what it takes to fight malaria, without dwelling on malaria treatment that is beyond this research, intervention efficiency is attained when the calibration and distribution of the available resources and services achieve the best outcomes for all the people in need (Palmer & Torgerson, 1999). Thus, the ensemble of the specificities of this research has made it a *three-in-one* research project (detailed ahead): first, it has features of *causal-comparative research*; second, it has aspects of *correlational research*; third, it is a *quasi-experimental research*[5]. This *three-in-one* characteristic complicated the modelling of its operationalization strategy, and the processes of material identification and collection.

From the collection of material to the analysis of data, and to the realization of the objective, I have tried to satisfy validity, reliability, and generalizability—the three fundamental properties of proficient healthcare research. What I mean by *validity* is the extent to which research measures what it is intended to measure, and renders results that are meaningful and relevant to the scientific community. By r*eliability* I refer to general research consistency, the extent to which similar results can be obtained by later research under similar conditions. I am talking of g*eneralizability* referring to the quality that determines the extent to which research results can be applied to other settings and attain similar validity and reliability (Shantikumar, 2018).

While striving to satisfy these values, first, I will expose one of the greatest and least expected antimalarial weaknesses in SSA—that FAMR activities are concentrated away from the dense concentration of malaria endemicity. Though malaria is endemic in almost all parts of SSA, some regions are more densely endemic than others, and act as plasmodium reservoirs. Second, I will

[5] See details provided by Winston-Salem State University – North Carolina at https://www.wssu.edu/about/offices-and-departments/office-of-sponsored-programs/pre-award/_Files/documents/develop-quantitative.pdf (Accessed 27/08/2021).

propose an innovative intervention strategy to enforce the fight against malaria in SSA. The magnitude of the weakness of antimalarial interventions in SSA amid decades of antimalarial endeavours in that part of the world, certifies the validity of this research project. Also, my results are rated reliable because they are based on the representative findings on the reality of the malaria situation in SSA. In addition, I use both inductive and deductive analytical approaches to ascertain the generalizability of my results. Since my objective is corrective, I will verify why the inverse relationship between FAMR and malaria endemicity in SSA has persisted for so long.

In relation to this verification, a question arises as to whether this weak antimalarial intervention in SSA is caused by context-sensitive ignorance in designing a better intervention procedure to face reality, or it is professional negligence, or the fruits of the conflict of interest. Who or what is to blame? Domestic health stakeholders/governments? Local health regulations? Antimalarial funders? Antimalarial researchers? In Chapter 7 I show that many antimalarial researchers often find themselves confronted by *pull* and *push* factors. Many pull factors, other than malaria endemicity, often attract them to particular countries, no matter the endemicity. Also, push factors, other than malaria endemicity, often condition them to situate their research activities in some particular countries, no matter the prevailing malaria density.

I use the exploration of these questions to substantiate the neglected importance of the pragmatic aptitude of applied ethics in animating antimalarial intervention processes in SSA. This approach provides contextualization that can be used to move beyond variations in non-biological malaria vector factors. Also, given that malaria has become a disease of the poor (Kouyate et al., 2007), I demonstrate the need for an ethics of care to enforce healthcare justice in the fight against malaria in SSA. This strategy highlights the importance of empathetic responsibility (an empathy-based

approach), and the present study shows how interdisciplinary efforts can provide a strong palliative to some strong human tendencies like conflicts of interest.

1.7. Procedural Orientation and Structural Layout of this Thesis

My thesis has three parts: Part One—General Presentation and Operationalization, Part Two—Malaria Inequalities and Antimalarial Intervention in SSA, and Part Three—Analytical Discussion and Evaluative Conclusion. Part One is a general overview of the whole work: the problem statement of the research; the search methodology; the research question; and the objective. Part Two, which is the body of thesis, presents my research findings, analysis, results, and the proposed solution pathfinding mechanism. Part Three discusses and evaluates my findings and results, and provides a general conclusion, which is evaluative in content.

I further subdivide these three parts into eight chapters: Part One (Chapters 1, 2, and 3), Part Two (Chapters 4, 5, and 6), and Part Three (Chapters 7 and 8). I acknowledge that there are many repetitions in inter-chapter connections to link transitions and avoid knowledge gaps. While I use much of the material from Part One as the groundwork of Part Two, I develop Part Three from the material in Parts One and Two. Also, I include these repetitions because I have designed and presented some subsections (chapters) as full scientific articles.

This interconnectedness within the parts is especially prevalent in Part Two. Also, Chapter 4 reveals the weakness of FAMR in SSA, and functions as the databank for the other Chapters. For example, I use the results from Chapter 4 to design the orientation of Chapter 5 which demonstrates how the theory of ethical governance in healthcare can help to minimize inequalities. Also, I use statistics from Chapter 4 to design *the greatest-need target antimalarial intervention strategy* in Chapter 6, and the insights obtained in Chapter 5 to demonstrate the

operationalization of this strategy. Thus, I use in Chapter 4 most of the methodological analysis and developments I have made in Chapters 3.

In this research, I gathered my findings, obtained my results, and presented my solutions in sequence to ensure that my conclusion is valid, although it still will be a hypothetical probability based on the validity of my premises. The logic in this research entailed a fair-minded data-mining process, a critical approach to the analysis of facts, and an unbiased testing of the hypotheses. This testing will either confirm the *null* hypothesis (H_o) and falsify the *Alternative* hypothesis (H_a), or reject H_o and approve *Ha* (Yu, 2021). To maintain this research rigour, I used a mixed-methods research approach (a qualitative-quantitative research strategy) and also applied vertical and horizontal methods of analysis. I also designed most of the chapters, especially in Part Two, to answer questions in sequence to satisfy both the validity and veracity of my findings and results.

In that sequence, I set the main objective of Chapter 4 to determine the orientation pattern of FAMR in SSA. Thus, I mapped the number of FAMR activities in each country with their respective malaria infection rates per 1000 people (MIR/^{000}), which I used to depict malaria endemicity. So Chapter 4 sets the groundwork for the articulation and orientation of this thesis, and clarifies the H_o and H_a hypotheses with the logic of inverse probability (Joyce, 2019). Inverse probability means that while the *inverse* relationship between FAMR and MIR/^{000} rejects H_o and confirms $H_{a,}$ the *proportional* relationship confirms H_o and rejects H_a. I used this logic to validate Chapter 4, and then used the results of this chapter to define Chapter 5 and substantiate Chapter 6.

Therefore, since the results from Chapter 4 rejected the H_o with the inverse relationship between FAMR and MIR/^{000}, I designed Chapter 5 as a corrective mechanism to challenge health

inequalities. Then, I used the insights from the demonstrations in Chapter 5 and statistics from Chapter 4 to develop Chapter 6. That is to illustrate how *the greatest-need target antimalarial intervention strategy* can initiate the strategic location of FAMR activities in SSA *vis-à-vis* MIR/^{000}, and move towards equitable equality in malaria decline across countries in SSA. As previously mentioned, I highlight the problem in Chapter 4, develop the intervention mechanism in Chapter 5, and present the solution finding strategy in Chapter 6.

Overall, ethical integrity obliges me to answer two questions to maintain the credibility of this research. First, what is the probability that the results I obtain in Chapter 4 are conditional to the location strategy of FAMR activities in SSA? Second, what is the probability that my proposed antimalarial intervention strategy for SSA will change these results to favour the malaria hard-hit populations? To find answers, I sought inspiration from Bayesian theory and subjectivists' inductive logic for testing hypotheses and validating conditional probabilities (Joyce, 2019; Yu, 2021). Unlike deductive logic by which conclusions cannot be false if the premises are true, valid conclusions in subjectivists' inductive logic may still be false even if the premises are assumed true. This is called *abductive logic* where the second premise can be a hypothetical prediction, and the conclusion is probability.

Therefore, I validate *veracity* with the substantiation comparison of statistics from scientific publications with those from governmental malaria reports, and I ascertain *validity* through the logical testing of hypotheses. This process will provide a satisfactory *likelihood* that my results are true, and my conclusion valid as testified by statistical probability. With this conviction in mind, I used Chapter 7 to examine why this inverse relationship between FAMR and malaria endemicity had continued existing in SSA. In other words, why these equitable intervention

insights had never been adopted in SSA despite the decades of antimalarial endeavours in that part of the world.

My research findings show a convincing degree of probability that some of these lapses might be the results of the conflict between the interest of partners and the benefits to SSA populations. This is why I will encourage antimalarial stakeholders to inculcate and promote the ethics of care and empathy to resolve this conflict. In addition, there also exist some repelling domestic policies of some countries in SSA that discourage funders and researchers. Thus, I will advocate for the establishment of external ethical regulations to minimize the dominance of self-interest within global healthcare interventions.

Following are the questions that each chapter will answer:

Chapter 1 – What can readers expect to find in this thesis? How did the underlying idea evolve to what it became later?

Chapter 2 – What is the problem with the fight against malaria in SSA? Why should we worry about it? What corrective measures are necessary?

Chapter 3 – How was the data (narrative and statistics) obtained for this research? How was it treated (filtered and analyzed) to ascertain credibility and reliability?

Chapter 4 – Why is the malaria morbidity/mortality inequality-gap in SSA increasing rather than decreasing, even with the increasing efforts?

Chapter 5 – According to the results in Chapter 4, what strategies should antimalarial stakeholders in SSA apply to target and minimize inequalities?

Chapter 6 – Which antimalarial intervention strategy can exploit the insights demonstrated in Chapter 5 and create positive malaria outcomes in SSA?

Chapter 7 – What factors caused antimalarial funders and researchers in SSA to continue to focus FAMR activities away from areas of dense malaria endemicity? Was it the fault of ignorance, professional negligence, or conflict of interest? Whatever the case may be, can ethical dispositions motivate stakeholders to move beyond these weaknesses and alleviate the vulnerability of the malaria hard-hit populations in that part of the world?

Chapter 8 – What key points are underscored by this research project, and what is its take-home message? What are its socio-scientific merits and demerits?

Chapter 2: Conceptual-Theoretical Framework

2.1. Rationale: Human Rights to *Health for All*

The bottom line of all human rights is the human rights to health and wellbeing (Solomon R Benatar, 1998). I consider the wider concept of *wellbeing* as a state of being able to enjoy all the things that are good for a person or a group of people to flourish. This wider perspective "extends beyond the biomedical notion of health to include psychological, spiritual, and emotional health status, as well as the economic and socio-political dimensions of place and of what it means to be human" (Onyango & Kangmennaang, 2020, p. 265).

To me, human wellbeing is integral to human health. Thus, I use the concept of *health* to refer to "a state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity" (WHO & OHCHR, 2008, p. 1). Although this wider concept of health includes all the peoples of the world, I came to realize that some people in some parts of SSA have never enjoyed this fundamental human right. Upon verification, I diagnosed that this global healthcare disequilibrium stems from intensive health inequities that lead to intensive health inequalities. Thus, I am emphasizing that health inequalities impact human rights to health, and complicate human health, either as causes or consequences.

The global healthcare community has invested enormous resources to fight health inequalities across the world. For example, global healthcare stakeholders conceived and commissioned the concept of *global health* to override the oversights of colonial medicine and overcome health inequalities among the people of the world (Gray, 1982; A. Pinto & Upshur, 2013). I believe, as

do many others, that global health was initiated to be a medium through which various preventive measures could be channelled to fight and minimize health inequalities and move towards equitable health equality (Koplan et al., 2009). In addition, global health stakeholders have signed many universal declarations to support this fight: the *Declaration of Alma Ata* (WHO, 1978); the *Declaration of Human Rights to Health* (WHO & OHCHR, 2008); the *Declaration of Astana* (WHO & UNICEF, 2018).

Global stakeholders and policymakers initiated these measures when they discovered that health inequalities were becoming a serious threat to the primordiality of human rights to health. Thus, they perceived a pressing need to strive to reduce health inequalities and ameliorate the lives and health of the people globally. They reinforced the mission of Global Health with various efforts through the WHO and the Office of the High Commissioner of Human Rights (OHCHR) (A. Pinto & Upshur, 2013). From this perspective, the main mission of Global Health, which is predominantly preventive, has been to ensure that all the citizens of the world as a *global village* should enjoy, at a minimum, their rights to health and wellbeing (Koplan et al., 2009).

The main aim of these efforts was to create a healthy world for a healthy people with the vision of *health for all* (Braveman, 2014; Braveman et al., 2011). At the eve of the millennium, global health stakeholders recognized that health inequalities were increasing among and across the peoples of the world. By 2012, global health taskforce emphasized as the millennium ambition to fight health inequalities and attain equitable health equality. The WHO enforced this ambition with the cliché "leaving no one behind" (WHO, 2016a, p. 23; 2018a). These desires had necessitated the initiation of *Healthy People 2020* with a mission to enhance *global health equality* by fighting health inequalities.

A decade later, the global health taskforce recognized once more that *health equality* (equality in healthcare) is not a proficient method of fighting health inequalities in a diversified world. So they initiated *Healthy People 2020*, and this time, they added the word *equity* to *equality* as equitable equality in health, and called it *equitable health equality* (Braveman et al., 2011). The United Nations Organization (UNO) endorsed this view and referred to it in most *Sustainable Development Goals,* especially goals number 3 and 10[6] (UNO, 2015). Since the year 2000, the global emphasis on detecting, targeting, and minimizing health inequalities across world populations has been increasing (Kneipp et al., 2018).

Notwithstanding these emphases and efforts, mainly industrialized countries have manifested minimal awareness and engagements to minimize health inequalities. To a greater extent, people in the Developing World have less sensitivity to health inequalities for two plausible reasons. First, most of their stakeholders are less informed or aware about the intricacies of health inequalities as the causes and consequences of many health problems (Jasso, 2015; Leon, Walt, & Gilson, 2001). Second, they lack the necessary economic capacity to offer what it takes to target and minimize health inequalities (Leon et al., 2001; WHO, 2018a).

I also recognized that the semantic misunderstandings of the concepts of *health inequalities, health disparities,* and *health inequities* undermine the fight against health inequalities, especially in the Developing World. Given that "equity is not the same as equality" (Braveman, Arkin, Orleans, Proctor, & Plough, 2018, p. 7), these misunderstandings should not be taken-for-granted. They are the reason why the global health taskforce, as already mentioned, has moved

[6] See https://www.un.org/sustainabledevelopment/health/ and https://www.un.org/sustainabledevelopment/inequality/, respectively (Accessed 20/01/2021).

from emphasizing *equality in health* for *Healthy People 2010* to *equity in health* for *Healthy People 2020*.

As previously mentioned, equality in healthcare intervention cannot minimize health inequalities amid diversity. By extension, malaria inequalities in SSA continue to increase due to the intensive heterogeneity in malaria prevalence in that part of the world (WHO, 2018d; Zhang et al., 2018). To avert such consequences, the taskforce combined *equality* and *equity* in 2012 to become *equitable health equality* because the two concepts are necessary complements for providing efficient healthcare interventions. Despite this evolution, children in SSA are still more than 15 times more likely to die before their fifth anniversary than children of the same age in other parts of the world (Barreto, 2017).

The situation in SSA is exacerbated by the nonstrategic antimalarial intervention processes that fail to minimize malaria inequalities and attain equitable equality in decline to relieve the malaria hard-hit populations. So, what is the appropriate antimalarial intervention strategy to fight malaria inequalities in SSA and attain equitable equality in decline to relieve the malaria hard-hit populations? To attempt to answer this question, I needed to understand the main causes of health inequalities in SSA. However, to understand these causes, I needed to distinguish the peculiar attributes of health inequalities. Above all, I needed to understand the concept of *health inequalities* because it is central to my research project.

2.2. Central Concept: Health Inequalities and its Peculiarities

Many people often take-for-granted that everyone knows what the concept of *health inequalities* means. Rare are the authors who attempt to give it a precise definition, and the rare attempts vary

widely. To some people, *health inequalities* refers to the disproportionate burden of disease and the behavioural risk factors experienced by subgroups of a population (Bleich, Jarlenski, Bell, & LaVeist, 2012). Others understand the concept to mean the ensemble of a broad range of differences in both health experience and health status in countries, regions, and socioeconomic groups (Leon et al., 2001). Still others understand the concept as a generic term that designates the totality of differences, variations, and disparities in the health achievements of individuals and groups (Kawachi, Subramanian, & Almeida-Filho, 2002).

These varied descriptive definitions can create confusion and incompatibility between the concept of *health inequalities* and its associated concepts of *health disparities* and *health inequities*. Often, these three concepts are used interchangeably, thereby causing serious difficulties in implementing healthcare policies (Braveman et al., 2018). Although *health* is their common denominator, they neither mean the same thing nor provoke the same reaction or approach in all situations. Each of these concepts reflects different aspects of health outcomes, and demands different strategies and actions. They differ in their underlying values, orientations, and assumptions, and each of them points to different ways of framing and addressing health matters (Reutter & Kushner, 2010).

The use of *health inequalities* as a synonym for *health disparities* in all situations leads to a failure to identify the many fundamental causes of health inequalities rooted in societal structures and policies, and it also distorts the ethics of social justice that are imperative for addressing these causes (Reutter & Kushner, 2010). Health stakeholders and partners need a shared understanding of the common characteristics that distinguish *health inequalities* from other associated concepts so to support fairer decision-making. This knowledge will help them to be equitable in the allocation of health resources, and in designing the orientation of the intervention process

(Braveman et al., 2018). Even at the time in which life expectancy was improving, since many killer diseases were being defeated, health inequalities across the peoples of the world were increasing (Graham & Kelly, 2004).

A common front in healthcare intervention cannot be established without a consensus to differentiate these concepts. Although health disparities determine health inequalities and health inequities (Braveman et al., 2018), not all health disparities are indicative of health inequalities or health inequities (Zere, Moeti, Kirigia, Mwase, & Kataika, 2007). For example, a health disparity exists in the rate of the successful treatment of cancer in teenage patients in their early 10s as compared to the treatment of the same type of cancer in elderly patients in their post-70s. This situation might not be indicative of health inequalities or any sign of health inequities. Also, the disparity in the rate of Alzheimer illness between aging populations and youth does not suggest health inequality or any sign of health inequity. Another example is that the disparity in malaria disease in the Tropics and the Arctic is not a mark of health inequalities. Nevertheless, the disparity in malaria morbidity/mortality rates across countries in SSA indicates health inequalities that are the result of health inequities, which can be minimized by health equities.

According to this analysis, health disparities incorporate all health differences across peoples—epidemiological differences, risk factor differences across diverse populations, and distribution of diseases differences (Braveman, 2006; Mantwill, Monestel-Umana, & Schulz, 2015; Reutter & Kushner, 2010). In other words, the concept of *health disparities* refers to the systemic differences in disease prevalence, morbidity, mortality, and the burdens of one group compared to others, according to underlying social, environmental, economic, or scientific advantages or disadvantages (Bronheim & Goode, 2013).

Health inequalities are distinguished from other *health disparities* by being ***avoidable*** and ***unfair***. As part of health disparities, health inequalities are health differences that are systematically observed between groups of people from different social settings. Moreover, health inequalities are unfair because they result from differences in key health determinants such as wealth, power, and other advantages. Thus, health inequalities can be prevented, avoided, or averted (Braveman et al., 2011; Braveman & Tarimo, 2002). This is crucial, since health inequalities also entail the failure to avoid or overcome ***systematic*** disparities that infringe on the ***fairness*** of human rights to health and wellbeing (WHO, 2018a; WHO & OHCHR, 2008). In other words, the concept of *health inequalities* refers to the ensemble of unfair health differences created by social behaviour and circumstances (Leon et al., 2001).

This notion of *health inequalities* is associated with the concept of *health inequities*, which is an indication of the absence of social justice in healthcare intervention. In other words, *health inequities* refer to the absence of health equity in an intervention strategy. *Health equity* is the ethical principle that motivates healthcare stakeholders and their partners to strive to eliminate **unfair** and **avoidable** health disparities (health inequalities) from populations (Braveman et al., 2018). Although the enforcement of health equity in healthcare justice may produce greater qualitative outcomes than quantitative, it not only can prevent health inequalities, but also can prevent or mitigate the effects of these inequalities (Jasso, 2015).

Despite these distinctions, many are yet to correct the various errors of the past to articulate and use fitting and distinguishing definitions. For example, in 2020, Adam Wildgen and Denny Keith still used the confusing definition of *health equities* provided by Margaret Whitehead in 1991: the "differences which are unnecessary and avoidable but, in addition, are also considered unfair and unjust". […] "[I]n order to describe a certain situation as inequitable, the cause has to be

examined and judged to be unfair in the context of what is going on in the rest of society" (Wildgen & Denny, 2020, p. 247). This definition confuses *health inequities*, which is the ethical principle that guides an intervention process, and *health inequalities* which are observable situations or occurrences.

To summarize, first, *health disparities* inform us of the presence of various health differences among and across populations. Second, *health inequalities* indicate the absence of health facilities or opportunities for people who could access them. Third, *health inequities* indicate the absence of health equities within the healthcare intervention process. Although health inequalities have natural causes, they also occur as unexpected results from less strategic or poorly executed health policies and healthcare interventions. In other words, health inequalities also occur as fallouts of health inequities. Thus, health inequalities can be avoided, minimized, or eliminated through health equities—an equitable healthcare intervention process. I propose that an equitable healthcare intervention process should always be designed to exploit the insights of the theory of ethical governance in healthcare, which is the central theory I have used in this research project as an operational guide for creating equitable antimalarial interventions against malaria inequalities in SSA.

2.3. Theory of Operation: The Theory of Ethical Governance in Healthcare

Since my aim was to design a mechanism to fight health inequalities, by focusing on malaria in SSA, I highlight health equity as the proficient mode of healthcare intervention for subduing health inequalities. Health equity is the central principle of the theory of ethical governance in

healthcare that I use as the theoretical framework of this research project. Health equity is widely recommended for enhancing or accelerating healthcare improvements against health inequalities (Sen, 2002; WHO, 2018a). Thus, the practice of health equity should be integrated in healthcare funding and healthcare research so to detect and address the many impediments of global healthcare.

The enforcement of health equity in global healthcare will facilitate the achievement of transformative health impacts that will benefit everyone in need (Joseph, Rice, & Li, 2016; WHO, 2018b). Some cautious global health partners and funders already have taken serious steps towards implementing equity as the guiding principle of their interventions. For example, the *Canadian Institutes of Health Research* (CIHR) recently updated their *Framework for Action on Global Health Research* for 2021–2026 with an emphasis to "pursue Health Equity through Research" (p. 4). According to this CIHR framework, "it is the single most powerful concept for accelerating health improvement around the world" (p. 5)[7].

Notwithstanding these efforts, global healthcare funding is still overwhelmed by inequities (Charani et al., 2022), and the consequences fall on the vulnerable and disadvantaged. Thus, I turn to the insights from the theory of ethical governance in healthcare to acclaim equity in healthcare as the proficient mode of operation to fight inequalities. I argue that the theory of ethical governance in healthcare is the best theory of operation for fighting malaria inequalities in SSA, which is a profound example of health inequalities. Moreover, this theory enforces equitable input for equal output.

[7] See https://cihr-irsc.gc.ca/e/documents/CIHR_framework_2021-en.pdf (Accessed 20/12/2021).

The first scientific article

2.4. Ethical Governance in Healthcare: The Theory of Operation to Fight Health Inequalities

This article is under review with *Canadian Journal of Bioethics/Revue Canadienne de bioéthique*
+ Article type: Critical Commentary
+ Manuscript ID: 508-Article Text-5159-3-2-20211124
+ Author: Charles Biradzem, DINE

Abstract

Although multidimensional health efforts are invested to fight health inequalities, less context-sensitive and nonstrategic healthcare intervention mechanisms have maintained this health adversity conspicuously omnipresent among and across different populations of the world. Thus, this article presents the *theory of ethical governance in healthcare*, a context-sensitive conceptual frame to help global healthcare stakeholders establish new intervention strategies that bring context to knowledge and knowledge to context, and facilitate the fight against health inequalities.

Keywords: Ethical governance in healthcare, healthcare policy, health inequalities, health equity, global healthcare, health vulnerability.

Introduction

The fight against health inequalities is complicated, given that the same inequalities need to appear as a common motive for adopting a particular healthcare theory of operation, and for imploring a particular method of intervention. Health inequalities have a great propensity of widening or increasing if the healthcare theory of operation applied or the method of implementation implored are inappropriate or inappropriately executed (Jasso, 2015).

Three fundamental characteristics of health inequalities determine what theory of operation should be instituted, and how it should be implored. First, health inequalities *per se* are more social than biological, and thus, are avoidable and *minimizable*. Second, these inequalities are neither universal nor always *universalizable*, since their causes and manifestations often differ over time and space. Third, the perception of the practical influence of health inequalities on

human health is a recent issue, and so few or no past operational concrete cases are available for reference.

Although some populations have been living with health inequalities for a long time, it was only in the later part of the 20th century that researchers ascertained the practical influence of these inequalities on human health and health management (Mackenbach, 2006). It was not until 1980 that the Working Group on Inequalities in Health published the first known report on health inequalities called *The Black Report* after Sir Douglas Black who headed the research (Gray, 1982). This report awakened an international awareness about the extent to which different populations unequally experience Disease/Disability Adjusted Life Years (DALYs), and this information opened a new era in global healthcare research and intervention (Kneipp et al., 2018).

As mentioned previously, health inequalities are not only based on biological/biomedical factors, but also on socioeconomic and environmental factors—social determinants—that reflect contextual realities. Thus, the prevailing bio-socio-environmental factors often determine the rate of health inequalities, the reason why health inequalities differ along contextual outlines (Leon et al., 2001). In other words, health inequalities are not only attributable to failures in National Health Systems (NHS) but also can be caused by natural and man-made 'social' factors. Therefore, tackling health inequalities through these determinants is a fundamental mechanism for achieving *health for all* while addressing health inequalities (Graham & Kelly, 2004).

Questions concerning *where*, *why*, *how*, and *for whom* should be analyzed before designing any intervention strategy for confronting health inequalities (Agatiello & Lamond, 2008). This insight is paramount because many of the inequalities influencing human health stem from inequalities

in the social determinants of health, and these inequalities need to be detected before they can be targeted (Gray, 1982). Moreover, such a strategy demands an interdisciplinary approach. Generally, interdisciplinary knowledge is essential with respect to designing a strategy to confront diseases with a heterogeneous prevalence, such as the case of malaria in SSA. The same concern arises when intervening within a society with a peculiar cultural distinction—ex., the Indigenous Peoples (Kim, 2019).

Any healthcare intervention attempt in any of the situations just mentioned may aggravate the health situation of the poor and vulnerable if this insight is overlooked (Dine, 2020b; Heggenhougen et al., 2003). To identify various health inequalities, a wide normative judgment that practical/applied science alone cannot determine needs to be applied (Kawachi et al., 2002). This is why discourses on health inequalities are instigating questions within the scientific community. The arguments and counterarguments of recent discourses on health inequalities are prompting a critical re-examination of the causality mechanisms that contribute to health inequalities (Kneipp et al., 2018).

In summary, health inequalities are the differences that people experience within the gap between health wants and means. Thus, a proactive theory to fight health inequalities must not only adhere to scientific or biomedical deontology to be effective, it also must be interdisciplinary and ethically susceptible (Kawachi et al., 2002). As a foundation, we need contextual assurance as to which health determinants simultaneously influence the overall health of the populations and its distribution, and we need to know how.

Also, the global sensitivity about and for the fight against health inequalities is a recent issue (Gray, 1982). Thus, a reference to historical empirical findings is not necessary to certify the

reliability of a theory to fight health inequalities. Such a theory should be innovative in conception, and founded on the characteristics that can operate and uphold a context-sensitive intervention process (A. Cortina et al., 2017). The insights from the theory of ethical governance in healthcare falls into this category because it is an innovative theory that avoids stereotypes in favour of contextualization when confronting health inequalities.

The Theory of Ethical Governance in Healthcare

This is an ethical context-sensitive theory that makes good use of the impetus of the *ethics* of *care* as an aspect of applied ethics to enforce healthcare interventions. It applies *health equity* as its *modus operandi* to target *health inequalities* by envisaging *equitable health equality*. From this perspective, the concept of *health equity* has a pivotal role in this theory. Therefore, *health equity* must be adequately distinguished from its allied concepts—*health inequities, health inequalities* and *health disparities*—to avoid any confusion that might undermine action/practicality (Wildgen & Denny, 2020). Health equity, whose absence may be a sign of health inequities, is both an ethics and human rights intervention principle to motivate the elimination of **unfair** and **avoidable** health disparities (health inequalities) from the world's populations (Braveman et al., 2018).

This concept of *health equity* provides the basis for an ethical evaluation of healthcare justice, which may yield more qualitative terms than quantitative. The ethical insights that frame this process not only help to prevent health inequalities, but also help to prevent or mitigate the effects of these inequalities, such as any resulting vulnerability and calamities (Jasso, 2015). Therefore, a theory of ethical governance must be the base of any (global) healthcare intervention process. This theory has the operational motivation to help detect and target the most vulnerable,

especially since health inequalities are fast increasing among the poorer populations of the world. For example, the malaria situation across countries in SSA from East to West has produced a high degree of inequalities; in addition, health inequalities across different population groups have been perpetuated by the recent COVID-19 pandemic; and similar health inequalities are being experienced by Indigenous peoples.

According to the exigencies of this theory, ethical governance in healthcare helps to establish a practical cordiality between healthcare engagements and healthcare justice. It inspires professionals to moderate healthcare justice with the ethical virtue of equity/fairness, and use the philosophy of social justice to target health inequalities. This process can bring context to knowledge and knowledge to context (A. Cortina et al., 2017) by facilitating the contextual application of knowledge and empowering the intervention process with a context-sensitive impetus. In applying these insights, the healthcare intervention process can touch the lives of the health vulnerable without subjugating prejudices, and thereby satisfy their human rights to health. The theory of ethical governance in healthcare relies on interdisciplinary input and aspires to interdisciplinary output, since the identification of health inequalities goes beyond a monodisciplinary capability, and the minimization of these inequalities goes beyond the framework of conventional rules.

At the moment when the fight against health inequalities became imminent, the rapidity of scientific involvement and engagement outweighed ethical and contextual consciousness. When technoscientific and biomedical deontology overpowered health equity, it became difficult for vulnerable populations to benefit from various healthcare services (Anisa, Abdallah, & Peter, 2003; Wahlberg et al., 2013). Questions concerning *who* should benefit, and *how* to satisfy those who are in the greatest need, became too challenging. The situation worsened when diversity in

contextual health factors (social determinants) became an influential variable for determining human health and wellbeing (Bronheim & Goode, 2013). These ideological and professional conflicts began to ruin global healthcare efficiency, thereby distorting the expected results. At this juncture, it became necessary to introduce and enforce the concept of *ethical governance* in all healthcare initiatives (Wahlberg et al., 2013).

The Operationalization of the Theory of Ethical Governance in Healthcare

We can better establish the link between health knowledge and healthcare practice, and define the difference between illness and health, with the aid of insights from the theory ethical governance in healthcare. This theory correlates with virtue ethics, and takes conscience and behaviour beyond the role of law and biomedical deontology (Emmerich, 2018). In the words of James Orbinski, it helps "to initiate action with explicit ethical reasoning and to evaluate outcomes from both objective and ethical perspectives to improve our future choices and actions" (emphasized) (A. Pinto & Upshur, 2013, p. x). As such, this theory enables a consideration of contextual health-factor variables.

The determination and evaluation of *a priori* inequalities in contextual health realities are crucial to the enforcement of 'level-grounded' healthcare politics and policies across distinct cultures; otherwise, the disadvantaged will experience further health vulnerability. The insights from ethical governance in healthcare are indispensable for helping people with relatively weak economic capabilities and high health burdens. For example, we need these insights to ameliorate a fragile healthcare situation like the antimalarial intervention in SSA, and when intervening with people who are relatively disfavoured, e.g., Indigenous populations. In either of these cases,

sufficient contextual knowledge and sensitivity are necessary to render pure scientific knowledge productive.

As Mary Roch Rocklage has highlighted, ethical governance in healthcare refers to effective health management and decision-making processes that consider the interests and benefits of the community served, as well as those of health stakeholders (Ritvo et al., 2004). Ethical governance in healthcare ensures that the expected mission embedded in any healthcare intervention—especially in low– and middle–income countries—can be achieved to benefit all, especially the vulnerable. The effectiveness of this process demands the pragmatic disposition of applied ethics that can target variations in the social determinants of health and health inequalities, since not all the social determinants of health determine health inequalities.

Therefore, the solution to health inequalities is not a haphazard provision of health services and resources. That is, a haphazard distribution of financial aid to fight health inequalities might not have the same impact across different populations—ex., it will not have the same impact in SSA or among Indigenous peoples as it would in Western societies. We have this diversity because financial income, as a part of health determinants, depends on other factors like social and health services to effectively impact health outcomes. The intervention process must first investigate *which* health determinants affect both health and its distribution within the context in question, and *how*. On the basis of this information, a strategy can be designed to target these determinants/factors (Wahlberg et al., 2013). Thus, health inequalities also infer the unfair failure to overcome avoidable health disparities, which infringe on human rights to health and wellbeing (WHO, 2018a).

In addition to being a consensus focused theory, ethical governance in healthcare is an investigative theory established with consciousness of contextual variations—both time and space—in the social determinants of health inequalities. This theory operates within health contextual dynamics without reaching absolute relativity because it still respects all the standard principles of bioethics while also considering the importance of context (Ritvo et al., 2004). In other words, this theory emphasizes and enforces the analytical capacity of health stakeholders with the philosophy of contextualization.

According to Kurt Bayertz, contextualization is a pragmatic approach adopted in applied ethics to create immediate practical relevance in conformity with contextual reality (A. Cortina et al., 2017). In healthcare, contextualization is achieved when the insights from ethical governance in healthcare have enticed health stakeholders and partners to consider both the environmental and economic backgrounds of populations before defining their intervention mechanism (Holland, 2011). As such, healthcare stakeholders and their partners—moral or individual—target health inequalities. In the intervention process, they abide by various principles embedded in ethical approaches and models, such as ethical enquiry, ethical deliberation, ethical regulation, ethical supervision, and ethical interaction (Wahlberg et al., 2013).

When these ethical principles and dispositions guide healthcare professionals, they provide relative interpretations and applications to static laws. Thus, professionalism meets relativism, and interventions move beyond stereotypes. This approach is helpful for answering pertinent context-sensitive questions about human health (Ritvo et al., 2004) because health inequalities often reflect contextual variations and disadvantages between peoples (Braveman et al., 2011; WHO, 2018b). For example, the absence of this insight in the various antimalarial interventions in SSA is partly responsible for 61.07% of antimalarial funding and research being concentrated

in the Eastern part of SSA (Head et al., 2017) while 58.45% of calamitous malaria endemicity/vulnerability is concentrated in the western part (GHO, 2017). Similarly, the COVID-19 pandemic has caused serious catastrophic effects in long-term-care centres/homes in many countries partly because this insight did not guide stakeholders to design initial anti-COVID-19 prevention mechanisms that could target the most vulnerable.

However, I acknowledge that the practicality of applying this theory is complicated. It involves an interplay between the conceptual clarifications of *equality* and *equity,* and the practical differentiation of *healthcare justice* from *healthcare social justice*. In addition, the application of this theory would enlarge the scope of the ethics of care to put more stress on the relationships between individuals and include societies or communities as aspects of these relationships. These emphases clarify that, on the one hand, the concept of *equality* and the practice of *justice* are based on the 'Law' (principle-based approach) so to satisfy the philosophy of *sameness* (Greenberg & Cohen, 2014); whereas, on the other hand, the concept of *equity* and the practice of *social justice* are empowered by the ethics of care so to satisfy need (empathy-based approach) and relieve vulnerability (Adams & Bell, 2016; Braveman et al., 2018; Greenberg & Cohen, 2014).

Conclusion

As I have demonstrated in this paper, a Law is the synthesis of stereotypical observations of particular facts and occurrences (Ratner, 2003), and care is the moral motivation to meet and redress the needs of the vulnerable in relation to their context (Dine, 2020b). The combination of law and care in the health domain unites governance and health, political will and healthcare, justice and empathy, equity and equality, and benefits and interests. When these combinations are

managed with the logic of contextualization, any healthcare intervention targeting health inequalities should provide special attention to vulnerable populations through equitable intervention (Jehu-Appiah et al., 2008). In this sense, 'need' becomes the main determining factor (Dine, 2020b).

The theory of ethical governance in healthcare materializes virtue ethics and contextualizes various intervention principles because neither principles nor virtues alone provide sufficient healthcare guidance. Whereas virtue theories alone cannot instruct us on how to handle the ethical conflicts between benefits and interests because these theories lack practicality (Resnik, 2012b), in a similar way, principle-based theories alone cannot instruct us on how to handle the ethical conflicts between principles like justice and care (Morris & Morris, 2016). The insights of the theory of ethical governance in healthcare provide healthcare virtues and principles with the benefits of practical wisdom.

The process of applying this theory needs a stage of 'contextual deliberation' that helps with the interpretation and application of necessary virtues and principles in conformity with external variables or differentiating factors. Both virtues and principles "require situational appreciation" to be effective (Morris & Morris, 2016, p. 203). These intervention dynamics are absent in low- and middle-income countries that have been overwhelmed by many untreated treatable diseases (de Campos, 2017). As mentioned previously, this weakness is clear in the case of malaria in SSA that has been exacerbated by less-than-strategic antimalarial interventions within and across countries (Aaby, Rodrigues, Kofoed, & Benn, 2015; Golding et al., 2017; Zhang et al., 2018). Also, the multidimensional health inequalities among Indigenous peoples have been perpetuated by less-than-culture-sensitive healthcare interventions/provisions (Kim, 2019). The theory of ethical governance in healthcare brings to bear the pragmatic impetus of applied ethics that

recommends equitable, interdisciplinary, and context-sensitive efforts to confront and minimize health inequalities.

Declarations

Acknowledgement: Great thanks to the blind reviewers for their enriching comments.

Conflict of interest: None

Funding: None

Reference

Aaby, P., Rodrigues, A., Kofoed, P. E., & Benn, C. S. (2015). RTS,S/AS01 malaria vaccine and child mortality. *Lancet, 386*(10005), 1735-1736. doi:https://doi.org/10.1016/S0140-6736(15)00693-5

Adams, M., & Bell, L. A. (Eds.). (2016). *Teaching for diversity and social justice* (3rd ed.). New York: Routledge.

Agatiello, O. R., & Lamond, D. (2008). Ethical governance: beyond good practices and standards. *Management Decision, 46*(8), 1132-1145. doi:https://doi.org/10.1108/00251740810901345

Anisa, M., Abdallah, S. D., & Peter, A. S. (2003). 'Mind the gap': science and ethics in nanotechnology. *Nanotechnology, 14*(3), R9. doi:https://doi.org/10.1088/0957-4484/14/3/201

Braveman, P., Arkin, E., Orleans, T., Proctor, D., & Plough, A. (2018). What is Health Equity? *Behaviorial Science & Policy, 4*(1), 1-14. doi:https://doi.org/10.1353/bsp.2018.0000

Braveman, P., Kumanyika, S., Fielding, J., Laveist, T., Borrell, L. N., Manderscheid, R., & Troutman, A. (2011). Health disparities and health equity: the issue is justice. *Am J Public Health, 101 Suppl 1*(S1), S149-155. doi:http://dx.doi.org/10.2105/AJPH.2010.300062

Bronheim, S., & Goode, T. (2013). Documenting the Implementation of Cultural and Linguistic Competence: Guide for Maternal and Child Health Bureau Funded Training Programs. In G. U. C. f. C. a. H. Development (Ed.). Washington, DC: National Center for Cultural Competence.

Cortina, A., García-Marzá, D., & Conill, J. (Eds.). (2017). *Public Reason and Applied Ethics: The Ways of Practical Reason in a Pluralist Society*. London/Now York: Routledge-Taylor & Francis.

de Campos, T. C. (2017). *The Global Health Crisis: Ethical Responsibilities* (Vol. 36). London: Cambridge University Press.

Dine, C. B. (2020). Socio-ethical Dimension of COVID-19 Prevention Mechanism-The Triumph of Care Ethics. *Asian Bioethics Review, 12*(4), 539-550. doi:https://doi.org/10.1007/s41649-020-00143-1

Emmerich, N. (2018). Virtue and the Ethics of Social Research. In N. Emmerich (Ed.), *Virtue Ethics in the Conduct and Governance of Social Science Research* (Vol. 3). Bingley: Emerald Publishing Limited.

GHO. (2017). Annex B: Tables of health statistics by country, WHO region. *World Health Statistics* Retrieved from http://www.who.int/gho/en/ 20/08/2018.

Golding, N., Burstein, R., Longbottom, J., Browne, A. J., Fullman, N., Osgood-Zimmerman, A., . . . Hay, S. I. (2017). Mapping under-5 and neonatal mortality in Africa, 2000-15: a baseline analysis for the Sustainable Development Goals. *Lancet, 390*(10108), 2171-2182. doi:https://dx.doi.org/10.1016/S0140-6736(17)31758-0

Graham, H., & Kelly, M. P. (2004). *Health inequalities: concepts, frameworks and policy*. London: Citeseer/Health Development Agency.

Gray, A. M. (1982). Inequalities in health. The Black Report: a summary and comment. *Int J Health Serv, 12*(3), 349-380. doi:https://doi.org/10.2190/XXMM-JMQU-2A7Y-HX1E

Greenberg, J., & Cohen, R. L. (Eds.). (2014). *Equity and justice in social behavior*. New York, NY: Academic Press.

Head, M. G., Goss, S., Gelister, Y., Alegana, V., Brown, R. J., Clarke, S. C., . . . Tatem, A. J. (2017). Global funding trends for malaria research in sub-Saharan Africa: a systematic analysis. *Lancet Glob Health, 5*(8), e772-e781. doi:https://dx.doi.org/10.1016/S2214-109X(17)30245-0

Heggenhougen, H. K., Hackethal, V., & Vivek, P. (2003). *The behavioural and social aspects of malaria and its control* (Vol. 03). Geneva: WHO/UNDP/WB.

Holland, S. (2011). The virtue ethics approach to bioethics. *Bioethics, 25*(4), 192-201. doi:https://doi.org/10.1111/j.1467-8519.2009.01758.x

Jasso, G. (2015). Inequality Analysis: Overview. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 885-893 / doi: https://doi.org/810.1016/B1978-1010-1008-097086-097088.032199-097087). Oxford: Elsevier.

Jehu-Appiah, C., Baltussen, R., Acquah, C., Aikins, M., d'Almeida, S. A., Bosu, W. K., . . . Adjei, S. (2008). Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis. *Value Health, 11*(7), 1081-1087. doi:http://dx.doi.org/10.1111/j.1524-4733.2008.00392.x

Kawachi, I., Subramanian, S. V., & Almeida-Filho, N. (2002). A glossary for health inequalities. *J Epidemiol Community Health, 56*(9), 647-652. doi:https://doi.org/10.1136/jech.56.9.647

Kim, P. J. (2019). Social Determinants of Health Inequities in Indigenous Canadians Through a Life Course Approach to Colonialism and the Residential School System. *Health Equity, 3*(1), 378-381. doi:https://doi.org/10.1089/heq.2019.0041

Kneipp, S. M., Schwartz, T. A., Drevdahl, D. J., Canales, M. K., Santacroce, S., Santos, H. P., Jr., & Anderson, R. (2018). Trends in Health Disparities, Health Inequity, and Social Determinants of Health Research: A 17-Year Analysis of NINR, NCI, NHLBI, and NIMHD Funding. *Nurs Res, 67*(3), 231-241. doi:https://doi.org/10.1097/NNR.0000000000000278

Leon, D. A., Walt, G., & Gilson, L. (2001). Recent advances: International perspectives on health inequalities and policy. *BMJ, 322*(7286), 591-594. doi:http://dx.doi.org/10.1136/bmj.322.7286.591

Mackenbach, J. P. (2006). *Health inequalities: Europe in profile*. Rotterdam: Department of Public Health-Erasmus MC / European Union.

Morris, M. C., & Morris, J. Z. (2016). The importance of virtue ethics in the IRB. *Research Ethics, 12*(4), 201-216. doi:https://doi.org/10.1177/1747016116656023

Pinto, A., & Upshur, R. (2013). *An introduction to global health ethics*. New York: Routledge.

Ratner, L. W. (2003). Part V - Philosophy and Logic of Physical Theory. In L. W. Ratner (Ed.), *Non-Linear Theory of Elasticity and Optimal Design* (pp. 155-261). Amsterdam: Elsevier Science.

Resnik, D. (2012). Ethical virtues in scientific research. *Accountability in Research, 19*(6), 329-343. doi:https://doi.org/10.1080/08989621.2012.728908

Ritvo, R., Ohlsen, J., & Holland, T. (2004). *Ethical Governance in Health Care*. Chicago: library of Congress.

Wahlberg, A., Rehmann-Sutter, C., Sleeboom-Faulkner, M., Lu, G., Doring, O., Cong, Y., . . . Rose, N. (2013). From global bioethics to ethical governance of biomedical research collaborations. *Soc Sci Med, 98*, 293-300. doi:http://dx.doi.org/10.1016/j.socscimed.2013.03.041

WHO. (2018a). Equity. *Health Systems: https://www.who.int/healthsystems/topics/equity/en/ (Accessed 24/03/2019).*

WHO. (2018b). Gender, Equity and Human Rights. *https://www.who.int/gender-equity-rights/en/ (Accessed 20/01/2018).*

Wildgen, A., & Denny, K. (2020). Health Equity's Missing Substance: (Re)Engaging the Normative in Public Health Discourse and Knowledge Making. *Public Health Ethics, 13*(3), 247-258. doi:https://doi.org/10.1093/phe/phaa019

Zhang, M., Wang, C., Otto, T. D., Oberstaller, J., Liao, X., Adapa, S. R., . . . Adams, J. H. (2018). Uncovering the essential genes of the human malaria parasite Plasmodium falciparum by saturation mutagenesis. *Science, 360*(6388). doi:http://dx.doi.org/10.1126/science.aap7847

2.5. Problem Statement: Malaria Morbidity/Mortality Inequality-Gap in SSA Increases

Although malaria disease, especially plasmodium falciparum, has remained endemic in many countries in SSA (Aaby et al., 2015; WHO, 2017a, 2018c), it is not *ipso facto* rated as a neglected disease (WHO, 2017c). Global healthcare stakeholders and their partners already have invested enormous efforts in SSA to fight against this disease. The main and unpredictable characteristic of this species of malaria is the intensive heterogeneity in its prevalence across countries. This characteristic is generated by the variations in sociocultural and socio-contextual vector factors such as environment, climate, lifestyle, beliefs, and economic activities of the populations (Hay et al., 2000; Snow et al., 1999).

In other words, the great variations in the presence of the vector factors of plasmodium falciparum across countries are responsible for the variations in its prevalence rates, either as parasite or disease. Thus, the populations living in regions with many favourable malaria vector factors experience perennial severe malaria infections, whereas those living in regions with a scarcity of these factors experience much less frequent severe malaria infections (Doolan, Dobano, & Baird, 2009; Ferguson et al., 2010; Golding et al., 2017). These same dynamics are present in both urban centres and rural areas. Most socioeconomic activities (farming, fishing, and animal rearing) and socio-environmental characteristics (swampy areas, forests, and water pools) in many rural areas in SSA favour malaria prevalence (De Silva & Marshall, 2012).

From a global perspective, these imbalances have maintained SSA as the epicentre of malaria morbidity and mortality in the world. Between 1990 and 2017, SSA had an average of 90.2% of the global malaria burden, and an average of 86.69% of global malaria morbidity. In addition to the whole of SSA being the leader in the global malaria count, it also has become divided into malaria infection zones. The Western part of SSA is the most infected and affected zone, accounting for 58.45% of malaria morbidities (GHO, 2017; WHO, 2017a).

The efforts to fight the various disastrous effects of malaria in SSA have been ongoing for decades. For example, the 1950 Kampala–Uganda malaria conference, organized by the WHO, was held to discuss and design better antimalarial intervention strategies for SSA (Winstanley, Ward, Snow, & Breckenridge, 2004). This conference, and many similar others, have led to the establishment of programs like Roll Back Malaria to facilitate the fight against malaria in SSA. In addition, the UN Millennium Development Goals and the UN Sustainable Development Goals have further enforced the many antimalarial initiatives in SSA.

Through and beyond these programs, investments in various antimalarial initiatives in SSA have been increasing. For example, since 2000, the greatest fraction of the global expenditure on malaria research has gone to SSA (WHO, 2017c, 2018c). As well, this expenditure has had annual increases: US$ 585.2 million in 2006; US$ 931.8 million in 2007; US$ 1.1 billion in 2008; US$ 1.7 billion in 2009; US$ 1.8 billion in 2010; US$ 1.9 billion in 2011—totalling US$ 8 billion for these years (Head et al., 2017) and US$ 3.1 billion in 2017[8].

Antimalarial research in SSA—both fundamental and clinical—also has had a sequential increase. For example, clinical antimalarial trials increased from *n*=5,635 in 2000 to *n*=175,013

[8] See http://www.who.int/news-room/fact-sheets/detail/malaria. For various updates on malaria, see http://www.who.int/malaria/en/ (Accessed 21/05/2018).

in 2014 (Puppalwar, Mourya, Kadhe, & Mane, 2015), with ≥333 new cohorts of malaria research awards for SSA (Head et al., 2017). With this huge economic and scientific input, studies on the peculiarity of plasmodium falciparum have intensified, although much is still left to do (Zhang et al., 2018). Also, various physical antimalarial measures have been greatly promoted, such as the massive distribution of insecticide-treated bed nets and periodic indoor spraying (Mwangoka et al., 2013; Trape, Robert, & Rogier, 2011).

As of 2016, more than 30 different types of antimalarial drugs and vaccines have been available across SSA (WHO, 2016a). Above all, "The Quines …" like Quinine, Chloroquine, Amodiaquine, just to name but these few (O'Meara, Mangeni, Steketee, & Greenwood, 2010; WHO, 2016a). Although these drugs generated some hope in SSA, they were confronted with serious parasitic resistance in the malaria-endemic regions/countries (Kouyate et al., 2007; Paul, 2011). For example, from 2000 to 2007, a chloroquine combination was exclusively administered, together with a massive distribution of insecticide-treated bed nets in malaria-endemic Nouna Health District in Burkina Faso. Unfortunately, the results of this exercise proved to be a great failure, since the malaria cases in this district tripled (Muller et al., 2009; Paul, 2011).

A similar failure occurred in Mozambique, which caused South Africa to adopt a massive antimalarial vaccination along its border with Mozambique. South African health stakeholders claimed that immigrants from Mozambique were importing malaria parasites into their territory (Silal, Little, Barnes, & White, 2015). These failures and the high parasitic drug resistance in malaria-endemic countries—especially to chloroquine—tempted the WHO to warn against the indiscriminate administration of chloroquine in SSA (WHO, 2018c). In the midst of these uncertainties, some antimalarial partners and pharmaceutical companies engaged in a search for a

new antimalarial drug candidate that could resist and subdue the malaria parasites in SSA. As part of this effort, a group of researchers spearheaded by African scientists conceived a new anti-falciparum vaccine candidate called Mosquirix-RTS,S (Mwangoka et al., 2013).

Although Mosquirix-RTS,S is still in its pilot stage, it already has shown an approximate 50% efficiency against severe malaria in children between 5 to 17 months, and a 36.6% efficiency in children between 6 and 12 weeks (Mwangoka et al., 2013; Winskill, Walker, Griffin, & Ghani, 2017). This is the only antimalarial drug candidate to have reached clinical trials Phase III in SSA (Kakkilaya, 2015a). Also, it already has received positive regulatory assessment recommendations and confirmation from the European Medicines Agency (EMA) (Aaby et al., 2015; Sauboin, Van Bellinghen, Van De Velde, & Van Vlaenderen, 2015; WHO, 2016a).

Despite these successes, this drug candidate still faces some challenges with respect to satisfying its Phase III trials. For example, it failed in malaria-endemic countries to activate and correlate with antibodies to develop protective immunity against falciparum (Aaby et al., 2015; Sauboin et al., 2015). If that deficiency should persist in these countries, this drug candidate always will need to be reenforced with some other antimalarial drug combinations to help it adapt to the immune system of these populations (Mwangoka et al., 2013). Unfortunately, this process will likely make it too expensive for the most hard-hit vulnerable populations in SSA (Winskill et al., 2017).

As mentioned above, the intensive variations in malaria vector factors in SSA are responsible for these malarial dynamics. These variations give rise to natural inequalities in the malaria parasitic prevalence across countries in SSA. In turn, these dynamics and difficulties intensify malaria morbidity/mortality inequalities across countries in SSA. Since this cycle has persisted for such a

long time, malaria inequalities have become a permanent feature across SSA. Thus, it has become a herculean task to attain equitable equality in the fight against malaria in SSA and to ensure human rights to *health for all.* For example, between 2000 and 2016, malaria inequalities across countries in SSA ranged from as high as 389.2/^{000} infection rate in Burkina Faso to as low as 0.9/^{000} infection rate in Botswana (GHO, 2017). Within the same period, inequalities in the under-five malaria mortality ranged from ≤5/^{000} in Botswana to ≥135/^{000} in the Central African Republic (Golding et al., 2017).

These diverging antimalarial dynamics in SSA have widened the already wide malaria morbidity/mortality inequality-gap across countries in that part of the world. As these malaria-endemic countries become holoendemic, their populations become vulnerable to various malaria calamities. For example, at the moment, the acute severe comorbidity of the malaria-anaemia mortality rate is as high as ≥11% in Burkina Faso, and as low as ≤1% in Rwanda and Tanzania (Papaioannou et al., 2019). In contrast, between 2000 and 2016, the malaria mortality decreased in the Eastern part of SSA, whereas during the same time period, it increased in the Western part (WHO, 2017a).

In light of these dynamics, I acknowledge that it will be difficult to fight malaria in SSA, despite a desire to attain equitable equality in malaria decline across SSA and satisfy human rights to *health for all* (WHO, 2017c, 2018c). To complicate matters, the semi-immune populations in SSA, who are still unidentified, store the malaria plasmodium and disguise its propagation vector pattern (Gosling, Okell, Mosha, & Chandramohan, 2011). Importantly, SSA is a region of uneven socioeconomic, sociocultural, and socio-environmental or ecological setups that instigate high variations in the types of malaria plasmodium and malaria parasitic prevalence (Ferguson et al., 2010; Zhang et al., 2018).

The ensemble of these unfavourable conditions has rendered the fight against malaria in SSA a difficult endeavour. However, this difficulty does not minimize the importance of human rights to health as one of the basic universal human rights for everyone to enjoy (Rawaf, 2017; WHO & OHCHR, 2008). It remains our responsibility to ensure that we do not disfavour anyone from achieving their full health potentiality. In other words, we need to take responsibility to ensure the fulfilment of everyone's human rights to health whenever possible (Sklar, 2018).

Thus, the empathetic emotion of care has enticed me to take up the responsibility to better analyze this situation and propose an intervention strategy that can help to restore the health rights of the vulnerable malaria hard-hit populations in SSA. Two fundamental observations can guide the execution of this responsibility. First, many antimalarial strategies already are exploited in SSA, despite the accumulating negative feedback. Second, the malaria prevalence in SSA is too heterogeneous with great dispersion, and the inequitable antimalarial interventions in that part of the world have a high risk of worsening the situation of vulnerable hard-hit populations.

Therefore, the fight against malaria in SSA needs an innovative intervention strategy to enhance an efficient antimalarial intervention process and override the failures of the past. Such an efficient intervention process must be equitable *vis-à-vis* the heterogeneous malaria endemicity. Thus, the allocation process of available antimalarial resources and services must be based on need, which will provide an equal opportunity for all the populations in SSA to enjoy their rights to health, even at a minimum. This is the only process that will relieve the vulnerable malaria hard-hit populations and assure equitable equality in malaria decline across SSA countries.

I attest that any antimalarial intervention strategy with these qualities can minimize the malaria morbidity/mortality inequality-gap with equitable equality in malaria decline. As per my analysis

in Section 2.3, the insights from the theory of ethical governance in healthcare, which also are innovative in the healthcare domain, can help to provide these qualities and expectations. Therefore, the expected innovative intervention strategy to enhance the fight against malaria in SSA should be empowered with the insights of the theory of ethical governance in healthcare to ensure efficiency in the antimalarial intervention processes. But what innovative intervention strategy can enhance the equitable antimalarial process in SSA to attain equitable equality in malaria decline across countries and relieve malaria hard-hit populations?

2.6. Research Objective

To begin, I want to repeat that this research is neither biomedical research nor a challenge to the various biomedical efforts already invested in SSA to fight against malaria. It is a proactive philosophical healthcare research of applied ethics with empathy-based orientations from the ethics of care and of the human right to *health for all*. Since malaria has remained the main threat to the human right to health in SSA and to the health vulnerability of its populations, I designed my research to propose an innovative antimalarial intervention strategy capable of fighting malaria inequalities in these countries.

When I analyzed the various negative dynamics that define most antimalarial outcomes in SSA, I felt as frustrated as some conscious antimalarial partners and sympathizers. Among many, Bill Gates already had cautioned various health stakeholders and partners in Africa to be aware of the general health destitution in that part of world. He declared that this situation will tempt countries in SSA to rearrange their health systems to ensure that interventions get to those in need (Gulland, 2012). Worst of all, populations in SSA have experienced these negative dynamics for decades. Also, I felt as frustrated as some sympathetic academics who already were pleading to

African health stakeholders to always design various healthcare policies to favour their populations (Resnik, 2012a).

These frustrations awakened an empathetic responsibility in me to invent an intervention strategy to contribute towards the amelioration of the malaria situation in SSA. I am convinced, as are many others, that "if we continue employing the same level of resources and the same interventions—we will face near-certain increases in malaria cases and deaths" (WHO, 2017c, p. V). In addition, I also am moved by the fact that from a socio-ethical perspective, it is unfair and against the ethics of human rights to health to abandon the vulnerable, such as the malaria hard-hit populations in SSA, to their misery.

To help restore the health rights of the malaria hard-hit populations in SSA, various antimalarial partners—moral or individual persons—should embrace ethical consciousness. They should come to the aid of everyone in need rather than create unfair socio-ethical imbalances (Resnik, 2002). As applied ethics suggests, the satisfaction of excellence when exercising context-sensitive health professional activities depends not only on the conventional laws that need to be followed, but also on the contextual determinants of human health. An *ethos* embedded in context-sensitive values, principles, and virtues is needed to characterize and frame these activities (A. Cortina et al., 2017).

Therefore, a proactive antimalarial intervention strategy to help the vulnerable malaria hard-hit populations of SSA should not only focus on the microbiological characteristics of malaria as a disease, but also on the unmeasurable socio-contextual malaria variables so to overcome various vector alterations (Paul, 2011; Um, Ac, An, & Nwakwuo, 2015). This insight also is important because, as already mentioned several times, the fight against any aspect of health inequalities

should not only aim at preventing inequalities, but also at preventing or mitigating the manifesting effects of these inequalities (Jasso, 2015).

With these concerns in mind, the main objective of the present research is to design an innovative antimalarial intervention strategy to minimize the malaria morbidity/mortality inequality-gap and so facilitate equitable equality in malaria decline. Thus, I designed *the greatest-need target antimalarial intervention strategy*, an innovative intervention strategy empowered by the insights of the theory of ethical governance in healthcare. This strategy is capable of directing antimalarial services in SSA according to degree of need so to relieve the vulnerable malaria hard-hit populations and restore their rights to *health for all*. This intervention strategy is equitable in operation, since it combines care ethics and justice, and strives to achieve human rights to health for all as an aspect of social justice in healthcare. Therefore, in application, it targets malaria endemicity to attain equitable equality in malaria decline across countries in SSA.

As explained previously, the theory of ethical governance in healthcare goes beyond conventional prototypes and necessitates an investigative intervention methodology that can obtain context-sensitive findings to construct a context-sensitive solution pathfinding mechanism. To begin, I am convinced that an efficient antimalarial intervention process in SSA must start with strategic antimalarial research (Bhutta, 2002). Strategic research produces representative (context-sensitive) and reliable data, which is a prerequisite for the equitable orientation of the antimalarial intervention process (Fathalla & Fathalla, 2004; Hammer et al., 2006). Representative malaria data help in the equitable calibration of available antimalarial resources, and thereby make it possible for resources to be targeted to malaria hard-hit populations. In turn, this equitable process increases the potentiality of minimizing the malaria inequality-gap across countries.

From a wider and far-reaching perspective, this strategy has the potential to minimize the rampant malarial drug parasitic resistance in malaria-endemic parts of SSA because it can detect the asymptomatic carriers and provide representative data that can be used to calibrate drug production. Above all, this strategy can control both the means of fighting against malaria and the outcome of the fight against malaria. It can certify the veracity of statistical results with contextual reality, and the validity of the conclusion with the logical strength and soundness of the analysis. Thus, this research has both statistical measurement and ethical evaluation, with logic at its base.

I have focused my analysis of the antimalarial intervention process in SSA mainly at the level of research for two reasons, though working in correlation with funding. First, malaria is a communicable disease with an undefined propagation vector. Since dense heterogeneous malaria endemicity further complicates this characteristic in SSA, it is important to determine this heterogeneity through research findings and to target it through intervention. Second, when this heterogeneity is not determined and targeted, undetected carriers can develop complicated malaria-related health comorbidities, and many of them augment the group of the asymptomatic parasite propagators (Papaioannou et al., 2019; Teh, Sumbele, Meduke, Ojong, & Kimbi, 2018; Um et al., 2015).

Therefore, I recommend that antimalarial stakeholders and their partners in or for SSA should develop a certain degree of accuracy and reliability with respect to information mining, so they can answer questions about *where, why, for whom,* and *how* before endorsing any antimalarial intervention endeavours. Although strategic antimalarial research is necessary for obtaining accurate and reliable malaria information, only the insights of the theory of ethical governance in healthcare can assure that potentiality. Thus, the *greatest-need target antimalarial intervention*

strategy has the capacity to facilitate both antimalarial data mining and the antimalarial intervention process in SSA.

According to the exigencies of the theory of ethical governance in healthcare exploited in this research, this strategy needs to follow a step-by-step extraction of information to balance findings and results with contextual reality, and to avert prejudices and stereotypes. I also employ this procedure in the execution process of this research project. First, I determine the relationship between FAMR activities in SSA and malaria endemicity ($MIR/^{000}$). Second, I illustrate and demonstrate how the theory of ethical governance in healthcare can be used to subdue health inequalities to attain equitable equality. Third, I develop *the greatest-need target antimalarial intervention strategy* and demonstrate how it operationalizes the theory of ethical governance in healthcare using malaria data obtained from examining the relationship between FAMR activities in SSA and malaria endemicity. Moreover, I use the *greatest-need target antimalarial intervention strategy* to show the capability of the theory of ethical governance in healthcare to minimize the malaria inequality-gap in SSA and to attain equitable equality in malaria decline.

Chapter 3: Methodology and Operationalization

3.1. Introduction: Research Orientation and Complexities

To begin, the phrasing of the title of this research project is simple, but its context and content are complicated. With respect to its context, I have treated the whole of SSA as a single unit. Thus, I was compelled to exercise my data mining and analysis across many countries with varied socio-contextual backgrounds. With respect to its content, I used multidisciplinary material searches, and employed inductive and deductive methods of analysis with subjectivist and objectivist approaches. Thus, I developed my research project with a mixed-methods interdisciplinary research methodology to substantiate its content and argument with qualitative and quantitative findings and results.

This level of complexity was necessary for this research project due to the multidimensional characteristics of malaria disease and antimalarial intervention in SSA. For example, malaria in SSA is not a single illness for the medical corps to handle. In addition to the fact that malaria is an opportunistic disease that exploits any health fragility to manifest, it has become a wider social problem in SSA where it affects many aspects of the daily lives of populations. Thus, it was indispensable to highlight the importance of the epistemology of interdisciplinary methodology for designing both a malaria research procedure and an antimalarial intervention strategy. As will be explained in Section 3.3, the epistemology of interdisciplinary methodology harmonizes and enriches the dominance of the applied sciences in healthcare with insights from the humanities, and behavioural and social sciences.

Also, I appraised qualitative and quantitative data extraction as the best way of analyzing various facts about malaria in SSA so to diagnose outstanding weaknesses and facilitate an equitable intervention process. I used this method to harmonize statistics and narratives, and also applied inductive and deductive analyses to validate results from one country to many, and from many countries to one. In the same way and for the same reasons, I used vertical and horizontal verification processes to substantiate my results across countries, and to evaluate the rates at which malaria dynamics evolve over years. I used and recommend these systematic procedures when researching malaria in SSA to capture the variations and inequalities that characterize malaria in that part of the world.

I present this methodology section as a chapter, although many researchers often treat it as part of a conceptual–theoretical framework (Varpio, Paradis, Uijtdehaage, & Young, 2020). By presenting my methodology as a chapter, I am able to clarify many complications and support better comprehension. Thus, I outline the various mechanisms I used to access data, I provide a sufficient explanation of the various stages in my research and analysis, and I sequentially align facts to demonstrate coherence and facilitate understanding.

3.2. Method: Strategy of Material Search

I conceived and designed this research project from a philosophical perspective with literature-based information and findings on malaria in SSA. Unlike a secondary dataset analysis, I established the databank of this research from information/data—narrative and statistics—gathered through an in-depth analysis of literature or documented sources. Research experts recommend literature-based research methods for healthcare research because they enhance a systematic analysis of facts from a wide variety of sources. This strategy helps in the comparison

and contrast of findings from different contexts, and in the harmonizing of different viewpoints to detect the causes and consequences of health disparities and inequalities (Chan, McGarey, & Sclafani, 2018).

I exploited these characteristics to gather and analyze malaria findings from countries across SSA, and to harmonize multidisciplinary views about malaria in SSA. By using this approach, I detected the different causes and consequences of malaria morbidity and mortality inequalities across SSA from east to west. Since this method entails a systematic and coherent attention to greater detail (Willig & Rogers, 2017), it helped me to provide objective answers to pending questions about the fight against malaria in SSA. In turn, this disposition helped me to propose a plausible strategy to help shape the antimalarial intervention process in that part of the world.

From a general perspective, the research method I applied in this study is part of what linguists call the *corpus-based analysis research method,* which consists of probing, evaluating and optimizing knowledge from documented information sources (Farahin Musa & Khamis, 2015). In conformity with the exigencies of the theory of ethical governance in healthcare, I used this research method to investigate the antimalarial intervention process in SSA, and to crosscheck both the validity and veracity of my results. Thus, I discovered evolutionary patterns of malaria disease and antimalarial intervention in SSA, as documented in both scientific and organizational literature, and designed a valuable ethical critique. I consider these steps necessary to render my recommendations plausible.

From a particular perspective, the wide interdisciplinary dimension of the debates related to malaria in SSA conditioned me to adopt Schatzman's method of collecting literature sources. Schatzman encourages a wide selection and collection of literature sources that can provide

useful information which is not limited by disciplinary boundaries (Hadley, 2017; Poliquin, 2015). I used this approach to avoid disciplinary stereotypes, and to think differently and widely about the fight against malaria in SSA. This strategy helped to generate different kinds of analyses and to propose prospective ways to fight malaria in SSA. I screened the various scientific sources of my scientific corpus using the main keywords of this research so to include only first-hand documents void of biases (Monageng, 2006).

Also, I needed to harmonize facts and generate research findings and results representative enough to be credible for enhancing successful antimalarial efforts in SSA. I corroborated scientific data on the malaria situation across countries in SSA with information I obtained from local malaria reports by Local Malaria Control Committees, the WHO, and the GHO. I administered this process to validate that my data were from genuine sources, and credible enough to be reliable. To a greater extent, I wanted to be sure that the information I examined was representative of the totality of the relevant information about malaria in SSA.

However, I acknowledge that the *corpus-based analysis research method* has limitations. One of these shortcomings is the difficulty in ensuring (to a 100% certainty) the testimony of the contextual representation of the material consulted and of the findings extracted (Onwuegbuzie & Leech, 2007). Thus, when using this method, it is difficult to ascertain that the literature consulted provides accurate information about the health situation of the populations in question. Since I was aware of this risk, I turned to basic inspiration from Preferred Reporting Items in Systematic and Meta-Analysis by Extension to Scoping Review (PRISMA-ScR) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2010; Tricco et al., 2018). This approach provided me with guidance about how to satisfy some parts of this research with strategic and systematic selection, screening, and filtration of literature sources.

That notwithstanding, this research—in totality or in part—is neither a systematic review nor a scoping review. However, many of its parts combine some aspects of systematic and scoping reviews because I wanted to avoid distractions from the various lapses in literature availability, and to provide comprehensive explanations of its main concepts. I want to emphasize that the main concepts of this research are either novel in themselves, or 'compound concepts' composed of novel concepts that have limited exploitation within scientific circles. Thus, I conceived this research to clarify some *taken-for-granted* global healthcare weaknesses that have undermined successful antimalarial intervention in SSA, but unfortunately, I cannot ensure the coherence in my literature search to the extent that I can ensure the objectivity and credibility of my databank.

In light of these peculiarities and variations, I realized that the best way to subdue resulting difficulties and obtain satisfactory findings was to use a mixed-methods (quantitative and qualitative) research approach. I used this strategy to generate varied theories about malaria in SSA, harmonize narratives and statistics, and satisfy validity and veracity. We know that mixed-methods research benefits from combining the qualities of qualitative and quantitative methods, and enhances clarity, understanding, and corroboration (Schoonenboom & Johnson, 2017). However, in this research, I used the QUALI—quanti core (Shorten & Smith, 2017) due to the dominance of the qualitative stem of the mixed-methods approach that I found most relevant to the issues I wanted to address, although I also validated my findings using statistics.

One of the reasons I used a mixed-methods approach to generate my findings and a deductive-inductive approach to validate my results is because my research combines *exploration–description* and *testing–prediction* research drives that need mixed-methods for material search and deductive-inductive for analysis (Schoonenboom & Johnson, 2017). Too, the main questions and objective of this research focus on the relation between antimalarial intervention and the

inequality-gap in SSA, thus, necessitating a deductive and inductive validation of results. I have also used qualitative data for the inductive substantiation of quantitative findings, and quantitative data (statistics) for the deductive testing of qualitative hypotheses (Schoonenboom & Johnson, 2017).

3.3. Material Identification and Collection Procedures

I framed this research work by combining several research systems, as just explained, to deal with the malaria vector factors variation in SSA. First, I exploited aspects of systematic review and meta-analysis because I had to analyze a wide range of literature sources (Moher et al., 2010) to diagnose and situate the problem of antimalarial intervention in SSA. Second, I also used some aspects of scoping review because I needed to address some knowledge-gaps (Aromataris & Munn, 2017; Tricco et al., 2018) that have undermined a successful antimalarial intervention process in SSA. Third, I employed a fundamental research analysis approach because my objective was to propose or suggest an innovative intervention strategy (Monageng, 2006) for malarial management in SSA

Thus, this research became a *three-in-one* research project. First, it has features of *causal-comparative research* because it verifies cause-effect relationships among variables. Second, it also has aspects of *correlational research* because it uses statistical data to establish the relationship between variables. Third, it is *quasi-experimental research* because it sets directives for practical/applied intervention without manipulating independent variables, as often is done in

pure experimental research[9]. This *three-in-one* characteristic complicated the modelling of its operationalization strategy, and the processes of material identification and collection.

Thus, to simplify its operational complexity, I undertook the research process of this project in two separate steps with the intention of also developing its analytical process in two stages. On the one hand, I had to determine the relationship between FAMR in SSA and malaria endemicity, and on the other, I had to demonstrate the productive interaction between the theory of ethical governance in healthcare—the main theory that defines the operation of this research—and health inequalities—the central concept of this research. Whereas the former seeks to provide the underlying material for the present research, the latter seeks to provide its object and tools.

Correspondingly, I also carried out the data/information mining for this research in the two steps just described. Although I sought out and sorted the needed material under different rubrics and guidelines, I used common multidisciplinary search engines to access many scientific databases. As will be explained later, I used different search procedures to collect material and data for the two stages. For example, I provide research details on antimalarial intervention and malaria inequalities in SSA in Chapter 4, and details on health inequalities and ethical governance in healthcare in Chapter 5. In Chapter 6, I examine the practical combination of the two.

3.3.1. Health Inequalities and the Theory of Ethical Governance in Healthcare

I used Google, Google Scholar, and WorldCat to generate a range of literature sources on health inequalities, health disparities, health inequities, and ethical governance in healthcare from across many scientific databases. First, I obtained interdisciplinary material that permitted me to define

[9] See details provided by Winston-Salem State University – North Carolina at https://www.wssu.edu/about/offices-and-departments/office-of-sponsored-programs/pre-award/_Files/documents/develop-quantitative.pdf (Accessed 27/08/2021).

and distinguish *health inequalities, health disparities*, and *health inequities*. I used this process to highlight the differentiating peculiarities of *health inequalities* because it is the central concept of this research. Second, I searched for material on the theory of ethical governance in healthcare. This search was limited because this research is still emerging as its first generation of researchers begin to develop a conceptual framework of the theory. However, given that it is an emerging theory in applied ethics, I searched for supporting material from other areas of applied ethics that focus on contextualization, deliberation, and pragmatism.

By using these two complementary search processes, I limited my literature extraction to the year 2000 from the present. In addition, I wanted to work with as recent publications as possible, since the main concepts of this research—health inequalities, health equity, health disparity, ethical governance—were more developed at the beginning of the millennium. Thus, I sought help on literature screening from the Enhancing the Quality and Transparency of Health Research (EQUATOR) guidelines and the PRISMA-ScR guidelines (Aromataris & Munn, 2017; Tricco et al., 2018) to overcome inconsistencies. To satisfy the interdisciplinary dimension of my research, I carried out my literature search across the physical sciences, life sciences, health sciences, social sciences, and human sciences.

First, I screened various literature sources from their titles to ensure the pertinence of each document, the process through which I exported n=267 titles to my EndNote X8 library. Then, I eliminated any duplicated documents, and retained n=110 of them for further screening. My main eligibility criterion for the screening process was that each document had to treat all or at least one of the key concepts I mention above. As I read through various abstracts, and scanned through documents whose abstracts were not clear, I extracted n=85 plausible documents. Then, I

read through all these documents with an inclusion criterion in mind, which was to identify those documents that had at least a definition for at least one of my main concepts.

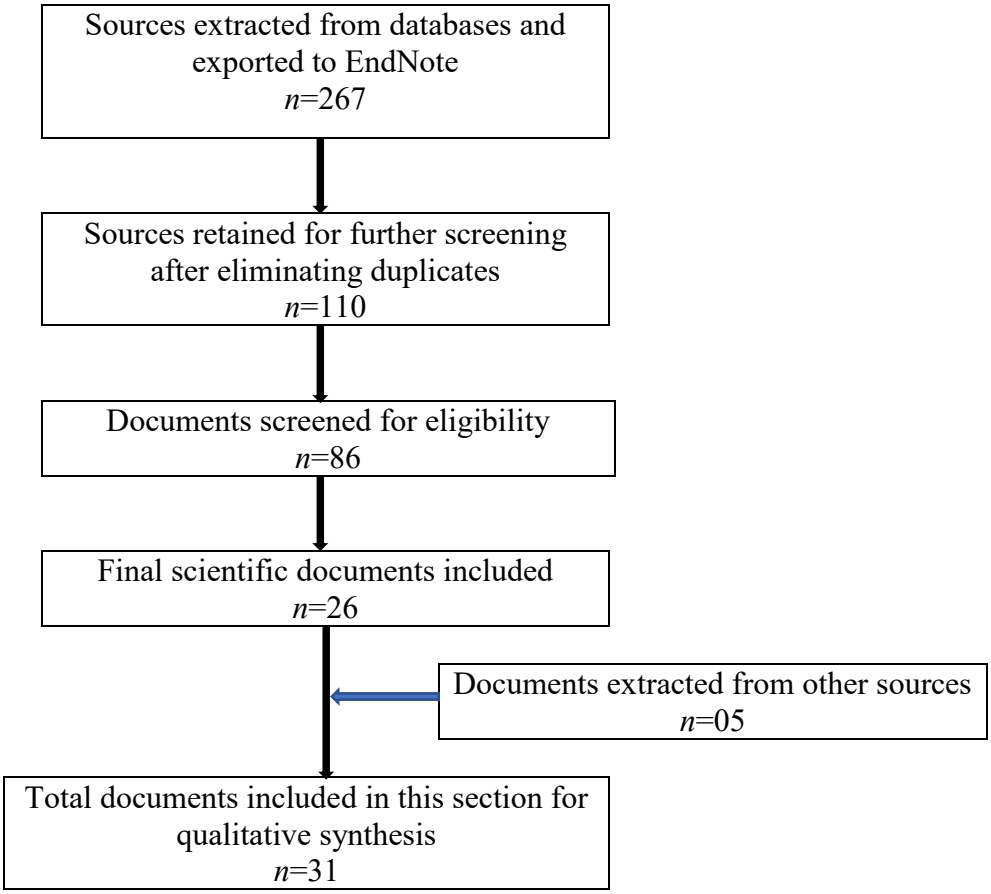
I stress the issue of definitions because I also intended to capture the distinguishing characteristics of these concepts, especially *health inequalities*. With this criterion, I validated a scientific corpus of n=25 documents with contributions from a wide disciplinary background. I must emphasize that the theory of ethical governance in healthcare is a compound concept composed of a synthesis of principles in applied ethics to fight health inequalities. As mentioned previously, this theory is a procedural novelty through which various healthcare intervention strategies are enforced with the pragmatic rationale of applied ethics that includes the impacts of contextualization.

From my scientific corpus, I recorded the different definitions and characterizations of my main concepts, and undertook a vertical comparative analysis across different perspectives and schools of thought—biomedical, philosophical, and economic. I wanted to harmonize the semantic distinctions and bridge knowledge-gaps, with respect to these concepts, that have arisen from interdisciplinary inconsistencies. I also undertook a horizontal analysis across years to understand the evolutionary coherence in the general knowledge about these concepts.

During this analysis, I began to realize that it was important to say something about the historicity of health inequalities—when and how health inequalities had started to attract general attention. Thus, I included an article that was published before the year 2000, thereby increasing my scientific corpus to n=26 documents. I further reenforced the scientific corpus with n=05 governmental (grey) literature documents from the WHO website and of its associate global

healthcare organizations. Thus, I included *n*=31 literature sources for the first part of my research project (Table 1).

Table 1. Literature Screening flow-chart – Health Inequalities & Ethical Governance



Key: Literature screening flow chart inspired by the PRISMA flow chart.

3.3.2. Antimalarial Endeavours and Malaria Morbidity and Mortality Inequalities in SSA

For this section, I used the terms—malaria in SSA, malaria morbidity/mortality in SSA, malaria funding in SSA, malaria research in SSA—as the main over-riding key search concepts. By using the main search engines—Google, Google scholar, WorldCat—I accessed necessary literature from prominent scientific databases: PubMed (NLM); PubMed Central (PMC); Global Health (DIMDI); EMBASE, UpToDate; Scopus; ScienceDirect; JSTOR; and Web of Science. This

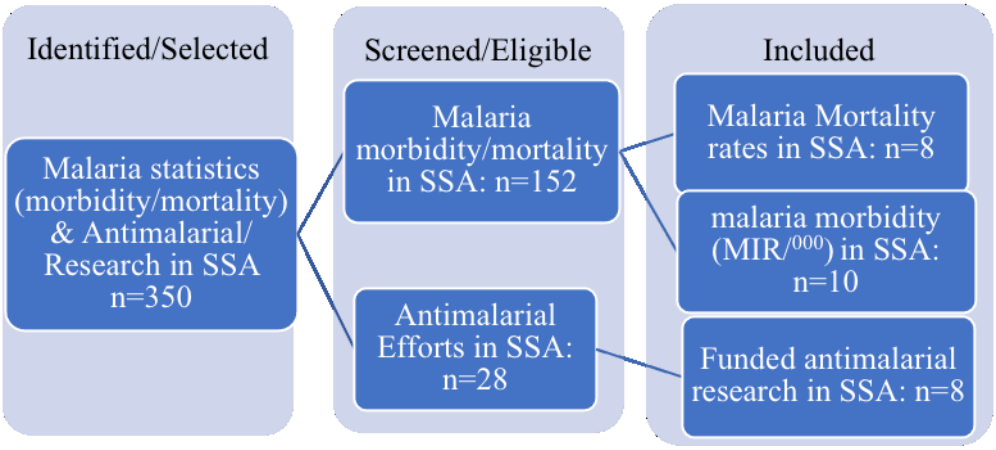
literature search ranged from the 1990s to 2017/2018. I extended my search to the 1990s to capture the evolutionary period from when the complications of plasmodium falciparum came to light through that of the Roll Back Malaria program to the era of the UN Millennium Development Goals. However, in the end, I worked only with statistics registered between 2000 and 2016, the era of Millennium Development Goals, because of the consistency in the available material.

This process generated a selected bibliography of n=350 documents—both narrative and statistics—for further screening to build my scientific corpus. I first scrutinized the documents beginning with their titles, and then read the abstracts of those selected. After this preliminary stage, I read through the various documents to ascertain their consistency and coherence. I considered data to be coherent only when I did not detect any information gaps in it. Then, I validated the credibility and the authenticity of the data through a comparative substantiation with related malaria reports. Generally, I eliminated any document that did not satisfy my main guiding principle of being representative enough to provide a *closer-to-real* understanding of the malaria situation in SSA.

When I realized that the literature characterization and filtration for this section were complicated, I used a three-dimensional (3D) literature screening process to satisfy the interdisciplinary peculiarities of my objective. First, I selected all the literature sources of the statistics on malaria disease and antimalarial efforts (funding and research) in SSA. Second, I separated the literature on malaria statistics (morbidity and mortality) from that on antimalarial efforts. Third, I further separated the literature on malaria mortality (deaths) in SSA from that on malaria morbidity (infection rates) in SSA.

This process gave me a selected bibliography of *n*=350 documents. I screened and filtered them down to a scientific corpus of 26 documents. In other words, I included *n*=26 main scientific literature sources classified under three rubrics: malaria mortality (deaths) in SSA; malaria morbidity (MIR/^{000}) in SSA; antimalarial efforts (FAMR) in SSA (Table 2).

Table 2. The Selection and Inclusion of Malaria Literature Sources



I further reenforced these scientific sources with *n*=12 governmental/grey sources (both documents and webpages) to double-check and corroborate my findings and results. Thus, I included a total of *n*=38 main documents for both quantitative and qualitative analyses. However, in the course of the work, I also got some useful information from some literature sources outside of my defined range through the Directory of Open Science Journals (DOSJ) and African Index Medicus (AIM). These documents are not counted in the 38 included main sources because I only extracted supporting information on malaria.

Information Charting

To begin, I want to underscore that this part of this research is more quantitative than qualitative, and it concentrates more on malaria-related statistics from SSA than on literature sources. In other words, this section focuses on the statistics on FAMR, MIR/^{000} and malaria deaths from SSA, rather than on literature sources because the validity of malaria information matters more to me than the number of publications. Thus, I extracted and compiled various statistics on malaria mortality and morbidity from 2000 to 2017 for n=38 countries in SSA. I also recorded the numbers of FAMR initiatives that were carried out in each of these n=38 countries within the same period.

First, I scrutinized both narrative and statistic malaria information from my scientific corpus to ascertain credibility and coherence. Then, I undertook a comparative substantiation with local malaria reports, either from local stakeholders or international global health agents, to ensure my selected information was representative, credible and authentic. I rated any information/data to be credible and authentic if its corroborative evidence was substantial. In the same way, I considered any data to be coherent when I could not detect any gaps in the information transmission. In other words, I was concerned with balancing my scientific findings and results with those results provided in various malaria reports.

Since I aimed at satisfying the authenticity and reliability of my findings and results to ensure the credibility of my research, I adopted the principle that my scientific findings and results should match the information provided by local malaria reports and documentations, with error margins considered. That is, I substantiated and complemented statistics from scientific sources with those from grey sources (malaria reports by the GHO and National Malaria Control Unites, and from

Annual Malaria Reports for African Region by the WHO). Through this rigorous research procedure, I had confidence that I could capture the necessary fraction of substantial data on malaria in SSA to render my results credible.

In addition, I made good use of various malaria-related reports and evaluations that were documented at the end of the era of the UN Millennium Development Goals before outlining the expectations of the UN Sustainable Development Goals. That is, various malaria reports and evaluations made by healthcare stakeholders and partners at the end of the era of the Millennium Development Goals when they were defining the expectations of the Sustainable Development Goals. For example, I used reports by the National Malaria Control Units, Global Malaria Statistics by the GHO, and a Malaria Report by the WHO. I used this approach to be sure that I had satisfactory and substantial statistical information on the malaria evolution in SSA for the defined period of my research. For the sake of uniformity, I considered malaria morbidity (infection rates) per 1,000 people ($MIR/^{000}$) for all countries to avoid any numerical discrepancies that percentage ratings can generate.

I undertook a vertical analysis across these statistics to capture the geographical heterogeneity of malaria prevalence and the inequalities in FAMR initiatives across countries in SSA. I also undertook horizontal analysis to determine how these dynamics had been changing over time or across years. Later, I used these analyses to map the heterogeneity of malaria endemicity and FAMR to determine their relationship across SSA. I want to emphasize that this relationship is a strong contributing factor to antimalarial outcomes because FAMR is the bedrock of antimalarial efficiency in SSA (Hammer et al., 2006). This association is a strong indicator of the relationship between malaria inequalities across countries in SSA and the antimalarial intervention strategy carried out in these countries.

I am confident that as far as my research takes me, I have established an evidence-based databank of the malaria situation in SSA that both its content and context are interdisciplinary as to satisfy various facets of this research. Above all, I have demonstrated and ascertained the importance of monitoring the relationship between FAMR and malaria endemicity in the fight against malaria in SSA so as to regulate the dynamics of malaria morbidity/mortality across SSA. This explanation justifies why I gave priority to these malaria-related statistics over the quantity of literature sources. During my analysis and discussion, I will use these statistics to test my hypothetical premises.

Although this study involves the whole of SSA, I extracted and displayed malaria statistics at the national level for n=38 countries, and I will do the same for the analysis. I used this strategy to capture the heterogeneity of malaria endemicity across SSA countries, and I also wanted to use a Small-Area Analysis (SAA) system to obtain malaria statistics in SSA. This system is used to determine population-based measures of allocating and employing available resources by examining data from smaller groups such as countries. Such smaller groups are known to be more homogenous than larger diverse populations. Thus, this measure helps to determine input and output variations across geographical areas, and provides guidance for finding explanations for these variations (Barrett & Shantikumar, 2018). In the same way, I needed it to determine the variations in malaria disease and antimalarial services across countries in SSA.

Therefore, as already mentioned above, I applied purposeful deductive sampling and inductive substantiation to infer and validate my results for the whole of SSA. Then, I confirmed the substantiation process using comprehensive malaria statistics from SSA (GHO, 2017; WHO, 2017a). Healthcare research specialists recommend this long screening procedure for any healthcare research that deals with health inequalities because it facilitates comparative analysis,

and minimizes the consumption of biased publications (Chan et al., 2018). Although I cannot claim to have generated all the documents related to malaria in SSA published within my defined period, I had enough information and data to proceed with the analysis.

Sampling Procedure

I scrutinized each of the 38 countries included in this research on basis of their malaria morbidity and mortality statistics, and matched them with their antimalarial statistics. Since I could not undertake the analysis with all 38 countries, I sampled the first three countries with the highest MIR/^{000} representing malaria endemicity. I verified to ensure that the data for each of the countries I sampled were consistent and coherent with domestic or contextual malaria reports. In a situation where my verifications of any plausible country did not satisfy any of these elimination criteria, I replaced the country in question with the next country in the list. In the same way, I extracted statistics on the FAMR initiatives attempted in each of these 38 countries, and sampled the first 3 countries with the greatest number of these initiatives.

Procedure of Analysis

I mapped the first three countries I sampled with the highest MIR/^{000} side-by-side with three other sampled countries with the greatest numbers of FAMR initiatives to verify any cross intersections. Thus, I could undertake this data analysis with a maximum of six countries composed of the two groups, or down to at least three, if there are any intersections across the two sampled groups. This mapping process helped to establish the relationship between FAMR initiatives in SSA and malaria endemicity measured in MIR/^{000}, and determine their relationship with the increasing malaria inequalities across countries in SSA. Too, I used it to satisfy three

qualities: the rigidity of the process of analysis; the criticality of the analysis itself; and the substantial validity of results (Corbin & Strauss, 2008).

Methodologies of Analysis

I adopted an interdisciplinary procedure of analysis composed of a variety of insights, as postulated by the epistemology of interdisciplinary research methodology (section 3.3), to validate both my theoretical and statistical results. For theoretical results, I used a subjectivists' approach to inductive logic to analyze and validate the interconnectedness of the number of FAMRs with the malaria statistics ($MIR/^{000}$) of each sampled country. This inferential procedure is often used to analyze the relationship between the propositions and predicates of the available data, and to present valid predictions and conclusions (Romeijn, 2011). This is why I used it to validate my sampling, test my hypotheses, and determine probabilities.

For statistical results, I sought inspiration from the insights of Bayesian Theory and Fiducial Confidence Theory (Hayes & Westfall, 2020; Wang, 2000). While I used statistical analyses to test my hypotheses through statistical distribution inference (Yu, 2021), I used insight from the conditional probability Theorem of Bayes to postulate my conclusions. This probability theorem assumes that posterior probability is a dependent variable conditional to changes that occur when a new value is added to prior probability (Hayes & Westfall, 2020). In this research, I classify 'malaria treatment' as a dependent variable that is determined by the strategic confrontation between FAMRs and malaria endemicity, each of which I considered as independent variables.

3.4. The Epistemology of Interdisciplinary Research Methodology

I used the interdisciplinary dimension of this research to establish an evidence-based databank. As such, the databank of this research is wide enough in theoretical and epistemological variations to be representative of SSA. One of the reasons I used mixed-methods research characteristics (quantitative-qualitative) was to satisfy the various exigencies of interdisciplinary research methodology. I had to use statistics to test hypotheses, and theories to validate probabilities and conclusions. Thus, I based my sampling on countries, and my analysis on malaria and antimalarial statistics, rather than on literature sources. This strategy helped me to ascertain the magnitude of the malaria morbidity/mortality inequalities in SSA, and to establish the probability of the causal relationship between the location strategy of FAMR and antimalarial outcomes.

Although the outstanding merits of interdisciplinary research methodology often entice many researchers, few are able to put it into practice. More often than not, when researchers start discussing interdisciplinary research, they end up with peripheral discussions concerning the concept of *interdisciplinarity*. I acknowledge that this concept confuses many researchers, since it overlaps multidisciplinarity and transdisciplinarity. While the concept of *interdisciplinarity* is a noun describing the quality of interdisciplinary knowledge (the intrinsic combination of varied disciplinary knowledges), *interdisciplinarity* as a method of research describes the process of developing interdisciplinary knowledge. Methods are fundamental paradigms tailored to produce or obtain the required quality of knowledge structure (Lury, 2018). Thus, the interdisciplinary method is used to produce or attain interdisciplinary knowledge.

However, some time ago, theorists ignored the emphasis on interdisciplinary knowledge as a pertinent asset within the realm of human sciences, since many disciplines within the humanities— especially philosophy as the mother-discipline—are intrinsically interdisciplinary in content (Laflamme, 2011). That notwithstanding, debates on the quest for interdisciplinary knowledge gained ground across many schools of thought, especially as its advocates demonstrated the importance of an inclusive collaboration between the applied and human sciences. They argued that although philosophy is indeed the mother-discipline, it has lost the various fundamental characteristics of universal knowledge as it has gradually disintegrated into many disciplines (Habermas, 1971).

This is why Michel Serres argued:

> Has not philosophy restricted itself to exploring—inadequately—the 'on' with respect to transcendence, the 'under', with respect to substance and the subject and the 'in' with respect to the immanence of the world and the self? Does this not leave room for expansion, in following out the 'with' of communication and contract, the 'across' of translation, the 'among' and 'between' of interferences, the 'through' of the channels through which Hermes and the Angels pass, the 'alongside' of the parasite, the 'beyond' of detachment … all the spatio-temporal variations preposed by all the prepositions, declensions and inflections? (Lury, 2018, p. 1).

Above all, Hegel's critique of Kant's transcendental logic on the grounds that Kant's transcendental logic presupposes us to know before knowing, marked the collapse of philosophy to a position to which it has become a servant of the applied sciences.

Hegel's critique undermined epistemology and enhanced the development of positivism by thinkers like Auguste Comte (Habermas, 1971). Over time, philosophical scientific movements developed quickly, and progressively replaced the concept of the *theory of knowledge,* which

signified philosophy, with the concept of *methodology*. This orientation of thought was the end of philosophy as the source of knowledge development. Thus, Jürgen Habermas has observed that Philosophy (as a discipline) was dislodged from its position as the theory of knowledge by philosophy (as thought) (Habermas, 1971). In the light of these changes, the applied sciences claimed the leading position in knowledge production.

However, many facts since have proven that the autonomous privilege reclaimed by the applied sciences, as the main source of reliable knowledge, was more due to the force of human interest than the desire for pure scientific knowledge. According to Habermas, the fear of speculative knowledge that motivated the superficial rejection of all that is theoretical in favour of all that is practical was simple bias. To him, positivism did not take the scientific world out of the shallowness of knowledge its advocates clamoured (Habermas, 1971). The practical sciences cannot excel without the theoretical and behavioural sciences because some socio-scientific domains, e.g., the health sciences, can only survive by way of interdisciplinary methodologies (Laflamme, 2011).

From this perspective, Habermas declared that theoretical knowledge is necessary for generating proactive ideas that can nourish actions endowed with an energy that carries enough ethical significance. In his *Knowledge and Human-Interests*, Habermas has argued that beneficial action must take its orientation from knowledge based on a theoretical attitude free from human interest. This approach signifies the unconditional commitment of knowledge to theories, and the disconnection of knowledge from human interest (Habermas, 1971). Also, an increasing acknowledgement has grown that interdisciplinary studies and research are indispensable for developing and disseminating profitable knowledge. As Boix Mansilla, Lamont, and Sato have observed, “interdisciplinary research is increasingly viewed by… scientific funding agencies and

policy makers as the philosopher's stone, capable of turning vulgar metals into gold" (Lury, 2018, p. 2).

That notwithstanding, anything referred to as *interdisciplinary* inspires excitement, and stimulates confusion and uncertainty. Thus, the development of interdisciplinary studies and research has continued to be confronted by a certain degree of hesitation. Although universities have been excited to preach interdisciplinarity and create interdisciplinary programs—ex., Programmes d'études interdiscilinaires – University of Montréal, Interdisciplinary School of Health Sciences – University of Ottawa, Institute of Interdisciplinary Studies – University of Carleton—their partner contributors and consumers are still hesitant out of fear. While contributors have exhibited fears related to the relinquishing of their monodisciplinary rights of specialization, consumers have been overwhelmed by the fears of remaining unemployed with academic degrees in interdisciplinary studies (Laflamme, 2011).

Despite these inconsistencies, interdisciplinary research remains indispensable to satisfying both the validity and veracity of knowledge development. It converges theories and actions (cognitive knowledge and practical knowledge) and enhances efficiency. This impetus of interdisciplinary research methodology has helped me to overcome the various antimalarial distractions I mentioned previously. Thus, I have assembled both philosophical and statistical data on the evolution of malaria in SSA, and have used interdisciplinary dispositions to analyze them. That is how I diagnosed the plausible cause for the various negative dynamics in antimalarial outcomes in SSA, and established an intervention strategy to enhance the fight against malaria in SSA.

With the inspiration from the anthropological insight of Gilles Bibeau, I am applying an interdisciplinary research methodology in the present research with the conviction that the involvement of social scientists in public health enhances preventive and curative health

programs by theorizing around the rationality of human beings with critical insights on the connections between beliefs, behaviours, knowledge, attitudes, and practices related to the decision-making process and the use of health services (Bibeau, 1997). This insight exemplifies as aspect of what Bob White, from his experience across SSA, referred to as the power of collaboration—"le pouvoir de la collaboration" (p. 329)—in assuring human wellbeing (White, 2011).

I used these aspects of the interdisciplinary research methodology and was able to address the interwoven characteristics of this research project. I navigated from the semantic clarification and epistemological distinction of *health inequalities* to an illustrative demonstration of the theory of ethical governance in healthcare. As I put these facets together, I established and demonstrated a proactive antimalarial intervention strategy for SSA. Through this interdisciplinary research, I have shown the practical aspects of the human sciences as applied human sciences, especially with respect to how they can collaborate with and enhance the applied sciences in interdisciplinary health. Therefore, interdisciplinary research provides an inquiry approach through which its problem statement, questions, objective, and the aspirations of its results can transcend disciplinary boundaries.

3.5. Research Evaluation: Bias, Limitations, and Strength

The greatest enemy of good research is *research bias*, which refers to any systematic inclination or prejudice for or against any research idea or group of people, especially with respect to whether these inclinations or prejudices may be rated to be unfair (Smith & Noble, 2014). To minimize the infiltration of research bias, I began this research project with a well-designed protocol guided by open-ended hypotheses and research question. My research supervisors

provided critical reviews of the protocol, and confirmed various amendments without any pre-empted expectations or conclusions. As I explained in Chapter 1, this research project went through a series of amendments and evolution during the research process.

From the time I conceived this research, I already had previewed the possible weaknesses or shortcomings that could easily discredit findings, and correspondingly the results of theoretical research. For example, the risk of directing the research process towards obtaining a predetermined conclusion, or contaminating findings with imagination and falsity. In light of these concerns, I designed a neutral protocol that we (my supervisors and myself) individually reviewed and collectively amended where necessary without any particular pre-empted expectations. This procedure averted any possibility of tailoring this research to a preconceived conclusion, as I have testified in Chapter 1.

In addition to the rigorous scrutiny I exercised on literature sources and information, I took some precautionary measures: 1) I used a mixed-methods research methodology with open-ended hypotheses and research question; 2) subjected my findings and results to 'cross-checking' substantiation with local or contextualized malaria reports, such as the general malaria statistics provided by the GHO (GHO, 2017); and 3) conducted this research as an investigation with sequential questions and answers to ensure coherence in my findings and premises, and validity in my results and conclusions. With these measures, I hope to have minimized the possibility of research bias.

Nevertheless, some aspects of bias could still possibly infiltrate by way of limitations in my literature selection, data mining, data screening, and data analysis. For example, first, I worked mainly with literature sources in the English and French languages, whereas it is possible that

some valuable information may published in other languages. Second, I cannot claim to have recorded all FAMR initiatives undertaken in SSA within the defined period of my research, since I do not know whether all FAMRs were registered in accessible repositories or websites. Third, I could have unexpectedly consumed some 'publication biases' through sponsored open access publications since I used a *purposeful sampling method*. This is a research method in which sampling is based on particular characteristics or some particular reasons (Onwuegbuzie & Leech, 2007).

Thus, I have established my conclusions and propositions only on logical probability, since, at present, they serve only as indicators pending practical/empirical validation. But to ensure the credibility of my findings, I used an interdisciplinary research methodology to access literature sources and facts, mixed methods to collect data, and both vertical and horizontal processes to analyze data and findings. Also, to ensure the validity and reliability of my research, I used reports and documentations on local malaria situation to substantiate my findings and results, and inductive and deductive methods to validate them. Thus, this procedural rigour indicates the generalizability of my research project results.

This approach has helped to ensure that the various observations and conclusions I made in this research project concerning malaria and the antimalarial dynamics in SSA have a high probability of satisfying practical reality. For example, my conclusion in the second part of the present research is the posterior probability that I have validated through the affirmation of the *alternative* hypothesis (H_a), since my statistical analysis rejected the *null* hypothesis (*Ho*) in the first part. This is the best research methodology or procedure for studying various aspects of malaria research in SSA because it facilitates navigation across various inconsistencies and variations.

I know that logical validity does not fail in practice when its implementation supported by good intentions, given that its veracity is more qualitative than quantitative. Thus, I took for granted that any people—moral or individuals—involved in any aspect of the fight against malaria in SSA have a desire to achieve antimalarial efficiency. I also considered that antimalarial intervention would gain efficiency in SSA only when it substantially alleviates malaria-inflicted health vulnerability from its hard-hit populations. Thus, I defined and developed a proficient antimalarial intervention strategy to help with the fight against malaria in SSA by achieving this efficiency (see Chapter 6).

PART TWO: FINDINGS, ANALYSIS, AND SOLUTION

Chapter 4: Findings and Analysis

4.1. Introduction

While the previous chapters simply outlined the ideas, observations, desires, plans, and provided the material that support the importance and validity of this research project, Chapter 4 lays out its analytic foundation. This chapter brings together my evidence about the malaria situation in SSA by presenting my basic analyses. In other words, I have used the malaria findings from Chapter 3 to analytically investigate the process of antimalarial intervention in SSA so to diagnose what should be done differently, or what should be done that is not being done. The orientation and development of the proceeding parts of this thesis rely on the results in this chapter.

To better develop this chapter, given its importance to my research project, I designed and executed it as an investigation with successive questions and answers as outlined in Chapter 3, the methodology page. Mainly, I used Chapter 4 to examine all the necessary statistics on malaria and antimalarial input and output in SSA as displayed in the databank (Table 3). Then, I mapped the recorded FAMR initiatives in SSA with malaria endemicity (MIR/^{000}) across various countries. As already mentioned above, this step is indispensable because the relationship between FAMR and MIR/^{000} is an indicator of the orientation strategy of the antimalarial intervention process (Head et al., 2017). As such, the readings I obtained from this mapping provide insights into the causes of the increasing malaria morbidity/mortality inequality-gap across SSA. In a nutshell, this chapter provides the orientation of this research project.

4.2. Malaria Inequalities in sub-Saharan Africa Increase! *Effect-to-cause* investigation.

Malaria prevalence in SSA is averagely rated 'high' (Aaby et al., 2015; WHO, 2017a, 2018c) with uneven endemicity as determined by various socio-contextual vector factors (Hay et al., 2000; Snow et al., 1999). Whereas some regions have dense parasitic prevalence signifying a high malaria endemicity that leads to perennial severe infections, some other regions have relatively scanty parasitic prevalence signifying lesser endemicity with mainly seasonal infections, although these are deadly as well (Doolan et al., 2009; Ferguson et al., 2010; Golding et al., 2017).

This heterogenous malaria prevalence across SSA is characterized by unpredictable geographical overdispersion by which a small densely infected proportion of the population can be responsible for much of the storage and transmission of the malaria parasite (Gosling et al., 2011). Thus, some people under some conditions or in some areas are more vulnerable to various malaria hazards than others, a situation that complicates the struggle to satisfy human rights to *health for all* in that part of the world. Thus, for any antimalarial endeavour in or for SSA to relieve the densely infected and affected populations, it should be 1) equitable *vis-à-vis* the heterogeneity of malaria endemicity as its main determining factor and 2) geared towards equitable equality in malaria decline across SSA countries.

An equitable intervention strategy would provide various antimalarial services to all populations in need, thereby giving disadvantaged populations an equal opportunity to health. Thus, the orientation of malaria dynamics in SSA would become a dependent output of the interplay between antimalarial input and its determinants. While various aspects of antimalarial

interventions would act in their ensemble as input, malaria morbidity would become their determinant, and the dynamics in malaria mortality their output. This strategy would satisfy the admonition of the ethics of care and of human rights that everyone is entitled to attain their full health potential, and no one should be disadvantaged from achieving it (Braveman et al., 2011; Sklar, 2018).

4.2.1. The Fight Against Malaria in SSA

The fight against malaria in SSA has been operating for decades with enormous international engagement (Winstanley et al., 2004). The UN Millennium Development Goal No. 6 foresaw the elimination of malaria among other diseases by 2015. The Sustainable Development Goal No. 3 also expressed that ambition while emphasizing the necessity of achieving universal health coverage to ensure human rights to health for all, at all ages. Although these exigencies intensified antimalarial endeavours in SSA, this part of the world still carries the brunt of the global malaria burden.

I acknowledge that it is difficult to fight malaria in SSA because of the various inconsistencies that characterize the diverse sociocultural and socioenvironmental malaria vector factors. Also, studies on the peculiarity of malaria falciparum—the type of malaria that victimizes much of SSA—have been difficult because of its complicated composition and parasitic variations in time, location, and host (Zhang et al., 2018). However, a general decline in malaria disease in SSA (Cibulskis et al., 2016; Teh et al., 2018) has visible, since close to 6.2 million malaria-caused deaths in infants were prevented during the era of the Millennium Development Goals (Way, 2015). That notwithstanding, inequalities in malaria morbidity/mortality among and across countries in SSA have persistently increased, especially during the era of the Millennium Development Goals (Cibulskis et al., 2016).

As previously mentioned, 1) malaria dynamics (output) in SSA depend on the interplay between antimalarial input and its determinants, and 2) while FAMR is considered in this research to be the bedrock of antimalarial input in SSA, its output is a fluctuation in malaria mortality rates. Well executed FAMR activities can provide evidence-based reliable malaria data to facilitate the antimalarial intervention process (Hammer et al., 2006) because of variations and inequalities across countries (Cibulskis et al., 2016; Head et al., 2017). Thus, I used the methodological guides presented in Chapter 3 to obtain general information about FAMR activities carried out in SSA and their corresponding malaria dynamics which I will use to lay the analytical foundation of the present research.

4.3. Findings

4.3.1. Statistics of Malaria and Antimalarial Variables in SSA

It was prudent for me to establish a complete record of these elements (records of antimalarial input and of the various components of malaria dynamics in SSA) to work with representative evidence-based information. My main objective was to establish a reliable databank of malaria statistics for SSA within a defined period that would include national malaria mortality rates, national malaria morbidity rates, and the number of FAMR activities in various countries. With reliable statistics, I would be able to determine both the vertical and horizontal evolution of antimalarial input and malaria dynamics in SSA, as well as the interplay between these antimalarial variables.

Malaria Morbidity and Mortality Rates in SSA

Although we may know that malaria disease and its comorbidities are unevenly distributed across SSA, we may neither have a good apprehension of the extent of this dispersion across countries,

nor a good knowledge of the evolution of malaria across SSA, without a harmonized databank of demonstrable statistics. Thus, I had to produce a comprehensive record of malaria deaths across SSA countries for the defined period of my research, and also various MIR/^{000} for countries across SSA within that period. As explained above, I scrutinized statistics for 38 SSA countries.

First, I examined and established statistics on malaria mortality for all 38 countries between 2000 and 2016 (Fields 2 and 4 of Table 3). Then, I established the trend of change in malaria mortality across SSA for this 16-year period (Field 9 of Table 3), the era of Millennium Development Goals. I further searched and recorded the percentage of these malaria mortality statistics, for each of the 38 countries for the period between 2000 and 2016, that were attributed to children under 5 years old (Fields 3 & 5 of Table 3). However, this age bracket was greatly targeted by various antimalarial initiatives in SSA from the year 2000 (Mwangoka et al., 2013; Winskill et al., 2017), although they still accounted for a good percentage of malaria mortality in SSA.

I also scrutinized and recorded various statistics on national MIRs/^{000} as of 2016 (Field 6 of Table 3) for all 38 countries. The various MIRs/^{000} of 2016 were the average malaria infection rates recorded at the end of the era of Millennium Development Goals. These statistics display a satisfactory malaria statue of SSA because they contain the main elements used by global health agents to evaluate malarial evolution (GHO, 2017; Golding et al., 2017). In addition to these statistics on antimalarial determinants and output, I also recorded statistics on FAMR, the main antimalarial input in SSA.

Funded Antimalarial Research (FAMR) Initiatives in SSA

The antimalarial endeavour in SSA has received significant scientific, economic, and material contributions from foreign governments, partner institutions and establishments, and corporate

bodies (Penny et al., 2015; WHO, 2017b). During the information charting, I understood that the financial enforcement (funding) of the fight against malaria in SSA passes through three gateways: as domestic efforts under the supervision of the ministries of health; as aid through foreign partnership with government institutions; or as externally masterminded research funded by partner organizations and pharmaceutical companies. In the first two categories fall the malarial funding/aid from the Global Fund (GF) and the President's Malaria Initiative (PMI), which are jointly referred to as Malaria Control Funding. Since these funding sources are often based on national efforts and bilateral relations, and the funding is directed to particular countries, it is often recorded as part of the gross domestic product (GDP) of the particular country (Head et al., 2017).

Therefore, I focused on the antimalarial research initiatives of FAMR that are masterminded and funded by external or foreign pharmaceutical companies and other antimalarial funding foundations/organizations. I have considered only those FAMR activities that are directly initiated by the following malaria partners: the US Centre for Disease Prevention and Control (CDC); the UK Department for International Development (DFID); the European Commission; the European & Developing Countries Clinical Trials Partnership (EDCTP); the Bill & Melinda Gates Foundation; the Institut national de la santé et de la recherche médicale (INSERM); the Institut Pasteur; the UK Medical Research Council; the US National Institute for Health; the Research Council of Norway; the Swedish Research Council; and the Swiss National Science Foundation and Welcome Trust (GHO, 2017; Head et al., 2017).

In addition to the fact that these institutions, organizations, and establishments are reputable partners with regular FAMR activities across SSA, (Head et al., 2017; Puppalwar et al., 2015), their registered records are reliable and easily trackable (GHO, 2017; Head et al., 2017). As per

my findings, these partner organizations sponsored *n*=1061 FAMR activities between 2000 and 2014 in almost all the 38 countries that I have included in this research (Field 7 of Table 3). In this exercise, I did not take into consideration the monetary values of FAMR. I limited the records of FAMR only up to 2014 because the last FAMR cohort whose results were evaluated in 2016 was that of 2014 (GHO, 2017). Often, researchers believe that it takes two years after a FAMR intervention begins for the effectiveness of the antimalarial research to be known (Head et al., 2017; Puppalwar et al., 2015).

Table 3. Inclusive table of malaria statistics for SSA between 2000 and 2016

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9
Country	**TMDs**	**PMUFDs**	**MIR/^{000} (Average)**	**FAMR**	**IA**	**TMDs**	**PMUFDs**	**C16yrs**
	2000					**2016**		
Angola	9462.068931	9%	124	1	124.00	8546.05473	6%	916.0142
Benin	7143.289204	10%	293.7	20	14.69	9608.76093	12%	-2465.472
Botswana	6.48965237	1%	0.9	0	0.00	5.57625767	0%	0.913395
Burkina Faso	29214.54557	35%	389.2	70	5.56	30761.5994	25%	-1547.054
Burundi	15007.20165	20%	126.3	3	42.10	8699.94642	7%	6307.255
Cameroon	19883.07324	16%	264.2	15	17.61	22312.1099	10%	-2429.037
C. A. Republic	4128.300874	22%	289.5	0	#DIV/0!	3829.0813	14%	299.2196
Chad	6601.862816	6%	163.2	0	#DIV/0!	7674.61871	6%	-1072.756
Congo	2982.687815	12%	173.3	0	#DIV/0!	2245.36864	7%	737.3192
Cote d'Ivoire	28093.37516	28%	348.8	11	31.71	16463.4179	8%	11629.96
D R Congo	101212.421	32%	246	13	18.92	81622.268	13%	19590.15
Eq Guinea	1228.513318	17%	215.1	4	53.78	896.842355	18%	331.671
Eritrea	8.940897669	0%	14.5	2	7.25	9.43853242	1%	-0.497635
Ethiopia	19228.7627	2%	58.6	28	2.09	2723.06942	1%	16505.69

Gabon	938.4455165	8%	232.4	13	17.88	710.687502	6%	227.758
Gambia	845.6268214	6%	208.8	61	3.42	133.66683	4%	711.96
Ghana	23738.80814	17%	266.4	83	3.21	18921.5966	11%	4817.212
Guinea	10346.784	17%	367.8	4	91.95	11328.2362	21%	-981.452
Guinea-Bissau	1174.935204	8%	89.3	5	17.86	238.143221	4%	936.792
Kenya	15573.14806	6%	166	148	1.12	4625.38446	4%	11437.24
Liberia	4135.903795	17%	246.2	1	246.20	2866.52457	9%	1269.379
Madagascar	4961.586366	2%	104.2	22	4.74	5776.23283	7%	-814.6465
Malawi	17262.46734	14%	188.8	67	2.82	6942.41845	8%	10320.05
Mali	19582.25754	18%	448.6	42	10.68	25339.8891	24%	-5757.632
Mozambique	32767.69917	23%	297.7	19	15.67	18544.6721	12%	14223.03
Niger	17790.64982	11%	356.5	7	50.93	30848.159	17%	-13057.51
Nigeria	200435.1305	16%	380.8	36	10.58	153334.808	13%	47100.32
Rwanda	8830.280428	8%	301.3	12	25.11	3061.21215	6%	5769.068
Senegal	8831.10539	7%	97.6	36	2.71	2154.16682	4%	6676.939
Sierra Leone	11052.8485	21%	302.8	0	#DIV/0!	11164.4567	20%	-111.6083
Somalia	3813.562384	1%	85.5	2	42.75	1167.76008	2%	2645.802
South Sudan	4690.779608	10%	156	0	#DIV/0!	3888.76306	5%	802.0166
Sudan	4008.016154	3%	36.6	7	5.23	2560.06553	2%	1447.951
Tanzania	34753.87841	11%	113.9	170	0.67	15418.848	5%	19335.03
Togo	5262.40049	19%	345.1	4	86.28	6994.21865	19%	-1731.818
Uganda	57160.42694	25%	218.3	115	1.90	22489.4558	7%	34670.97
Zambia	6483.743264	11%	173.7	34	5.11	4677.34209	7%	1806.401
Zimbabwe	869.9003855	7%	114.2	6	19.03	701.471672	2%	168.4287

Key:

- **TMDs** = Total malaria deaths
- **PMUFDs** = Percentage of malaria under five deaths
- **MIR/^{000}** = Malaria infection rate per 1,000 people
- **FAMR** = Funded antimalarial research
- **IA** = Intervention Average
- **C16yrs** = Change in malaria-caused deaths for 16 years (negative figures signify negative results)

Sources:

- Maternal and Child Epidemiology Estimation Group (MCEE) estimates - 2018 (WHO) https://apps.who.int/gho/data/node.main.ChildMort?lang=en
- Estimates of malaria-caused child death, (UNICEF) - February 2018.
- Global Health Observatory (GHO) statistics - 2017
- Head MG. et al. (2017). Global funding trends for malaria research in sub-Saharan Africa
- WHO statistics for infectious diseases by regions of the world - 2017.
- WHO Annex B: Tables of Health Statistics by Country: WHO Region and Globally - 2017

To a great extent, this multidimensional search procedure has produced closer-to-real malaria statistics for SSA, a satisfactory evidence-based statistical databank. In addition, this exercise has enabled me to capture the comparative evolution of both malaria morbidity and mortality statistics across SSA from 2000 to 2016. It will also help me in the next chapter to match the geographical heterogeneity of malaria morbidity/mortality in SSA with FAMR initiatives. I cannot claim to have registered all FAMR activities carried out in SSA within my defined period of years, but I have substantial data to render my analysis representative and reliable.

4.4. Analysis

4.4.1. Malaria Heterogeneity Across in SSA: Health Inequalities

The results of the fight against malaria in SSA is determined by the interplay between the main variables: antimalarial intervention strategy; malaria morbidity; and malaria mortality. With respect to this research, I consider *malaria mortality* as the dependent variable of the relationship between the intervention strategy and malaria morbidity, both of which I consider as independent variables. The antimalarial intervention strategy in SSA is modelled to target malaria morbidity and alter malaria mortality. If an antimalarial intervention strategy properly targets malaria morbidity, a possibility arises that all SSA countries will record positive changes (decreases) in malaria mortality. In case of the contrary, a possibility arises that malaria endemic countries in SSA will instead record negative changes (increases) in malaria mortality.

However, this assertion remains hypothetical until substantiated with facts because many social determinants influence changes in malaria mortality. Thus, I began this verification process by establishing a satisfactory evidence-based databank of malaria information from SSA countries (Table 3). This databank satisfies two important concerns: 1) detecting and managing the various social determinants of malaria are essential to the intervention process, and 2) FAMR activities are the bedrock of antimalarial intervention because they help in the realization of the first concern. Thus, strategic research is necessary for obtaining the evidence-based information that is needed for directing equitable healthcare services (Fathalla & Fathalla, 2004).

According to my findings (Table 3), I have determined the intensive heterogeneity of malaria infection (morbidity) and malaria deaths (mortality) across SSA. First, I undertook a vertical comparative analysis of malaria morbidity ($MIR/^{000}$) and the malaria mortality (deaths) statistics of 2000 and 2016 for all 38 countries in my research to capture the heterogeneity of malaria across various countries. Then, I complemented this vertical analysis with a horizontal analysis of malaria mortality (deaths) for each of these 38 countries from 2000 to 2016, and determined how this dependent variable had changed over this period. These analyses gave me important insights into the various imbalances in malaria dynamics across SSA.

I know that changes in malaria mortality across countries in SSA are not uniform because of the variations that define the many social determinants of malaria disease. However, the orientation of change should be the same to facilitate equitable equality in malaria decline across these countries. In other words, all SSA countries should experience positive change as a sign that everyone in their populations have an equal opportunity to be healthy as an aspect of their rights to health for all. With respect to the reality revealed in Table 3, SSA countries have experienced divergent changes in malaria mortality, and the inequality-gap has increased, despite all efforts.

For example, even though the malaria mortality in Tanzania decreased from 34,753.9 in 2000 to 15,418.8 in 2016, in Niger it increased from 17,790.6 in 2000 to 30,848.2 in 2016. These diverging antimalarial outcomes in SSA have continued in spite of the millennium ambition to achieve universal human rights to *health for all*.

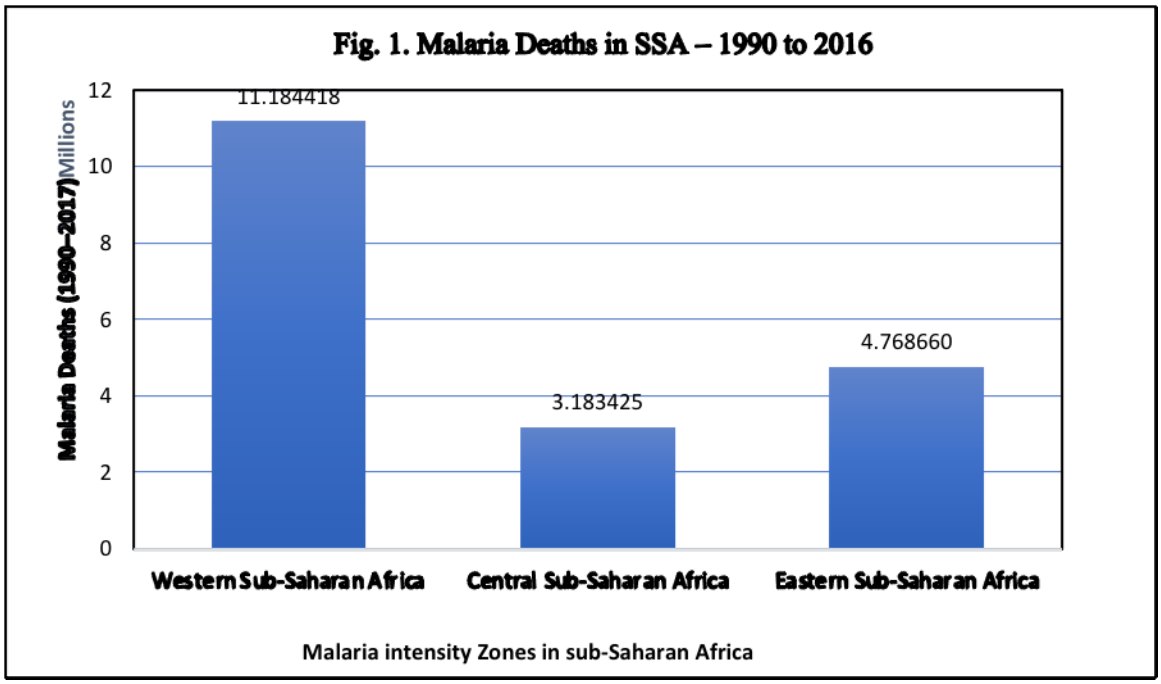
I did the same analysis on the positioning strategies of FAMR across the 38 countries in my research to determine their relationship (interplay) with malaria morbidity, while considering both as independent variables. As per my analysis with the statistics in Table 3, the majority (61.07%) of FAMR activities in SSA within the defined period of my research were carried out in the Eastern part of SSA. According to the scenario in Table 3, the two independent variables of antimalarial intervention—FAMR and MIR/^{000}—inversely relate. While these independent variables need to be considered when designing any antimalarial intervention strategy in SSA, malaria mortality is the detestable consequence to avoid as a dependent variable.

Thus, while I can determine the outcome of this inverse intervention relationship from changes in malaria mortality as a dependent variable, I can also judge the modelling strategy of this intervention process from the malaria mortality records across SSA as of the year 2000. These records present the picture of the heterogeneity of malaria mortality across SSA at the moment that the exigencies of the Millennium Development Goals came into force. According to the evaluations made in 1990 and in 2017, 58.45% of these malaria deaths recorded in SSA occurred in the western part.

Of the total of 19,136,503 malaria deaths recorded in SSA (86.69% of the global malaria deaths), 11,184,418 western part, 4,768,660 in the eastern part recorded, and 3,183,425 in the central part (Figure 1) (GHO, 2017; WHO, 2017a). Since this information only serves as the base of my

verification analysis, I will not go into detail. I acknowledge that while malaria-death count remains the evident dependent variable of the fight against malaria in SSA, its accuracy is challenged by variations in the health survey reporting systems, in the sociocultural contexts, in the political interests, and many others. However, though the statistical accuracy may be questionable, the inclination dynamics cannot be totally faulty.

FIGURE 1. MALARIA DEATHS IN SSA VIEWED IN 'THREE MALARIA INFECTION SUB-ZONES'



As per the information in Figure 1, efficient antimalarial intervention in SSA would have seen more FAMR in the western part so as to be proportional to malaria endemicity (Bhutta, 2002). In other words, proportional FAMR strategy in SSA could be able to record the diversity across various contextual determinants so as to be able to give a better intervention orientation for efficient realizations and proficient outcomes in the reduction of the malaria death-toll (Charani et al., 2022; Mwenesi et al., 2022).

As previously mentioned, while the heterogeneity of malaria endemicity that is read from the variations in the MIRs (Table 3) should determine the intervention orientation, malaria deaths should determine the intervention efficiency (Figure 1). In other words, high malaria death-toll is the ultimate unwanted consequence that various antimalarial strategies strive to prevent. Therefore, given that the ensemble of malaria dynamics in SSA is a variable dependent on the interplay between the two independent variables mentioned above, is this inverse relationship responsible for the widening malaria morbidity/mortality inequality-gap across countries in SSA?

The Second scientific article

4.5. As antimalarial intervention resources in sub-Saharan Africa increase, so too do malaria inequalities! Epidemiological Consequences of Ethical Failures

- This article is submitted to the journal *Public Health Ethics* – OUP publication
- Article type: Original Article
- Manuscript ID: PHE-2022-0116
- Authors: Charles Biradzem, Dine, Dany Rondeau, and Bob White.

Abstract

Malaria inequalities in sub-Saharan Africa (SSA) increase with many hard-hit malaria endemic countries fast turning holoendemic despite increases in antimalarial resources, services and activities in that part of the world. Antimalarial resources and malaria endemicity inversely relate, funding and research—the bedrock of the efficient antimalarial intervention in that part of the world—concentrate away from malaria endemic countries. As this inverse relationship undermines the recommended equitable antimalarial intervention strategy to target the heterogeneity of malaria endemicity, it exacerbates inequalities and negative malaria dynamics in that part of the world. To a greater extent, therefore, the negative malaria dynamics in SSA are the epidemiological consequences of the ethical antimalarial failures to implement the equitable intervention strategies as to counter the malaria heterogeneous endemicity and minimize its morbidity/mortality inequalities.

Keywords: Malaria; sub-Saharan Africa; Health inequalities; Health vulnerability; Healthcare inequities; Malaria research.

4.5.1. Introduction

Despite the global call to fight health inequalities and attain equitable health equality (IHP, 2018), malaria inequalities among and across countries in sub-Saharan Africa (SSA) continue to increase despite increasing antimalarial attempts in that part of the world. Though some countries experience remarkable malaria decreases, the malaria hard-hit endemic countries instead record drastic increases, thereby increasing the malaria inequality-gap across countries. These stagnating malaria dynamics maintain SSA as the epicenter of global malaria burden because as the malaria

endemic countries transit to holoendemic, they become plasmodium reservoirs. However, there had been a general decrease in the malaria incidence in the whole of SSA since 2000, especially among the under-five (WHO, 2021).

We acknowledge that multiple factors are responsible for malaria dynamics in SSA. On the one hand, there are natural factors that determine and influence malaria dynamics, and on the other, antimalarial intervention mechanisms determine the malaria dynamics as outcome. In this research, we are talking of antimalarial intervention in SSA referring to the ensemble of all investments, gestures and engagements—funding, research, provision of antimalarials, etc.—aimed at fighting the expansion of malaria as plasmodium or as disease in that part of the world. However, we are more interested in antimalarial funding and research, the fundamental antimalarial intervention inputs that serve as the bedrock of the efficient fight against malaria in SSA. To that effect, we are using a combined format of the two as *funded antimalarial research* (FAMR), and referring to them in the ensemble as the best indicator of the intervention orientation to fight the malaria heterogeneity in SSA.

Though SSA carries the brunt of the global malaria burden, the malaria prevalence—as plasmodium and as disease—in that part of the world displays an intensive heterogeneous dispersion. This peculiar characteristic gives rise to unequal malaria endemicity across SSA, as well as increase in its morbidity/mortality inequalities. Thus, the distribution strategy of FAMR initiatives across this part of the world need to be calibrated proportionally or equitably to malaria endemicity indicated by national malaria infection rates. This intervention strategy satisfies the ethical call for the equitable antimalarial intervention process in SSA because it entails the unequal distribution of the resources *vis-à-vis* malaria endemicity to produce equal outcomes.

The equitable allocation of FAMR could easily determine the geographical dispersion pattern of malaria prevalence across countries in SSA, identify the plausible pools of plasmodium, and determine the intervention orientation to target the hard-hit populations (Head et al., 2017). The ethical exigencies needed to guide the dynamics of antimalarial intervention in SSA fall within the jurisdiction of public health and global health ethics. This dimension positions the operationalization of the fight against malaria in SSA under the combined surveyance of the *global-public healthcare partnerships* (IHP, 2018). On the one hand, an aspect of public healthcare because its operationalization postulates the preventive strategies for a disease that degenerates the health of the populations. On the other, an aspect of global health because it fights for the health of the populations as a universal human right "seeking a world where all enjoy a certain standard of health and healthcare" (A. D. Pinto & Upshur, 2009, p. 3).

Therefore, besides the ethical exigencies of clinical deontology, antimalarial intervention in SSA should abide by various strategic ethical principles and theories of public and global health ethics to inform healthcare research on how to confront contextual complexities (Drue et al., 2016a; Orbinski, 2013). Contextual complexities in relation to malaria prevalence in SSA makes allusion of the intensive socioenvironmental variations that determine the intensity of plasmodium from one country to another, as well as the socioeconomic variations that determine intervention. It is in reference to these ethico-epidemiological factors that is recommended the proportionate and equitable intervention strategy for the fight against malaria in SSA. This strategy facilitates the calibration of the available resources and defines the distribution orientation of antimalarial services (Head et al., 2017; Heggenhougen et al., 2003). What, in the light of this recommendation, are the ethical implications of the malaria epidemiological dynamics in SSA?

4.5.2. Objective

While the main objective in the present study is to establish the ethical implications of malarial dynamics in SSA, this article will ascertain the extent to which the positioning strategy of FAMR contributes to the dynamics of malaria mortality in that part of the world. From the ethical perspective, it will establish the relationship between the distribution strategy of FAMR in SSA and malaria endemicity, and evaluate the contributions of this relationship to the dynamics of malaria mortality inequality-gap across countries. As such, we will determine the ethical implications of the malaria epidemiological records in SSA.

With the example of the fight against malaria in SSA, the purpose of this article is to demonstrate 1/the pragmatic interdisciplinary dimensions of healthcare ethics that inform the intervention process to fight inequalities and save the vulnerable populations; and 2/that the socio-ethical consciousness of place and people in the fight against health inequalities is as important as the socio-scientific aptitude of the intervention process. We are talking here of health inequalities referring to the *unfair* and *avoidable* health disparities among people (Braveman et al., 2018) that are resolvable with healthcare equity (Bleich et al., 2012).

4.5.3. Materials and Method

Data search and mining

We used a databank of general malaria statistics (input and output) from 2000 to 2016—the era of Millennium Development Goals—for 38 (≥80%) countries from across SSA (Table 3). From this databank, we extracted statistics under different rubrics: the number of FAMR initiatives carried out in each of these 38 countries; average malaria morbidity (infection rate) of each of

these countries within this period; malaria mortality (deaths) of each of these countries as of 2000; malaria mortality (deaths) of each of these countries as of 2016; and the malaria mortality changes (malaria dynamics) experienced in each of these countries between 2000 and 2016.

In building the databank used for this research, all the FAMR activities in SSA that were engineered by the domestic malaria control units/organs of the ministries of health of each country, and those that were executed as Malaria Control Grants from corporate bodies to domestic institutions and governments to enforce domestic malaria control measures, were excluded. Since research activities in this category are often considered the fruits of national efforts or of their bilateral relations, funding therein is always recorded as part of the gross domestic product (GDP) of the country in question (Head et al., 2017). Thus, we only worked with the FAMR activities that were executed in SSA but generally funded by foreign malaria partner organizations and pharmaceutical companies.

In terms of the sample size, we involved 38 countries in this research 1) because no single country in SSA could provide the representative malaria data to validate any substantial malaria studies in that part of the world, given the wide heterogeneity and variation that define malaria prevalence across countries; and 2) because no single country in SSA is economically viable enough to command or entice any pharmaceutical company to undertake a complete antimalarial process. Thus, to obtain comparative findings, these socioenvironmental and socioeconomic factors, together with other scientific factors, often condition antimalarial partners to implement their FAMR activities and validate their findings in many countries (Najera, 2019).

For the purpose of substantiation and credibility, the statistical data we used in this research were comparatively validated with the general malaria statistics provided by Global Health

Observatory (GHO) (GHO, 2017). That notwithstanding, the analytical methodology we used required that we only undertake our analysis with a sample-set of few countries from among the 38. To that effect, our sampling criteria were purposeful: countries with high malaria infection rates; countries with the greater number of FAMR activities. This sampling process was necessary because our objective is purposeful—to establish the relationship between the increasing malaria inequality-gap across countries in SSA and the positioning strategy of FAMR activities.

Sampling Procedure

We sampled the first three malaria endemic countries in order of the intensity of the malaria infection rate (MIR/^{000}). Our main elimination condition at this stage was the consideration of the ensemble of various risk factors such as the sociopolitical instabilities that could disturb any attempts of FAMR within the country in question. This condition helped us to eliminate some malaria endemic countries with the conviction that these situations could scare researchers even if they would have loved to undertake their research activities in those countries. In addition to this criterion, the data for each sampled country had to be consistent and coherent with sufficiently available domestic malaria reports to be substantiated. In a situation where a potential country that could be sampled did not satisfy any of these conditions, we eliminate it for the next in the list by merit. We also sampled the first three countries with the greatest numbers of antimalarial research initiatives.

Procedure of analysis

For each of the six sampled countries in the two rubrics above, we mapped their MIR/^{000} side-by-side their number of FAMR initiatives. Our analyses were guided by two hypotheses: the *null* hypothesis (H_o) stating that if the relationship between FAMR in SSA and malaria endemicity is

proportional, then its positioning strategy does not intensify the malaria mortality inequality-gap; and the *alternative* hypothesis (H_a) stating that if the relationship is inverse, then it intensifies this inequality-gap. These hypotheses will be determined by mapping various statistics across countries in the two sampling groups. If the relationship between FAMR and MIR/^{000} across our six sampled countries is proportional, then it supports the H_o, but if it is inverse (diverging), it instead confirms the H_a. The former indicates the recommended equitable intervention process, and the latter indicates intervention inequities with a high probability of deviating services from the hard-hit and increasing mortality inequalities. We will substantiate these indications by determining the malaria mortality dynamics across the six sampled countries from 2000 to 2016.

Overall, we are confident to have produced valid results because the sample size of six countries (15.8%) is large enough to validate results for 38 potential countries. According to the American Psychology Association (APA) research guide, a 12.5% sampling in a quasi-experimental mixed-methods research like this one is accepted as a good medium sample size to validate results for the whole (Price, Jhangiani, & Chiang, 2015). In the same way, 38 countries (≥80%) from SSA are enough to validate research for the whole of SSA. In addition, we determined the intervention efficiency ratio (ER) from the *case-to-research* average, a good indicator of the probability efficiency in dispersion analysis research[10]. It is common to ascertain the level of malaria endemicity of a defined area from its MIR/^{000}, and the malaria infection heterogeneity from the disparity across various MIR/^{000}. Thus, the equitable antimalarial intervention will assure that more intervention resources are directed to the highly malaria infested areas.

To that effect, we established that the higher the *case-to-research average* (ER), the lower the efficiency potentiality of FAMR activities. Or the other way around, the lower the ER, the higher

[10] Investopedia staff (Blog, 2021): https://www.investopedia.com/terms/d/dispersion.asp (Accessed 10/05/2021).

the efficiency potentiality for FAMR to produce reliable data/results. This systematic analytical procedure reliably guides the comparative studies of the evolution of malaria in SSA given the intensive heterogeneity of malaria endemicity across countries. It gave us a good knowledge of the past performances in the fight against malaria in SSA, and unveiled the plausible causes of the stagnating situation malaria in that part of the world, thereby giving the orientation for the efficient corrective antimalarial measures in SSA. We used Microsoft Excel 16.62 and IMB SPSS-Statistics 25 for the statistical analyses which we validated with the insight from the statistics distribution inference for confirming a hypothesis.

4.5.4. Findings

Sample of malaria morbidity/Infection Rate (MIR/^{000}) in SSA

As per our elimination criteria established above, we disqualified Mali, although it was in the first position of highly infected countries with a MIR/^{000} of 448.6/^{000}. Mali is at a level 4 touristic warning[11] because of the high degree of the sociocultural and sociopolitical insecurity characterized by attacks and kidnappings, especially on foreign nationals. This situation could compromise the number of FAMR activities in Mali, since many antimalarial researchers could not choose Mali as their research destination for safety concerns. In addition to similar insecurity reasons as the case of Mali, especially the insecurity provoked by Boko Haram (an Islamic armed group), we also disqualified Nigeria because of the inconsistencies in its domestic malaria statistics, although Nigeria was in the third position of the high malaria infested countries with the MIR/^{000} of 380.8/^{000}.

[11] Level 4 'warning' on tourists' safety. Ex. https://travel.state.gov/content/travel/en/traveladvisories/traveladvisories/mali-travel-advisory.html (Accessed 22/09/2020).

Therefore, after we eliminated Mali and Nigeria, the first three positions of countries with high MIR/^{000} were occupied by Burkina Faso with 389.2/^{000}, which overall was 2nd; Guinea with 367.8/^{000}, which overall was 4th; and Niger with 356.5/^{000}, which overall was 5th. Retaining these three countries does not mean that they are free of insecurities. It is just that their insecurity levels are relatively lower, and much of their insecurity problems are spillovers from neighbouring countries. We have displayed the MIR statistics of each country alongside their corresponding FAMR statistics to make our information clearer, and to facilitate further analysis (Table 4).

Table 4. The first three countries in SSA with higher MIRs/^{000} as of 2016

Country	**MIR/^{000}**	FAMR
Burkina Faso	**389.2**	70
Guinea	**367.8**	4
Niger	**356.5**	7

Sample of Funded Antimalarial Research (FAMR) Initiatives in SSA

As per our findings, a large fraction of the global malaria expenditure of up to US$ 3.1 billion by 2017[12] goes to SSA. As consequence, antimalarial research activities in SSA—both fundamental and clinical—have been increasing (Head et al., 2017) as studies on the peculiarity of plasmodium falciparum have been intensifying (Zhang et al., 2018). Generally, much antimalarial funding and research resources (however, fewer than needed) are still invested to fight malaria disease in SSA, especially the dominating plasmodium falciparum (WHO, 2017c). We recorded 1,061 FAMR activities that took place in SSA between 2000 and 2016. The first three countries

[12] See: http://www.who.int/news-room/fact-sheets/detail/malaria For various updates on malaria, see: http://www.who.int/malaria/en/ (Accessed 21/05/2018)

that received the greatest number of these FAMR initiatives are Tanzania with 170 FAMR, Kenya with 148 FAMR, and Uganda with 115 FAMR. We have also displayed the FAMR statistics of each country alongside their MIR/^{000} statistics to render our records clearer, and to facilitate further analysis s (Table 5).

Table 5. The first three countries in SSA with great numbers of FAMR in SSA as of 2016.

Country	MIR/^{000}	**FAMR**
Tanzania	113.9	**170**
Kenya	166	**148**
Uganda	218.3	**115**

4.5.5. Analysis

Relationship Analysis: Mapping FAMR in SSA versus MIRs/^{000}

From the one hand, we classify FAMR and MIR/^{000} as the two main factors involved in the fight against malaria in SSA. From the other, we are using the dynamics of malaria deaths (mortality) as the measure to substantiate the efficiency of antimalarial outcome. Thus, while we consider MIR/^{000} as the determining factor of antimalarial intervention mechanism, we consider FAMR activities as the controlling factor of malaria dynamics. Antimalarial stakeholders and partners use MIR/^{000} as the factor that determines their intervention mechanism with the aim of controlling or minimizing malaria infection. For this reason, we arranged all the six sampled countries together in the descending order of their MIR/^{000} and matched them with the number of FAMR activities hosted by each country (Table 6). This arrangement automatically displays the relationship that exists between FAMR in SSA and malaria endemicity, using MIR/^{000} as the immediate indicator of malaria endemicity.

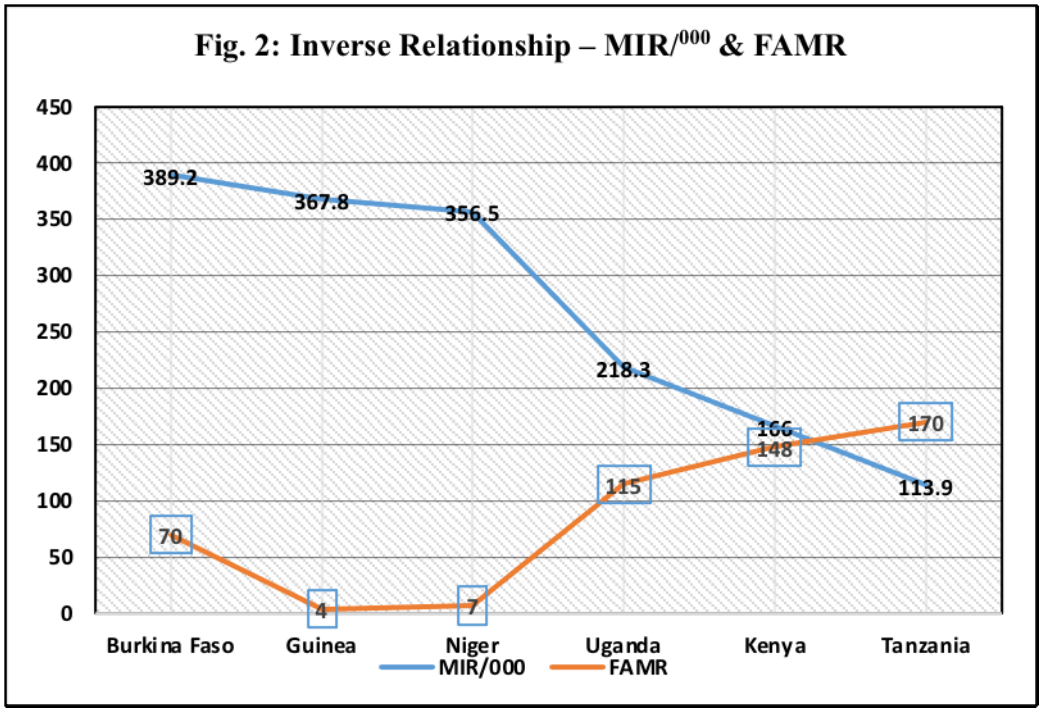
Table 6. The mapping table of MIR and FAMR in SSA as of 2016.

Country	MIR/^{000}	FAMR
Burkina Faso	**389.2**	**70**
Guinea	**367.8**	**4**
Niger	**356.5**	**7**
Uganda	**218.3**	**115**
Kenya	**166**	**148**
Tanzania	**113.9**	**170**

Key: Countries are arranged in the descending order of MIR/^{000} and matched with their respective number of FAMRs.

We could undertake this analysis with at least three countries if the three countries with the greatest number of FAMR initiatives coincided with the three countries with high MIR/^{000}. This number could be increasing if we had more than zero but less than three countries intersecting. However, we do not have any intersection in this research, so we continue our analysis with all the six sampled countries. At a glance, Table 6 indicates aspects of the intervention inequities since the FAMR activities in SSA inversely relate with malaria endemicity, and decrease as we move into dense malaria endemic countries. The graphical illustration of inequities (Figure 6) clearly shows how the curves of MIR/^{000} and FAMR diverge from each other as malaria infection intensifies.

FIGURE 2. INVERSE RELATIONSHIP BETWEEN FAMR AND MIR/^{000} IN SSA



Key: FAMR activities increase as MIR/^{000} decreases, indicating an inverse relationship.

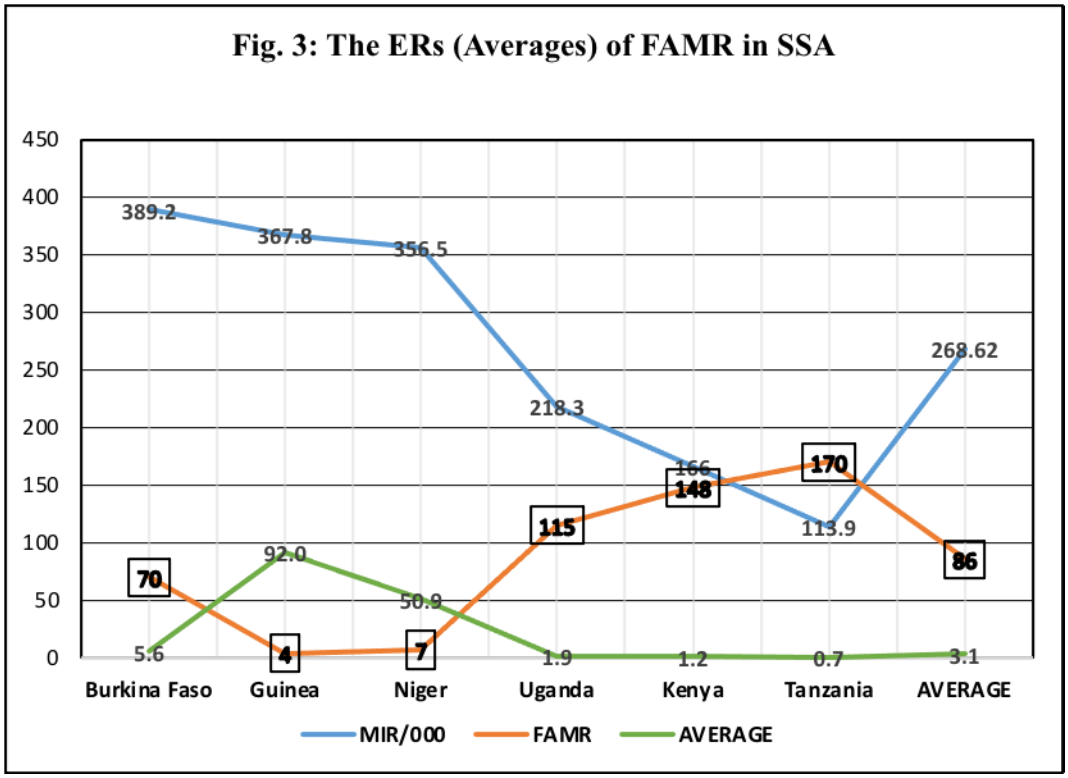
This mapping analysis indicates an inverse or the diverging relationship between FAMR in SSA and malaria endemicity (MIR/^{000}), an inclination towards the H_a. Notwithstanding this inclination, we still wonder if this inverse relationship helps to increase malaria mortality in malaria endemic countries in a way to intensify the inequality-gap. We applied a step-by-step efficiency verification procedure to determine the potentiality of this antimalarial relationship in SSA to produce or not negative malaria dynamics in that part of the world. Generally, efficiency in healthcare intervention is attained when the distribution of the available resources achieves the best health outcomes for all the people in need (Palmer & Torgerson, 1999).

In such a situation of wide dispersion in health infection, like the case at hand, healthcare efficiency operates on an inverse relationship with the intervention average number of cases (IA)

which we have also referred to above as the ER. Healthcare intervention efficiency decreases as the average number of patients per intervention increases, and increases as the average number of patients per intervention decreases. That is, we considered that the higher the average number of malaria cases estimated to be targeted by one FAMR, the lower the probability for the research process to be efficient as to produce fairer results, and vice versa. In this case, the Mean IA functions as the referential *index* from which the intervention equity is determined. When the IA of a particular intervention process is above the Mean, we are faced by the potentiality of recording negative malaria outcomes (malaria deaths), and when it is below the Mean, we have a higher probability of recording positive malaria outcomes.

Antimalarial intervention in SSA, given that malaria is a heterogeneous communicable disease, must strive to bring the IAs of the malaria endemic countries closer to or lower than the Mean. We also refer to this procedure as the *allocative efficiency* because it determines whether the allocation mechanism of the available resources widely benefits the communities that are in desperate need (Palmer & Torgerson, 1999). This efficiency that is determined by 1FAMR**:**(MIR/^{000}÷FAMR) 1/shows whether the intervention orientation is equitable or inverse, and 2/indicates whether the possible/foreseen results will be negative or positive. In the same way, the difference between the lowest IA and the highest IA indicates the inequality-gap (Figure 3).

FIGURE 3. SAMPLE OF THE IA OF FAMR IN SSA



Key: According to the IA (green) graph, while the Mean IA is 3 (Mean ER 1:3), the IA of Tanzania is already at 0.7 (ER 1:0.7), lower than the Mean, and Guinea is still stagnating at 92 (ER 1:92), too far above the Mean.

The As mentioned above, the difference between the lowest and highest values of IA is a strategic indicator of the inequality-gap. As Figure 3 indicates, the great difference between the IA of Guinea (the highest) and that of Tanzania (the lowest) indicates the great malaria inequality-gap in SSA. In the same way, the low IA/ER (1:0.7) in Tanzania indicates a potential high efficiency, and the high IA/ER (1:92) in Guinea indicates a potential low efficiency. The wide difference between these two intervention ratios (the lowest and the highest) demonstrate high antimalarial input inequities in SSA.

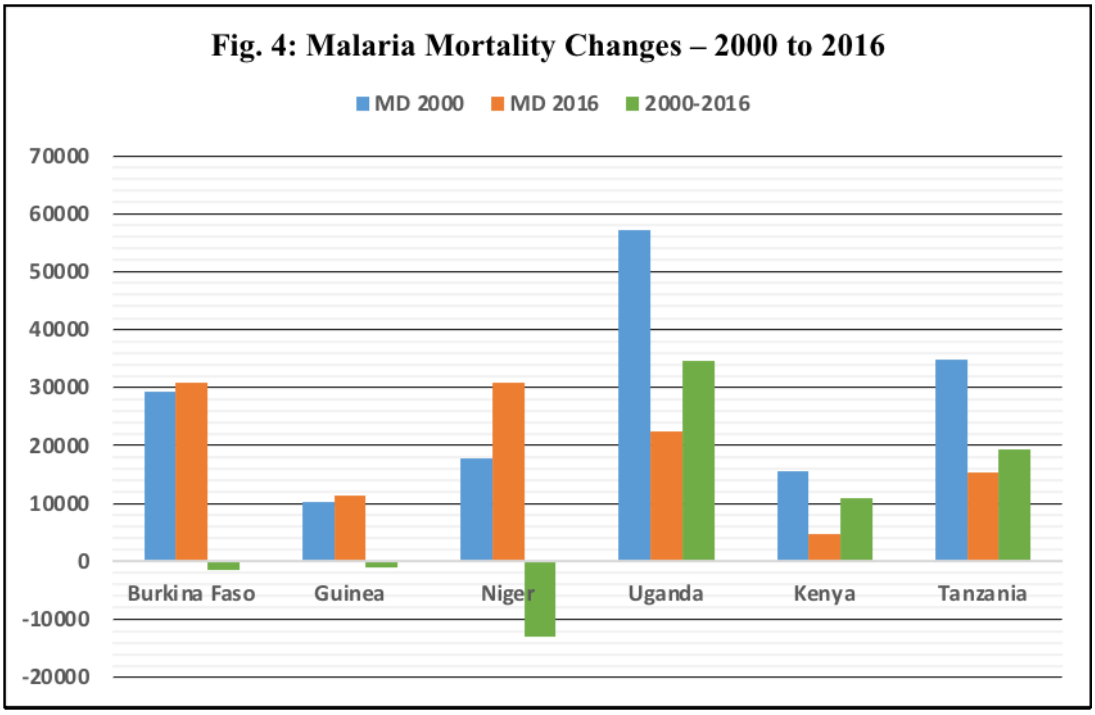
Though these statistics show potentiality of the demonstrated inverse antimalarial intervention relationship in SSA to facilitate increase in the malaria inequality-gap, it is not yet clear whether it leads to the negative malaria dynamics recorded across SSA. Thus, we further verified the dynamics of the malaria mortality in SSA in the light of the results in Figure 2. As per Figure 2, from 2000 to 2016, the IA/ER of three of the six sampled countries fell below their Mean, and these of the other three countries went above their Mean. Did the countries whose IA/ER fell below the Mean record positive dynamics in their malaria death (MD) and the countries whose IA/ER went above the Mean record negative dynamics in their MD records? (Table 7 and Figure 4).

Table 7. Widening malaria mortality in SSA – 2000 to 2016

Country	MD 2000	MD 2016	Change 2000–2016
Burkina Faso	29215	30762	-1547
Guinea	10347	11328	-981
Niger	17791	30848	-13058
Uganda	57160	22489	34671
Kenya	15573	4625	10948
Tanzania	34754	15419	19335

Key: Statistics in this table are rounded up/down, since we are referring to people. A negative change does not mean a reduction in malaria mortality, rather it indicates an increase (negative dynamics).

FIGURE 4. PILE CHART DEMONSTRATION OF STATISTICS IN TABLE 7

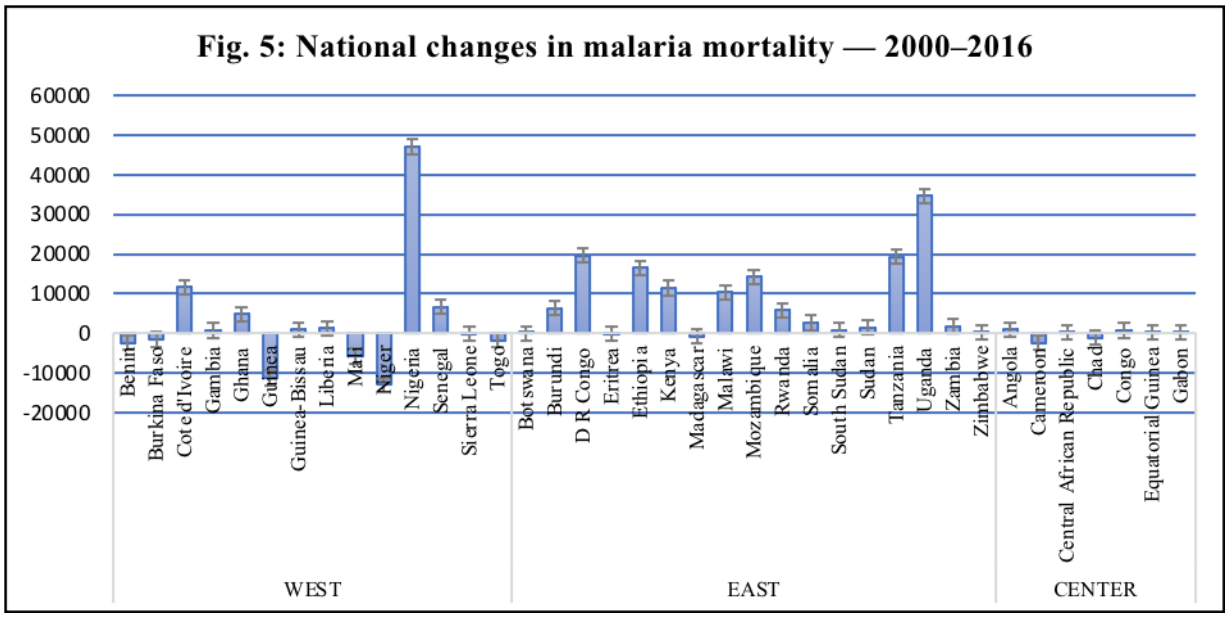


Key: Negative changes are indicated by statistics below zero, and positive changes are indicated by statistics above zero.

As per Table 7 and Figure 3, Uganda, Kenya and Tanzania whose IA/ER went below the Mean recorded decreases in their malaria deaths (positive changes). On the contrary, Niger, Guinea and Burkina Faso whose IA/ER went above the Mean recorded increases in their malaria deaths (negative changes). We consider these results valid for the whole of SSA because we are using to confirm hypothetical probabilities. When using statistics distribution inference. the validity ascertained for the sampled part is considered valid for the whole population on the same basis, everything remaining equal (Yu, 2021). This assertion is also held by the subjectivists in inductive logic, although they often give their conclusions some latitudes for empirical substantiation and adjustments (Joyce, 2019).

As we already established above, the malaria endemic western part of SSA is inversely targeted by FAMR initiatives (Table 6). We also have established (Table 7) that this inverse relationship perpetuates some imbalances in the dynamics of malaria mortality in SSA. However, we are indicating if this is an indication that the results in Table 7 & Figure 4 can be inferred as the reality of the whole of SSA. Do these dynamics reflect the same scenario across all the 38 countries studied in this research? We are verifying if a majority of countries in the western part of SSA are experiencing negative dynamics in their MDs, and those in the eastern part of SSA are experiencing positive dynamics as shown in Figure 5.

FIGURE 5. CHANGES IN MALARIA MORTALITY IN SSA BETWEEN 2000 AND 2016



Key: SSA is treated here as regions because some characteristic malaria factors are common to a majority of countries in a region. Similar to Fig. 4, the negative changes fall below the zero line, and the positive changes rise above the zero line. They are arranged from left to right in the descending order of malaria intensity.

Figure 5 shows that 7 on 14 (50%) of countries in the western part of SSA experienced increases in MDs (negative dynamics) from 2000 to 2016. Within the same period, only 2 on 16 (12.5%) of countries in the eastern part experienced increases in MD. This trend of positive malaria dynamics in the eastern part and negative dynamics in the western part follow the distribution pattern of FAMR across SSA. Between 2000 and 2016, we identified 1,061 FAMR activities across SSA, and 648 (61.07%) were carried out in the eastern part. Correspondingly, a majority (≥ 80%) of countries in that part recorded greater positive changes in MDs as compared to the rest of SSA.

These results confirm our H_a that the location strategy of FAMR activities in SSA is inverse to malaria endemicity and contributes to increasing the malaria inequality-gap across countries. The fact that the Mean IA (3.1) of the 6 sampled countries in Figure 3 is close to the Mean IA (3.9) of all the 38 countries studied, allowing the error margin of 0.5, substantiates the validity of our inductive verification. To a greater extent, these statistics show that the antimalarial intervention mechanism in SSA instead complicates the malaria dynamics in that part of the world at the detriment of the malaria hard-hit countries.

4.5.6. Discussion

Ethical dimension of the fight against malaria in SSA: Combined efforts

Given the diversity that frames the prevalence and the intensity of malaria in SSA, various antimalarial activities and engagements in that part of the world necessitate the combined efforts of the biomedical and the ethical insights. As mentioned above, the ethical dimension of the fight against malaria in SSA falls within the combined influence of public health and global health ethics. On the one hand, we are looking at public health ethics from its functional implication as a

systematic process designed to clarify and justify some scientific acts and actions of public health with a combination of ethical principles and beliefs of stakeholders (Ortmann et al., 2016). On the other hand, global health ethics acts as a conscientizing tool to tickle self-reflection in terms of place in the healthcare practitioner, and adjudicates scientific input—as material and as action—in terms of disease burden and healthcare benefit (A. D. Pinto, Birn, & Upshur, 2013). The latter recognizes that the situation and problems encountered in context may be peculiar and different from those of the practitioner.

The functional curricula of the two orientations of healthcare ethics draw much inspiration from the ethical principles related to the clinical and deontological ethics of biomedicine, as well as from bioethics, to regulate healthcare research and practice. While public health ethics may incline more on the horizontal diversity across the populations, global health ethics may turn more towards the vertical diversity across peoples and places. But the two jointly emphasize the consciousness of context-sensitivity in various healthcare intervention processes to satisfy the fact of diversity. Diversity in context, content, and determinants instills in healthcare professionals the consciousness to adapt question-and-answer verification methodologies (any form it may take) to acquire enough context-sensitive information prior to their practical engagements (Ortmann et al., 2016; A. D. Pinto et al., 2013).

However, though we square the fight against malaria in SSA within the ethical parameters defined by global health ethics and public health ethics, the reality surrounding malaria in SSA demonstrate diverse complicated peculiarities from east to west. 1/The populations of SSA are not just *the other people* but the vulnerable, thus, necessitating empathy-based intervention approaches to supplement the standardized principal-based healthcare approach. 2/While the health burden of malaria in SSA is borne by their populations, the economic and scientific

burdens of malaria in that part of the world are dominantly borne by the western philanthropists, people who have and may never experience malaria illness. 3/The diversity that defines the fact of malaria in SSA is interwoven in a complex heterogeneity of differences: across different cultures; across different social environments; interwoven within subsistent economies.

To enforce the practical healthcare regulatory exigencies of global and public health ethics to disintegrate these context-sensitive complexities of the fight against in SSA, antimalarial stakeholders, partners, and professionals in that part of the world must abide by the pragmatic interdisciplinary exigencies of applied ethics. This dimension of applied ethics emphasizes that in exercising professional activities that demand efficiency and excellence, it is insufficient to only abide by statutory deontological laws. Thus, in the form of pragmatic interdisciplinary healthcare ethics, applied ethics cautions us to always fashion the pragmatic *ethos* and operate within the guides that link theoretical values, principles and virtues to context (Adela Cortina, 2017). It is, thus, believed that healthcare professionals must take their professional ingenuities beyond the deontological and classical principles of bioethics and guide their professional activities—especially research and application—with what others call *a global state of mind* (Solomon R. Benatar, Daar, & Singer, 2003). As these dexterities are yet to guide antimalarial endeavours in SSA, the socio-epidemiological consequences mount.

Socio-Epidemiological consequences of ethical failures

At the base of the fight against malaria in SSA, there is a pragmatic ethical recommendation to assure the equitable distribution of FAMR in SSA—the main input of antimalarial intervention—vis-à-vis malaria endemicity. In any healthcare research that faces diversity—especially in fundamental research—the equitable research intervention process is recommended to direct the *how* and the *where* of the healthcare intervention process and obtain positive outcomes. In the

eventuality of the contrary, as in the allocation of FAMR activities across SSA, some people will be unjustly overrewarded with too far more resources and services than others, and some are unjustly under rewarded with too far less resources and services than needed.

It is evident from the statistical demonstrations above that this socio-ethical weakness handicapped the antimalarial input processes in SSA between the eastern and the western parts. To begin, the concentration of 61.07% of FAMR activities in the eastern part of SSA meanwhile 58.45% of malaria deaths are instead recorded in the western part is an indication of the ethical failure to abide by the recommended equitable intervention. The ensemble of such ethical weaknesses has degenerated degrading epidemiological results with many countries in the malaria endemic western part transiting to becoming malaria holoendemic. As such, the malaria inequalities across SSA increase as their malaria mortality records in the endemic countries skyrocket. For example, from 2000 to 2016, Niger recorded 13,058 more malaria deaths (negative changes) and Tanzania recorded 19,335 less malaria deaths (positive changes). To this effect, encouraging positive changes, like the case of Tanzania, are replaced by the discouraging negative changes, like the case of Niger, and SSA maintains its position as the epicenter of the global malaria burden.

Second, despite decades of antimalarial engagements in SSA, no antimalarial drug candidate had ever reached Phase III clinical trial stage in that part of the world but for Mosquirix RTS,S, the latest malaria drug candidate that is still under the validation process (Aaby et al., 2015; Kakkilaya, 2015a). On the one hand, failure in the equitable distribution of FAMR activities led to failure in obtaining representative malaria reality to guide effective antimalarial drug production, thereby causing failure to complete the production process. On the other hand, the success of Mosquirix RTS,S, the lone antimalarial drug candidate spearheaded by African-based

pharmacological scientists, is proof of the importance of contextualization (context-sensitive antimalarial engagement) to successfully fight against malaria in SSA.

The ensemble of these antimalarial weaknesses in SSA are proof of the failure to establish inclusive interdisciplinary antimalarial engagements between clinical and social healthcare scientists. This weakness enhances systemic failure in the structural organization of the various facets of antimalarial interventions in SSA. However, we are aware of some tendencies of exploitation and of the conflict of interest that affect and derail some antimalarial initiatives in SSA for private gains (Bidima, 2018). Consequently, the range between the maximum positive and maximum negative changes in the MDs across SSA (the inequality-gap) increased to more than 60,000 deaths by 2016, with the standard deviation of more than 11,000 deaths. For the 16-year period included in this study, the stagnating situation of malaria across SSA held the average malaria positive change at only ≈4746, and more than 50% of the countries registered less than 859 malaria-death reduction per annum (Table 8).

Table 8. Statistical analysis of Malaria changes in SSA between 2000 and 2016.

Number of countries	38
Mean	4746.704
Median	859.015
Standard Deviation	11245.169
Range	60157.831
Minimum	-13057.509
Maximum	47100.322

Key: Analyses made with IBM SPSS statistics.

These dynamics confirm research as an indispensable variable in the proficient fight against malaria because it provides the necessary malaria data from which we postulate efficient intervention processes to envisage malaria elimination (Druetz et al., 2020). In other words, the accurate detection of the pattern of malaria incidence is indispensable for malaria epidemiological screening and surveillance to determine the best malaria control strategies, and to test and validate the efficacy of various antimalarials (Gosling et al., 2011; Head et al., 2017). From this dimension, specialists in *malariology* attest that the strategic diagnosis of the pattern of malaria endemicity is critical to the implementation of the appropriate mechanism to control malaria disease and minimize its comorbidities (Hopkins, Daily, & Baron, 2015).

When the malaria infested populations go undetected and untreated—like the case of many countries in the western part of SSA—they are exposed to a greater risk of becoming holoendemic. The probability that a larger proportion of those populations becomes asymptomatic is high, and it is evident that will in turn act as disguised parasitic storage and propagators of plasmodium. These are some of the socio-epidemiological consequences of the various ethical failures in the fight against malaria in SSA that have further complicated the general reality of malaria in that part of the world. Among many, those dynamics enhance the development of complex malaria-related comorbidities across many countries in the western part of SSA (Papaioannou et al., 2019).

Distractions of antimalarial ambitions in SSA: The ambiguity of *interest*

Meditating on the recurring negative dynamics highlighted above, one may wonder if the *interest* that underlies the fight against malaria in SSA envisages the elimination of this disease to relieve its victims. Or if the health benefits of the local populations is often the common target or the

envisaged mission of various antimalarial endeavours in that part of the world. This ethico-scientific dilemma in the fight against malaria in SSA dangles on the ambiguity of the concept of *interest* that confuses the evaluation of the intervention output. To a greater extent, this ambiguity distorts the necessary equitable orientation of antimalarial endeavours in SSA and handicaps its efficiency potentiality. This is one of the reasons for which malaria prevalence in that part of the world is still averagely rated *high* in the 21st century (Aaby et al., 2015; WHO, 2017a, 2018c).

As mentioned above, the fight against malaria in SSA necessitates the involvement of global and public healthcare partnership, as well as that of foreign and domestic healthcare stakeholders and partners. While the exigencies of global and public healthcare ethics jointly strive to harmonize the interests of various partners as explained above, it remains difficult to determine if their interests all share the same visions and objectives. Ex., given that the embodiment of FAMR is the mainstay of the efficient antimalarial intervention in SSA (Hammer et al., 2006; Head et al., 2017), the orientation of FAMR activities in that part of the world *vis-à-vis* the endemicity of malaria prevalence provokes a thought of questioning the underlying visions and objectives their interest.

Among the resolutions of the 2001 global health seminar for Africa that took place in Arusha, Tanzania, there was a call to always harmonize various interests and targets of global healthcare research in that part of the world. That notwithstanding, each country in SSA still had to adopt its own superseding public health politics and policies to reflect their contextual healthcare realities and needs (Puppalwar et al., 2015). Thus, though various motives of partners—foreign and domestic stakeholders and partners—engaging in SSA are still each labelled as healthcare interest, diversity in objectives and targets sets in and complicates the evaluation of success.

On the one hand, healthcare interests of stakeholders and policymakers in some countries are directed towards other emerging healthcare needs than on an ancient disease like malaria. Ex., the investment of a good fraction of healthcare interest in Niger to remedy some emerging health frailties like malnutrition, waterborne diseases, and maternal deaths distracts the necessary investment in the fight against malaria[13] than is the case in Tanzania. As such, malaria infection and calamities are bound to increase in Niger than in Tanzania. On the other hand, repulsive sociopolitical atmosphere and bad governance characterized by corruption and mistrust, as well as lack of transparency or consistency in the National Malaria Surveillance Systems in many malaria-endemic countries in SSA, also negatively affect the interest of many antimalarial partners (Head et al., 2017; WHO, 2017c).

To that effect, most antimalarial partners and funders in SSA often initiate area-specific antimalarial intervention programs and strategies (Druetz, 2018) for other reasons and interests than malaria elimination. Ex., among many, they go to countries where they can easily get faster results to hit the market earlier than their competitors irrespective of the overall outcome.

> While the cost and time to bring a new drug to market have intensified, the pressure to reduce the amount of time and cost to market, the fierce competition for patients due to increased regulatory requirements for licensure and recruiting across a broad range of patients has also increased. The escalating costs of the research and development of new drugs, as well as reduced access to large populations of treatment-naïve patients, has led the pharmaceutical industry to devise ways to reduce the time in getting the drugs licensed and approved in newer locations of sub-Saharan Africa (Puppalwar et al., 2015, p. 23).

---

[13] See: USAID Fact sheet: Health in Niger, 2022. https://www.usaid.gov/sites/default/files/2022-12/Niger%20Health%20Fact%20Sheet%20February%202022%20Final.pdf

This may justify the general failure of almost all antimalarial drugs in SSA despite the abundance of the assorted types across countries in that part of the world. Generally speaking, the inclination tendency of the interest of antimalarial stakeholders, partners and funders/researchers in SSA is easily determined from various dimensions: 1) the choice of their sites for FAMR activities; 2) the duration of FAMR in SSA; 3) the dominance of the orthodoxy of biomedical sciences over other complementary social sciences that could better analyze the context-sensitive non-biological malaria vector factors (Golding et al., 2017; Puppalwar et al., 2015). As this ambiguity of interest intensifies, the proficient combination of the *scientific* and *ethical validations* becomes hard to attain, and the intervention processes fail to achieve the necessary epidemiological efficiency that benefits the populations in need.

Scientific evaluation of this research: relevance and weaknesses

While this research confirms health as one of the fundamental human rights that everybody wishes for everyone (Braveman & Gruskin, 2003; WHO & OHCHR, 2008), it informs us of why some people in some parts of SSA have remained desperately vulnerable to malaria. From the general perspective, this article highlights the pivotal role of ethics in healthcare. As James Orbinski emphasized in (Orbinski, 2013), ethics empowers healthcare professionals to initiate interventional actions with explicit ethical reasoning and to evaluate outcomes from both objective and ethical perspectives that improve future choices and actions. Thus, it refreshes the admonition of the ethics of human rights to health that we should always ensure no one is disadvantaged from achieving their full health potentiality for reasons of their circumstances (Braveman et al., 2011; Sklar, 2018).

From a particular perspective, this research informs healthcare stakeholders, policymakers and partners involved with the fight against malaria in SSA of the necessity to record the concentration of malaria parasitemia as the main intervention factor. Without going too clinical, the concentrations of malaria parasitemia in SSA are often associated to the high frequency of malaria-related comorbidities and deaths (Teh et al., 2018) as the case of high malaria-anaemia comorbidity across countries in western SSA (Papaioannou et al., 2019). Without claiming to have provided a magic solution to the longstanding problem of malaria in SSA, though, this article saves *an ethical pointer of the fight against malaria in SSA.* We acknowledge, however, that the results of this research are based on correlational analysis that may not fully certify the causality relationship emphasized. Thus, the logical validity of this research may still need context-sensitive practical verifications to capture full confidence.

While some qualitative researchers may see the statistical size of six countries insufficient to infer satisfactory significance for all of SSA, some quantitative researchers might have loved to see us concentrate on more detailed analysis in only one sampled country. While those expectations have their merits, we judge the sampling size of six on 38 (15.8%) strong enough to predict a significant veracity for SSA. However, this article has paved the way for further research to determine which intervention strategy could render antimalarial intervention in SSA equitable enough to benefit the malaria hard-hit populations and minimize inequalities.

4.5.7. Conclusion

From the ethical perspective, increase in health inequalities is a common indicator of the absence of social justice in healthcare policies and practices, especially when diversity in the healthcare *needs* of the populations had been ignored (Dine, 2020b). Such a situation easily leads to

healthcare inequity where more of the available resources are misdirected to areas that relatively need lesser, and lesser to areas that relatively need more (Jasso, 2015). This analogy aligns with the allocation strategy of FAMR in SSA *vis-à-vis* malaria endemicity shown in Table 4 above. However, such intervention inequities could be corrected with healthcare equity, the main intervention tool recommended to minimize health inequalities and attain equitable health equality (Braveman et al., 2018). Equitable intervention strategy is equality recommended for the fight against malaria in SSA (Head et al., 2017).

As substantiated above with various frameworks of the pragmatic interdisciplinary perspective of healthcare ethics, the successful fight against malaria in SSA cannot be achieved with the haphazard distribution of the available resources. Antimalarial intervention strategy demands the strategic research that records various contextual peculiarities and implements necessary ethical norms to satisfy various variables (Wildgen & Denny, 2020). Even at minimal, this research dimension demands the inclusive involvement of local researchers (clinical and fundamental) to provide a closer sense of place in the process. This is one of the main force behind the successes recorded by Mosquirix RTS,S/AS in Africa because its development is spearheaded by African scientists (Kakkilaya, 2015a).

However, since the beginning of the millennium, SSA has recorded a general decline in malaria mortality, and encouragingly significant for the under-five children. By the year 2000, SSA was recording 739,511.92 malaria-caused under-five deaths, but this number dropped to 549,286.33 deaths (a reduction of 190,225.59 deaths) by 2016 (GHO, 2017). That notwithstanding, we still need to increase this decline and impact many societies. This view aims at helping antimalarial stakeholders and partners in SSA to relieve the malaria inflicted health destitute of the hard-hit

populations in that part of the world. As such, they will be upholding the global ambition of attaining *equitable health equality* and assuring health for all.

Declaration

Acknowledgement:

Conflict of interest: None

Funding: None

References

Austin, P. C. (2016). Variance estimation when using inverse probability of treatment weighting (IPTW) with survival analysis. *Stat Med, 35*(30), 5642-5655. doi:https://doi.org/10.1002/sim.7084

Braveman, P., & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology & Community Health, 57*(4), 254-258. doi:http://dx.doi.org/10.1136/jech.57.4.254

Braveman, P., Kumanyika, S., Fielding, J., Laveist, T., Borrell, L. N., Manderscheid, R., & Troutman, A. (2011). Health disparities and health equity: the issue is justice. *Am J Public Health, 101 Suppl 1*(S1), S149-155. doi:http://dx.doi.org/10.2105/AJPH.2010.300062

Druetz, T., Stresman, G., Ashton, R. A., van den Hoogen, L. L., Joseph, V., Fayette, C., . . . Eisele, T. P. (2020). Programmatic options for monitoring malaria in elimination settings: easy access group surveys to investigate Plasmodium falciparum epidemiology in two regions with differing endemicity in Haiti. *BMC medicine, 18*(1), 141. doi:https://doi.org/10.1186/s12916-020-01611-z

GHO. (2017). Annex B: Tables of health statistics by country, WHO region. *World Health Statistics* Retrieved from http://www.who.int/gho/en/ 20/08/2018.

Gosling, R. D., Okell, L., Mosha, J., & Chandramohan, D. (2011). The role of antimalarial treatment in the elimination of malaria. *Clin Microbiol Infect, 17*(11), 1617-1623. doi:http://dx.doi.org/10.1111/j.1469-0691.2011.03660.x

Head, M. G., Goss, S., Gelister, Y., Alegana, V., Brown, R. J., Clarke, S. C., . . . Tatem, A. J. (2017). Global funding trends for malaria research in sub-Saharan Africa: a systematic analysis. *Lancet Glob Health, 5*(8), e772-e781. doi:https://dx.doi.org/10.1016/S2214-109X(17)30245-0

Heggenhougen, H. K., Hackethal, V., & Vivek, P. (2003). *The behavioural and social aspects of malaria and its control* (Vol. 03). Geneva: WHO/UNDP/WB.

Hopkins, H., Daily, J., & Baron, E. (2015). Diagnosis of malaria. *UpToDate, Daily, J (Ed), UpToDate, Waltham: MA. http://www.uptodate.com/contents/diagnosis-of-malaria (Accessed 10/02/2017).*

Jasso, G. (2015). Inequality Analysis: Overview. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 885-893 / doi: https://doi.org/810.1016/B1978-1010-1008-097086-097088.032199-097087). Oxford: Elsevier.

Joyce, J. (2019). Bayes' Theorem. In E. N. Zalta (Ed.), The Stanford Encyclopedia of Philosophy (Vol. Spring 2019). Stanford University: Metaphysics Research Lab. Retrieved from https://plato.stanford.edu/entries/bayes-theorem/ (Accessed 28/11/2020).

Kakkilaya, B. S. (2015). Malaria Vaccines. *Malaria Site.* Retrieved from https://www.malariasite.com/malaria-vaccines/ (Accessed 15/04/2021).

Najera, R. (2019). Malaria and Malaria Vaccine Candidates. *The History of Vaccines: An Educational Resources by The College of Physicians of Philadelphia.* Retrieved from https://ftp.historyofvaccines.org/content/articles/malaria-and-malaria-vaccine-candidates (Accessed 23/01/2021).

Palmer, S., & Torgerson, D. J. (1999). Definitions of efficiency. *BMJ, 318*(7191), 1136. doi:https://doi.org/10.1136/bmj.318.7191.1136

Papaioannou, I., Utzinger, J., & Vounatsou, P. (2019). Malaria-anemia comorbidity prevalence as a measure of malaria-related deaths in sub-Saharan Africa. *Scientific Reports, 9*(1), 11323. doi:http://dx.doi.org/10.1038/s41598-019-47614-6

Price, P., Jhangiani, R., & Chiang, I. (2015). *Research Methods of Psychology* (Vol. 2nd Canadian Edition). Victoria (B.C.): B.C. University Press.

Sklar, D. P. (2018). Disparities, Health Inequities, and Vulnerable Populations: Will Academic Medicine Meet the Challenge? *Acad Med, 93*(1), 1-3. doi:http://dx.doi.org/10.1097/ACM.0000000000002010

Snow, R. W., Craig, M. H., & le Sueur, D. (1999). A climate-based distribution model of malaria transmission in sub-Saharan Africa. *Parasitol Today, 15*(3), 105-111. doi:https://doi.org/10.1016/S0169-4758(99)01396-4

Teh, R. N., Sumbele, I. U. N., Meduke, D. N., Ojong, S. T., & Kimbi, H. K. (2018). Malaria parasitaemia, anaemia and malnutrition in children less than 15 years residing in different altitudes along the slope of Mount Cameroon: prevalence, intensity and risk factors. *Malaria Journal, 17*(1), 336. doi:https://doi.org/10.1186/s12936-018-2492-1

Wang, Y. H. (2000). Fiducial Intervals: What Are They? *The American Statistician, 54*(2), 105-111. doi:https://doi.org/10.2307/2686026

WHO. (2016). Weekly epidemiological record - 29 January 2016. *Weekly epidemiological record / Relevé épidémiologique hebdomadaire, 91*(4), 33-52. https://www.who.int/wer/2016/WER9104.pdf?ua=2011 (Accessed 2024/2002/2019).

WHO. (2017a). Annex B: Tables of Health Statistics by Country: WHO Region and Globally. *Global Health Observatory (GHO) Report: https://www.who.int/gho/publications/world_health_statistics/2016/Annex_B/en/ (Accessed 10/02/2018).*

WHO. (2017b). World malaria report 2017. . WHO publication Retrieved 20 September 2018 https://www.who.int/malaria/publications/world-malaria-report-2017/en/ (Accessed 20/09/2018).

WHO. (2018). Equity. *Health Systems: https://www.who.int/healthsystems/topics/equity/en/ (Accessed 24/03/2019).*

WHO, & OHCHR. (2008). The Right to Health. from Office of the High Commissioner for Human Rights, and World Health Organization https://www.who.int/gender-equityrights/knowledge/right-to-health-factsheet/en/ (Accessed 02/09/2017).

Yu, Y. (2021). Introduction to Statistical Inference. In Biostatistics—Open Learning Textbook. Gainesville: University of Florida. Retrieved from https://bolt.mph.ufl.edu/6050-6052/unit-4/ (Accessed 04/06/2021).

Zhang, M., Wang, C., Otto, T. D., Oberstaller, J., Liao, X., Adapa, S. R., . . . Adams, J. H. (2018). Uncovering the essential genes of the human malaria parasite Plasmodium falciparum by saturation mutagenesis. *Science, 360*(6388). doi:http://dx.doi.org/10.1126/science.aap7847

4.6. Summarizing Conclusion

This chapter has provided a general clarity about the malaria dynamics observed in SSA. While these statistical analyses have provided a better understanding of the intensity of the dispersion of malaria endemicity across countries in SSA, they also show the orientation of FAMR activities in SSA, and their relationship with malaria endemicity. Within and beyond this research, this information is indispensable for understanding the real facts surrounding the prominence of malaria in SSA. We already have diagnosed a counterproductive consequence of the inverse relationship between FAMRs and MIR/^{000} in SSA, especially as it challenges health equity, which is the intervention strategy recommended for situations like malaria in SSA for which the dilemma of health inequalities is at issue.

I have demonstrated how this inverse relationship is the evident reason why malaria-endemic countries in the western part of SSA are fast becoming holoendemic. These imbalances plunge the citizens of those countries into perennial severe malaria infections, thereby escalating the rate of malaria calamities and comorbidities across many countries. In turn, these negative dynamics further widen the already wide malaria morbidity/mortality inequality-gap across SSA countries. In the midst of this situation, two points are at issue: first, malaria hard-hit populations in SSA have fallen into further health vulnerability as measured against the ethics of human rights to *health for all*; and second, the universal call to fight health inequalities and attain equitable health equality as a prelude to assuring the universality of human rights to health is put in jeopardy.

With this admonition in mind, I am moved by the spirit of empathy emanating from the ethics of care and human rights as evoked by Dany Rondeau. According to Rondeau, when we look to such aspects of global healthcare discrepancies, like the situation described above, we see that

health vulnerability and suffering are interwoven. While the suffering side of the vulnerability endangers the life of the victim, its sensitive side provokes our love and empathy towards the suffering victims, what Paul Ricœur and Hans Jonas called human responsibility towards the suffering, the view that Robert Goodin also emphasized (Rondeau, 2019). Therefore, I am enticed to look for a plausible intervention mechanism by which these negative malaria dynamics in SSA can be reversed. To begin, I have to establish an intervention formular that can equitably subdue health inequalities and give everyone an equal opportunity to human rights to health by attaining equitable health equality.

Chapter 5: The Operational Guide for Attaining Equitable Health Equality

5.1. Introduction

How can we subdue health inequalities to attain equitable health equality and give everyone equal opportunity to human rights to *health for all*? As stated in Chapter 1, we can only deal with such an inclusive ethical dilemma in healthcare from an interdisciplinary perspective. In this perspective, ethics plays a central role by helping healthcare professionals to amalgamate interdisciplinary views and ideas from different schools of thought, and then by helping to galvanize these diverse views and ideas towards creating a greater solution pathfinding mechanism (A. Pinto & Upshur, 2013). In this chapter, I show how the insights from the theory of ethical governance in healthcare can be exploited to confront health inequalities and attain equitable health equality.

Thus, I define the general intervention mechanism that can be adapted to fight against malaria in SSA to subdue malaria inequalities and relieve the malaria hard-hit populations with respect to their rights to health for all. According to the theory of ethical governance in healthcare, we need to include empathy-based and virtue-based pragmatic approaches in the decision-making processes of healthcare interventions. Those perspectives connect governance and health, political will and healthcare, justice and care, equity and equality, and benefits and interests. The theory of ethical governance in healthcare, as an aspect of applied ethics, serves as a reliable operational guide to direct both the interpretation and application of various ethical principles.

The Third scientific article

5.2. From *Health Inequalities* to *Equitable Health Equality*: Ethical Governance in Healthcare Empowers Equity as Social Justice

This article is submitted to the *Journal of Health Inequalities*
+ Manuscript Draft ID: JHI-00328-2023-01.pdf
+ Article type: Original Research Article
+ Authors: Charles Biradzem, Dine, Dany Rondeau, and Bob White.

Abstract

Global millennium healthcare ambition to attain *equitable health equality* as a prelude to achieving *health for all* is challenged by increasing health inequalities. First, *diversity* in the contemporary world is emerging as the unreckoned determinant of health inequalities, and second, the healthcare intervention modalities to subdue health inequalities amidst *diversity* and attain *equitable health equality* are yet well articulated to help. Thus, the objective of this research is to illustratively demonstrate an innovative healthcare intervention framework to subdue health inequalities amidst diversity. That is, how ethical governance in healthcare empowers equitable intervention against diversity with the impetus of social justice to minimize health inequalities and attain *equitable health equality*. This healthcare intervention mechanism informs context-sensitive healthcare efforts to assure that all the people in *need*—communities and individuals—are given equal opportunities to have what it takes to be healthy.

Keywords: Health inequalities, health equality, health equity, ethical governance in healthcare, equitable health equality, social justice in healthcare.

5.2.1. Introduction

Health is one of the universal human rights and aspirations rated a basic human need that everybody should enjoy (Rawaf, 2017; WHO & OHCHR, 2008). To this effect, the Global Healthcare Taskforce established the millennium ambition to attain *equitable health equality* as a prelude to achieving *health for all,* the ambition they further emphasized that it is "leaving no one behind" (WHO, 2016a, p. 23). This ambition was again emphasized in the *Sustainable Development Goals* with the universal intention "to assure human rights to health for all at all

ages" (Goal #3) (IHP, 2018). The multidimensional struggle towards the realization of this ambition is not achieving much, and health inequalities among and across the peoples of the world are instead increasing: between the global North-South societies (Barreto, 2017); across European countries (Marmot, 2020); within the Global South (Tosam, Chi, Munung, Oukem-Boyer, & Tangwa, 2018); with Indigenous peoples (Kim, 2019), just to name but these few.

To begin, the main causes to this failure are perceived at both the micro and macro levels of healthcare. At the micro level, the distinction between the concepts *equity* and *equality* in healthcare are not well established to help healthcare professionals practically apply them as complements to attain *equitable health equality*. As this weakness impedes or distorts strategic healthcare intervention processes amid diversity, inequalities instead increase (Jasso, 2015). We are talking of health inequalities referring to the *unfair* and *avoidable* health disparities that result from systematic differences in key health determinants between groups of people from different social settings (Braveman et al., 2018; Braveman et al., 2011). That is, health differences resulting from socially determined circumstances and behaviour that can be detected, managed and avoided (Leon et al., 2001).

Thus, unlike other health disparities that might be biologically defined, we distinguish health inequalities by their fact of being *avoidable* and *unfair* because we have great control over them. For example, we may not have control over any health disparities that come with aging because they are biologically defined, but we have managerial control over the diversity that defines the functionality of various social determinants of health. We need to apply equitable healthcare intervention strategy to overcome diversity and assure health for all, otherwise we instead risk increasing health inequalities. This is one of the reasons for which the prevalence of health

inequalities also infers failure to avoid or to overcome the *avoidable* disparities that infringe the *fairness* of human rights to health and wellbeing (WHO, 2018b).

At the macro level, both the political and professional *governing* structures of the healthcare systems do not coherently harmonize various determinant of health to galvanize healthcare intervention processes towards the realization of this ambition. Given that various determinants of health are the individual factors that influence human health amidst diverse healthcare needs across the populations, we must harmonize these determinants to satisfy 1/the diversity that characterizes various healthcare needs of the populations, and 2/the universality of human rights to health for all. Therefore, while recognizing this harmonization process as indispensable and central in healthcare intervention amidst diversity, we classify *governance*[14] as the structural determinant of healthcare, and its harmonization responsibility as the main aspect of *ethical governance in healthcare*.

To this effect, healthcare stakeholders, partners and policymakers must exploit the impetus of ethical governance in healthcare to subdue health inequalities and attain *equitable health equality* to assure human rights to *health for all*. But how can they exploit the impetus of *ethical governance in healthcare* to subdue *health inequalities* to attain *equitable health equality*? Our main objective in this article is to demonstrate an innovative healthcare approach against health inequalities amidst diversity: how the insight from ethical governance in healthcare could guide healthcare intervention process to overcome health inequalities and attain equitable health equality. It is, therefore, clear that while the key theme of this research—equitable health

[14] We are talking of *governance* referring to the notion of the World Bank as the utilization of the institutional power to determine the distribution and use of resources for the benefit of the whole society without discrimination.

equality—is a novel millennium concept that is yet extensively developed in the scientific literature, both the conceptual and theoretical framings of the research are innovative.

Thus, we used *thematic-based research* procedure in which we identify, extract, analyze, incorporate, and harmonize themes relevant to the research question (Willig & Rogers, 2017). Also, as necessitated by these novel characteristics, we will adopt a step-by-step illustrative demonstration to clearly show how ethical governance in healthcare implores equity with the impetus of social justice to confront diversity and give equal healthcare opportunity to all the people in need. Though these illustrations and demonstrations will be prototypical, they will be underscoring the importance of contextualization—context-sensitive intervention—as an aspect of the pragmatic interdisciplinary perspective of applied ethics that enforces equity in healthcare. As such, this article demonstrates the ideal guide for the calibration, distribution, and application of the available healthcare resources, especially as the fundamental analysis of healthcare intervention.

5.2.2. Operationalization

Health Equity: Strategy to minimize health inequalities

Mu Ever since the early 80s that the knowledge about health inequalities come to limelight (Gray, 1982), this healthcare adversity among and across the populations of the world had been increasing. Many people are, thus, tempted to believe that we only have to accept these inequalities and live with them. Proponents of this school of thought often associate health inequalities only to the socioeconomic health factors, thereby attributing them to some peoples in the same way income is directly assigned and indexed to individuals (Kneipp et al., 2018). They often forget that we determine, evaluate, and target health inequalities from the prevailing bio-

socio-environmental factors that vary from one context to another, the reason for which these inequalities are avoidable (Braveman et al., 2018; Dine, 2020b).

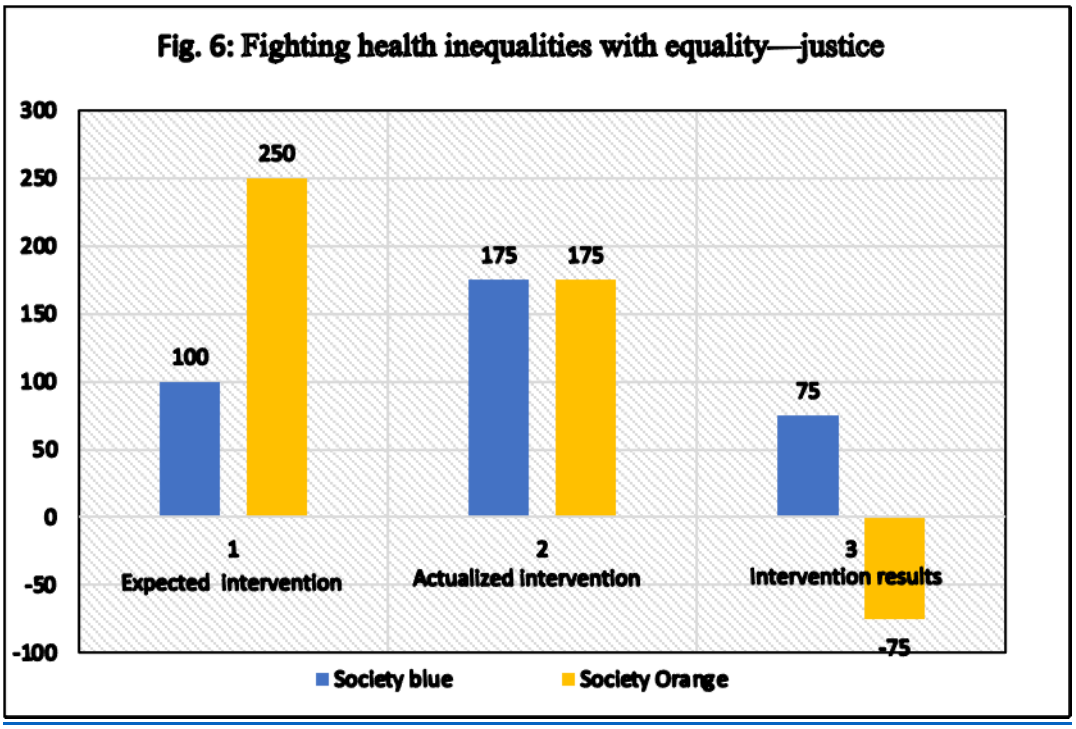
That notwithstanding, WHO holds to the millennium ambition to attain equitable health equality and give everyone equal opportunity to be healthy, thus, calling for the equitable healthcare to minimize health differences between people or groups of people (WHO, 2018a). The initiation of this ambition instigated questions within the scientific community because identifying, targeting, and redressing health inequalities involve interdisciplinary normative judgment that applied science alone cannot determine (Kawachi et al., 2002). As such, there had been the critical re-examination of the causal interconnections that lead to health inequalities, thereby opening up for collaborative interdisciplinary context-sensitive efforts. We need interdisciplinary context-sensitive knowledge in healthcare to determine how health inequalities are experienced under different contexts, especially by the vulnerable (Kneipp et al., 2018).

This knowledge facilitates the implementation of the equitable healthcare intervention process to overcome diversity. Equitable healthcare intervention is a recommended procedure to fight health inequalities because health inequalities unexpectedly increase or result from less strategic healthcare intervention models *vis-à-vis* diversity. When the calibration and the distribution of healthcare resources and services amidst diversity or in a situation of health inequalities is based on equality (equal distribution), there is a great risk of instead increasing health inequalities by disfavouring the worst-off populations. Equal distribution of the resources and services will render the situation of the better-off group excessively positive, while the one of the worst-off group worsens, thereby increasing the inequality-gap (Jasso, 2015).

As the better-off group is comparatively over-rewarded, judging from the difference in their

healthcare *needs,* the worse-off group is relatively under-rewarded, and their health records go further negative. The outcome can be even more drastic if more resources are invested on the better-off society/populations than on their worst-off counterparts. We are using imaginary scenario (Blue and Orange societies in Fig. 6 below) to demonstrate consequences of an ideal situation in which stakeholders used equal healthcare intervention process in a situation characterized by health inequalities.

FIGURE 6. EQUALITY IN HEALTHCARE INTERVENTION—JUSTICE



Key:

- The Y axis = Value. When reading for morbidity, each spacing is equal to 50 cases. When reading for intervention, each spacing is valued at 50M US$, henceforth written simply as US$.
- The X axis = intervention categories (sections).
- Blue bars indicate the amount/value of the intervention resources for `Society Blue´.
- Orange bars indicate the amount/value of the intervention resources for `Society Orange´.

Fig. 6: We imagine some two societies manifesting health inequalities in their morbidity cases. Society Blue has the morbidity of 100 cases, and society Orange has the morbidity of 250 cases. Estimating that 1US$ could cure one case, health stakeholders are entitled to the intervention resources worth 350US$. As

`expected intervention′ (section 1 of the X-axis), 100US$ could go to Society Blue for its 100 cases and 250US$ to Society Orange for its 250 cases. But based on **justice**, stakeholders agreed on equal intervention worth 175US$ to each of the two societies (section 2 of the X-axis). This move is in perfect accord with justice as a measure that satisfies equality. In the light of our explanation above, we see that Society Blue is unjustly over-rewarded by +75US$ because it needs 100US$, but justice gives 175US$. In the same way, Society Orange is unjustly under-rewarded by –75US$ because it needs 250US$, but justice gives 175US$ (section 3 of the X-axis). At the end of the intervention, Society Blue has the pending excess of +75US$ (superfluous) while Society Orange is still at –75US$ (deficit). This situation still maintains health inequalities of 150 cases between the two societies because Society Blue has enough to cure any 75 cases that come up while Society Orange still has 75 cases in need of resources to cure. The situation of the worst-off (Society Orange) risks becoming chronic and more endemic. With equal healthcare intervention as an act of justice, neither is the problem of health inequalities solved nor the targeted illness eliminated.

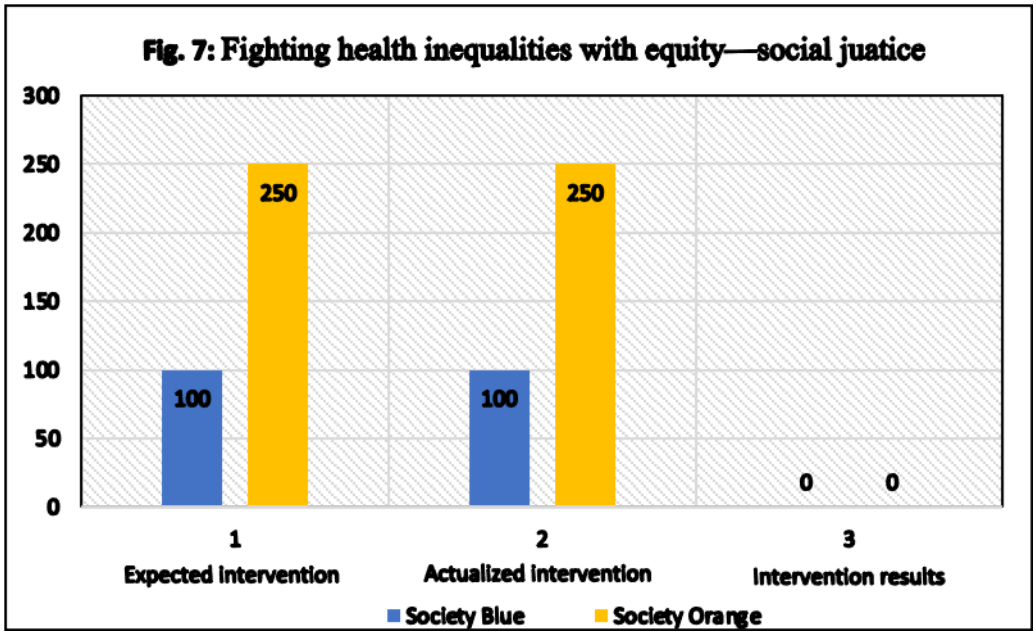
The inequality-gap could increase wider if Society Blue were awarded more resources than Society Orange. As practical example, during the era of the Millennium Development Goals, while 58.45% of malaria calamities in sub-Saharan Africa (SSA) was being recorded in the Western part, 61.07% of antimalarial funding and research was instead directed to the Eastern part. Consequently, within that period—2000 to 2016—malaria became holoendemic in many countries in the Western part with enormous increases in malaria comorbidities and deaths as compared to countries in the Eastern part (GHO, 2017; Papaioannou et al., 2019). Ex., Niger recorded a 13,058-malaria death increase and Tanzania recorded a 19,335-malaria death decrease. While this disequilibrium instead widens the health inequality-gap across countries, it also complicates the fight against malaria in that part of the world.

However, though it favours the populations of many countries in the eastern part of SSA, but it safeguards malaria in a larger part of SSA, thereby maintaining the position of SSA as the epicenter of global malaria burden (WHO, 2018c). Thus, from the pragmatic perspective of applied ethics, healthcare justice should be moderated with the philosophy of fairness through equitable healthcare intervention so that all the people be given equal healthcare opportunity. We

can better and rapidly minimize health inequalities with equity in healthcare intervention (equitable input amidst diversity) to obtain equitable equality (equal healthcare opportunity) in outcome.

Unlike the case of equality in healthcare intervention demonstrated above (Fig. 1), the operationalization of the equity in healthcare intervention is based on healthcare *need*. In equitable healthcare intervention, we calibrate the distribution of the available resources and design the intervention strategy according to the gradient of *need* as enforced by the ethics of care and of human rights to health (Braveman et al., 2018). This dimension takes us to the idea of social justice in healthcare which is based on distributive justice (the fair allocation of resources) to satisfy the health needs of a wider population. It yields more in qualitative than quantitative units by helping to improve the Quality Adjusted Life Years (QALYs) of the populations. Equitable healthcare intervention does not only aim at preventing inequalities, but also at preventing or mitigating the resulting effects of health inequalities (Jasso, 2015). As such, it helps to attain *equitable health equality* as a prelude to achieving *health for all* (Fig. 7).

FIGURE 7. EQUITY IN HEALTHCARE INTERVENTION—SOCIAL JUSTICE

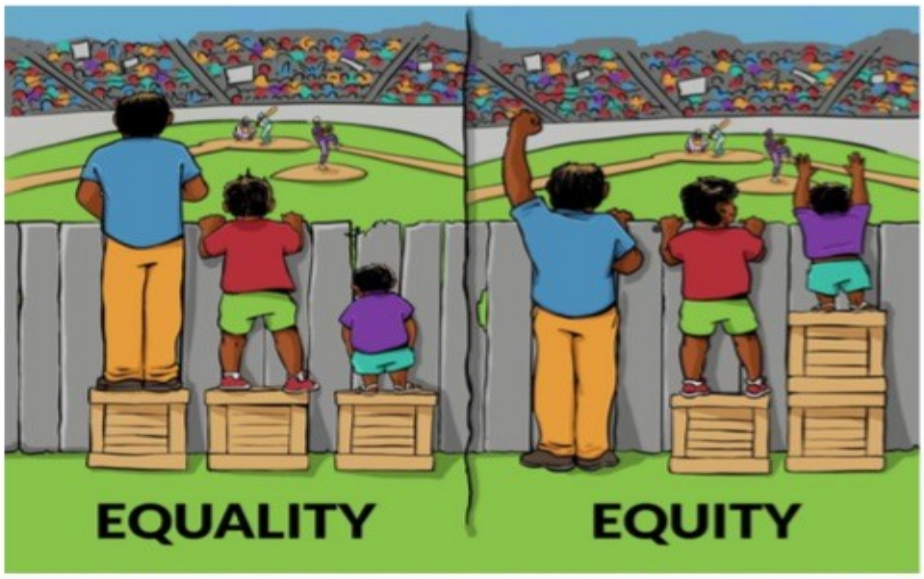


Key: All the references and readings in this Fig. 7 are the same as in Fig. 6.

Fig. 7: As already explained in Fig.6, Society Blue expects 100US$ to cure its 100 cases (expected intervention), and so it is provided with the amount it needs (actualized intervention). Society Orange needs 250US$ to cure all its 250 cases (expected intervention), and so it is provided with the amount it needs (actualized intervention). This represents an equitable healthcare intervention, since `need´ determines the intervention process/amount. Society Blue does not feel cheated, since the amount it receives is the amount it needs/expected, although relatively smaller than the amount Society Orange receives. All cases are eliminated to zero (intervention results) because the two beneficiary societies were justly rewarded.

Here, we diagrammatically illustrate the difference between `equality´ and `equity´ in the distribution of (health) resources with the artistic work of Augus Maguire (Fig. 8).

FIGURE 8. DIAGRAMMATICAL ILLUSTRATION OF `EQUALITY´ AND `EQUITY´



Reproduced with thanks from Interaction Institute for Social Change | Artist: Angus Maguire. Original available from interactioninstitute.org and madewithangus.com

Fig. 8[15]**:** With respect to equality, the available resources (footstools) are equally distributed, despite the visible inequalities (height differences). By using this method, inequalities are not addressed, and an equality in outcome is not achieved (for all spectators to watch the game). The worst-off (the shortest) spectator cannot watch (enjoy) the game like the others. In contrast, by using the equity approach, the available resources (footstools) are distributed equitably according to need. Equity simultaneously redresses the inequalities (height differences) and achieves equality in outcome for all spectators (to watch the game), including the worst-off (the shortest) spectator. When considering this analogy in relation to the concept of *health inequalities*, the latter scenario shades light on the achievement of equitable health equality through health equity.

[15] We have access to this image thanks to its online publication by Rachel Kwiatkowska in 2016: https://www.healthknowledge.org.uk/public-health-textbook/medical-sociology-policy-economics/4c-equality-equity-policy/balancing-equity-efficiency (Accessed 10/06/2019). Permission to reuse the image was granted by its publisher Healthknowledge - phast (enquiries@phast.org.uk), signed by Dr Catherine Brogan – PHAST CIC (catherine.brogan@phast.org.uk).

From Health Inequalities to Equitable Health Equality: Ethical Governance in Healthcare as Social Justice in Healthcare

The Among the many recurring complications in global healthcare, there had ever been the difficulties in the harmonization and contextualization of the universal healthcare theories to realize context-sensitive healthcare interventions in the world staked by diversity. Many people within the scientific communities had ever manifested serious disagreements on the call to tailor health policies, politics and practice to suit contextual health realities (Reutter & Kushner, 2010). Then, there came a time when these differences and disagreements generated some unpredicted professional complications that corrupted healthcare systems, ruined practical healthcare efficiency, and distorted pathways to achieving expected healthcare results. This situation necessitated the practical inculcation and enforcement of ethical theories and virtues in the healthcare domain to harmonize differences and regulate healthcare interventions (Emmerich, 2018; Wahlberg et al., 2013).

This idea gained a wide endorsement from many health stakeholders and policymakers who believed that the link between theoretical healthcare knowledge and practical healthcare intervention is better discerned and understood with ethical governance in healthcare. Generally, ethical governance takes conscience and behaviour beyond the role of law (Emmerich, 2018) with the practice of *reflective equilibrium.* Reflective equilibrium facilitates the acquisition of context-sensitive knowledge, thereby enabling the proper application of various principles (Emmerich, 2018; Keeling & Bellefleur, 2016). Though the process of reflective equilibrium *per se* may require common acceptance, the disposition of ethical governance in healthcare uses mainly that process to assure rigorous testing and refinement of context-sensitive facts and data.

Ethical governance in healthcare has no established definition other than the embodiment of the ethical decision-making processes in healthcare that satisfy the interests of the community served and that of stakeholders involved (Ritvo et al., 2004). It upholds various principles of the pragmatic interdisciplinary ethics with the axiom that theories and principles are useless unless they enhance action, practice, and experience (Morgan, 2014). Ethical governance in healthcare comes into play when each leading authority (political or professional) involved at any stage of the healthcare intervention process organizes various determinants to satisfy diversity according to contextual healthcare needs. While the insight from ethical governance in healthcare is enforced by the respect for human rights to health, it also instructs healthcare stakeholders and partners to respect various stages of the healthcare intervention processes.

It invigorates the analytical capacity of health professionals—the autoregulatory stem of applied ethics—to exploit the ethical values embedded in necessary ethical dispositions of efficient management: 1/ethical enquiry that lures professionals into seeking context-sensitive knowledge through investigative question-answer processes; 2/ethical deliberation that encourages authorities to listen to colleagues/subordinates and seek collaborative and interdisciplinary engagements; 3/ethical regulation that necessitates honesty, integrity, respect, responsibility, trustworthiness and concern for others in all actions and decision-making; 4/ethical supervision where authorities exercise personal responsibilities with the sole aim of solving the problems in question; 5/ethical interaction where relations prioritize altruism and the respect for others.

This impetus further goes to answer context-sensitive questions to equalize intervention with contextual healthcare realities (Holland, 2011; Wahlberg et al., 2013). Among many of such questions: What are the categories of the determinants of health inequalities in the society in question? Which health services do they need? What factors can possibly deter or enhance the

intervention process? This investigative healthcare intervention procedure produces context-sensitive information that satisfies the hetero-regulatory stem of applied ethics. Thence, the two stems—autoregulatory and hetero-regulatory—complement to render the intervention process equitably efficient as an aspect of social justice.

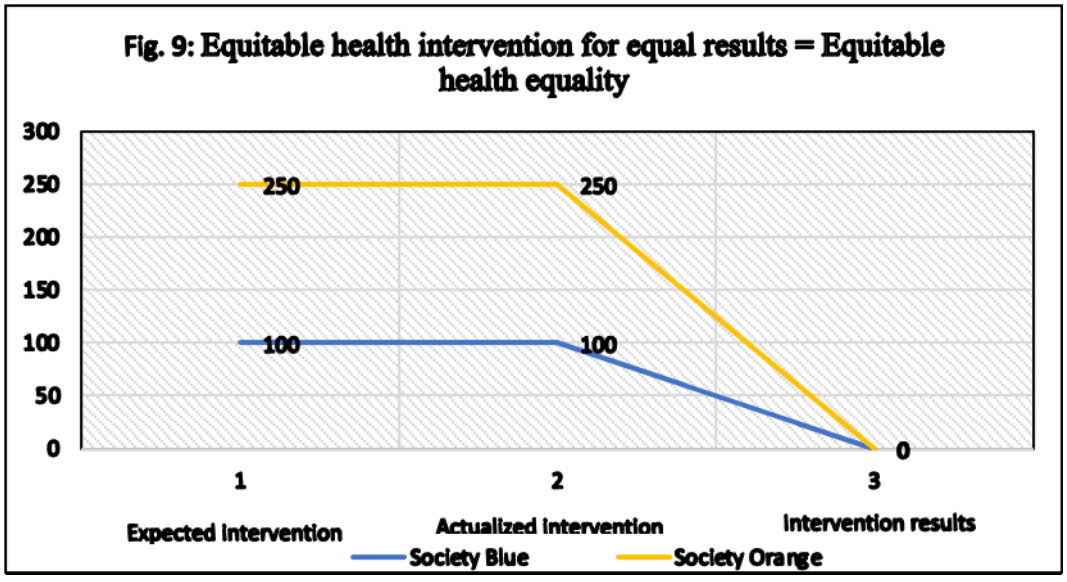
As mentioned above, governance—as systems or individuals—has the structuralizing responsibility to assure the effectiveness of this ethical process in the domain of healthcare: WHO has the global responsibility; Regional organizations have continental responsibility; Ministries of Health have national responsibilities; Heads of hospital and healthcare units have the responsibility towards their workers and patients; etc. Ex., when the COVID-19 illness was declared an epidemy, the *European Commission-backed Access to COVID-19 Tools (ACT) Accelerator* was launched. In its responsibility as the structural determinant of healthcare, it established a framework for the equitable intervention and distribution of COVID-19 vaccines and therapeutics. This initiative was immediately endorsed during the G7 summit of June 2020, supported by the G20 states involved in the development of COVID-19 countermeasures (Bollyky, Gostin, & Hamburg, 2020).

While it is obvious that this mission set by the G7 might not have been easy, we believe it greatly contributed to subdue COVID-19 in less than four years despite its magnitude. That notwithstanding, the global call for healthcare systems to attain equitable health equality remains challenging, given that "equity is not the same as equality" (Braveman et al., 2018, p. 7). Nonetheless, this call remains the measurable strategy to fight health inequalities and influence the health lives of the least advantaged populations. Thus, as the highest global healthcare authority, "WHO must play a central role in planning and coordinating the implementation of the equitable frameworks" (p. 2463). Any governing system that promotes equitable access to

healthcare measures envisaging equitable health equality needs to earn the confidence of the international community (Bollyky et al., 2020).

Equitable health equality signifies the situation in which the calibration of the available healthcare resources and the distribution of the healthcare services among and across the populations are based on the degree of healthcare need. While the intervention (the calibration and distribution) mechanism is equitable (according to need), the outcome is the equal healthcare opportunity it gives to the populations in need (Fig. 9). That is, when we determine the distribution process of the available resources and services from people`s healthcare needs, the outcomes provide equal health opportunities to all the populations (Lane, Sarkies, Martin, & Haines, 2017).

FIGURE 9. EQUITABLE HEALTH EQUALITY



Key: All the references and readings in this Fig. 9 are the same as in Fig. 6.

Fig. 9: With respect to the equitable healthcare intervention process by which the allocation of the intervention resources is according to need (expected), the two societies (Blue and Orange) can obtain equal results (outcome). In that spirit, the graphs of Society Blue and Society Orange have finally

converged to a common point of value 0 (intervention results). When the intervention strategy is based on equity (need), the outcome is equal (equality), since all the cases identified in these two societies are eliminated, with the result being that these two societies reach equality at 0. This outcome demonstrates a state of `equitable health equality´ which could not be possible with equal healthcare intervention process.

It thus goes without saying that we need the unconditional provision of "equal access for equal need" (Oliver & Mossialos, 2004, p. 655) to attain equitable health equality. That is, we need to provide equal access to healthcare services to people with equal healthcare needs, and unequal access to healthcare services to those with unequal healthcare needs. We refer to the former as horizontal equity because it "implies equal treatment or satisfaction for equal needs"; and to the latter as vertical equity which "implies that individuals with unequal needs should be treated unequally [not as discrimination] according to their differential needs" (Zere et al., 2007, p. 3). From another perspective, we look at the horizontal equity as the equal treatment of equals compromised by fair outcomes, and at the vertical equity as the unequal but fair treatment of the `unequals´ compromised by a fair process (Joseph et al., 2016).

When we apply equity in healthcare intervention (Figs. 7 and 9 above), we provide fair treatment in the distribution of the available resources, and get equal outcomes in the elimination of the disease, thereby giving equal opportunity to all the citizens to be healthy. Nonetheless, we still have some confusion on the practical reality of the notion of *equal access for equal need*. We use the term *access* with reference to the opportunity or the ease with which people or communities can get appropriate healthcare services in proportion to their need (Richard et al., 2016). But the phrase "equal access for equal need" (p. 655) entails "the ability to secure a specified set of healthcare services, at a specified level of quality, subject to a specified maximum level of

personal inconvenience and cost, while in possession of a specified amount of information" (Oliver & Mossialos, 2004, p. 656).

The overriding position of the term *specified* in this notion signals the unavoidable process of contextualization when designing and implementing healthcare policies to capture the specific determinants of health inequalities in the specific regions/locations/countries to help stakeholders address specific healthcare needs. This is another area where the insight from ethical governance in healthcare becomes primordial in the process of healthcare intervention. It inspires and supports stakeholders to detect and direct the available resources to the populations that direly need them, when they direly need them, and in the quantity they direly need.

5.2.3. Discussion

All national and international healthcare systems always wish to achieve health efficiency and health equity. While health equity aims at minimizing the avoidable health differences among the populations with the available resources, we achieve health efficiency when we use the available health resources to maximize the health of the populations. The main objective of these two healthcare qualities is to give the disadvantaged and vulnerable populations equal opportunity to be healthy (Jehu-Appiah et al., 2008). The insight from the intervention procedure initiated with ethical governance in healthcare insinuates that we apply equitable intervention process to confront contextual diversities and obtain health efficiency. This type of the healthcare intervention process brings the rationale of social justice into healthcare to impact the vulnerable and attain equitable health equality.

The infusion of the rationale of social justice in the distribution of healthcare intervention services is not only mean to treat illnesses but also to enforce healthcare against factors that

influence and shape human health, thereby envisaging equitable health equality (Sklar, 2018). As health equity means equal opportunity for all the populations to be healthy, equity in healthcare refers to the proportionate intervention process in which everyone is granted fair opportunities to be healthy (Braveman et al., 2018). But when the contextual diversity that defines various health determinants, as well as the healthcare needs of the populations, was emerged as a determining factor of healthcare, the fact of fairness become a factor of the distribution mechanism of various healthcare resources to benefit the disadvantaged and the vulnerable (Sklar, 2018).

While the practical enforcement of *fairness* in healthcare intervention modified the concept of *justice* beyond what others call *traditional justice* (Greenberg & Cohen, 2014), their blend goes beyond the normative standards of *fairness* into the ethical concerns about human rights to health and wellbeing (Braveman et al., 2018). The combination of equity, fairness, and justice takes us closer to the sociopolitical philosophy of John Rawls. First, John Rawls wished that we should make justice the central virtue of all human interactions and interventions (Rawls, 2005). We are talking of justice here referring to "the quality according to which goods are justly distributed equally" by giving to each their due according to the law (Greenberg & Cohen, 2014, p. 2).

But John Rawls later emphasized that we should shape our social systems in a way that the practice of justice should benefit the most vulnerable, thereby instigating the concept of social justice. Though from the socio-political perspective, he further instructed stakeholders to design fair social policies to favour the disadvantaged (Rawls, 2005). According to him, the notion of social justice which he also called *fairness,* refers to the act of giving each member of the society fair treatment and equal opportunities (Macer, 2006). The insertion of Rawls' dimension of social justice into healthcare aligns with the human capability theory insinuated by the Nobel Prize Laureate economist Amartya Sen. According to his human capability theory, stakeholders are

expected to design health policies in the way to give the vulnerable populations maximum opportunity to achieve good health and avert escapable morbidity and preventable mortality (Braveman et al., 2011; Ruger, 2004).

According to Lee Anne Bell in (Adams & Bell, 2016) social justice is both a "goal" and a "process". As a goal, it refers to "full and equitable participation of people from all social identity groups in a society that is mutually shaped to meet their needs" (p. 3). As a process to attain these goals, it is "democratic and participatory, respectful of human diversity and group differences" (p. 3). The practice of social justice creates "a world in which the distribution of resources is equitable and ecologically sustainable, and all members […] are treated with respect […] and are interdependent" (p. 3). Instead of taking social justice as minimizing the importance of justice, social justice simply complements the principle-based healthcare emphasis with empathy-based approaches that favour the vulnerable and minimizes the inequality gap.

Considering health inequalities as the main elements that animate the gap between the health situation of the best-off and worst-off groups or populations, social justice in healthcare intensifies the need for the ethics of Care and of human rights to health. 1/These two perspectives of the applied ethics emphasize that we should always allocate more healthcare services and resources to people with the greatest health needs and fewest capabilities to give them equal healthcare opportunities (Braveman et al., 2018). 2/They implore the insight of distributive social justice that emphasizes the equitable allocation of healthcare resources amidst diversity to minimize the adverse effects of inequalities (Joseph et al., 2016). These dimensions underscore the pragmatic interdisciplinary impetus of applied ethics embedded in the theory of ethical governance in healthcare.

As demonstrated above, the pragmatic interdisciplinary perspective of applied ethics enforces ethical governance in healthcare and enables health stakeholders to generate, incorporate and disseminate interdisciplinary health knowledge needed to fight health inequalities. The fight against health inequalities is no longer the sole responsibility of biomedicine or biomedical sciences. It needs the practical engagement of various multi-sectoral global actions of social justice to address health inequalities and move towards the equitable health equality (Barreto, 2017). This is partly because the proper management of human health requires varied knowledge (Dine, 2020a; Resnik, 2016), and partly because most aspects of health inequalities have varied/diverse causes and manifestations (Kneipp et al., 2018; WHO, 2018a).

The insight from ethical governance in healthcare mobilizes both global and local healthcare stakeholders, governments, and policymakers to always strive collecting enough information about contextual health realities. As such, they will be able to inform fair healthcare policies and equitable intervention strategies so to target and minimize health inequalities. To this effect, the best healthcare outcome is not only determined at the intermediary (micro) level by counting the number of people treated but at the community (macro) level by evaluating the general improvement in the QALYs of the populations.

Thus, when fighting health inequalities to attain equitable health equality and achieve *health for all,* health stakeholders and partners should strive for optimum health efficiency (Joseph et al., 2016). In other words, healthcare *governance* must proficiently calibrate and distribute the available healthcare resources and services envisaging the best outcome on the populations. It assumes the context-sensitive role as the structural determinant of healthcare that harmonizes healthcare engagements and informs healthcare interventions to target the diversity that defines healthcare needs and minimizes the inequality gap. While I refer to this process as ethical

governance in healthcare, I'm talking of *governance* referring to the utilization of the institutional power to determine the distribution and use of resources for the benefit of the citizenry without discrimination. We achieve this standard when hierarchy has successively mobilized the healthcare system with efficient healthcare policies and regulations to equitably intervene and protect the health of the vulnerable.

5.2.4. Conclusion

We have established the equitable health equality as the healthcare scenario where health inequalities are minimized with equitable healthcare intervention to ensure and assure equal healthcare opportunities to all the people in need. The realization of this situation relies much on the managing integrity that exploits various ethical dispositions—enquiry, deliberation, contextualization, etc.— to harmonize and channel various healthcare intervention resources and services towards the peoples in need. However, the realization of the equitable health equality is yet a global reality, and the Global South caries the greatest impact of health inequalities. For example, in the twenty-first century, children in Africa are still more than 15 times likely to die before their fifth anniversary than their age mates in the western world (Barreto, 2017). Even within Africa (SSA in particular), they are still recording a high degree of health inequalities across countries, especially with the increasing malaria morbidity/mortality inequalities (GHO, 2017; Head et al., 2017).

Nonetheless, our prototypical illustrations in this article have demonstrated how the insight from ethical governance in healthcare can lead healthcare interventions to attain equitable health equality and satisfy human rights to *health for all*. The time to boost this enforcement and attain this global healthcare ambition is now. We acknowledge that various demonstrations and

illustrations in this article might be too idealistic as compared to realities around us. But we know that various healthcare stakeholders and partners need such a prototypical guide from which to adapt their context-sensitive intervention processes to subdue health inequalities. It is through theoretical knowledge of this calibre that professionals gain proactive ideas that complement technoscientific practices and nourish actions endowed with energy and significance (Habermas, 1971). This article is pioneer in demonstrating how healthcare intervention could use health equity to convert health inequalities into equitable health equality and move towards achieving *health for all*.

Declaration

Acknowledge:
Conflict of interest: None
Funding: None

Reference

Adams, M., & Bell, L. A. (Eds.). (2016). *Teaching for diversity and social justice* (3rd ed.). New York: Routledge.

Anisa, M., Abdallah, S. D., & Peter, A. S. (2003). 'Mind the gap': science and ethics in nanotechnology. *Nanotechnology, 14*(3), R9. doi:https://doi.org/10.1088/0957-4484/14/3/201

Barreto, M. L. (2017). Health inequalities: a global perspective. *Ciência & Saúde Coletiva, 22*, 2097-2108. doi:https://doi.org/10.1590/1413-81232017227.02742017

Bleich, S. N., Jarlenski, M. P., Bell, C. N., & LaVeist, T. A. (2012). Health inequalities: trends, progress, and policy. *Annu Rev Public Health, 33*(1), 7-40. doi:https://doi.org/10.1146/annurev-publhealth-031811-124658

Braveman, P., Arkin, E., Orleans, T., Proctor, D., & Plough, A. (2018). What is Health Equity? *Behaviorial Science & Policy, 4*(1), 1-14. doi:https://doi.org/10.1353/bsp.2018.0000

Braveman, P., & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology & Community Health, 57*(4), 254-258. doi:http://dx.doi.org/10.1136/jech.57.4.254

Braveman, P., Krieger, N., & Lynch, J. (2000) Health inequalities and social inequalities in health. In, *Bulletin of the World Health Organization: Vol. 78* (2000/04/01 ed., pp. 232-234; discussion 234-235): WHO https://www.who.int/bulletin/archives/volume78_2/en/ (Accessed 20/05/2019).

Braveman, P., Kumanyika, S., Fielding, J., Laveist, T., Borrell, L. N., Manderscheid, R., & Troutman, A. (2011). Health disparities and health equity: the issue is justice. *Am J Public Health, 101 Suppl 1*(S1), S149-155. doi:http://dx.doi.org/10.2105/AJPH.2010.300062

Braveman, P., & Tarimo, E. (2002). Social inequalities in health within countries: not only an issue for affluent nations. *Social Science & Medicine, 54*(11), 1621-1635. doi:https://doi.org/10.1016/S0277-9536(01)00331-8

Bronheim, S., & Goode, T. (2013). Documenting the Implementation of Cultural and Linguistic Competence: Guide for Maternal and Child Health Bureau Funded Training Programs. In G. U. C. f. C. a. H. Development (Ed.). Washington, DC: National Center for Cultural Competence.

Chung, R. (2021). Structural health vulnerability: Health inequalities, structural and epistemic injustice. *Journal of Social Philosophy, 52*(2), 201-216. doi:https://doi.org/10.1111/josp.12393

Dine, C. B. (2020a). 'Responsible' in Global Health management: ingenious interdisciplinarity as relief to the epistemological complexity of transdisciplinarity. *Les chantiers de l'intervention en sciences humaines, 5*, 62-72. Retrieved from http://labrri.net/parution-du-nouveau-volume-de-la-revue-chantiers-de-lintervention-en-sciences-humaines-interdisciplinarite-pratique-et-action-professionnelle/. (Accessed 4/08/2020).

Dine, C. B. (2020b). Socio-ethical Dimension of COVID-19 Prevention Mechanism-The Triumph of Care Ethics. *Asian Bioethics Review, 12*(4), 539-550. doi:https://doi.org/10.1007/s41649-020-00143-1

Emmerich, N. (2018). Virtue and the Ethics of Social Research. In N. Emmerich (Ed.), *Virtue Ethics in the Conduct and Governance of Social Science Research* (Vol. 3). Bingley: Emerald Publishing Limited.

GHO. (2017). Annex B: Tables of health statistics by country, WHO region. *World Health Statistics* Retrieved from http://www.who.int/gho/en/ 20/08/2018.

Graham, H., & Kelly, M. P. (2004). *Health inequalities: concepts, frameworks and policy*. London: Citeseer/Health Development Agency.

Gray, A. M. (1982). Inequalities in health. The Black Report: a summary and comment. *Int J Health Serv, 12*(3), 349-380. doi:https://doi.org/10.2190/XXMM-JMQU-2A7Y-HX1E

Greenberg, J., & Cohen, R. L. (Eds.). (2014). *Equity and justice in social behavior*. New York, NY: Academic Press.

Habermas, J. (1971). *Knowledge and Human Interests* (J. J. Shapiro, Trans.). Boston: Beacon Press.

Holland, S. (2011). The virtue ethics approach to bioethics. *Bioethics, 25*(4), 192-201. doi:https://doi.org/10.1111/j.1467-8519.2009.01758.x

Jasso, G. (2015). Inequality Analysis: Overview. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 885-893 / doi: https://doi.org/810.1016/B1978-1010-1008-097086-097088.032199-097087). Oxford: Elsevier.

Jehu-Appiah, C., Baltussen, R., Acquah, C., Aikins, M., d'Almeida, S. A., Bosu, W. K., . . . Adjei, S. (2008). Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis. *Value Health, 11*(7), 1081-1087. doi:http://dx.doi.org/10.1111/j.1524-4733.2008.00392.x

Joseph, K. T., Rice, K., & Li, C. (2016). Integrating Equity in a Public Health Funding Strategy. *J Public Health Manag Pract, 22 Suppl 1*, S68-76. doi:http://dx.doi.org/10.1097/PHH.0000000000000346

Kawachi, I., Subramanian, S. V., & Almeida-Filho, N. (2002). A glossary for health inequalities. *J Epidemiol Community Health, 56*(9), 647-652. doi:https://doi.org/10.1136/jech.56.9.647

Keeling, M., & Bellefleur, O. (2016). *'Principlism'and Frameworks in Public Health Ethics*. Montréal: National Collaborating Centre for Healthy Public Policy: http://www.ncchpp.ca/docs/2016_Ethics_Principlism_En.pdf (Accessed 28/05/2021).

Kim, P. J. (2019). Social Determinants of Health Inequities in Indigenous Canadians Through a Life Course Approach to Colonialism and the Residential School System. *Health Equity, 3*(1), 378-381. doi:https://doi.org/10.1089/heq.2019.0041

Kneipp, S. M., Schwartz, T. A., Drevdahl, D. J., Canales, M. K., Santacroce, S., Santos, H. P., Jr., & Anderson, R. (2018). Trends in Health Disparities, Health Inequity, and Social Determinants of Health Research: A 17-Year Analysis of NINR, NCI, NHLBI, and NIMHD Funding. *Nurs Res, 67*(3), 231-241. doi:https://doi.org/10.1097/NNR.0000000000000278

Koplan, J. P., Bond, T. C., Merson, M. H., Reddy, K. S., Rodriguez, M. H., Sewankambo, N. K., & Wasserheit, J. N. (2009). Towards a common definition of global health. *The Lancet, 373*(9679), 1993-1995. doi:https://doi.org/10.1016/S0140-6736(09)60332-9

Lane, H., Sarkies, M., Martin, J., & Haines, T. (2017). Equity in healthcare resource allocation decision making: A systematic review. *Soc Sci Med, 175*, 11-27. doi:https://doi.org/10.1016/j.socscimed.2016.12.012

Leon, D. A., Walt, G., & Gilson, L. (2001). Recent advances: International perspectives on health inequalities and policy. *BMJ, 322*(7286), 591-594. doi:http://dx.doi.org/10.1136/bmj.322.7286.591

Macer, D. R. J. (2006). *A cross-cultural introduction to bioethics*: Eubios Ethics Institute Prakanong, BangkokThailand.

Marmot, M. (2005). Social determinants of health inequalities. *Lancet, 365*(9464), 1099-1104. doi:https://doi.org/10.1016/S0140-6736(05)71146-6

Marmot, M. (2020). Health equity in England: the Marmot review 10 years on. *BMJ, 368*, m693. doi:https://doi.org/10.1136/bmj.m693

McInnes, C., Kamradt-Scott, A., Lee, K., Roemer-Mahler, A., Rushton, S., & Williams, O. (2014). *The transformation of global health governance*. Basingstoke: Springer/Palgrave Macmillan.

Morgan, L. D. (2014). Pragmatism as a Paradigm for Mixed Methods Research. In Integrating Qualitative and Quantitative Methods: A Pragmatic Approach. 55 City Road, London: SAGE Publications, Inc. Retrieved from https://methods.sagepub.com/book/integrating-qualitative-and-quantitative-methods-a-pragmatic-approach doi:https://doi.org/10.4135/9781544304533 (Accessed 07/10/2020).

Oliver, A., & Mossialos, E. (2004). Equity of access to health care: outlining the foundations for action. *J Epidemiol Community Health, 58*(8), 655-658. doi:https://doi.org/10.1136/jech.2003.017731

Palmer, S., & Torgerson, D. J. (1999). Definitions of efficiency. *BMJ, 318*(7191), 1136. doi:https://doi.org/10.1136/bmj.318.7191.1136

Papaioannou, I., Utzinger, J., & Vounatsou, P. (2019). Malaria-anemia comorbidity prevalence as a measure of malaria-related deaths in sub-Saharan Africa. *Scientific Reports, 9*(1), 11323. doi:http://dx.doi.org/10.1038/s41598-019-47614-6

Rawaf, S. (2017). Health Inequities: Can it be Addressed Through Health System Reforms? *Shiraz E-Medical Journal, 18*(11), e62554. doi:https://doi.org/10.5812/semj.62554

Rawls, J. (2005). *A theory of justice* (Original ed.). Cambridge: Belknap/Harvard University Press.

Resnik, D. (2016). Ethics in Science. In P. Humphreys (Ed.), *The Oxford Handbook of Philosophy of Science* (pp. 25). Oxford: oxford University Press.

Reutter, L., & Kushner, K. E. (2010). 'Health equity through action on the social determinants of health': taking up the challenge in nursing. *Nurs Inq, 17*(3), 269-280. doi:http://dx.doi.org/10.1111/j.1440-1800.2010.00500.x

Richard, L., Furler, J., Densley, K., Haggerty, J., Russell, G., Levesque, J. F., & Gunn, J. (2016). Equity of access to primary healthcare for vulnerable populations: the IMPACT international online survey of innovations. *Int J Equity Health, 15*(1), 64. doi:https://doi.org/10.1186/s12939-016-0351-7

Ritvo, R., Ohlsen, J., & Holland, T. (2004). *Ethical Governance in Health Care*. Chicago: library of Congress.

Rondeau, D. (2007). Mémoire, identité, altérité : contribution de la narration à une éthique de la réconciliation *Éthique publique, 9*(2). doi:https://doi.org/10.4000/ethiquepublique.1762

Ruger, J. P. (2004). Health and social justice. *Lancet, 364*(9439), 1075-1080. doi:http://dx.doi.org/10.1016/S0140-6736(04)17064-5

Singh, J. A. (2013). Global health governance and ethics. In A. Pinto & R. Upshur (Eds.), *An Introduction to Global Health Ethics* (pp. 58-72). New York: Routledge

Sklar, D. P. (2018). Disparities, Health Inequities, and Vulnerable Populations: Will Academic Medicine Meet the Challenge? *Acad Med, 93*(1), 1-3. doi:http://dx.doi.org/10.1097/ACM.0000000000002010

Tosam, M. J., Chi, P. C., Munung, N. S., Oukem-Boyer, O. O. M., & Tangwa, G. B. (2018). Global health inequalities and the need for solidarity: a view from the Global South. *Dev World Bioeth, 18*(3), 241-249. doi:https://doi.org/10.1111/dewb.12182

Wahlberg, A., Rehmann-Sutter, C., Sleeboom-Faulkner, M., Lu, G., Doring, O., Cong, Y., . . . Rose, N. (2013). From global bioethics to ethical governance of biomedical research collaborations. *Soc Sci Med, 98*, 293-300. doi:http://dx.doi.org/10.1016/j.socscimed.2013.03.041

WHO. (2016). Weekly epidemiological record - 29 January 2016. *Weekly epidemiological record / Relevé épidémiologique hebdomadaire, 91*(4), 33-52. https://www.who.int/wer/2016/WER9104.pdf?ua=2011 (Accessed 2024/2002/2019).

WHO. (2018a). Equity. *Health Systems: https://www.who.int/healthsystems/topics/equity/en/ (Accessed 24/03/2019).*

WHO. (2018b). Gender, Equity and Human Rights. *https://www.who.int/gender-equity-rights/en/ (Accessed 20/01/2018).*

WHO. (2018c). Malaria. *Fact sheets: https://www.who.int/news-room/fact-sheets/detail/malaria (Accessed 12/02/2018).*

WHO, & OHCHR. (2008). The Right to Health. from Office of the High Commissioner for Human Rights, and World Health Organization https://www.who.int/gender-equityrights/knowledge/right-to-health-factsheet/en/ (Accessed 02/09/2017).

WHO, & UNICEF. (2018). *Declaration of Astana*. Astana: World Health Organization/United Nation Children's Fund.

Willig, C., & Rogers, W. S. (2017). *The SAGE handbook of qualitative research in psychology*: Sage.

Zere, E., Moeti, M., Kirigia, J., Mwase, T., & Kataika, E. (2007). Equity in health and healthcare in Malawi: analysis of trends. *BMC Public Health, 7*(1), 78. doi:http://dx.doi.org/10.1186/1471-2458-7-78

5.3. Summarizing Conclusion

When it came to light in the early 1980s that health inequalities were a thread to the populations of the world, the concept of global health was initiated with the mission to look for ways of minimizing these inequalities. Since then, this ambition had been at vanguard whenever healthcare stakeholders meet—from Alma Mata in 1978 to Astana in 2018—re-echoing the call to strive and attain universal health coverage (WHO & UNICEF, 2018). As these meetings increase in number, so are conceptual terminologies—health inequalities, health inequities, health equities, health disparities, equitable health equalities—without any directives to guide their practical implementation. This is the healthcare lacuna that the article attempted to solve. But from the general perspective displayed in this article to a particular perspective, how can the mechanism illustrated in this article be applied to fight malaria inequalities in SSA? This question is perfectly answered in the next chapter.

Chapter 6: Prospective Antimalarial Strategy for sub-Saharan Africa

6.1. Introduction

As the foundation for Chapter 6, I combined the results obtained in Chapter 4 and the illustrations demonstrated in Chapter 5. Specifically, the results from Chapter 4 rate the malaria situation across SSA as a good example of health inequalities that are exacerbated by less strategic intervention mechanisms. On the basis of this awareness, I developed Chapter 5 by showing how ethical governance in healthcare is a plausible solution pathfinding mechanism. With inspiration from those demonstrations in Chapter 5, I have designed the *greatest-need target antimalarial intervention strategy* as a proficient approach/model to fight against malaria in SSA.

I have designed the *greatest-need target antimalarial intervention strategy* to help stakeholders target and subdue the skyrocketing malaria inequalities across countries in SSA. If any antimalarial intervention process in SSA—at any of its stages—is to impact the lives of all those living in these countries, the intervention strategy must be proportional to the heterogeneity of malaria endemicity (Head et al., 2017). Such an intervention as professed with the *greatest-need target antimalarial intervention strategy* will equitably minimize inequalities and attain equitable equality in malaria decline to benefit the vulnerable malaria hard-hit populations to. But how does the *greatest-need target antimalarial intervention strategy* enhance equitable intervention process to benefit the malaria hard-hit populations?

The Fourth Scientific Article

6.2. The *Greatest-Need Target Antimalarial Intervention Strategy*: Prospective Antimalarial Intervention Model for sub-Saharan Africa

This article is to be submitted to the journal *Health Policy and Planning* – OUP publication
+ Article Type: Original Research Article
+ Authors: Charles Biradzem Dine, Dany Rondeau, and Bob White

Abstract

Many malaria-endemic countries in sub-Saharan Africa (SSA) are becoming holoendemic, and malaria morbidity/mortality inequalities across countries are increasing. These imbalances are principally the fallouts of nonstrategic antimalarial intervention processes misdirected by nonstrategic FAMR activities in that part of the world. We have designed the *greatest-need target antimalarial intervention strategy* as a solution pathfinding intervention model to redress adverse antimalarial outcomes in SSA. As this pragmatic interdisciplinary intervention model enriches antimalarial endeavours in SSA with the insights from ethical governance in healthcare, it evokes the rationale of social justice and facilitates equitable antimalarial intervention processes. Equitable antimalarial intervention process directs the available resources (materials and services) to malaria hard-hit populations, and assures equitable equality in malaria decline across countries.

Keywords: Health inequalities, Health equity, Health vulnerability, Malaria inequalities, Antimalarial research, Greatest-need target strategy.

6.2.1. Introduction

Often, two sets of determinants of malaria as a communicable vector-borne disease are confronted in any engagement against malaria in SSA: the contextual determinants of malaria; and the determinants of an effective antimalarial intervention strategy. The first set of determinants (contextual) often are referred to as the social determinants (sociocultural, socioeconomic, socioenvironmental) of malaria parasitic prevalence. The ensemble of these factors is responsible for the distribution, heterogeneity, and intensity of malaria disease across

different countries or regions. Since these determinants are uneven across SSA, they correspondingly bring about an uneven dispersion of malaria endemicity across countries in that part of the world (Heggenhougen et al., 2003; Plewes, Leopold, Kingston, & Dondorp, 2019).

The second set of determinants (determinants of the intervention strategies) are associated with the ensemble of the factors that determine the calibration of available antimalarial resources, the orientation of the intervention process, and the type of intervention strategy carried out. In other words, healthcare stakeholders and partners use these factors to determine *where* to direct available antimalarial services, *how* to direct these services, and *when* to direct them. This approach helps to ensure that available resources/services are sent to the right places, at the right time, in the right quantity, and for the right reasons (Um et al., 2015). In other words, directed by these factors, the adopted strategy strives to achieve equitable equality in malaria decline across countries.

However, these two sets of determinants intersect. For example, malaria morbidity/mortality inequalities across countries in SSA are caused mainly by variations in the social determinants of malaria across these countries (GHO, 2017; Snow et al., 1999). Therefore, although malaria determinants may not always be considered *ipso facto* as antimalarial determinants, antimalarial interventions always strive to minimize the inequalities in malaria morbidity and mortality (Omumbo, Noor, Fall, & Snow, 2013; Um et al., 2015). Thus, antimalarial stakeholders, partners, and other health professional often function at the intersection zone of these determinants.

First, they must detect the distribution pattern of various malaria determinants to establish the possible pattern of malaria inequalities and so design proficient intervention processes. This process often begins with antimalarial FAMR, the stage of antimalarial intervention which

produces and provides representative malaria data for the whole intervention process. Whether these data already have been produced and stored in a databank or are freshly produced as part of an intervention process at hand, the fundamental requirement is that they should be representative of the malaria reality in SSA. Efficient antimalarial intervention process must always begin with or from effective antimalarial research, and depends on its data because refined information is necessary for designing an efficient intervention process (Druetz et al., 2020).

Second, available representative data is necessary to guide the whole antimalarial intervention process, so it will be equitable in its intervention procedures and equal in outcome. As such, the intervention process will be able to attain equitable equality in malaria declines across countries, and assure human rights to *health for all*. When we used this approach to analyze the increasing malaria morbidity/mortality inequalities in SSA,

> [o]ur analysis identified deficiencies in human resources, training, and capacity building at all levels, from research and development to community involvement. Addressing these needs will require active and coordinated engagement of stakeholders as well as implementation of effective strategies, with malaria-endemic countries owning the relevant processes. Capacity strengthening is required in all relevant areas of malaria research and development, clinical and public health provision, […] (Mwenesi et al., 2022, p. 1).

Our statistical analysis showed that antimalarial failure in SSA has its origins in the failure to direct funding resources to the right places to ensure that effective research will produce evidence-based data to drive strategic intervention processes. As repeatedly highlighted, while the malaria endemic western part of SSA bears the brunt of malaria calamities in that part of the world, majority of FAMR activities in SSA are concentrated in the eastern part. Consequently, malaria becomes more endemic across countries in the western part, and malaria calamities

continue to increase alongside inequalities (GHO, 2017; Head et al., 2017). In light of this disaster, it is necessary to establish an innovative antimalarial intervention strategy with insights from social sciences to enhance normative judgment values in regard to fighting malaria in SSA. This would be a strategy that can provide contextualization for the execution process of various intervention approaches, which would pursue health equity within the framework of social justice (Peter, 2004).

Thus, we propose the *greatest-need target antimalarial intervention strategy* as an innovative antimalarial intervention model suitable for addressing the heterogeneity of malaria endemicity in SSA. We designed this strategy to render the antimalarial intervention process in SSA proportionate to the malaria endemicity across its countries, and to give all its populations, especially those hard-hit by malaria, an equal antimalarial opportunity to survive. In other words, we designed this strategy to facilitate an equitable antimalarial intervention process in SSA so to ensure equitable equality in malaria decline across all SSA countries. But how can this strategy ensure an equitable antimalarial intervention process in SSA to establish equitable equality in malaria decline across its countries?

Our objective was to demonstrate the practice-oriented conceptual processes of the *greatest-need target antimalarial intervention strategy,* and show how it can enhance equitable antimalarial intervention process in SSA, and facilitate equitable equality in malaria decline across its countries. Thus, we applied a step-by-step procedure to realize this objective, according to the exigencies of the insights from the theory of ethical governance in healthcare. This step-by-step procedure will help in finding answers for some strategic questions concerning the extraction of information and the presentation of facts: Is it necessary to initiate a new antimalarial

intervention strategy for SSA? What characteristics make this strategy new and different from others that already have been tried? What are the potential changes it will bring, and how?

6.2.2. Development

This present research uses prior evidence knowledge statistics from the databank of the statistics on the malaria situation in SSA (Table 3) to answer the procedural questions above. From this databank, we extracted the necessary statistics and used them to demonstrate the operationalization of the *greatest-need target antimalarial intervention strategy* and to calculate the probability of the expected change. We used the inspiration from Bayes' theory on probability and fiducial confidence theory (Hayes & Westfall, 2020; Wang, 2000) to substantiate the statistical probability that negative malaria dynamics in SSA were conditional to the intervention strategy used. We also used the same method to substantiate the positive expectations in malaria dynamics in SSA, which were conditional to the actualization of the *greatest-need target antimalarial intervention strategy*.

Necessity of the *Greatest-Need Target Antimalarial Intervention Strategy*: Research Rationale

Initially, it seemed absurd to be asking in the twenty-first century what was needed in SSA to alter the antimalarial outcomes of its countries, given decades of antimalarial endeavours in that part of the world. After analyzing the malaria statistics from that part of the world, we diagnosed that antimalarial intervention disfavours malaria hard-hit populations (malaria endemic regions) by investing relatively less resources on them. This aspect of health inequity intensifies health vulnerability as malaria becomes holoendemic, a situation that undermines the human rights to health for all. This empathetic situation inspired us to remember the admonition of the ethics of

human rights to always strive towards establishing everyone's rights to *health for all* whenever and wherever possible (Sklar, 2018).

In our analysis mentioned above, we detected many counterproductive factors that jointly function as our prior evidence information, which enticed us to act:

1) When we analyzed the malaria statistics from SSA (Table 3) from 2000 to 2016—the era of Millennium Development Goals—we did not find any intersection between the first three countries that had the highest number of FAMR activities (within this period) and the first three countries that recorded the highest MIR/^{000}.

2) These nonstrategic FAMR activities in SSA have produced unrepresentative data that misdirects the antimalarial intervention process from the calibration and distribution of available resources and services to the production and implementation of various antimalarials. As proof, malaria endemic countries are becoming holoendemic with serious increases in malaria mortality (Table 9) and comorbidities (Papaioannou et al., 2019). The combination of these weaknesses has led to rampant malarial drug resistance in many malaria-endemic countries. For example, 61.1% failure of amodiaquine tablets in Burkina Faso during the era of Millennium Development Goals (Arora & Sharma, 2019).

Table 9. Changes in malaria mortality between 2000 and 2016

Country	**MD 2000**	**MIR/^{000}**	**FAMR**	**MD 2016**	**CMD2000-2016**
Burkina Faso	29215	389.2	70	30762	-1547
Guinea	10347	367.8	4	11328	-981
Niger	17791	356.5	7	30848	-13058
Uganda	57160	218.3	115	22489	34671
Kenya	15573	166	148	4625	10948
Tanzania	34754	113.9	170	15419	19335

Key: Between 2000 and 2016, the first three countries with the highest MIR/^{000} had relatively fewer FAMR activities and correspondingly recorded negative changes in malaria deaths (increase CMD2000-2016). In contrast, the first three countries that had the greater number of FAMR activities had relatively mild MIR/^{000} and correspondingly recorded a positive (decrease) CMD.

3) From a socio-epidemiological perspective, these counterproductive features also have intensified and complicated various malaria comorbidities and other malaria-related health issues in many malaria-endemic SSA countries. For example, when Tanzania was registering the lowest rate of acute malaria-anaemia comorbidity (≤1%), Burkina Faso was registering the highest rate (≥11%) (Papaioannou et al., 2019).

4) From a socio-ethical perspective, these imbalances complicate the health vulnerability of the malaria hard-hit populations and undermine their rights to *health for all*. According to our analysis, the various negative malaria dynamics in SSA have kept malaria disease alive and active in that part of the world. Moreover, neglected or untreated infected populations conserve and propagate the plasmodium parasite (Teh et al., 2018). As we recorded declines in malaria morbidity and mortality in one SSA country, we also were recording a similar increase in morbidity and mortality in another SSA country, a situation which has maintained SSA as the global epicenter of malaria. For example, when we recorded a 19,335 decline in malaria-deaths in Tanzania between 2000 and 2016 (Table 9), we also recorded a 13,058 increase in malaria-deaths in Niger within that same period. This data shows that within the 16-year period from 2000 to 2016, antimalarial efforts in Tanzania and Niger recorded only a malaria-death decline of 6,277 deaths, which is an annual average decline of 392.3 deaths, with Tanzania as the only beneficiary.

Thus, these antimalarial imbalances indicate that something is wrong with the current antimalarial intervention process in SSA, and so something new must be tried to alter these

disastrous antimalarial outcomes. Given the decades of antimalarial engagement in SSA, we knew that the ideal approach for altering antimalarial uncertainties was the development of innovative and effective antimalarial drugs that could address the malaria parasitic resistance in malaria endemic countries. However, we also knew, as already mentioned previously, that the development of innovative antimalarial drugs for SSA required strategic antimalarial research to provide evidence-based representative and reliable data (Aaby et al., 2015; Marder, Laughren, & Romano, 2017).

Unfortunately, such malaria data are rare for SSA (Hammer et al., 2006), partly because FAMR activities inversely relate with malaria endemicity (Table 3), and partly because the malaria hard-hit populations often are located in rural setups that often escape FAMR activities by omission (Gosling et al., 2011; Teh et al., 2018). In the struggle to overcome these antimalarial lapses with respect to SSA, we designed the *greatest-need target antimalarial intervention strategy*. Its prominent characteristics make it a great fit in the struggle to help improve the antimalarial intervention process and outcomes in SSA.

Characterization of the *Greatest-Need Target Antimalarial Intervention Strategy*

Socio-epidemiological characterization: Pragmatic perspective

We designed the *greatest-need target antimalarial intervention strategy* to proportionately target the heterogeneity of malaria endemicity across SSA regions and countries and extend FAMR activities to malaria endemic areas, thus, facilitating equitable antimalarial intervention process. If put into practice, such an equitable process could relieve malaria hard-hit populations, and attain equitable equality in malaria decline across countries. As mentioned previously, the

heterogeneous malaria endemicity across countries in SSA is one of the peculiar variables of malaria disease in SSA, which also result from variations in the social determinants of malaria.

Consequently, we have found a great variation in the intensity of malaria disease in SSA from one region to another, across countries, and between urban centres and rural areas (De Silva & Marshall, 2012; Kouyate et al., 2007). Thus, an efficient antimalarial intervention process for SSA needs to proportionally target these variations so to break the plasmodium evolution chain and alter the distribution vector of the parasite. In other words, an equitable FAMR distribution *vis-à-vis* the heterogeneity of malaria endemicity is needed to ensure that the various intervention services and resources will reach the malaria hard-hit populations (Head et al., 2017).

In designing this intervention strategy, for socio-ethical and socio-epidemiological reasons, we considered that the malaria hard-hit populations were in the greatest need for antimalarial intervention services. From a socio-ethical perspective, these hard-hit populations need antimalarial assistance for *themselves* to renew their hopes of moving beyond health destitution and health vulnerability. Thus, this assistance could provide them an equal opportunity as citizens to regain their rights to *health for all*. From a socio-epidemiological perspective, these hard-hit populations have a great need for antimalarial assistance for *others* because they risk becoming asymptomatic. In the eventuality of becoming asymptomatic, they will become disguised reservoirs and propagators of the malaria plasmodium for the whole community (Kakkilaya, 2015b).

Our analysis shows that these considerations are yet to determine the allocation strategy of FAMR activities in SSA, which, nevertheless, form the bedrock of an efficient antimalarial intervention process in that part of the world. As our study is doing, some sympathetic

antimalarial partners have been speaking out against this unfavourable intervention strategy in SSA. For example, Bill Gates (speaking for the Bill & Melinda Gates Foundation) has cautioned other partners about the general malaria-related health destitution among the SSA populations. According to Gates, countries, stakeholders, and partners ought to already have reorganized the various health systems and efforts in SSA to ensure that interventions get to those who need them the most (Gulland, 2012).

We designed the *greatest-need target antimalarial intervention strategy* on basis of health equity, inspired by the insights from the theory of ethical governance in healthcare. Our motivation was to promote the aptitude of social justice in healthcare and minimize health inequalities so to relieve health vulnerability (Dine, 2020b). This model of intervention creates the possibility for the malaria hard-hit populations in SSA to regain their rights to *health for all* (Kroeger-Mappes, 1994). Our intervention strategy employs *equity* in healthcare as its mode of the intervention process, and uses *equality* in healthcare as its measure of the intervention outcome (Sen, 2002). We endowed the features of this intervention strategy with context-sensitive pragmatic characteristics to confront the various malaria factors in their contextual settings and to relieve malaria hard-hit populations and attain *equitable equality* in malaria decline across SSA.

Socio-ethical characterization: Interdisciplinary perspective

Given the multidimensionality of factors that can influence the fight against malaria in SSA, we conceptualized the *greatest-need target antimalarial intervention strategy* using the insights of interdisciplinary health ethics. This approach brought together various pragmatic aspects of applied ethics—the ethics of care, virtue ethics, ethics of human rights—to enforce the perspectives of the applied health sciences. When we inculcate the ethics of care and virtue ethics

into healthcare, we enrich the applied health sciences with empathy and benevolence, and the human rights to *health for all* become a priority (Kroeger-Mappes, 1994).

These ethical dispositions entice health stakeholders and professionals to judge the malaria hard-hit populations as being unable to achieve their health potentiality without assistance, and thus rate them as vulnerable (Resnik, 2004). We attribute the adjective *vulnerable* to this desperate group to prevent any tendency of exploitation, knowing that we can still exploit a population without harming them (Macklin, 2003). Thus, we support the application of this antimalarial intervention strategy with the rationale of social justice in healthcare so to ensure that the equitable distribution of available antimalarial resources will be used to supplement the limited capabilities of the hardest hit populations, so they can potentially achieve their rights to health (Sen, 2002).

Empathy-based and virtue-based approaches are necessary in the fight against malaria in SSA because they can harmonize the *kindness* and *professionalism* that are needed to confront the health vulnerability of malaria victims. As such, these approaches bring in the idea of *need* as the factor of the intervention process which is executed as *responsibility.* In other words, this ethical perspective conscientizes scientific professionalism with a humanitarian spirit that puts human rights to health at the forefront of interventions (Resnik, 2016). Across SSA, malaria has become the disease of the poor who need to be helped to be healed (De Silva & Marshall, 2012; Kouyate et al., 2007).

In addition to the conscientizing characteristics of this antimalarial intervention strategy, it also emphasizes the indispensable importance of contextualization in the fight against malaria in SSA. This strategy, as do many other aspects of the pragmatic interdisciplinary approach of applied

ethics, operates through open-ended questions to obtain unbiased context-sensitive information (Ritvo et al., 2004; Zeng & Resnik, 2010). In situations in which inequalities exist, such as the case of malaria in SSA, a good knowledge is always needed with respect to how different people experience health inequalities in their contexts, especially the vulnerable, before confronting them (Reutter & Kushner, 2010).

We want to highlight two related points: 1) that the conscientizing characteristic of this intervention strategy will prompt malaria stakeholders and partners to enforce various antimalarial practices with ethical deliberations, ethical regulations, ethical supervisions, and ethical interactions (Wahlberg et al., 2013); and 2) that its contextualization incentives will help them to design equitable antimalarial intervention processes and give everyone, especially the vulnerable, an equal opportunity to attain their full health potential (Braveman et al., 2011; Sklar, 2018). The fight against malaria in SSA needs to be strategic and accurate in its interventions because health inequalities also entail a failure to avoid or overcome the various unfair health disparities that infringe on the human rights to health and wellbeing (WHO, 2018b).

The efficiency of the *greatest-need target antimalarial intervention strategy* can only be determined by a general improvement in the quality adjusted life years (QALYs) of the malaria hard-hit populations, rather than on a per head health improvement of these populations. That notwithstanding, we have undertaken statistical validations using the interactions between $MIRs/^{000}$ of each country and the number of FAMR initiatives hosted by those countries. Thus, to determine the probability of success, we argue that we must always calculate the efficiency probability at all stages of the antimalarial intervention process (from FAMR to outcome at the end of the process).

However, it is necessary to substantiate the *greatest-need target antimalarial intervention strategy* by establishing the framework of the intervention process, and then using the Mean average (*n*MIR÷*n*FAMR) of the various intervention averages determined as the central point of Statistical Reference (Yu, 2021). We can make various intervention adjustments by referring to this Mean, thereby making it possible to optimize the probability of reducing the inequality-gap and attain equitable equality in malaria decline.

Illustrative Substantiation of the *Greatest-Need Target Antimalarial Intervention Strategy*

Malaria disease is the main source of health vulnerability in SSA as either a consequence or a cause. As a consequence, the malaria plasmodium takes advantage of socio-environmental conditions to develop and propagate, and then malaria disease exploits any health weaknesses in the host at the manifestation stage. As cause, the presence of the malaria plasmodium in a host aggravates the health weaknesses of this person, and endangers the lives of all their neighbours (Najera, 2019). Due to the characteristic over-dispersion of malaria disease in SSA, a small untreated fraction of the population stores and disseminates the plasmodium (Gosling et al., 2011; Teh et al., 2018).

Thus, we have used the *greatest-need target antimalarial intervention strategy* to endorse the hypothesis to always determine the heterogeneity of malaria endemicity in SSA before designing an efficient antimalarial intervention process. This strategy relies on the principle of *equity in healthcare intervention* as a symbol of *social justice* in healthcare to improve the health of the vulnerable populations in malaria-endemic countries. By prioritizing the situation of malaria endemic SSA countries, the malaria inequality gap can be minimized with equitable equality in

malaria decline across these countries. If this intervention strategy is implemented, the malaria situation in malaria endemic SSA countries can be prevented from becoming holoendemic.

However, we designed this intervention strategy to be complementary and corrective to existing efforts, and thus, to be an intervention movement from *prior evidence* to *likelihood*. In other words, an intervention movement from *what is* to *what could be,* from *actuality* to *probability*, and from *the known* to *the expected*. Our prior evidence (Table 1) shows a high malaria concentration in the western part of SSA with Burkina Faso recording a MIR of $389.2/^{000}$ between 2000 and 2016 (GHO, 2017). Our motivation to initiate this innovative antimalarial intervention strategy was to help alleviate the health vulnerability of the malaria hard-hit populations, e.g., the case of Burkina Faso, and ensure the universal benefits of human rights to health (Dine, 2020b).

Thus, we use this strategy to recommend that an efficient antimalarial intervention process in SSA should start by establishing a databank of representative malaria statistics from that part of the world as the bedrock of the intervention process. As already mentioned, we can only obtain such context-sensitive representative data through equitably strategic FAMR activities across SSA countries (Bhutta, 2002). Moreover, the operationalization process of FAMR in SSA must follow the step-by-step investigative exigencies of the theory of ethical governance in healthcare to obtain coherent and context-sensitive output.

To facilitate apprehension, we show how we implemented the *greatest-need target antimalarial intervention strategy* at the level of FAMR to obtain representative data. This strategy recommends an equitable allocation of FAMR across SSA countries so to target the heterogeneity of malaria endemicity in that part of the world. Thus, the greater number of FAMR

initiatives should go to Burkina Faso to proportionately correspond with its high MIR/^{000}. This recommended intervention strategy reverses the inverse relationship between FAMR and MIR/^{000} in SSA presented in our prior evidence data (Table 10a and Figure 10a) with a proportional relationship (Table 10b and Figure 10b).

Table 10. The Sampled Relationships between MIR and FAMR

Table 10a – Inverse Relationship

Country	MIR/^{000}	FAMR
Burkina Faso	389.2	70
Guinea	367.8	4
Niger	356.5	7
Uganda	218.3	115
Kenya	166	148
Tanzania	113.9	170

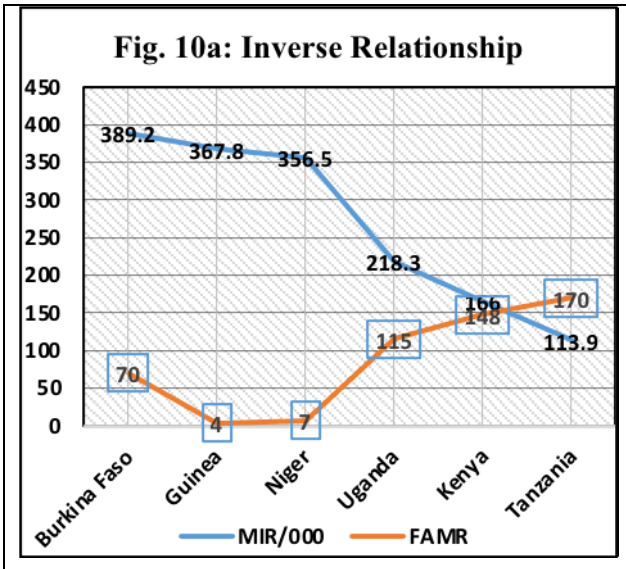
Key: Countries are arranged in the descending order of their real MIR/^{000} matched with their respective numbers of FAMR.

Table 10b – Proportional Relationship

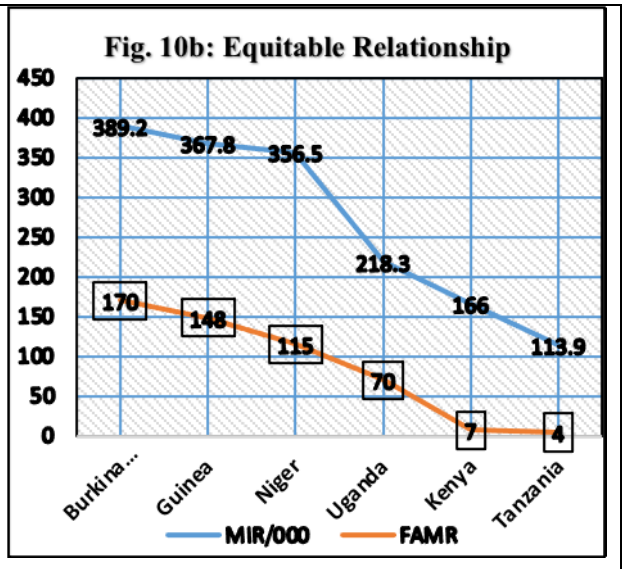
Country	MIR/^{000}	FAMR
Burkina Faso	389.2	170
Guinea	367.8	148
Niger	356.5	115
Uganda	218.3	70
Kenya	166	7
Tanzania	113.9	4

Key: Countries are arranged in the descending order of their real MIR/^{000}, but the corresponding numbers of FAMR are altered and rearranged on the basis of equity so to demonstrate the proportional relationship (equitable intervention).

FIGURE 10. THE ILLUSTRATION OF THE RELATIONSHIP BETWEEN MIR/^{000} AND FAMR IN SSA.



Key: FAMR increases as MIR/^{000} (malaria endemicity) decreases.



Key: With the *greatest-need target antimalarial intervention strategy*, FAMRs relatively increase as MIR/^{000} (malaria endemicity) increases.

Table 10b and Figure 10b show that many FAMR activities should proportionately occur in malaria-endemic countries, based on their MIR/^{000}. According to the exigencies of the theory of ethical governance in healthcare, when more FAMR activities are carried out, answers will become available to questions such as why these countries are more malaria endemic, and how we could redress this situation. Thus, we have undertaken an intensive antimalarial investigation in these countries to determine the various contributing factors, and to distinguish the factors that are generalizable to SSA, while, at the same time, still considering the impacts of contextual peculiarities. Our results will help antimalarial stakeholders and partners to equitably calibrate and allocate available antimalarial resources based on reliable knowledge about *which* antimalarial measures are suitable for which countries, and *why*.

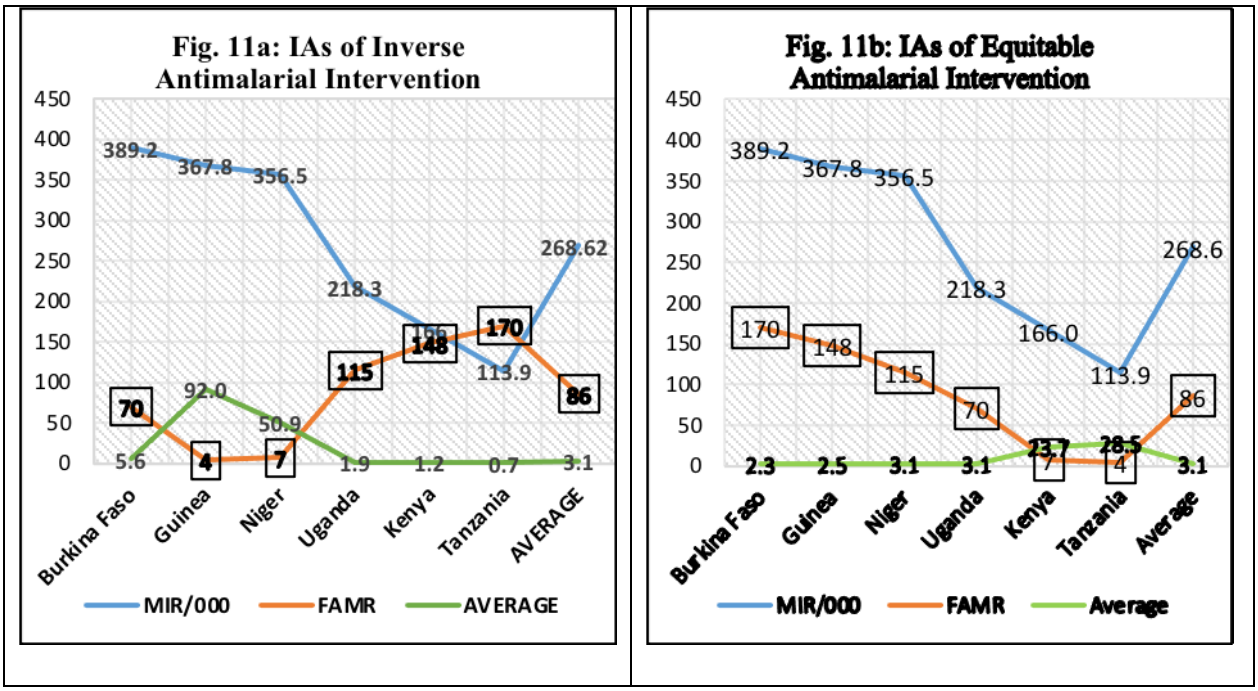
Thus, equitable FAMR activities across SSA will guarantee equitable antimalarial intervention mechanisms, and will facilitate the attainment of equitable equality in malaria decline across countries (Head et al., 2017). Our demonstrations show how the implementation of the *greatest-need target antimalarial intervention strategy* flattens the MIR/^{000} graph towards zero and validates the theory of fair interventions for equal outcomes. Given the intensive over-dispersion of malaria endemicity across SSA, first, we must use accurate statistics to determine the equitable calibration of resources and the intervention process, and second, we must calculate the intervention averages (IAs) of various countries (MIR/^{000}÷FAMR) to determine their efficiency potential, using the Mean average as the point of reference.

To strive for equitable equality in outcome, we must strive to equalize various IAs, even in the allocation policy for FAMR initiatives, so the graph of IAs can flatten towards zero (Figure 11b). This step-by-step verification process is required because health inequalities also emerge from non-strategic intervention processes (Jasso, 2015). To make the verification process equitably

equal, we calculated the efficiency potentiality of the intervention process at all stages with reference from the general IA, which is (*n*MIR÷*n*FAMR) at this stage. This general IA gives the average size of the gap between the *seeking* and *provision*. We used various IAs of various countries to find the efficiency ratio (ER) (case-to-intervention ratio). The ER provides a greater likelihood or probability of the orientation (positive or negative) of the expected outcome with reference from their Mean.

The higher the ER from the Mean, the lower the efficiency potentiality for that intervention to produce representative reliable results under the same conditions. In the same way, the lower the ER from the Mean, the higher the efficiency potentiality for that intervention to produce representative reliable results under the same conditions. If the ER becomes perpetual above the Mean, it creates a negative dynamic that pushes endemic countries into a desperate vulnerability with increasing malaria mortality (Fig. 10a). This situation is an indicator that the *seeking* far exceeds the *provision*, which implies a higher possibility of missing the many infected people that greatly need antimalarial services. When the ER stabilizes below the Mean, it increases a positive dynamic. However, when all ERs converge towards the Mean, the probability to attain equitable equality in malaria decline increases. We observed this dynamic as the gap between the various IAs lessened, as all the IAs came closer to their Mean (Fig. 11b).

FIGURE 11. UNFAIR IAS OF THE INVERSE FAMR-MIR RELATIONSHIP IN SSA



We designed the *greatest-need target antimalarial intervention strategy* to minimize inequalities and transform antimalarial intervention outcomes in SSA as is shown in Figure 11. Antimalarial intervention inequities are determined by the difference between the highest and the lowest IAs. The wider the difference, the more intensive are the intervention inequities, and the smaller the difference, the lesser are the inequities.

In the same way, more intervention inequities mean lower efficiency potentials of the general intervention process. The lower the efficiency potential of the general intervention process, the wider the malaria morbidity/mortality inequality-gap. The wider the malaria morbidity/mortality inequality-gap, the lower the potential to attain equitable equality in malaria decline. Moreover, the lower the potential to attain equitable equality in malaria decline, the more an equitable antimalarial intervention strategy is required. Unfortunately, we found a perpetual negative

dynamic in antimalarial outcomes in SSA (Fig. 11a), and also that the malaria morbidity/mortality inequality-gap across its countries continues to increase.

According to the inverse intervention scenario presented in Figure 11a, whereas the IA of Tanzania is already 0.7 (ER of 1:0.7), far below their Mean average which 3.1 (ER 1:3.1), the IA of Guinea is still 92 (ER 1:92), too far above the Mean. The large difference-size of 91.3 (ER 1:91.3) between Tanzania (the lowest) and Guinea (the highest) indicate three things: 1) intensive antimalarial intervention inequities, 2) a low potential for intervention efficiency, and 3) a wide malaria morbidity/mortality inequality-gap in SSA. In our equitable antimalarial intervention corrective scenario presented in Figure 11b, the Mean intervention average remains at 3.1 (ER 1:3.1), which signifies accuracy and authenticity. In this scenario, the IA of Guinea is down from 92 (ER 1:92) in Figure 11a to 28.5 (ER 1:28.5), and the IA of Tanzania up from 0.7 (ER 1:0.7) in Figure 11a to 2.3 (ER 1:2.3).

As these IAs move towards their Mean (Fig. 11b), they reduce the difference-size (the inequality-gap) from 91.3 (ER 1:91.3) in Fig.11a down to 26.2 (ER 1:26.2). This is an important move towards achieving equitable equality in malaria decline across SSA countries as the average graph flattens to the same Mean average. This dynamic also signifies an increase in antimalarial intervention equities and a decreasing malaria morbidity/mortality inequality-gap. The greatest-*need target antimalarial intervention strategy* is a move towards a greater positive dynamic—to a higher antimalarial intervention efficiency that gives everyone an equal opportunity to benefit from antimalarial intervention services as part of their rights to *health for all*.

Statistical Substantiation of the *Greatest-Need Target Antimalarial Intervention Strategy*: Probability Validation

To begin, we extracted from Table 9 the malaria statistics for Burkina Faso, the country with the highest MIR/^{000}, so we could calculate the probability of change conditional to the implementation of the *greatest-need target antimalarial intervention strategy*. The insights from Bayesian theory assured us that any ascertained probability remains valid, until otherwise proven false, as long as the lacunas reported in the previous input are revised, or when the required variables have been added (Hayes & Westfall, 2020). Thus, we consider our results valid for the whole of SSA based on the subjectivists' approach to inductive logic. Subjectivists logic validates results from the sampled part as a probability for the whole, provided all the variables remain the same (Joyce, 2019).

As already mentioned previously, we used the prior evidence statistics from Burkina Faso to calculate the probability of change with respect to their actual MIR/^{000}. First, we had to calculate the unconditional probability of their MIR/^{000} (MIR÷*n*MIR) to determine what would be found without a change/alteration in the FAMR strategy. Second, we used this unconditional probability to calculate the conditional probability of change in their MIR/^{000} as the dependent variable to change in the FAMR strategy which is an independent variable. That is, 1-[(MIR÷*n*MIR) ÷ (FAMR÷*n*FAMR)].

The unconditional probability of change for the MIR/^{000} of Burkina Faso (389.2/^{000}) equals 389.2÷8129.8=0.048. So, the probability that their MIR/^{000} (389.2/^{000}) will change as the dependent variable to change in the strategy of FAMR (increase in FAMR to 170) as an independent variable = 1–[(0.048÷(170÷1061=0.160)] = 1-(0.048÷0.160) = 1-0.3 = 0.7 (70%).

This means that a 0.7 (70%) probability exists that the MIR/^{000} for Burkina Faso could likely change, conditional to change in the number of FAMR activities. Although this probability shows the likelihood of change, we were not certain whether it is a positive change (a decrease) or a negative change (an increase).

Thus, we turned to the inverse probability inspiration from the insights of the Bayesian theory on inverse probability and Fiducial confidence interval (Wang, 2000) to clarify that uncertainty. However, logical probability predictions or likelihood theories based on *prior evidence* statistics may not have as much statistical precision or veracity as will be their indications, which must be valid. In other words, new statistics may not be precise, but new intervention trajectories/indications are valid because we apply the conditional element (***if***) of inductive logic to validate the probable change.

We worked with 389.2/^{000}, the MIR/^{000} for Burkina Faso, but while all the other variables remained the same, we used 170 as the number of their FAMRs. If Burkina Faso recorded 389.2/^{000} with 70 FAMR^{1}, then with 170 FAMR^{2}, they will record (MIRxFAMR^{1}) ÷ FAMR^{2}, which is (389.2x70) ÷170 = 27,244 ÷170=160.3/^{000} MIR. As per this calculation, it is probable that their MIR/^{000} will drop from 389.2/^{000} to 160.3/^{000}, which indicates a positive probability change. Should this be the case, their new IA will be MIR÷FAMR = 160.3÷170=0.94 (ER 1:0.94) down from 5.6 (1:5.6). If 389.2/^{000} MIR produced 30,762 MD, then 160.3/^{000} MIR would produce (30,762÷389.2) x160.3 = 79.04x160.3=12,670, all variables remaining the same.

If Burkina Faso recorded 12,670 MD down from 30,762 MD by 2016, their MD change between 2000 and 2016 would have been MD2000 minus MD2016 = 29,215–12,670=16,545 (positive dynamics); or the other way around, as MD2016–MD2000 = 12,670–29,215= –16,545

(decrease). This probability could produce the malaria mortality reduction of 30,762–12,670=18,092MD, giving a probability percentage reduction of 18,092÷30,762=0.588X100=58.8%.

Or if 389.2/^{000} MIR produced 1,547 MD change, then 160.3 MIR would produce (1,547÷3,89.2)x160.3=637 MD. The probability percentage of change equals 1,547 minus 632 divided by 1,547 multiplied by 100 = [(1,547–632) ÷1,547]x100 = (915÷1,547)x100 = 0.591x100 = 59.1% probable decrease in malaria mortality. If we allow the error margin of 0.5%, these logical calculations give a probability percentage range between 58.3% and 59.6% of possible decrease in malaria mortality in Burkina Faso.

These results indicate that if the equitable intervention insights of the *greatest-need target antimalarial intervention strategy* become central in the fight against malaria in SSA, malaria-endemic countries will record positive changes in their malaria outcomes. With respect to the distribution statistics inference of confirming hypothetical probability, the validity we ascertain for the sampled part is valid for the whole population on the same basis and considerations (Yu, 2021). As mentioned previously, subjectivists share this view in their approach to inductive logic, although their conclusions often are subjected to empirical substantiation and adjustments (Joyce, 2019).

Ethico–Scientific Evaluation of the *Greatest-Need Target Antimalarial Intervention Strategy*: Equitable Equality

We recommend the equitable allocation of more FAMRs—the bedrock of an efficient antimalarial intervention process in SSA—to malaria-endemic countries so to obtain comprehensive malaria data and support equitable intervention processes. The exigencies of the

greatest-need target antimalarial intervention strategy require the equitable distribution of services beginning from FAMR initiatives, and the proportionate calibration of available antimalarial resources. This strategy encourages healthcare equity to minimize health inequalities, and fosters *health for all,* unlike healthcare inequity, which benefits only the select few. Healthcare inequities, especially with a heterogeneous situation like that of malaria in SSA, begin from the misallocation of resources and end in an aggravation of health inequalities (Jasso, 2015).

We used the *greatest-need target antimalarial intervention strategy* to promote and enforce the intensive inclusion of the rationale of social justice in healthcare. This strategy can enable an antimalarial intervention processes in SSA to obtain equitable equality in malaria decline across SSA countries. When we bring the insights of social justice to the antimalarial intervention process in SSA, we facilitate antimalarial efficiency and relieve health vulnerability to satisfy human rights to *health for all*. As already mentioned, antimalarial intervention efficiency in SSA can only be obtained when the intervention strategy targets malaria inequalities to minimize their morbidity/mortality inequality-gap across SSA populations/countries.

Our general aspiration for designing the *greatest-need target antimalarial intervention strategy* was to enhance antimalarial efficiency with equity and help reduce the number of asymptomatic individuals in SSA (WHO, 2017c). Thus, we designed this strategy both as a *means* and a *goal* for the fight against malaria in SSA. As a *means*, this strategy facilitates the equitable allocation of the available antimalarial resources in and for SSA to support healthcare sustainability. As a *goal*, it treats all malaria infected and affected populations in SSA as dependent equals with an independent gravity of needs.

These two dimensions of the strategy were inspired by John Rawls' philosophy on justice as fairness. Rawls emphasized that we should shape our social systems—including healthcare systems—in a way that the practice of various operations and interventions should benefit the most vulnerable (Rawls, 2005). This is how we enriched the concept of *justice* with *equity* to develop a paradigm of *social justice* (Greenberg & Cohen, 2014). When this paradigm of *social justice* is applied in the practice of healthcare, it transmits a special connotation of *fairness* for modifying the practice of justice in healthcare with empathy, which is an insight of the ethics of care (Dine, 2020b). We exploited the rationale of social justice in the fight against malaria in SSA through the *equitable intervention process* where *need* ($MIR/^{000}$) determines the intervention strategy.

As repeatedly mentioned, only FAMR can be used as the basic tool to detect and analyze the various factors associated with the antimalarial needs of SSA populations, and to determine which intervention strategy could achieve efficiency in satisfying those needs. This is why the implementation of the *greatest-need target antimalarial intervention strategy* in SSA has the potential to ensure malaria elimination in that part of the world. By *malaria elimination*, we mean the deliberate interruption of its transmission vector to bring down the average infection rate to zero (WHO, 2019).

From this perspective, malaria elimination is a variable dependent on the efficiency between *antimalarial intervention* and *malaria endemicity*, which are the independent variables. Thus, our primary ambition was to initiate the procedure by which can realize progressive positive changes (decrease) in malaria calamities across SSA countries by detecting and disrupting plasmodium propagation vector. This is the only way to ensure malaria elimination amid the intensive inequalities in its endemicity and socioenvironmental determinants (Joseph et al., 2016).

This dimension of the *greatest-need target antimalarial intervention strategy* can be applied to distributive social justice in healthcare. *Distributive social justice in healthcare* is a progressive intervention paradigm that generates a positive impact on all or most of malaria infected and affected populations. This paradigm can help to create equity in the intervention process and equality in outcomes, which can lead to equitable equality in malaria decline across various SSA societies and countries. *Equitable equality in malaria decline* occurs when more resources or services are invested in those who need more, thereby providing an equal recovery opportunity to all societies, so that all countries can experience progressive positive changes in their malaria outcomes.

As per the demonstration of this intervention strategy (Table 10b and Figure 10b), the countries with great numbers of FAMRs, e.g., Tanzania, will experience a reduction in antimalarial input and output. These dynamics are the balancing effects of helping the malaria hard-hit populations and disadvantaged countries like Burkina Faso to benefit more from available resources. As we continue with such adjustments in input responding to dynamics in outcomes, we can attain equitable equality in malaria decline across countries in the short run. In other words, equitable equality in malaria decline occurs when all countries are experiencing decreases in malaria morbidity and mortality, as the result of adjustments in input. All SSA countries do not always need the same degree of antimalarial services at the same time or at all times because of the variations in the composition of the social determinants of parasitic and malaria intensity.

6.2.3. Discussion and Conclusion

We attribute the difficulties in the fight against malaria in SSA to two main factors: 1) the main characteristics that determine the prevalence of malaria as a vector-borne communicable

disease—environment, economic activities, and mosquito life cycle—are too heterogeneous and complicated in SSA, and 2) whereas the socioeconomic capability of the greater fraction of SSA populations is too weak to sustain them, some of their sociocultural beliefs and activities often distort their healthcare adventures. The combination of many of these difficulties often leave malaria stakeholders and partners in SSA in a serious stalemate, and the vulnerable populations suffer the consequences. Thus, it was our desire to bridge these many perspectives and bring positive changes to the fight against malaria in SSA with our greatest-*need target antimalarial intervention strategy*.

From a socio-ethical perspective, we bridged the ethics of human rights to health by relieving the desperate health vulnerability of the malaria hard-hit populations in malaria-endemic countries in SSA. From a socio-epidemiological perspective, we tried to balance the various antimalarial imbalances across SSA populations by emphasizing the need for an equitable antimalarial intervention process and equal antimalarial outcomes. From a socioeconomic perspective, we discouraged the wastage of that available antimalarial resources in SSA that is generated by nonstrategic and inequitable intervention processes that instead have a high propensity to increase the malaria morbidity/mortality inequality-gap. These three perspectives summarize the major changes expected from the *greatest-need target antimalarial intervention strategy*.

We targeted these changes when designing this strategy because their absence jointly contribute to the far-reaching antimalarial failures in SSA. Also, the failures to properly manage these three pivotal perspectives regarding the fight against malaria in SSA have discouraged many antimalarial investors and partners to abandon their projects. For example, due to such failures, no antimalarial drug candidates, except for Mosquirix RTS,S, have ever reached the clinical trials Phase III in SSA (Kakkilaya, 2015b). Also, due to these same failures, many of the available

antimalarial drugs and vaccines have been confronted by serious parasitic resistance in most of the malaria-endemic SSA countries (WHO, 2019).

Above all, we were encouraged to propose this novel intervention strategy because discouraged antimalarial funders like the Bill and Melinda Gates Foundation were already asking for changes in the antimalarial intervention strategy in SSA (Gulland, 2012). The negative effects of these antimalarial failures have been enormous, and the disadvantaged hard-hit populations have borne a greater measure of their impact. For example, 1) the malaria morbidity/mortality inequality-gap across SSA countries has increased, and their malaria hard-hit populations have experienced a desperate health vulnerability with increasingly heavy calamities, and 2) malaria has remained a permanent perennial killer disease in that part of the world despite the decades of diverse antimalarial endeavours to eliminate this disease.

These negative antimalarial outcomes in SSA are distorting the global healthcare ambition to satisfy the human rights to health for all. Against this backdrop, the WHO cautioned antimalarial stakeholders and partners in SSA that "if we continue employing the same level of resources and the same interventions—we will face near-certain increases in malaria cases and deaths" (WHO, 2017c, p. v). This admonition inspired us to initiate the *greatest-need target antimalarial intervention strategy* to help the antimalarial intervention process in SSA to obtain fairer and better outcomes. Although it may be true that our statistical significance might not reflect the direct practical significance (Price et al., 2015), our 70% statistical significance is large enough to predict an encouraging practical significance, all error margins considered.

We acknowledge that the implementation of the *greatest-need target antimalarial intervention strategy* requires more funding because an equitable antimalarial intervention process requires

far-apart sampling across SSA. Therefore, we emphasize the importance of a combined exploitation of the ethics of care and social justice to bring the spirit of empathy and benevolence to the antimalarial intervention in SSA. This view seems right, since most antimalarial funders and partner organizations operate as philanthropists. However, we also took for granted that any moral or individual person involved in any stage of the antimalarial intervention process in SSA aims at relieving the populations in that part of the world from their health frailty.

Nevertheless, we are not ignorant of the deliberate exploitative tendencies that often define various antimalarial endeavours in SSA (Bidima, 2018; Doshi, 2020; Resnik, 2004, 2014). We simply have embraced the philanthropic expectations of the antimalarial intervention in SSA, and have endorsed the vision that when people engage in healthcare interventions in SSA, they need a certain degree of ethical consciousness towards the have-nots. We expect that pharmaceutical companies and other partner organizations should take it as their ethical duties to bring health solutions to these poorer populations while avoiding any possibility of creating a health crisis (Resnik, 2002). This is the main ethical dimension that upholds the operationalization of the *greatest-need target antimalarial intervention strategy*.

Declaration

Acknowledgment:

Funding: None

Conflict of interest: None

Reference

Aaby, P., Rodrigues, A., Kofoed, P. E., & Benn, C. S. (2015). RTS,S/AS01 malaria vaccine and child mortality. *Lancet, 386*(10005), 1735-1736. doi:https://doi.org/10.1016/S0140-6736(15)00693-5

Arora, T., & Sharma, S. (2019). Global scenario of counterfeit antimalarials: A potntial threat. *Journal of Vector Borne Diseases, 56*(4), 288-294. doi:https://doi.org/10.4103/0972-9062.302030

Bhutta, Z. A. (2002). Ethics in international health research: a perspective from the developing world (Review). (0042-9686 (Print/Linking)). from WHO/PMC https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2567726/ (Accessed 03/08/2019).

Bidima, J. G. (2018). Du consentement éclairé au «consentement négocié» en Afrique: points de suspension, ouvrons les guillemets…. *Revue française d'éthique appliquée, 1*(5), 81-94. doi:https://doi.org/10.3917/rfeap.005.0081

Braveman, P., Kumanyika, S., Fielding, J., Laveist, T., Borrell, L. N., Manderscheid, R., & Troutman, A. (2011). Health disparities and health equity: the issue is justice. *Am J Public Health, 101 Suppl 1*(S1), S149-155. doi:http://dx.doi.org/10.2105/AJPH.2010.300062

De Silva, P. M., & Marshall, J. M. (2012). Factors contributing to urban malaria transmission in sub-saharan Africa: a systematic review. *J Trop Med, 20*, 819563. doi:http://dx.doi.org/10.1155/2012/819563

Dine, C. B. (2020). Socio-ethical Dimension of COVID-19 Prevention Mechanism-The Triumph of Care Ethics. *Asian Bioethics Review, 12*(4), 539-550. doi:https://doi.org/10.1007/s41649-020-00143-1

Doshi, P. (2020). WHO's malaria vaccine study represents a "serious breach of international ethical standards". *BMJ, 368*, m734. doi:http://dx.doi.org/10.1136/bmj.m734

Druetz, T., Stresman, G., Ashton, R. A., van den Hoogen, L. L., Joseph, V., Fayette, C., . . . Eisele, T. P. (2020). Programmatic options for monitoring malaria in elimination settings: easy access group surveys to investigate Plasmodium falciparum epidemiology in two regions with differing endemicity in Haiti. *BMC medicine, 18*(1), 141. doi:https://doi.org/10.1186/s12916-020-01611-z

GHO. (2017). Annex B: Tables of health statistics by country, WHO region. *World Health Statistics* Retrieved from http://www.who.int/gho/en/ 20/08/2018.

Gosling, R. D., Okell, L., Mosha, J., & Chandramohan, D. (2011). The role of antimalarial treatment in the elimination of malaria. *Clin Microbiol Infect, 17*(11), 1617-1623. doi:http://dx.doi.org/10.1111/j.1469-0691.2011.03660.x

Greenberg, J., & Cohen, R. L. (Eds.). (2014). *Equity and justice in social behavior*. New York, NY: Academic Press.

Gulland, A. (2012). Governments and drug companies pledge to eliminate 10 neglected tropical diseases by 2020. *BMJ: British Medical Journal, 344*. doi:https://doi.org/10.1136/bmj.e773

Hammer, G. P., Somé, F., Müller, O., Kynast-Wolf, G., Kouyaté, B., & Becher, H. (2006). Pattern of cause-specific childhood mortality in a malaria endemic area of Burkina Faso. *Malaria Journal, 5*(1), 47. doi:https://doi.org/10.1186/1475-2875-5-47

Hayes, A., & Westfall, P. (2020). Bayes' Theorem Definition. Retrieved from https://www.investopedia.com/terms/b/bayes-theorem.asp (Accessed 02/06/2021).

Head, M. G., Goss, S., Gelister, Y., Alegana, V., Brown, R. J., Clarke, S. C., . . . Tatem, A. J. (2017). Global funding trends for malaria research in sub-Saharan Africa: a systematic analysis. *Lancet Glob Health, 5*(8), e772-e781. doi:https://dx.doi.org/10.1016/S2214-109X(17)30245-0

Heggenhougen, H. K., Hackethal, V., & Vivek, P. (2003). *The behavioural and social aspects of malaria and its control* (Vol. 03). Geneva: WHO/UNDP/WB.

Jasso, G. (2015). Inequality Analysis: Overview. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 885-893 / doi: https://doi.org/810.1016/B1978-1010-1008-097086-097088.032199-097087). Oxford: Elsevier.

Joseph, K. T., Rice, K., & Li, C. (2016). Integrating Equity in a Public Health Funding Strategy. *J Public Health Manag Pract, 22 Suppl 1*, S68-76. doi:http://dx.doi.org/10.1097/PHH.0000000000000346

Joyce, J. (2019). Bayes' Theorem. In E. N. Zalta (Ed.), The Stanford Encyclopedia of Philosophy (Vol. Spring 2019). Stanford University: Metaphysics Research Lab. Retrieved from https://plato.stanford.edu/entries/bayes-theorem/ (Accessed 28/11/2020).

Kakkilaya, B. S. (2015). Malaria Immunity. *Malaria Site.* Retrieved from https://www.malariasite.com/immunity/. (Accessed 20/11/2019).

Kouyate, B., Sie, A., Ye, M., De Allegri, M., & Muller, O. (2007). The great failure of malaria control in Africa: a district perspective from Burkina Faso. *PLoS Med, 4*(6), e127. doi:https://doi.org/10.1371/journal.pmed.0040127

Kroeger-Mappes, J. (1994). The Ethic of Care vis-à-vis the Ethic of Rights: A Problem for Contemporary Moral Theory. *Hypatia, 9*(3), 108-131. Retrieved from www.jstor.org/stable/3810191 (Accessed 06/06/2020) doi:https://doi.org/10.1111/j.1527-2001.1994.tb00452.x

Macklin, R. (2003). Bioethics, Vulnerability, and Protection. *Bioethics, 17*(5-6), 472-486. doi:https://doi.org/10.1111/1467-8519.00362

Marder, S. R., Laughren, T., & Romano, S. J. (2017). Why Are Innovative Drugs Failing in Phase III? *American Journal of Psychiatry, 174*(9), 829-831. doi:http://dx.doi.org/10.1176/appi.ajp.2017.17040426

Mwenesi, H., Mbogo, C., Casamitjana, N., Castro, M. C., Itoe, M. A., Okonofua, F., & Tanner, M. (2022). Rethinking human resources and capacity building needs for malaria control and elimination in Africa. *PLOS Global Public Health, 2*(5), e0000210. doi:https://doi.org/10.1371/journal.pgph.0000210

Najera, R. (2019). Malaria and Malaria Vaccine Candidates. *The History of Vaccines: An Educational Resources by The College of Physicians of Philadelphia.* Retrieved from https://ftp.historyofvaccines.org/content/articles/malaria-and-malaria-vaccine-candidates (Accessed 23/01/2021).

Omumbo, J. A., Noor, A. M., Fall, I. S., & Snow, R. W. (2013). How well are malaria maps used to design and finance malaria control in Africa? *PLoS One, 8*(1), e53198. doi:http://dx.doi.org/10.1371/journal.pone.0053198

Papaioannou, I., Utzinger, J., & Vounatsou, P. (2019). Malaria-anemia comorbidity prevalence as a measure of malaria-related deaths in sub-Saharan Africa. *Scientific Reports, 9*(1), 11323. doi:http://dx.doi.org/10.1038/s41598-019-47614-6

Peter, F. (2004). Health Equity and Social Justice. In A. Sen, S. Ahmed, & F. Peter (Eds.), *Public health, ethics, and equity* (pp. 93-106). Oxford: Oxford University Press.

Plewes, K., Leopold, S. J., Kingston, H. W. F., & Dondorp, A. M. (2019). Malaria: What's New in the Management of Malaria? *Infectious Disease Clinics of North America, 33*(1), 39-60. doi:https://doi.org/10.1016/j.idc.2018.10.002

Price, P., Jhangiani, R., & Chiang, I. (2015). *Research Methods of Psychology* (Vol. 2nd Canadian Edition). Victoria (B.C.): B.C. University Press.

Rawls, J. (2005). *A theory of justice* (Original ed.). Cambridge: Belknap/Harvard University Press.

Resnik, D. (2002). Developing drugs for the developing world: an economic, legal, moral, and political dilemma. *Developing World Bioethics, 1*(1), 11-32. doi: https://doi.org/10.1111/1471-8847.00004

Resnik, D. (2004). Research Subjects in Developing Nations and Vulnerability. *The American Journal of Bioethics, 4*(3), 63-64. doi:http://dx.doi.org/10.1080/15265160490497155

Resnik, D. (2014). Ethical issues in field trials of genetically modified disease-resistant mosquitoes. *Dev World Bioeth, 14*(1), 37-46. doi:http://dx.doi.org/10.1111/dewb.12011

Resnik, D. (2016). Ethics in Science. In P. Humphreys (Ed.), *The Oxford Handbook of Philosophy of Science* (pp. 25). Oxford: oxford University Press.

Reutter, L., & Kushner, K. E. (2010). 'Health equity through action on the social determinants of health': taking up the challenge in nursing. *Nurs Inq, 17*(3), 269-280. doi:http://dx.doi.org/10.1111/j.1440-1800.2010.00500.x

Ritvo, R., Ohlsen, J., & Holland, T. (2004). *Ethical Governance in Health Care*. Chicago: library of Congress.

Sen, A. (2002). Why health equity? In A. Sen, S. Ahmed, & F. Peter (Eds.), *Public Health, Ethics, and Equity* (pp. 21-33.). Oxford: Oxford University Press.

Sklar, D. P. (2018). Disparities, Health Inequities, and Vulnerable Populations: Will Academic Medicine Meet the Challenge? *Acad Med, 93*(1), 1-3. doi:http://dx.doi.org/10.1097/ACM.0000000000002010

Snow, R. W., Craig, M. H., & le Sueur, D. (1999). A climate-based distribution model of malaria transmission in sub-Saharan Africa. *Parasitol Today, 15*(3), 105-111. doi:https://doi.org/10.1016/S0169-4758(99)01396-4

Teh, R. N., Sumbele, I. U. N., Meduke, D. N., Ojong, S. T., & Kimbi, H. K. (2018). Malaria parasitaemia, anaemia and malnutrition in children less than 15 years residing in different altitudes along the slope of Mount Cameroon: prevalence, intensity and risk factors. *Malaria Journal, 17*(1), 336. doi:https://doi.org/10.1186/s12936-018-2492-1

Um, C., Ac, O., An, C., & Nwakwuo, G. (2015). Social Determinants of Malaria Treatment Seeking Time by Mothers for Children (0-5 Years) in South Eastern Nigeria. *Journal of Tropical Disease, 3*(1), 1-6. doi:http://dx.doi.org/10.4172/2329891X.1000154

Wahlberg, A., Rehmann-Sutter, C., Sleeboom-Faulkner, M., Lu, G., Doring, O., Cong, Y., . . . Rose, N. (2013). From global bioethics to ethical governance of biomedical research collaborations. *Soc Sci Med, 98*, 293-300. doi:http://dx.doi.org/10.1016/j.socscimed.2013.03.041

Wang, Y. H. (2000). Fiducial Intervals: What Are They? *The American Statistician, 54*(2), 105-111. doi:https://doi.org/10.2307/2686026

WHO. (2017). World malaria report 2017. . WHO publication Retrieved 20 September 2018 https://www.who.int/malaria/publications/world-malaria-report-2017/en/ (Accessed 20/09/2018).

WHO. (2018). Gender, Equity and Human Rights. *https://www.who.int/gender-equity-rights/en/ (Accessed 20/01/2018).*

WHO. (2019). Malaria. *Fact sheets.* Retrieved from https://www.who.int/news-room/fact-sheets/detail/malaria (10/12/2019)

Yu, Y. (2021). Introduction to Statistical Inference. In Biostatistics—Open Learning Textbook. Gainesville: University of Florida. Retrieved from https://bolt.mph.ufl.edu/6050-6052/unit-4/ (Accessed 04/06/2021).

Zeng, W., & Resnik, D. (2010). Research integrity in China: problems and prospects. *Dev World Bioeth, 10*(3), 164-171. doi:http://dx.doi.org/10.1111/j.1471-8847.2009.00263.x

6.3. Summarizing Conclusion

Therefore, whereas I used Chapter 4 to unveil the antimalarial problem or weakness in SSA, I used Chapter 5 to define the proper mechanism to overcome such a weakness, and I will use Chapter 6 to apply the insights from Chapter 5 on the results from Chapter 4. Chapter 6 realizes the main objective of this research project by answering the question of *how* to go about an efficient fight against malaria in SSA. It presents the *greatest-need target antimalarial intervention strategy*, the antimalarial intervention strategy that can enhance equitable intervention process to produce better and fairer outcomes that equally benefit the malaria hard-hit populations. But why have antimalarial partners—funders and researchers—been enticed into antimalarial inequities in SSA for so long? This question makes the object of the next chapter where I will try to find out some plausible reasons.

PART THREE: ANALYTICAL DISCUSSION AND EVALUATIVE CONCLUSION

Chapter 7: Inverse Antimalarial Intervention in sub-Saharan Africa, Ignorance? Professional Negligence? or Conflict of Interest?

7.1. Introduction: Socio-Ethical Evaluation

The orientation of the debate, the dimension of the argument, and the extent of the views that frame this thesis link my epidemiological findings and results to my ethical expectations about antimalarial interventions in SSA. In other words, while my findings and results uphold the socio-epidemiological perspective of this research, my expectations underlie its socio-ethical perspective. I combined these two perspectives to underscore that the fight against malaria in SSA needs the context-sensitive insights of ethical governance in healthcare to gain efficiency. More specifically, I wanted to find out if some socio-ethical factors superseded socio-epidemiological factors to determine the orientation of FAMR, the bedrock of an efficient antimalarial intervention process.

According to my findings in the previous chapters, the malaria prevalence in SSA is still averagely rated 'high' (Aaby et al., 2015; WHO, 2017a, 2018c) with an intensive heterogeneity in its prevalence across these countries. The SSA countries with a dense malaria parasitic prevalence also have a high malaria endemicity that leads to perennial severe malaria infections and manifestations. In contrast, the SSA countries with relatively scanty parasitic prevalence have a low endemicity with a lesser frequency of severe malaria infections and manifestations, although these infections and manifestations can be deadly as well (Doolan et al., 2009; Ferguson

et al., 2010; Golding et al., 2017). I also determined these dynamics in malaria endemicity be referring to the variations in its contextual vector factors that favour or disfavour mosquito breading (Hay et al., 2000; Snow et al., 1999).

These factors also should determine the orientation of the antimalarial intervention processes in SSA, since they are responsible for the malaria inequalities across SSA countries. My results show that the antimalarial stakeholders and partners in or for SSA have yet to use these factors when designing the orientation pattern of FAMR, which explains why so few FAMR activities are carried out in areas of dense malaria prevalence, even though FAMR is the mainstay of an efficient antimalarial intervention process in SSA (Hammer et al., 2006; Head et al., 2017). An equitable equality in malaria decline across SSA countries cannot be realized with this inverse relationship because it signifies antimalarial intervention inequities. In turn, this strategy worsens the health vulnerability of the malaria hard-hit populations in the malaria-endemic countries in SSA.

However, I acknowledge the differences that exist between most of those who live the burden of malaria disease (the populations in SSA) and most of those who carry the burden of the antimalarial cost (their foreign partners and Western sympathisers). The socio-contextual characteristics of the populations who live the burden of malaria disease are different from the socio-contextual characteristics of the Western world and their partners who carry the burden of the antimalarial cost. These differences can complicate the implementation of antimalarial activities in SSA. For example, ignorance of the contextual malaria realities lived by malaria hard-hit SSA populations can derail the antimalarial efforts of the Western world and their partners. Also, some of these partners can be tempted by the vulnerable nature of most of the populations in SSA to be less exigent in their professional input, which may be perceived as

professional negligence. In addition, these weaknesses can put malaria stakeholders and their partners in a conflict-of-interest situation in which they are prioritizing their interests, for utilitarian reasons, over the benefits to the malaria hard-hit populations.

It is difficult to determine which of these plausible distractions have prevented antimalarial funders and researchers from initiating an equitable antimalarial intervention process in SSA. Thus, in this chapter, I use the context-sensitive insights from the theory of ethical governance in healthcare to engage in an interdisciplinary analysis of the antimalarial situation in SSA. I combine the socio-epidemiological factors of the antimalarial intervention process in SSA with the socio-ethical factors to determine which of these factors have possibly influenced the allocation strategy of FAMR in SSA. Is it the ignorance of contextual malaria realities, or professional negligence, or conflict of interest?

7.2. Impediments to Targeting Malaria Inequalities in SSA

By bringing together the various aspects of applied ethics in healthcare (Dine, 2020b), I wanted to discover what disturbs an equitable implementation of FAMR in SSA *vis-à-vis* the heterogeneity of malaria endemicity. In other words, I wanted to investigate the possible factors (mischievous or professional) that had been directly or indirectly influencing the location strategy of FAMR in SSA, other than the intensity of the malaria disease itself. A good knowledge of the difficulties that have influenced the fight against malaria in SSA would help to better define the corrective characteristics of the *greatest-need target antimalarial intervention strategy* proposed in Chapter 6.

To begin, the *multidimensional* and *multisectoral* dispositions of different schools of thought are necessary for programing and managing the fight against malaria in SSA (Deaton & Tortora,

2015; Puppalwar et al., 2015). However, these dispositions often combine and materialize through two sectors: 1) the internal/domestic sector that includes domestic stakeholders such as ministries of health, antimalarial follow-up committees, and research ethics committees that design and enforce local public health politics and policies, and regulate FAMR within their territory; and 2) the external sector that includes antimalarial funding foundations and organizations, pharmaceutical companies and institutions, and researchers that provide or enforce the economic and scientific aspects of FAMR (WHO, 2017b).

7.2.1. Public Health Policies and Inverse Antimalarial Intervention in SSA: Domestic Contributions

It is a common phenomenon in SSA that wherever antimalarial funding goes, antimalarial research follows; or wherever antimalarial research goes, antimalarial funding follows. In addition, wherever antimalarial funding and research concentrate in SSA, antimalarial intervention follows. These three antimalarial inputs either develop together, or they function as complements to each other to realize their aims. As they each strive to realize their aims, they all want to attain antimalarial efficiency while intermingling *scientific validations* and *ethical regulations* to satisfy global health demands (Winstanley et al., 2004).

However, frameworks do not exist to distinguish *scientific validations* from *ethical regulations* or to provide a clear-cut guide on how to harmonize them in practice. To gain scientific validation for their work, antimalarial researchers refer to the various research specificities selected and emphasized by the WHO (Fathalla & Fathalla, 2004). On the other hand, national and institutional ethics committees turn to various specific global health research review guides in search of *ethical regulations* (Karlberg & Speers, 2010). Nevertheless, to support researchers and

ethics committees, a global health research framework exists that emphasizes a general promotion of the ethical guidelines outlined by the Global Network of WHO's Collaborating Centres for Bioethics (Drue et al., 2016b; WHO, 2015).

The absence of a scientific and ethical harmonization regarding the fight against malaria in SSA has led to parallel engagements by funders, researchers, ethics committees, and policymakers, which have reduced antimalarial efficiency at the expense of the malaria hard-hit populations. Generally, it has been a long-standing healthcare tradition that the frontline responsibility goes to research ethics and ethical review policies and regulations to ensure productive healthcare research procedures. In 2001, global health stakeholders held a Research Ethics Seminar in Arusha, Tanzania to emphasize the importance of ethical regulations for global healthcare research. As a result of that seminar, various global healthcare research review specificities were developed in accordance to their contextual realities, especially with respect to SSA (Puppalwar et al., 2015).

Each country then adapted its own superseding public health research politics and policies to reflect their local peculiarities and needs. They each formulated their local ethical review regulations and requirements through which they could influence the lucidity of the health research and healthcare interventions within their territories by either attracting or distracting funders and researchers. For example, the differences in the research ethics review procedures of Tanzania and Nigeria—two English-speaking countries in the East and West of SSA, respectively—may justify some of the dynamics of the antimalarial engagements in SSA.

To obtain health research ethical clearance in Tanzania, four copies of each complete research proposal must be submitted to the Director General of the National Institute for Medical

Research. A processing fee of US$ 300 per proposal must be directly paid to the Tanzania Food and Drugs Authority (TFDA), which oversees the whole research procedure to ensure public safety and pharmacovigilance[16]. Then, the National Health Research Ethics Review Sub-Committee (NatHREC) reviews the proposal and approves it within 28–42 days (Puppalwar et al., 2015). The domestic institution hosting the research must also have an ethics committee.

In Nigeria, the National Health Research Ethics Committee (NHREC) supervises all health research activities. However, the officially registered internal Health Research Ethics Committee (HREC) of the hosting institution can approve any phase IV clinical research taking place in less than three sites. If the research is to be carried out in three sites or more, its protocol has to be reviewed and approved by NHREC. The review process takes around 90 days, and the processing fees are paid in stages: the fee of 5,000 Nigerian Naira (NGN) (≈US$15) plus a 5% value-added tax that is paid upon submission; and the approval/authorization fee of 750,000 NGN (≈US$2000) for foreign funded research or 250,000 NGN (≈US$700) for locally sponsored research are levied on the industry/company sponsoring the research (Puppalwar et al., 2015).

These two examples illustrate the great variations in the economic, social, and administrative demands of their research review regulations and procedures. These variations have become great determining factors for antimalarial funders and researchers to choose where to direct their funding or where to carry out their FAMR in SSA. Obviously, most of them often turn to where the review procedures are relatively easier, faster, or cheaper. It is logical that the total amount of ≈US$ 300 in Tanzania as compared to ≈US$ 2,015 in Nigeria would attract funders and researchers to consider Tanzania for their research. In addition, the review duration of 1.5 months

[16] See: https://www.fdanews.com/ext/resources/files/10-15/10-26-15-Tanzania.pdf?1445374199 (Accessed 14/04/2020).

in Tanzania as compared to 3 months in Nigeria also can influence the time-factor interests of researchers. These contrasts may partly explain the differences in our antimalarial SSA statistics presented in the preceding chapters. Between 2000 and 2016, Nigeria hosted only 36 FAMR activities even though it had a high as $380.8/^{000}$ malaria endemicity, and within the same period, Tanzania hosted 170 FAMR activities with a relatively scanty malaria endemicity of $113.9/^{000}$ MIR (GHO, 2017).

To indicate the limitations of my demonstrative justification of the domestic contribution to the actual antimalarial dynamics in SSA, I provide the following example. I acknowledge that many non-malaria-related factors also discourage some partners from investing their financial and human resources in some countries, even though they are malaria endemic. For example, the repulsive sociopolitical conditions (wars and attacks), bad governance characterized by corruption and mistrust, and many others. Lack of transparency or consistency in the National Malaria Surveillance Systems in many malaria-endemic countries in SSA have discouraged many foreign antimalarial partners from contributing to interventions (Head et al., 2017; WHO, 2017c). This notwithstanding, I believe the story could be different if an abiding global healthcare research and intervention regulatory framework existed to condition or conscientize domestic healthcare stakeholders.

Thus, I will argue that such a global healthcare research and intervention regulatory framework could enforce global healthcare endeavours with the spirit of care to invoke empathy for vulnerable populations. While this framework would necessitate pragmatic drills of contextualization through deliberative reciprocity (to be explained further later), it also would engage the insights of the philosophy of social justice, thereby making the heterogeneity of malaria endemicity the main target of antimalarial endeavours. In other words, the combination

of empathy, care, and social justice would entice stakeholders, policymakers (private and public), funders, and researchers to focus on the interests of SSA populations as their aim, and the health of these populations as their responsibility.

From the pragmatic point of view, for example, such a framework could conscientize the healthcare stakeholders drawing up ethics regulatory guidelines to put the interests of the malaria hard-hit populations at the vanguard. As such, the protocol verifications and certifications by ethics committees would apply healthcare equity, and direct antimalarial researchers to regions of higher malaria endemicity. Correspondingly, the antimalarial researchers planning to research in SSA would be forced to undertake pre-verifications of the malaria heterogeneity in SSA and in the country of their destination before tabling their protocol for ratification. But other than ethics regulations, what external factors also determine where most antimalarial funders in SSA put their money/funds or where antimalarial researchers carry out their research activities?

7.2.2. Interests of Partners and Inverse Antimalarial Research in SSA: External Contributions

According to the pragmatic insights of applied ethics in healthcare, the proficient combination of *scientific validation* and *ethical regulations* in any healthcare intervention process results in healthcare effectiveness and efficiency. Whenever we strive to achieve these two ambitions, we are striving to satisfy the benefits of the affected and infected populations, alongside the interests of stakeholders and partners. To achieve these two ambitions, in a situation of intensive inequalities like the case of malaria in SSA, the target must be the dispersion of the infection pattern across countries. Thus, stakeholders and partners could attain their scientific and economic gains while benefiting the infected and affected populations.

As already mentioned previously, to bring providers and receivers together, it is necessary to combine the socio-ethical perspective of the intervention process with the socio-epidemiological perspective. Whereas the people who are experiencing the burden of the malaria disease are at the receiving end of the process waiting for external assistance from partners as providers, those who are experiencing the antimalarial cost burden are designing the intervention strategy. They often design this strategy to fit their means and interests, although their interests may be to help alleviate the malaria burden and relieve health vulnerability. If the main interest of the antimalarial partners in SSA is to alleviate the malaria burden and relieve the health vulnerability of the malaria hard-hit populations, the dispersion pattern of malaria endemicity should determine their intervention strategy. However, if they prioritize some other interests, the dispersion pattern of malaria endemicity may only be a coincidental factor of their intervention strategy.

The three factors for judging or determining the inclination of the interests of antimalarial partners (researchers and funders) in SSA are as follows: 1) the choice of their sites for FAMR, 2) the duration of FAMR in SSA, and 3) the dominance of the orthodoxy of biomedical and applied sciences over other complementary social sciences that could better analyze the contributions of the context-sensitive non-biological malaria vector factors. The abundance and wide variation of the non-biological malaria vector factors in SSA indicate that a single-handed *monodisciplinary* antimalarial endeavour in that part of the world can neither be effective nor efficient.

Notwithstanding all this, most antimalarial funders in SSA still initiate or endorse area-specific antimalarial programs with selective antimalarial interventions strategies (Druetz, 2018). Thus, they initiate most FAMR activities in some specific countries for specific reasons other than the intensity of malaria endemicity (Golding et al., 2017; Puppalwar et al., 2015). This situation

occurs when the desire for enormous economic profits, high scientific certainty, or a dodging of longer administrative procedures supersede the goal to relieve the health vulnerability of malaria hard-hit populations:

> While the cost and time to bring a new drug to market have intensified, the pressure to reduce the amount of time and cost to market, the fierce competition for patients due to increased regulatory requirements for licensure and recruiting across a broad range of patients has also increased. The escalating costs of the research and development of new drugs, as well as reduced access to large populations of treatment-naïve patients, has led the pharmaceutical industry to devise ways to reduce the time in getting the drugs licensed and approved in newer locations of sub-Saharan Africa (Puppalwar et al., 2015, p. 23).

Funders transmit this pressure down to researchers, which puts them under duress. It also generates competition among researchers, which makes it difficult for them to create enough research extensions and capture malaria variability across SSA. As such, they rush to some particular countries and towns where research centres or universities with ready-made databanks already exist. Often, they are directed through partnership affiliations with Western institutions that advertise and attract funding (Anisa et al., 2003; Gaskell et al., 2005; Golding et al., 2017). For example, "of the geographical distribution of global health partnerships with the 100 highest-ranked universities worldwide, Kenya, Tanzania, and Uganda have 43 partnerships" (Head et al., 2017, p. e777).

These partnerships have attracted many international healthcare research institutions to the eastern part of SSA where they have established their research affiliations. For example, the American Center for Disease Prevention and Control (CDC) concentrates its malaria research for

SSA in Tanzania, Malawi, and Kenya[17]. Thus, they often advertise, attract, and direct a good volume of antimalarial funding to countries in the eastern part of SSA, which disadvantages the malaria-endemic western part. I have corroborated these assertions with my findings and results above which show a concentration of FAMR activities in the eastern part of SSA (Tanzania, Uganda, Kenya, Malawi), while malaria endemicity is heaviest in the western part.

By extension, these imbalances tend to transmit or store less-representative information about the contextual realities of malaria infection in the Western part of SSA. As a consequence, they misinform the production process of malaria drugs, which in turn helps to create serious parasitic resistance in the dense malaria endemic countries in the Western part of SSA (Kouyate et al., 2007). As this vicious cycle has deteriorated unchecked to increase the malaria morbidity/mortality inequality-gap across SSA countries, malaria disease has become an illness of the poor—at the levels of society and individuals (Kouyate et al., 2007).

However, the intensity of human natural weakness—individuals and corporate bodies—is always manifested as situating their own interests at the forefront of any engagement. This is one of the reasons why ethical regulations are needed to rectify this weakness and ensure the good of all parties involved, including antimalarial stakeholders and partners, and vulnerable malarial victims. Moreover, to relieve this vulnerable situation, some of the governments of some SSA countries attract foreign antimalarial funders and build bilateral collaborations with foreign partners.

If these attractions are interwoven with good governance and transparency at the system level, it seems reasonable to believe that 1) either the countries in the Eastern part of SSA are better

[17] CDC's Global Malaria Activities – sub-Saharan Africa https://www.cdc.gov/malaria/malaria_worldwide/cdc_activities/sub-saharan_africa.html (Accessed 18/11/2020).

governed and more transparent than those in the Western part, or 2) the Anglo-Saxon countries in SSA are more transparent than their Francophone counterparts. That notwithstanding, we need to establish an enabling antimalarial management outlook capable of taking the available antimalarial resources in SSA beyond such hurdles to relieve the malaria hard-hit populations. Such a care-centered mechanism would defy the socio-political odds with its main aim to relieve the health vulnerability of the malaria hard-hit populations and also ensure that their rights to *health for all*.

7.3. Managing Malaria Vulnerability in SSA with Empathy: Ethics of Care in Healthcare

Almost everyone in the world knows something about malaria, but few of them have a good knowledge of its complexities and inconveniences as a disease. In many parts of SSA, the term *malaria* has gone beyond describing a particular illness to becoming a generic term that describes some undesirable malaise or health discomfort in life. But dominantly funded and informed by healthcare partner organizations and pharmaceutical companies in the global North, malaria stakeholders in SSA often gather their intervention funds and define their intervention methods to satisfy their own aims.

According to the findings and results presented in Chapter 4, their aims and results often are too far away from the expected "master end," which defines the good of antimalarial endeavours in SSA that is to relieve malaria vulnerability. According to the teachings of the philosophy of health and the ethics of care in healthcare management and provision, the aims of healthcare providers can be predicted from the approach they use, and their aims can be evaluated by how far they deviate from the master end. This view is inspired by Aristotle:

> Every art and every kind of inquiry, and likewise every act and purpose, seems to aim at some good: and so it has been well said that the good is that at which everything aims. But a difference is observable among these aims or ends. What is aimed at is sometimes the exercise of a faculty, sometimes a certain result beyond that exercise. And where there is an end beyond the act, there the result is better than the exercise of the faculty. Now since there are many kinds of actions and many arts and sciences, it follows that there are many ends also; e.g., health […]. But when several of these are subordinated to some one art or science […] then the end of the master-art is always more desired than the ends of the subordinate arts, since these are pursued for its sake. And this is equally true whether the end in view be the mere exercise of a faculty or something beyond (Aristotle, 1893, p. 8).

7.3.1. Ethics of Care and Antimalarial Intervention in SSA: The Evolution of the Healthcare Approach

Most approaches to promote integrity in the provision of healthcare services are principle-based. Some philosophers and philosophies directly inspire laws that regulate these principle-based approaches in the management of healthcare systems. For example, with respect to input, the categorical imperatives of the German philosopher Immanuel Kant are the base of the deontological stem of a principle-based approach in healthcare. With respect to output, the utilitarian philosophy of the English philosopher Jeremy Bentham is the base of the consequential stem (Resnik, 2012b). These two schools of thought and their theories suggest that some healthcare actions are absolute professional duties. These stances relegate empathy-based emotions to the periphery of healthcare interventions where it struggles in vain with social justice to comfort vulnerability.

In the nineteenth century, either some aspects of the principle-based approach inspired some positivist ideologies, or positivism developed to enforce some aspects of the principle-based

approach. The two—principle-based approach and positivism—became too empirically strict with respect to laws and rules, and had little or no moral reference. The more this spirit animated healthcare management, the more healthcare services were performed mainly to satisfy professional obligations. This approach left no room for the emotion supported moral responsibility to care for the health and lives of health vulnerable populations (Lachman, 2012). The more biomedical professionals performed those services to honour their professional obligations, the more the responsibility for healthcare was removed from the healthcare professionals affiliated to behavioural sciences.

The Scottish philosopher Sir William David Ross summarized the principle-based healthcare approach as being defined by the terms *justice, beneficence, non-maleficence*, and *autonomy* (Beauchamp & Childress, 2013). Despite this rationale, the principle-based healthcare approach still received serious criticism from many directions. The non-clinical healthcare professionals criticized the principle-based healthcare approach because it rendered the provision procedure of most healthcare services as unemotional. For them, the impulses that uphold the healthcare professions should come from within professionals as moral agents rather than from external regulations which only require that healthcare professionals should satisfy the exigencies of their profession (Resnik, 2012b).

Many of these critics have emphasized that the happiness of the healthcare receiver should be the ultimate end of a healthcare intervention, an attitude that draws inspiration from Aristotle's (1983) *Nicomachean Ethics*. Thus, they advocate for a virtue-based healthcare approach because it is motivated by good character traits rather than predefined principles and rules (Resnik, 2012b). From another perspective, as mentioned in Chapter 3, advocates of interdisciplinary knowledge acquisition and provision, like Jürgen Habermas, also have criticized the principle-

based approach for being too narrow. Habermas argued that this approach was not flexible enough to include the constructive contributions from the human and behavioural sciences (Habermas, 1971).

In addition, the critics of the principle-based sciences have articulated different options or proposals. While Habermas argued for combined or interdisciplinary efforts, those with moral motivations advocated for a complete replacement of the principle-based approach with a virtue-based approach. Complete replacement has proven false because the two approaches have complementary merits in search of convergence. Principle-based and virtue-based approaches are complementary ways to subordinate ends that lead to wellbeing and happiness as the ultimate goal (Aristotle, 1893).

Over time, the ethics of care developed a responsibility-based approach to healthcare that converged the aspects of the two other approaches to promote healthcare management. The ethics of care and virtue ethics both have the ethics of empathy in common, which includes the responsibility to satisfy the interests of *self* and *others* in the light of the golden mean to attain the ultimate end—the happiness of the healthcare receiver (Aristotle, 1893; Pettersen, 2011). From this perspective, the ethics of care has been highly promoted in the theoretical analysis of various models of healthcare and other human sciences (Rondeau et al., 2015).

That notwithstanding, the concept of *care* still lacks a precise definition because of the confusion between *clinical caring* as in nursing, and *social caring* as a moral disposition to seek the happiness and wellbeing of the other. *Caring* or *care*, as used here, refers to moral feelings and dispositions that exhibit concern and empathy for others. Caring strongly influences context-sensitive transpersonal relationships and actions to satisfy the good, happiness, and wellbeing of others (Lachman, 2012). Generally, the *ethics of care* is the philosophical perspective

underpinning relational- and context-based approaches to morality and decision making. It assumes a two-way capacity to be the nature of morality and the norm of ethical theory (Dunn & Burton, 2013). While these relational- and context-based characteristics make the ethics of care a part of applied ethics, its emphasis on empathy makes it more of a philosophical virtue (Dine, 2020b).

Applied ethics uses a philosophical rationale to provide the ethics of care with the capacity to strive to maintain an interdependent world that meets everyone's needs. This capacity generates and enforces the internal motivation to fight against the idealization of self, and to accept the responsibility to care for the vulnerable (Sander-Staudt, 2020). The ethics of care uses this capacity to soften the static predefined principles of the principle-based approach, and equips all parties involved with the moral motivations to value human interconnectedness. Thus, it helps the ethics of care to manage relationships, professional or social, from a closer or relational dimension to minimize exploitation and hurt (Pettersen, 2011).

Over time, the central conception of the ethics of care has gained in substance, and has become diversified in perspective. Nevertheless, all the perspectives of the ethics of care aim at ameliorating human wellbeing and ensuring human happiness. From whatever dimension we examine the ethics of care and from whatever perspective we use it, its original reference in Carol Gilligan's (1982) *In a Different Voice: Psychological Theory and Women's Development* always holds. Gilligan developed the idea of the ethics of care with the concept of "a different voice" to underscore female identity in moral development, and her initial point was made not from an ethics or philosophy perspective, but from the perspective of the psychology of human development and interaction (Slote, 2007).

According to her original perspective, the ethics of care is grounded in the premise that all humans are relational and responsive beings, characterized by connectedness and interdependence (Gilligan, 2008; Slote, 2007). Gilligan argued against and discouraged the use of the philosophy that supports the impartial deliberations on ethical issues that characterize the principle-based approach. She transformed moral theorizing and the psychological paradigm by promoting that care providers not feel independent and superior to those needing healthcare, but rather be open to feeling their own interconnections with their care receivers (Lachman, 2012). Initially, Gilligan only wanted to underscore some psychological differences in the way women approach the act of caring for others as compared to men (Slote, 2007). Thus, she contrasted the impartial justice perspectives of deontological and consequentialist moral theories by emphasizing the importance of context-based sensitivity, interdependence, relationships, and responsibility towards others (Koggel & Orme, 2010).

After Gilligan, Nel Noddings was one of the first to enlarge the substance of the ethics of care and open it to wider debates to what we now know as the ethics of care. Whereas Noddings defined the *ethics of care* as the sensitivity that renders human relationship with others, especially with the needy, emotional, and genuine (Slote, 2007), Joan Tronto enlarged this definition even further to include the sociopolitical perspective (Lachman, 2012). As relationship is central to the ethics of care, so it is absolutely essential to the ethics of care in healthcare provision. This focus on relationship helps healthcare providers to act in an ethically responsible way to the predictable needs of healthcare receivers (Dunn & Burton, 2013). With respect to the original conception of the ethics of care, we may mistakenly narrow this emphasis to intimacy between individuals, which is difficult to achieve at the level of global health issues, such as the case of malaria in

SSA, since antimalarial receivers are communities, and many of them are different and located at a distance from most antimalarial partners.

Thus, two difficulties emerge: 1) how to enlarge the intimacy recommended by the ethics of care from individuals to communities; and 2) how to exercise the ethics of care towards unknown people and those located far from most antimalarial providers. The ethics of care, as part of applied ethics, facilitates the development of intervention concepts, models, and methods to deal with situations in their respective magnitudes and contexts. In addressing challenging situations, this strategy activates a novel reading of the issues involved so to help conceive an approach that can address particular contextual-specific issues. Theorizing about care giving, in light of the insights of the ethics of care, can prompt new sets of pragmatic models and normative concepts that are different from those predefined by conventional theories (Pettersen, 2011).

Therefore, antimalarial stakeholders and partners must cultivate the spirit of empathy towards vulnerable malaria hard-hit populations, and widen their scope of 'concern for others' from individuals to communities so to target the communities in the greatest need. This dynamic is central in the moral self-education professed as the central teaching of the ethics of care (Pettersen, 2011). In the same way, the insights of the ethics of care help to develop emotional sensitivity in human beings. This emotional sensitivity conscientizes individuals to feel an obligation to care for others—near or distant, known or unknown—as an aspect of their moral responsibility towards humanity (Slote, 2007). This insight should motivate antimalarial funders and researchers to act as real philanthropists, and strive for the sole aim of relieving the health vulnerability of malaria victims in SSA. In this case, professional engagements are exercised as a vocational sacrifice by which professional satisfaction comes only when vulnerable malaria hard-hit populations benefit from these engagements.

7.3.2. Ethics of Care and Health Vulnerability: Empathy in Healthcare

We may be tempted to ask ourselves if the vulnerability of others emits any moral obligation in us (Rondeau, 2019). To begin, alongside the applied ethics that is still evolving, the ethics of care is enlarging in scope and influence. Thus, while many people still fasten the operationalization of the ethics of care as an emotional ethical theory of relationships that challenges normative impartial moral theories, I am taking it further to treat it as both ethical value and practice, and as the ethical guide to the action of caring (Held, 2006). This evolutionary stance highlights vulnerability, interdependence, caring-for, cared-for, based on deliberation to perceive/detect the needs of the cared-for and establish an adapted problem-solving mechanism in view of the wellbeing of the cared-for. The internal impulse to care for the needy and the vulnerable nourishes the natural inclination to care, thereby making this impulse obligatory in anyone who aspires as a caring person[18].

Thus, two points stand out: 1) the ethics of care in healthcare is neither confined to narrow relationships nor to abstract speculations about values; and 2) it does not operate as *top-down* nor *bottom-up* but simply as a normative ethical theory supported by contextual reality. Thus, the effectiveness of the ethics of care in healthcare needs wider and inclusive support from an enabling sociopolitical system towards the vulnerable. The idea of "vulnerability" invites the sociocultural insights of Robert Goodin into the realm of the ethics of care, and enlarges the concept of care. Goodin's theory of protecting the vulnerable has great potentials for various fields of applied ethics to promote interdependency as a source of moral responsibility, especially in an era where selfishness and egoism have evolved from vices to virtues (Enikő, 2016).

[18] See: https://www.britannica.com/topic/ethics-of-care (Accessed 20/06/2023).

Decisions about care delivery should be made on the moral basis towards the needs of the vulnerable so to avoid confrontations and complications.

From the sociopolitical perspective, Tronto also perceived the ethics of care from the wider dimension. Specifically, Tronto emphasized that our sociopolitical life should be framed by caring relationships, attentiveness, and responsibility for each other, especially the vulnerable (Lachman, 2012). This idea is a reminder of the sociopolitical philosophy of John Rawls in which he criticized the utilitarian views of Jeremy Bentham by emphasizing that we should instead fashion our policies to favour and care for the vulnerable (Rawls, 2005). From a similar perspective, the Nobel Prize Laureate economist Amartya Sen cautioned us to remember that human health is too wide and interwoven. He argued that health vulnerability was the result of inequalities in the human capacity to satisfy the health needs of all. For him, our health policies should be designed with the spirit of care to provide all people equal opportunities to achieve good health and avoid escapable morbidity and preventable mortality (Sen, 2002).

This analysis provides a perfect guide for the formation of the necessary ethical or moral mindset to fight against malaria in SSA, since malaria has become the disease of the poor (Kouyate et al., 2007). However, the issue of malaria in SSA is complicated both in content and context due to its many unpredictable and peculiar characteristics: 1) the geo-demographic variation in malaria vector factors across SSA countries disqualifies a uniform antimalarial intervention process; and 2) the weaker socioeconomic capability experienced by the majority of SSA countries aggravates the health vulnerability of their populations. At worst, the vulnerability in fragile domains like healthcare, within fragile economies like SSA, creates serious problems in the contemporary world because the concept of *vulnerability* has greatly evolved within interdisciplinary discourses

and across multidisciplinary domains to include more of the *on-the-ground reality* (Engster, 2019).

While health vulnerability is a natural characteristic of every human being who is exposed to potential harm (Mackenzie et al., 2014), it is greater for those with lesser-than-enough capabilities to prevent the actualization of potential harm (Dine, 2020b). Thus, *health vulnerability* refers to a state of being exposed to potential health harms without any foreseeable possibility of avoiding them (ten Have, 2016). Thus, health vulnerability engenders dependency on others and provokes a moral obligation to help and prevent the potential harm (Mackenzie et al., 2014). The people in this situation are vulnerable because health vulnerability confines them to being vulnerable dependents, and dependency makes them vulnerable to potential exploitation.

Therefore, any healthcare intervention in a situation of health vulnerability must aim at minimizing the level of vulnerability among populations because health vulnerability often connects health inequalities. Thus, many ethicists have criticized the principle-based approach to healthcare for being too impartial to minimize health inequalities and relieve health vulnerability (Bramer, 2010). Many critics of the principle-based approach see it as inflexible because it has a strict philosophy with static expectations. Whereas categorical imperatives underpin the principle-based approach to healthcare, imposed through deontological theory (Formosa, 2014), hedonic/pleasure sentiments motivate its expectations through consequential theory (Sinnott-Armstrong, 2015).

To that effect, the ethics of care in healthcare stress that healthcare professionals should cultivate a spirit of empathy towards the vulnerable (van Dijke, van Nistelrooij, Bos, & Duyndam, 2019). This spirit can animate a high degree of attentiveness and responsiveness to the vulnerable (Nair, 2005) and can activate a sense of responsibility towards their wellbeing (Held, 2007). As

mentioned previously, an ethical framework is needed to condition or conscientize ethics committees to question the effectiveness of healthcare equity in various protocols. This is exactly the spirit needed to boost antimalarial interventions in SSA, and ensure equitable equality in malaria decline across SSA countries.

7.3.3. Ethics of Care and Malaria Vulnerability in SSA

Most of the aspects of health vulnerability mentioned above describe the situation of malaria in SSA. From a socio-epidemiological perspective, dense geographical heterogeneity exists in malaria endemicity, and cross-country inequalities in its morbidity and mortality in SSA. From a socioeconomic perspective, the malaria-related health crises in SSA are more serious among the populations with limited or weaker economic capabilities. Thus, many of them are unable to prevent or avoid various malaria calamities.

In the same way, most healthcare intervention defects and shortcomings mentioned above represent the defects and shortcomings of antimalarial interventions in SSA. For decades, FAMRs carried out in SSA have inversely related with malaria endemicity by skipping malaria endemic countries. As consequence, malaria calamities (morbidity and mortality) have increased in many malaria-endemic countries in SSA because of rampant antimalarial drug resistance. This situation provokes empathy, which substantiates the necessity for an ethics of care in healthcare to animate the antimalarial intervention processes in SSA.

I am not suggesting that we should completely replace various conventional healthcare principles that guide antimalarial interventions in SSA, but rather enforce them with the insights from the ethics of care. This approach will help in the design of an antimalarial intervention process that takes account of contextual realities and animates interactive relationships (visible or invisible,

near or far) with empathetic emotions (Collins, 2015). Thus, while professional imperatives would support the intervention process regarding its scientific validity, outcomes would be monitored with regard to the extent to which they relieve vulnerability.

Although possibilities of corruption or professional malpractice exist, especially when researchers and/or committee members connive and validate unauthentic findings and results, I have taken for granted that, everything being equal, they still could be conscientized by the insights of the ethics of care put forward in an ethical guide. In that scenario, empathetic emotions could inspire antimalarial stakeholders and partners in SSA to develop cordial relationships with malaria victims, and assume a moral responsibility to help them in their contextual realities (Dunn & Burton, 2013). These stakeholders and partners also need the spirit of care to develop empathetic emotions towards malaria hard-hit populations. This spirit would encourage them to perceive and target the heterogeneity of malaria endemicity and its vulnerability.

The ethics of care could enhance knowledge of the contextual realities of malaria intensity, which relate to antimalarial capability, and help to consolidate empathetic relationships and arouse an emotional responsibility to care (Collins, 2015). According to the ethics of care in healthcare, decision-making should be based on deliberation rather than the mere application of principles and rules (Slote, 2007) so to detect and help the vulnerable (Goodin, 1986; Rawls, 2005). Thus, antimalarial stakeholders and partners in SSA should strive to direct FAMR to detect and relieve the vulnerable victims of malaria, and so provide them with the opportunity to escape avoidable morbidity and preventable mortality (Sen, 2002).

I am endorsing that we ought to guide the antimalarial intervention process in SSA—from FAMR to drug production/distribution—with the four key guidelines of the applied ethics. First, the

intervention process must commence with a context-sensitive deliberation to evoke and create empathetic relationship with the vulnerable. Second, this relationship with the vulnerable must be a representative paradigm of moral duties. Third, this moral duty must be animated or galvanized by the attitude of caring. Fourth, the main aim of an intervention process based on an attitude of caring must be for the interest/benefit of the vulnerable (Collins, 2015).

These guidelines must jointly function as complements and guide the intervention process as a single process, all stages put together. According to the exigencies of the theory of ethical governance in healthcare, which is the main theory of this thesis, the antimalarial intervention process in SSA ought to be sequentially procedural. As per these guidelines, the antimalarial partners destined for SSA (funders and researchers) must begin their intervention process by practically acquiring all the necessary contextual information of SSA related to malaria. For example, it would be prudent to obtain context-sensitive answers to some questions beforehand: Where is malaria more endemic? Why is malaria more endemic in some countries than others? What other socio-ethical conditions define the populations of most of these malaria endemic countries? What tools or strategies are needed to intervene and be beneficial to the greater fraction of the malaria hard-hit populations in SSA?

The pragmatic perspective of applied ethics develops on the conviction that although principles and values may be universal, their interpretation and application are context sensitive (Morris & Morris, 2016). Thus, should these guidelines animate the antimalarial intervention process in SSA, both antimalarial stakeholders and their partners could shun prototypes and instead deliberate to produce a fruitful analysis of context-based malaria realities. This approach would expose the heterogeneity of malaria endemicity, and its empathy-motivated moral duty to care for the vulnerable would locate interventions in the western part of SSA to minimize the health

inequalities and relieve the health vulnerability that exist in these countries. Moreover, this pragmatic approach could help to address the costs incurred and the time needed to complete the intervention process, as well as the credibility, reliability, and authenticity of this process.

To realize these goals, while minimizing costs and inconveniences, stakeholders also need to encourage local-based pharmaceutical scientists and companies to engage in intensive antimalarial intervention processes from research to drug production. The best way to achieve this may be to exploit local talents and knowledge, and, in turn, invest this knowledge according to contextual malaria realities, for example, as in the development of Mosquirix RTS,S. This may be one of the reasons why this antimalarial drug candidate is proving to be far more efficient than any foreign antimalarial drugs ever used in SSA (Aaby et al., 2015; Kakkilaya, 2015b).

However, a Western organization—the European Medicine Agency—still grants the authorization to venture in antimalarial drug production in or for SSA. Without suggesting that this Western organization might not be fair and efficient, one may simply be concerned that other factors like the ignorance of contextual malaria realities, professional negligence and oversight, or conflict of interest may overpower the moral spirit of the ethics of care *vis-à-vis* the degree of local health vulnerability. The advanced successes of Mosquirix RTS,S better substantiate the need for local healthcare pharmaceutical and biomedical scientists to spearhead the fight against malaria in SSA.

7.4. Conclusion

The objective I set for this chapter seemed unattainable, since it was difficult to ascertain whether the antimalarial weaknesses and failures in SSA were the fault of ignorance, professional negligence, or conflict of interest. However, two realizations encouraged me to set this objective.

First, ignorance, professional negligence, and conflict of interest are part of healthcare intervention impediments that often are rectified or discouraged by the ethical principles that guide the healthcare professions (Jaspers, Houtepen, & Horstman, 2013; Wahlberg et al., 2013). Second, when fighting against an unevenly distributed communicable disease like malaria in SSA, we must have background knowledge of its situation in neighbouring areas, which might be the reservoirs from which the disease comes or the destinations to where it might expand.

Thus, the first characteristic of global health intervention is preventive (Koplan et al., 2009), and so is the first characteristic of antimalarial intervention in SSA. In this research, I took a few observations for granted and developed my arguments on empathy-based conclusions: 1) that all antimalarial stakeholders and partners are moral agents in addition to being professionally apt health service providers directed by various ethical exigencies; 2) that all aspects of the antimalarial intervention process in SSA go through standard ethical checks and regulations; 3) that the intentions of antimalarial stakeholders and partners in SSA converge on the aim to relieve vulnerable malaria hard-hit populations. If these assertions are true, then neither ignorance, nor professional negligence, nor conflict of interest will derail the healthcare interventions in SSA.

My findings and results have proven that the objective I set for this chapter is pertinent. Unfortunately, many policymakers and healthcare stakeholders in many countries in SSA do not design their national healthcare policies and politics with an aim to relieve vulnerable populations (Puppalwar et al., 2015). In the same way, some antimalarial funders and researchers prioritize their interests over benefits to vulnerable populations, and promote area-specific FAMR (Druetz, 2018). These findings have convinced me of the pertinence of this objective for analyzing the real malaria situation in SSA.

I have difficulties in imagining that these weaknesses should stem from ignorance of the peculiarities of malaria in SSA, because many resources have provided knowledge to that effect. Moreover, guides to proper healthcare research procedures for SSA are available to avoid this kind of ignorance (Nyika, Kilama, Tangwa, Chilengi, & Tindana, 2009). For the same reason, the heterogeneity of the malaria infection pattern in SSA is well documented as demonstrated in the previous chapters. Also, to minimize the eventuality of such failures, numerous scientific publications exist on the socio-epidemiological and socio-ethical directives and indications for proficient antimalarial interventions in SSA (Ndebele & Musesengwa, 2012).

When I coupled these findings and results, I am enticed to attribute most of these antimalarial failures to professional negligence or conflict of interest, which is why I advocate that the responsibility-based conscientizing insights from the ethics of care should be highly influential with respect to antimalarial endeavours in SSA, so they can achieve efficiency. Above all, the continuous antimalarial intervention failures in SSA have converted malaria into an illness of the poor (Kouyate et al., 2007). The impetus of the ethics of care would enrich antimalarial stakeholders and partners to avoid basing antimalarial intervention on ontological or generalized vulnerability with the believe that everyone everywhere in SSA has the level of vulnerability to malaria. This may be true, but they need to be conscientized to strive to target situational or induced vulnerability from the highest degree because it either leads to or results from inequalities (Mackenzie et al., 2014; Rondeau, 2019). The more the vulnerable malaria infected populations increase, the more the lives of the less vulnerable populations is also endangered, and the vicious circle of vulnerability enlarges.

As already mentioned above, when this impetus facilitates the acquisition of context-based realities to relate malaria intensity with antimalarial capability, it arouses and consolidates

emotional responsibilities to care for the vulnerable (Collins, 2015). However, we need to widen this scope of antimalarial intervention parameters from relationships with individuals to relationships with communities and countries. However, more often than not, the ethical confidence level of the socio-political governance of various government systems in many countries in SSA either distracts or attracts partners. Reading from narrative presented in this research, healthcare intervention in SSA is depicts the post-colonial exhibition of the colonial inheritance.

Anglophone countries in SSA seem more receptive and conducive to foreign malaria partners—funders and researchers—as compared to francophone countries. For example, while the highest fraction of FAMR in SSA take place in the eastern part which is dominantly Anglo-Saxon, the situation of Ghana, fastened among struggling francophone countries in western SSA, is much better. Ghana is the lone country in western SSA that hosts the clinical trials of Mosquirix-RTS,S malaria vaccine candidate (Aaby et al., 2015). Thus, we also need to enforce the antimalarial intervention process in SSA with the insights from the theory of ethical governance in healthcare to produce context-sensitive malaria information and to design a context-sensitive intervention strategy.

The theory of ethical governance on healthcare provides an interdisciplinary dimension that enlarges the scope of the ethics of care from *filial* love to *agape* love, from family emotions to general emotions, and from self-interest to empathy towards the vulnerable. As such, it enlarges the understanding of *the cared for,* which is the object of compassion, to communities and countries. Then *care as value* provokes empathetic feeling for the vulnerable and galvanizes *care as action* to help the vulnerable and the needy (Held, 2006). This interdisciplinary dimension can facilitate an equitable antimalarial intervention process—from funding and research to drug

production and distribution—and ensure equitable equality in malaria decline across SSA countries.

An efficient antimalarial intervention in SSA needs inclusive interdisciplinary collaboration to subdue the intensive multidimensionality of the malaria vector factors in that part of the world (Deaton & Tortora, 2015; Williams & Jones, 2004). The two characteristics of what I mean by inclusive interdisciplinary collaboration in the antimalarial intervention process in SSA are as follows: 1) a situation in which domestic public health and antimalarial stakeholders work hand-in-glove with their international antimalarial partners for better results (Puppalwar et al., 2015) and 2) an intervention process in which social science professionals collaborate with applied science professionals to detect and target the intensity and pattern of malaria endemicity (Golding et al., 2017; Williams & Jones, 2004). Only a good combination of these skills and methods could guarantee successful malaria control in SSA (Heggenhougen et al., 2003).

Antimalarial intervention providers in SSA (stakeholders and partners) need to create and sustain a robust antimalarial research framework inspired by the ethics of care and enforced by the theory of ethical governance in healthcare. A robust antimalarial research framework will ensure the reliability of research findings and guarantee an equitable intervention orientation (Glickman et al., 2009). It also will help to identify and map out the malaria endemicity dispersion, its infection vector and concentrations, and the effectiveness of the intervention process (Druetz et al., 2020).

I hope the insights of this thesis will incite positive changes in the way antimalarial stakeholders and partners in SSA conceive and enforce their antimalarial intervention processes. I also hope that these insights will inspire other global health stakeholders and partners, and enrich the way they handle various health matters in a diversified world. Moreover, these insights are more

important at the level of research, which is the bedrock for efficient intervention and proficient drug production (Bhutta, 2002).

Chapter 8: General Evaluative Conclusion

8.1. Perspectives that Define this Research/Thesis

From a general perspective, I focused this research on health inequalities and diversity, in conjunction with health vulnerability. From a particular perspective, I used a multidimensional approach. First, I questioned and undertook an *effect to cause* investigation of the increasing malaria morbidity/mortality inequalities across countries in SSA. Second, I examined these increases as a phenomenon against the universality of human rights to *health for all.* Third, I demonstrated how these negative dynamics complicate the health vulnerability of the malaria hard-hit populations in that part of the world. Finally, I defined a possible solution pathfinding mechanism, and proposed an innovative antimalarial intervention strategy mainly modelled for SSA.

I framed the operationalization of this research—from input to output—within the exigencies of the theory of ethical governance in healthcare. This theory is interdisciplinary in its conception, context-based in content, mixed in its research approach, and investigative in its procedure. These characteristics empowered me to use each stage of this research to answer a pertinent question concerning the malaria situation in SSA. I determined the question for subsequent stages from the answer to the question of the previous stage with an aim to satisfy adequacy and coherence in material search and in the presentation of facts.

I conceived this research project from observing that, despite the decades of multidimensional antimalarial activities in SSA, positive feedback from these interventions was rare. First, malaria endemic countries in SSA are still becoming holoendemic and recording increases in their

malaria morbidity, meanwhile this negative dynamic undermines the ethics of human rights to *health for all*. Second, these countries also are still continuing to record drastic increases in malaria-caused deaths and related comorbidities as their citizens, who live in squalor, become vulnerable to all types of malaria frailties. Third, while this situation maintains the presence of active of malaria in SSA, the malaria morbidity/mortality inequality-gap between countries in SSA increases.

These antimalarial dynamics in SSA inspired me to search for causes, where these causes originate from, and why these particular causes. Are they due to lack of funds or funding? My findings and results showed that up to US$ 3.1 billion[19] in antimalarial funding had been invested in SSA as of 2017. Although a larger amount of funding is needed to enforce antimalarial endeavours in SSA, I still wondered whether the antimalarial results recorded in SSA were worth the amounts of money already invested. However, I also knew that funding alone might not achieve the needed results without the antimalarial research that is the bedrock of any efficient fight against malaria in SSA (Bhutta, 2002; Hammer et al., 2006).

Therefore, I questioned whether this situation was due to a lack of antimalarial research activities in SSA. To provide a possible answer, I considered the following two points: 1) that since funding needs research to achieve its aims and research needs funding to be efficient, I treated them together as FAMR; 2) that whether it is the same in all health situations defined by inequalities as it is in the case of malaria in SSA, the positioning strategy of FAMR is as important as its number. My research has shown that FAMR activities must target malaria inequalities to produce representative data and help the intervention process to attain equitable equality and satisfy the ethics of human rights to *health for all*.

[19] See http://www.who.int/news-room/fact-sheets/detail/malaria (Accessed 21/05/2018).

My research findings and results, which I have limited only to the era of the Millennium Development Goals, show that more than or equal to 1,061 FAMR activities were carried out in SSA during that period. With an average of 28 FAMR activities for each of the 38 countries I examined, I concluded that this number could produce representative results. Then, I determined whether the number of FAMR activities that could produce representative data really targeted malaria inequalities. In other words, I wanted to know whether their positioning strategy (where they were located) was proportional to the heterogeneity of malaria endemicity across countries in SSA.

Thus, when I mapped these FAMR activities with the MIR/^{000} of each of the 38 countries, my results showed an inverse relationship. These results reveal three invisible lapses that affect the fight against malaria in SSA: 1) antimalarial stakeholders and partners in SSA pay less attention to contextual realities given the great variations in malaria vector factors; 2) little or no attention has been paid to harmonizing the benefits to populations and the interests of stakeholders and partners; and 3) the needed interdisciplinary or inter-professional collaboration within the antimalarial intervention process in SSA is either non-existent or fragile. Consequently, the fight against malaria in SSA has been unable to facilitate the universal call for human rights to health for all, and this failure disfavours the malaria hard-hit populations (WHO & OHCHR, 2008).

How could this situation be reversed? To answer this question, I presented the insights of the theory of ethical governance in healthcare as an excellent operational guide to ensure the efficiency of the antimalarial intervention in SSA. From a general perspective, I demonstrated how this theory harmonizes deontological principles and diversity with an interdisciplinary approach (Ritvo et al., 2004). This strategy provides an orientation to healthcare interventions that can confront and subdue health inequalities, and satisfy the universality of human rights to

health for all. From a particular perspective, I demonstrated how this theory could empower antimalarial interventions in SSA with a pragmatic approach of applied ethics as the pivot of the intervention process.

Then, I harmonized these perspectives to establish the *greatest-need target antimalarial intervention strategy* as the prospective antimalarial intervention strategy for SSA. That notwithstanding, the socio-ethical perspective of this research still urged me to determine what factors might have derailed antimalarial interventions from considering the realities of malaria endemicity. In other words, from a socio-ethical perspective, I needed to know why the socio-epidemiological perspective had not been the target of FAMR initiatives in SSA. I had to determine whether this oversight was the fault of the ignorance of contextual realities, or professional negligence, or conflict of interest. I found that whereas some domestic health stakeholders did not design their healthcare policies to attract partners to help their vulnerable citizens, some other partners (funders and researchers) prioritized other interests than getting necessary aid to vulnerable malaria hard-hit populations.

To this effect, I discovered that many sympathizers to this state of affairs already had admonished African countries to take up the responsibility to enact and promote health policies and politics that would benefit their citizenry (Resnik, 2012a). The same caution was directed to pharmaceutical companies that if they wanted to help Africans fight malaria in their countries, they should exercise ethical vigilance in finding health solutions with optimum care not to create heavier social problems (Resnik, 2002). Thus, I emphasized the need to inculcate the ethics of care in the fight against malaria in SSA to reenforce the principle-based scientific approach with an empathy-based responsibility approach, which would help to stimulate emotional feelings and a responsibility of care to help vulnerable malaria hard-hit populations.

8.2. The Pivotal Role of Applied Ethics in this Research

As mentioned above, I used applied ethics to evaluate the antimalarial intervention process in SSA, and to determine how this process could be ameliorated. That is, how we can fight against malaria in SSA as a communicable disease characterized by uneven prevalence across countries in that part of the world. From an idealistic point of view, I consider applied ethics to be a bundle of directions that give practical orientation to scientific methods in complicated health situations, such as the case of malaria in SSA. From a realistic point of view, human beings have an intrinsic inclination to direct their reasoning towards a defined aim that they interpret and understand in the light of outstanding values. By exploiting the joint influence of these two points of view, the contextual realities of malaria in SSA can be apprehended.

In turn, this knowledge enhances the modelling of an appropriate antimalarial intervention strategy to minimize malaria inequalities and relieve the vulnerability of malaria hard-hit populations. While the idealistic dimension highlights the objectives that can be achieved through an impartial antimalarial intervention strategy in SSA, the realistic dimension indicates how those objectives can be achieved amid the heterogeneity of malaria endemicity. The latter shows how malaria vulnerability and calamities in SSA are tempered with the health rights of malaria hard-hit populations, and also indicates how this situation can be mitigated.

This analysis shows why I presented interdisciplinary engagements and context sensitivity as indispensable for ensuring antimalarial intervention efficiency in SSA. Thus, I framed this pivotal role of applied ethics with the concepts of interdisciplinarity and contextualization. *Interdisciplinary engagement* in antimalarial intervention process refers to the inclusive collaboration between the applied and social sciences (Golding et al., 2017; Williams & Jones,

2004), and between the biomedical and behavioural sciences (Deaton & Tortora, 2015). As much as these combinations help to detect the malaria infection vector, they also help in the design of an appropriate antimalarial intervention strategy.

Appropriate strategies to enhance antimalarial intervention process in SSA must combine the skills and methods of anthropology (Bibeau, 1997; White, 2011), the environmental sciences, and molecular biology (Heggenhougen et al., 2003). Notwithstanding, a successful interdisciplinary collaboration in the fight against malaria in SSA must rely on an intensive contextualization process (Rondeau, 2007) to apprehend various malaria peculiarities in that part of the world. To enhance this contextualization process, an antimalarial intervention strategy should be designed to conform to the contextual realities of plasmodium prevalence in SSA (Heggenhougen et al., 2003; Snow et al., 1999; Um et al., 2015).

This explanation justifies the assertion that various antimalarial endeavours in SSA have failed to obtain satisfactory results because "they have not been well adapted to local situations" (Heggenhougen et al., 2003, p. 9). If this is the case, ignorance is to blame. But if I accepted this explanation as true, I would equally accuse professional negligence, since good knowledge of contextual realities should be necessary for designing a successful healthcare intervention process. Thus, any healthcare intervention development in SSA that refuses to integrate the unavoidable relativity of local situations into its formulation will fail (Asouzu, 2005).

As I have demonstrated throughout this research with the case of antimalarial intervention in SSA, professional excellence in any healthcare activities must not only follow deontological principles/laws, but must also fashion an *ethos* that links intervention activities with context-sensitive values, principles, and virtues (A. Cortina et al., 2017). In delivering healthcare services, we always are confronted with the inherent dilemma of weighing competing values like

justice and care, benefits and interests, equity and equality. However, if we properly apply the insights from the theory of ethical governance in healthcare to guide our intervention processes, success will follow.

Importantly, applying the insights of the theory of ethical governance in healthcare to the fight against malaria in SSA helps to answer various context-sensitive questions. This process would engage ethical integrity in the fight against malaria destitution, and direct the empathy of the ethics of care to helping vulnerable malaria hard-hit populations (Zeng & Resnik, 2010). The theory of applied ethics helps, in the words of James Orbinski, "to initiate action with explicit moral [ethical] reasoning and to evaluate outcomes from both objective and moral [ethical] perspectives in order to improve our future choices and actions" (A. Pinto & Upshur, 2013, p. x).

Moreover, as Kurt Bayertz pointed out in (A. Cortina et al., 2017), applied ethics takes knowledge to context and context to knowledge. First, the paradigmatic subject of applied ethics is not action but actor. Second, the aim of applied ethics is not knowledge advancement but recommendations for practical advancement. Third, the operationalization process of applied ethics does not occur in solitude but within a contextual and interdisciplinary framework. Fourth, the end-product of applied ethics is not a written text, but rather a directive protocol addressed to and for the whole community. Thus, the impetus of the fight against malaria highlighted in the present research project is an aspect of humanitarianism that "stands in contrast to the more mainstream apolitical view of medical emergency relief that does not engage in the broader analysis of the socio-political causes of health vulnerabilities" (Chung, 2012, p. 49) mainly to save lives.

My profound analysis in this research gave me greater insight into global health because its scientific output is as wide as its conceptual input. Thus, I was happy presenting it as my

scientific contribution towards the advancement of global health. On the one hand, the fight against malaria in SSA represents one of the notorious longstanding difficulties in global health engagement among or for the vulnerable in the Global South. On the other, it also shows how global health is constrained in fighting health inequalities that are encountered in every human society. But what is the scientific relevance of the present research in the wider realm of global health research and engagement?

8.3. Evaluation: Relevance and Contribution to Global Healthcare

I intended the background message of this research to remind stakeholders that the concept of *global health* was conceived and commissioned to override the oversight of Colonial Medicine and International Health so to overcome health inequalities throughout the world (Gray, 1982; A. Pinto & Upshur, 2013). In other words, global health was initiated to put in place a medium through which preventive healthcare measures could be channelled to fight and minimize health inequalities and move towards equitable health equality (Koplan et al., 2009).

This philosophy had been theorized for centuries, but its practical implementation has been hesitant. One of the declarations of the world international conference on primary healthcare that took place in Alma Ata (Declaration of Alma Ata) expressed the urgent need to put this philosophy into action. First, this document cautioned all governments, the WHO, UNICEF, and the world community to engage collaborative forces to fight against the gross inequalities across and within countries. Second, it reminded them to protect and promote the health of all the peoples of the world, especially those in the Developing World. Third, it emphasized the need to attain the global goal of *health for all* by the year 2000 (WHO, 1978).

This conference was held in 1978, and its participants—global health stakeholders and partners—foresaw the possibility of health for all by the year 2000. Failure to realize the resolutions of Alma Ata after 4 decades, despite emphasis exerted through the Millennium Development Goals, a similar conference again took place in Astana (Declaration of Astana) in 2018 to commission this same responsibility to Sustainable Development Goals (WHO & UNICEF, 2018). Above all, global health also was expected to supplement the health of the worst-off vulnerable citizens and communities in low- and middle-income countries (LMICs) (de Campos, 2017). Thus, I used this research to determine why SSA is still overwhelmed by heavy malaria calamities within a global health disequilibrium. At worst, as already mentioned in the previous chapter, children in many parts of SSA are still more than 15 times likely to die before their fifth anniversary than their age mates in many other parts of the world (Barreto, 2017).

From the socio-anthropological perspective of health, I used diversity across SSA to depict diversity across the world. From the socio-epidemiological perspective of health, I used malaria morbidity and mortality inequalities across countries in SSA to show the intensity of health inequalities across the world. From the socio-ethical dimension, I demonstrated that not all aspects of health inequalities are determined by biomedical investigations, and that not all healthcare intervention strategies must be guided solely by deontological principles.

While most aspects of health inequalities are influenced by their context, most intervention strategies to minimize these health inequalities need the spirit of care and benevolence. This is the case because health inequalities, such as the malaria situation in SSA, disfavour populations or communities with limited capabilities, both economic and scientific. Benevolence is needed in global healthcare to take the needed interventions to the vulnerable/the poor (de Campos, 2017). Also, the spirit of care is needed to regulate justice with empathy, so the health *need* of the

populations becomes the determining factor for deciding about the locations of the interventions (Dine, 2020b). Thus, any health intervention that attempts to minimize inequalities must be equitable in input and equal in output to attain equitable health equality in outcomes (Jasso, 2015).

In all global health matters, an equitable healthcare intervention must be based on equitable and strategic research as the bedrock for obtaining representative data and for guiding the intervention process (Bhutta, 2002). However, "such data are often not available in developing countries, particularly in sub-Saharan Africa (SSA)" (Hammer et al., 2006, np.). As per my findings, this observation still holds for malaria interventions in SSA, which means that antimalarial services and resources do not get to the needy of that part of the world. Thus, health vulnerability worsens, as is demonstrated in Chapter 4, because this lack of services undermines human rights to health for all.

The following questions may help global health stakeholders to consider how to achieve an equitable healthcare intervention: 1) Who cares about the healthcare misconceptions and failures in LMICs like those in SSA? 2) Are these failures due to ignorance or do we not care about them because of ignorance? 3) Are these failures signs of professional negligence? 4) Or are they the effects of conflicts of interest? If we determine which one of these negative attributes—ignorance, professional negligence, conflict of interest—is responsible, how do we rectify the situation? Provided that many other LMICs experience the same failures, what should we do to achieve success?

According to my evaluation based on my research, we need to put in place a specific Global Health Research Ethics Framework to oversee global healthcare research. As such, health

research ethics committees will have an official tool and backing to emphasize health inequities *vis-à-vis* health inequalities when evaluating global health research protocols. This framework also would conscientize funders and researchers to target health inequalities in their global healthcare engagements. Cautious stakeholders could even use statistical balance establish a point of convergence between the interests of partners and the benefits to populations, since the ethical values of any global health research include statistical values. That is, "[w]hen evaluating research projects from an ethical and scientific point of view, such committees should also consider whether statistical methods have been used properly" (Atici & Erdemir, 2008, p. 297).

Such a universal tool would help research ethics committees to enforce the fight against *health inequities* so to minimize *health inequalities* and *health vulnerability,* thereby ensuring *health for all*. This tool also could be used to attain interdisciplinary collaboration in global healthcare engagements, and to emphasize contextual sensitivity in the intervention process. However, several guides already exist: the WHO's recommended guide for health researchers (Fathalla & Fathalla, 2004); the recommended guide for ethics committees (Karlberg & Speers, 2010); and WHO's publication entitled *Global Health Ethics* (WHO, 2015). Nevertheless, none of these documents show how to enforce the prevention of health inequities when targeting health inequalities, despite the importance.

This lacuna misinforms and misdirects many health professionals, and some healthcare researchers have tended to refer to global health as "public health somewhere else" (Turcotte-Tremblay, Fregonese, Kadio, Alam, & Merry, 2020, p. 1). In turn, such a notion complicates both the scope and the orientation of global health research and intervention, especially with the unpredictable communicable diseases like malaria. Funders may be more interested on *where* and *how* to direct their money to achieve fast results, and the desires or interests that condition a

misplaced "necessity" to relentlessly publish may pressure academics/researchers to rush their research projects (Ashuntantang, Luyckx, Naicker, & Venkatapuram, 2021). Therefore, stakeholders and ethics committees need a universal framework to help them deal with these disparate interests, so in the end, interventions also will benefit vulnerable communities.

The far-reaching perspective of my research has demonstrated that in the twenty-first century, we still do not have a substantial Global Health Research Ethics Framework to oversee global healthcare research amid diversity. Too, that no programs exist in academic circles to enforce a pragmatic interdisciplinary healthcare ethics. Such programs could clearly relate contextualization, pragmaticism, and deliberation to healthcare. First, as expressed in this research, contextualization brings knowledge to context and context to knowledge (A. Cortina et al., 2017) through context-sensitive equitable input for context-sensitive equal output. Second, pragmatism enables theories and principles to enhance practice, and guides practice with theories and principles to favour the vulnerable. Third, deliberation exploits contextual realities to manage the interpretation and application of universal healthcare principles in conformity with contextual variables. The ensemble of these concepts validates the fact that while healthcare virtues, theories and principles are universal and need each other, their interpretation and application "require situational appreciation" to be efficient (Morris & Morris, 2016, p. 203).

I have used the situation of malaria in SSA to reveal and underscore many significant and ignored lapses in global healthcare engagement in LMICs. Hopefully, my research will provide inspiration for many researchers to further develop the strategies for addressing health inequalities. Also, many researchers may use it to build and enlarge the scope of global healthcare, and that of antimalarial interventions in SSA. However, many healthcare researchers

also may construct critiques and criticisms, that also will enrich the field of global health research.

8.4. Evaluation: Research Limitations

In spite of the insightful development of this research, it has some limitations, though many of them are obvious because it is in the first generation of its kind. It is novel in its conceptual and theoretical frameworks, and also innovatively daring in its objective. I cannot attest to have seen any previous research projects that have demonstrated how to fight health inequalities to attain equitable health equality while also guarding diversity and avoiding health inequities. However, I acknowledge that this research would have been better if I had visited some or all of my six sampled countries in SSA for empirical data/information extraction. Unfortunately, this was not possible, mainly for economic reasons, since I never had any PhD scholarship or any other financial supports.

I know that proponents of empirical research might argue that a better understanding of the malaria dynamics in SSA could be achieved through in-the-field research in one country in that part of world. Although this view is not false, I included up to 38 countries (≥80% of countries in SSA) in my research, rather than just one, so to capture the wide heterogeneity and inequalities in malaria prevalence. Given that a malaria characteristic peculiar to SSA is the heterogeneous endemicity across regions and countries from east to west as previously demonstrated, no single country from that part of the world could validate any substantial and representative antimalarial data needed to realize the objective of this research. It is now from this point that this objective can be tested and substantiated in any one country in SSA.

Too, I know that all sampling processes always are directed towards an end. Thus, I took for granted that all the partners involved in any antimalarial activity in SSA have always had the desire to contribute towards malaria elimination in that part of the world and help alleviate the health vulnerability of the desperate populations. Therefore, my thesis has some of the weaknesses of all literature-based research, although it still is scientifically reliable. I am not inferring that I developed this research as a second-hand analysis of a published dataset, rather that I gathered the related information and established its statistical databank from literature sources. However, the basic information of this research is neither 'first-hand' nor the direct voices and narratives of the Indigenous populations in SSA, although I am Indigenous African myself.

As such, I know that the antimalarial intervention trajectory that I have proposed in this research might be different from the one that could be proposed by pure Indigenous culturalists in SSA. It is likely that the views of pure Indigenous culturalists in SSA, with respect to malaria treatment and elimination in that part of the world, would be parallel to biological and biomedical stances (White, 2017). Worst of all, many of them already might be discouraged by the seemingly obvious incapacity of modern medicine to overcome malaria, especially as Western healthcare partners do not seem to believe that any alternative endeavours against malaria would be better. In this research, I have treated various antimalarial measures as complementary.

To a great extent, this research should foster an advancement in the domain of scientific research and in global healthcare research. Although many parts of this research are based on proactive theories rather than empirical, it is a proficient base for efficient healthcare policymaking. Efficient healthcare interventions, especially in the Developing World, start from a theoretical analysis of the past to a proficient planning of the future before materializing in practical

interventions (Resnik, 2004). Also, theoretical knowledge is the basis for practice to gain substantial and ethical energy (Habermas, 1984). But though the daring objective of this research has gone beyond a simple demonstration of an intervention failure to proposing a corrective measure, it cannot satisfy all the goals of SMART.[20] As a theoretical proposal, it only satisfies the SMAR stem because it answers the questions of *where* and *how*, whereas it cannot satisfy the T since it cannot answer the question of *when* which belongs to the applied sciences.

Hopefully, the merits of this research have turned its few limitations into *footstools* for attaining efficient antimalarial interventions in SSA. Underneath this research, my emphasis on the necessity to implement equitable antimalarial intervention FAMR strategies in SSA is to ensure that the asymptomatic plasmodium carriers should be detected. I know that there is yet any scientific proof that detecting and targeting plasmodium carriers in SSA would bring a great positive change in that part of the world. However, this also is because the development of the interdisciplinary research methodology that could facilitate the orientation of malaria research to such dimensions as employed in this research is yet solid to help researchers. Notwithstanding that limitation, this research paves the way into that direction. As much as this research disfavours those who have been exploiting the vulnerability of malaria hard-hit populations in SSA for private interests, it favours these vulnerable populations and stimulates their hopes.

[20] SMART = Specific, Measurable, Adjustable, Realistic, and Timely.

Bibliographical References

Aaby, P., Rodrigues, A., Kofoed, P. E., & Benn, C. S. (2015). RTS,S/AS01 malaria vaccine and child mortality. *Lancet, 386*(10005), 1735-1736. doi:https://doi.org/10.1016/S0140-6736(15)00693-5

Adams, M., & Bell, L. A. (Eds.). (2016). *Teaching for diversity and social justice* (3rd ed.). New York: Routledge.

Agatiello, O. R., & Lamond, D. (2008). Ethical governance: beyond good practices and standards. *Management Decision, 46*(8), 1132-1145. doi:https://doi.org/10.1108/00251740810901345

Anisa, M., Abdallah, S. D., & Peter, A. S. (2003). 'Mind the gap': science and ethics in nanotechnology. *Nanotechnology, 14*(3), R9. doi:https://doi.org/10.1088/0957-4484/14/3/201

Aristotle. (1893). *Nicomachean Ethics* (F. H. Peters, Trans.). Oxford: Standard Ebooks.

Arku, G., Luginaah, I., Mkandawire, P., Baiden, P., & Asiedu, A. B. (2011). Housing and health in three contrasting neighbourhoods in Accra, Ghana. *Social Science & Medicine, 72*(11), 1864-1872. doi:https://doi.org/10.1016/j.socscimed.2011.03.023

Aromataris, E., & Munn, Z. (Eds.). (2017). *Joanna Briggs Institute Reviewer's Manual.*: The Joanna Briggs Institute. Available https://reviewersmanual.joannabriggs.org/ (Accessed 28/08/2019).

Arora, T., & Sharma, S. (2019). Global scenario of counterfeit antimalarials: A potntial threat. *Journal of Vector Borne Diseases, 56*(4), 288-294. doi:https://doi.org/10.4103/0972-9062.302030

Ashuntantang, G., Luyckx, V., Naicker, S., & Venkatapuram, S. (2021). Reform of research funding processes could pave the way for progress in global health. *The Lancet Global Health, 9*(8), e1053-e1054. doi:https://doi.org/10.1016/S2214-109X(21)00207-2

Asouzu, I. (2005). *The method and principles of complementary reflection in and beyond African philosophy* (Vol. 4): LIT Verlag Münster.

Atici, E., & Erdemir, A. D. (2008). Ethics in a scientific approach: the importance of the biostatistician in research ethics committees. *Journal of Medical Ethics, 34*(4), 297. doi:https://doi.org/10.1136/jme.2006.019349

Barreto, M. L. (2017). Health inequalities: a global perspective. *Ciência & Saúde Coletiva, 22*, 2097-2108. doi:https://doi.org/10.1590/1413-81232017227.02742017

Barrett, H., & Shantikumar, S. (2018). Analysis of Health and Disease in Small Areas. In H. K. Team (Ed.), *Public Health Textbook - Health Knowledge Education*. Retrieved from https://www.healthknowledge.org.uk/public-health-textbook/research-methods/1a-epidemiology/health-disease-analysis (Accessed 10/02/2022).

Beauchamp, T. L., & Childress, J. F. (2013). *Principles of Biomedical Ethics* (Seventh ed.). New York/Oxford: Oxford University Press.

Benatar, S. R. (1998). Global disparities in health and human rights: a critical commentary. *American Journal of Public Health, 88*(2), 295-300. doi:https://ajph.aphapublications.org/doi/pdf/10.2105/AJPH.88.2.295

Benatar, S. R., Daar, A. S., & Singer, P. A. (2003). Global health ethics: the rationale for mutual caring. *International Affairs, 79*(1), 107-138. doi:https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-2346.00298

Benelli, G., & Beier, J. C. (2017). Current vector control challenges in the fight against malaria. *Acta Tropica, 174*, 91-96. doi:https://doi.org/10.1016/j.actatropica.2017.06.028

Bhutta, Z. A. (2002). Ethics in international health research: a perspective from the developing world (Review). Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2567726/ (Accessed 03/08/2019). (0042-9686 (Print/Linking)). from WHO/PMC https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2567726/ (Accessed 03/08/2019).

Bibeau, G. (1997). At Work in the Fields of Public Health: The Abuse of Rationality. *Medical Anthropology Quarterly, 11*(2), 246-252. Retrieved from http://www.jstor.org/stable/649145

Bidima, J. G. (2018). Du consentement éclairé au «consentement négocié» en Afrique: points de suspension, ouvrons les guillemets…. *Revue française d'éthique appliquée, 1*(5), 81-94. doi:https://doi.org/10.3917/rfeap.005.0081

Bleich, S. N., Jarlenski, M. P., Bell, C. N., & LaVeist, T. A. (2012). Health inequalities: trends, progress, and policy. *Annu Rev Public Health, 33*(1), 7-40. doi:https://doi.org/10.1146/annurev-publhealth-031811-124658

Bollyky, T. J., Gostin, L. O., & Hamburg, M. A. (2020). The Equitable Distribution of COVID-19 Therapeutics and Vaccines. *JAMA, 323*(24), 2462-2463. doi:https://doi.org/10.1001/jama.2020.6641

Bramer, M. (2010). The Importance of Personal Relationships in Kantian Moral Theory: A Reply to Care Ethics. *Hypatia, 25*(1), 121-139. doi:https://doi.org/10.1111/j.1527-2001.2009.01087.x

Brannigan, M. C. (2012). Human Rights. In R. Chadwick (Ed.), *Encyclopedia of Applied Ethics (Second Edition)* (pp. 665-673). San Diego: Academic Press.

Braveman, P. (2006). Health disparities and health equity: concepts and measurement. *Annu Rev Public Health, 27*(1), 167-194. doi:http://dx.doi.org/10.1146/annurev.publhealth.27.021405.102103

Braveman, P. (2014). What are health disparities and health equity? We need to be clear. *Public Health Rep, 129 Suppl 2*(1_suppl2), 5-8. doi:https://doi.org/10.1177/00333549141291S203

Braveman, P., Arkin, E., Orleans, T., Proctor, D., & Plough, A. (2018). What is Health Equity? *Behaviorial Science & Policy, 4*(1), 1-14. doi:https://doi.org/10.1353/bsp.2018.0000

Braveman, P., & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology & Community Health, 57*(4), 254-258. doi:http://dx.doi.org/10.1136/jech.57.4.254

Braveman, P., Kumanyika, S., Fielding, J., Laveist, T., Borrell, L. N., Manderscheid, R., & Troutman, A. (2011). Health disparities and health equity: the issue is justice. *Am J Public Health, 101 Suppl 1*(S1), S149-155. doi:http://dx.doi.org/10.2105/AJPH.2010.300062

Braveman, P., & Tarimo, E. (2002). Social inequalities in health within countries: not only an issue for affluent nations. *Social Science & Medicine, 54*(11), 1621-1635. doi:https://doi.org/10.1016/S0277-9536(01)00331-8

Bronheim, S., & Goode, T. (2013). Documenting the Implementation of Cultural and Linguistic Competence: Guide for Maternal and Child Health Bureau Funded Training Programs. In G. U. C. f. C. a. H. Development (Ed.). Washington, DC: National Center for Cultural Competence.

Chan, L., McGarey, P., & Sclafani, J. A. (2018). Chapter 20 - Using Large Data Sets for Population-Based Health Research. In J. I. Gallin, F. P. Ognibene, & L. L. Johnson (Eds.), *Principles and Practice of Clinical Research (Fourth Edition)* (pp. 293-302). Boston: Academic Press.

Charani, E., Abimbola, S., Pai, M., Adeyi, O., Mendelson, M., Laxminarayan, R., & Rasheed, M. A. (2022). Funders: The missing link in equitable global health research? *PLOS Global Public Health, 2*(6), e0000583. doi:https://doi.org/10.1371/journal.pgph.0000583

Chung, R. (2012). A Theoretical Framework for a Comprehensive Approach to Medical Humanitarianism. *Public Health Ethics, 5*(1), 49-55. doi:https://doi.org/10.1093/phe/phs001

Cibulskis, R. E., Alonso, P., Aponte, J., Aregawi, M., Barrette, A., Bergeron, L., . . . Williams, R. (2016). Malaria: Global progress 2000 - 2015 and future challenges. *Infect Dis Poverty, 5*(1), 61. doi:http://dx.doi.org/10.1186/s40249-016-0151-8

Collins, S. (2015). *The Core of Care Ethics*. Manchester: Palgrave Macmillan UK.

Corbin, J., & Strauss, A. (2008). Basics of Qualitative Research (3rd ed.): Techniques and Procedures for Developing Grounded Theory. In. doi:10.4135/9781452230153

Cortina, A. (2017). The public task of applied ethics: Transnational civic ethics. In A. Cortina, D. García-Marzá, & J. Conill (Eds.), *Public Reason and Applied Ethics* (pp. 9-30). London/New York: Routledge - Taylor & Francis.

Cortina, A., García-Marzá, D., & Conill, J. (Eds.). (2017). *Public Reason and Applied Ethics: The Ways of Practical Reason in a Pluralist Society*. London/Now York: Routledge-Taylor & Francis.

Dambach, P., Traoré, I., Kaiser, A., Sié, A., Sauerborn, R., & Becker, N. (2016). Challenges of implementing a large scale larviciding campaign against malaria in rural Burkina Faso – lessons learned and recommendations derived from the EMIRA project. *BMC Public Health, 16*(1), 1023. doi:https://doi.org/10.1186/s12889-016-3587-7

de Campos, T. C. (2017). *The Global Health Crisis: Ethical Responsibilities* (Vol. 36). London: Cambridge University Press.

De Silva, P. M., & Marshall, J. M. (2012). Factors contributing to urban malaria transmission in sub-saharan Africa: a systematic review. *J Trop Med, 20*, 819563. doi:http://dx.doi.org/10.1155/2012/819563

Deaton, A. S., & Tortora, R. (2015). People in Sub-Saharan Africa rate their health and health care among the lowest in the world. *Health Affairs, 34*(3), 519-527. doi:https://doi.org/10.1377/hlthaff.2014.0798

Dine, C. B. (2020a). 'Responsible' in Global Health management: ingenious interdisciplinarity as relief to the epistemological complexity of transdisciplinarity. *Les chantiers de l'intervention en sciences humaines, 5*, 62-72. Retrieved from http://labrri.net/parution-du-nouveau-volume-de-la-revue-chantiers-de-lintervention-en-sciences-humaines-interdisciplinarite-pratique-et-action-professionnelle/. (Accessed 4/08/2020).

Dine, C. B. (2020b). Socio-ethical Dimension of COVID-19 Prevention Mechanism-The Triumph of Care Ethics. *Asian Bioethics Review, 12*(4), 539-550. doi:https://doi.org/10.1007/s41649-020-00143-1

Doolan, D. L., Dobano, C., & Baird, J. K. (2009). Acquired immunity to malaria. *Clin Microbiol Rev, 22*(1), 13-36. doi:http://dx.doi.org/10.1128/CMR.00025-08

Doshi, P. (2020). WHO's malaria vaccine study represents a "serious breach of international ethical standards". *BMJ, 368*, m734. doi:http://dx.doi.org/10.1136/bmj.m734

Drue, B., Ortmann, L., Dawson, A., Saenz, C., Reis, A., & Bolan, G. (2016a). Preface. In B. Drue, L. Ortmann, A. Dawson, C. Saenz, A. Reis, & G. Bolan (Eds.), *Public health ethics: Cases spanning the globe* (pp. xii - ix). Melbourne: Springer Open.

Drue, B., Ortmann, L., Dawson, A., Saenz, C., Reis, A., & Bolan, G. (2016b). *Public health ethics: Cases spanning the globe* (Vol. 3). Melbourne: Springer Nature.

Druetz, T. (2018). Integrated primary health care in low- and middle-income countries: a double challenge. *BMC Medical Ethics, 19*(1), 48. doi:https://doi.org/10.1186/s12910-018-0288-z

Druetz, T., Stresman, G., Ashton, R. A., van den Hoogen, L. L., Joseph, V., Fayette, C., . . . Eisele, T. P. (2020). Programmatic options for monitoring malaria in elimination settings: easy access group surveys to investigate Plasmodium falciparum epidemiology in two regions with differing endemicity in Haiti. *BMC medicine, 18*(1), 141. doi:https://doi.org/10.1186/s12916-020-01611-z

Dunn, C. P., & Burton, B. K. (2013). Ethics of Care. *Encyclopedia Britannica* Retrieved from https://www.britannica.com/topic/ethics-of-care (Accessed 22/01/2022).

Emmerich, N. (2018). Virtue and the Ethics of Social Research. In N. Emmerich (Ed.), *Virtue Ethics in the Conduct and Governance of Social Science Research* (Vol. 3). Bingley: Emerald Publishing Limited.

Engster, D. (2019). Care ethics, dependency, and vulnerability. *Ethics and Social Welfare, 13*(2), 100-114. doi:https://doi.org/10.1080/17496535.2018.1533029

Enikő, D. (2016). The principle of vulnerability and its potential applications in bioethics. *Ethics & Bioethics, 6*(3-4), 181-186. doi:https://doi.org/10.1515/ebce-2016-0017

Farahin Musa, N., & Khamis, N. (2015). Research Article Writing: A Review of a Complete Rhetorical Organisation. *Pertanika Journal of Social Science and Humanities, 23*(s), 111-122 - Retrived from https://www.researchgate.net/publication/289272333 (Accessed 289272320/289272306/289272020).

Fathalla, M. F., & Fathalla, M. M. (2004). *A practical guide for health researchers*: World Health Organization, Regional Office for the Eastern Mediterranean.

Ferguson, H. M., Dornhaus, A., Beeche, A., Borgemeister, C., Gottlieb, M., Mulla, M. S., . . . Killeen, G. F. (2010). Ecology: a prerequisite for malaria elimination and eradication. *PLoS Med, 7*(8), e1000303. doi:http://dx.doi.org/10.1371/journal.pmed.1000303

Formosa, P. (2014). The role of vulnerability in Kantian ethics. In C. Mackenzie, W. Rogers, & S. Dodds (Eds.), *Vulnerability: New essays in ethics and feminist philosophy* (pp. 88-109). New York: Oxford University Press.

Gaskell, G., Einsiedel, E., Hallman, W., Priest, S. H., Jackson, J., & Olsthoorn, J. (2005). Communication. Social values and the governance of science. *Science, 310*(5756), 1908-1909. doi:https://doi.org/10.1126/science.1119444

GHO. (2017). Annex B: Tables of health statistics by country, WHO region. *World Health Statistics* Retrieved from http://www.who.int/gho/en/ 20/08/2018.

Gilligan, C. (2008). *Une voix différente: pour une éthique du care*. Paris: Flammarion.

Glickman, S. W., McHutchison, J. G., Peterson, E. D., Cairns, C. B., Harrington, R. A., Califf, R. M., & Schulman, K. A. (2009). Ethical and scientific implications of the globalization of clinical research. *N Engl J Med, 360*(8), 816-823. doi:https://doi.org/10.1056/NEJMsb0803929

Golding, N., Burstein, R., Longbottom, J., Browne, A. J., Fullman, N., Osgood-Zimmerman, A., . . . Hay, S. I. (2017). Mapping under-5 and neonatal mortality in Africa, 2000-15: a baseline analysis for the Sustainable Development Goals. *Lancet, 390*(10108), 2171-2182. doi:https://dx.doi.org/10.1016/S0140-6736(17)31758-0

Goodin, R. E. (1986). *Protecting the Vulnerable: A Re-Analysis of Our Social Responsibilities*. Chocago: University of Chicago Press.

Gosling, R. D., Okell, L., Mosha, J., & Chandramohan, D. (2011). The role of antimalarial treatment in the elimination of malaria. *Clin Microbiol Infect, 17*(11), 1617-1623. doi:http://dx.doi.org/10.1111/j.1469-0691.2011.03660.x

Graham, H., & Kelly, M. P. (2004). *Health inequalities: concepts, frameworks and policy*. London: Citeseer/Health Development Agency.

Gray, A. M. (1982). Inequalities in health. The Black Report: a summary and comment. *Int J Health Serv, 12*(3), 349-380. doi:https://doi.org/10.2190/XXMM-JMQU-2A7Y-HX1E

Greenberg, J., & Cohen, R. L. (Eds.). (2014). *Equity and justice in social behavior*. New York, NY: Academic Press.

Gulland, A. (2012). Governments and drug companies pledge to eliminate 10 neglected tropical diseases by 2020. *BMJ: British Medical Journal, 344*. doi:https://doi.org/10.1136/bmj.e773

Habermas, J. (1971). *Knowledge and Human Interests* (J. J. Shapiro, Trans.). Boston: Beacon Press.

Habermas, J. (1984). *The theory of communicative action* (T. McCarthy, Trans. Vol. 1). Boston: Beacon.

Hadley, G. (2017). *Grounded Theory in Applied Linguistics Research: A Practical Guide*. New York: Routledge.

Hammer, G. P., Somé, F., Müller, O., Kynast-Wolf, G., Kouyaté, B., & Becher, H. (2006). Pattern of cause-specific childhood mortality in a malaria endemic area of Burkina Faso. *Malaria Journal, 5*(1), 47. doi:https://doi.org/10.1186/1475-2875-5-47

Hay, S. I., Omumbo, J. A., Craig, M. H., & Snow, R. W. (2000). Earth observation, geographic information systems and Plasmodium falciparum malaria in sub-Saharan Africa. *Advances in Parasitology, 47*, 173-215. doi:https://doi.org/10.1016/S0065-308X(00)47009-0

Hayes, A., & Westfall, P. (2020). Bayes' Theorem Definition. Retrieved from https://www.investopedia.com/terms/b/bayes-theorem.asp (Accessed 02/06/2021).

Head, M. G., Goss, S., Gelister, Y., Alegana, V., Brown, R. J., Clarke, S. C., . . . Tatem, A. J. (2017). Global funding trends for malaria research in sub-Saharan Africa: a systematic analysis. *Lancet Glob Health, 5*(8), e772-e781. doi:https://dx.doi.org/10.1016/S2214-109X(17)30245-0

Heggenhougen, H. K., Hackethal, V., & Vivek, P. (2003). *The behavioural and social aspects of malaria and its control* (Vol. 03). Geneva: WHO/UNDP/WB.

Held, V. (2006). *The ethics of care: Personal, political, and global*. Oxford: Oxford University Press.

Held, V. (2007). The Ethics of Care. In C. David (Ed.), *The Oxford Handbook of Ethical Theory*. London: Oxford University Press.

Hobbes, T. (1651). Leviathan. In E. W. a. D. Widger (Ed.), *Leviathan or the Matter, Forme, & Power of the Common-Wealth – Ecclesiastical and Civil*.

Holland, S. (2011). The virtue ethics approach to bioethics. *Bioethics, 25*(4), 192-201. doi:https://doi.org/10.1111/j.1467-8519.2009.01758.x

Hopkins, H., Daily, J., & Baron, E. (2015). Diagnosis of malaria. *UpToDate, Daily, J (Ed), UpToDate, Waltham: MA. http://www.uptodate.com/contents/diagnosis-of-malaria (Accessed 10/02/2017).* . Retrieved from http://www.uptodate.com/contents/diagnosis-of-malaria (Accessed 10/02/2017).

IHP. (2012). *Developing a Country Compact:What does it take and What are the gains?* Geneva: International Health Partners (ihp)

IHP. (2018). *Accelerating Political Momentum for Universal Health Coverage: UHC2030 Framework for Advocates*. Geneva: International Health Partners (IHP)

Jaspers, P., Houtepen, R., & Horstman, K. (2013). Ethical review: Standardizing procedures and local shaping of ethical review practices. *Soc Sci Med, 98*, 311-318. doi:https://doi.or/10.1016/j.socscimed.2013.03.043

Jasso, G. (2015). Inequality Analysis: Overview. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 885-893 / doi: https://doi.org/810.1016/B1978-1010-1008-097086-097088.032199-097087). Oxford: Elsevier.

Jehu-Appiah, C., Baltussen, R., Acquah, C., Aikins, M., d'Almeida, S. A., Bosu, W. K., . . . Adjei, S. (2008). Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis. *Value Health, 11*(7), 1081-1087. doi:http://dx.doi.org/10.1111/j.1524-4733.2008.00392.x

Joseph, K. T., Rice, K., & Li, C. (2016). Integrating Equity in a Public Health Funding Strategy. *J Public Health Manag Pract, 22 Suppl 1*, S68-76. doi:http://dx.doi.org/10.1097/PHH.0000000000000346

Joyce, J. (2019). Bayes' Theorem. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Vol. Spring 2019). Retrieved from https://plato.stanford.edu/entries/bayes-theorem/ (Accessed 28/11/2020).

Kakkilaya, B. S. (2015a). Malaria Vaccines. *Malaria Site.* Retrieved from https://www.malariasite.com/malaria-vaccines/ (Accessed 15/04/2021).

Kakkilaya, B. S. (2015b). Malaria Immunity. *Malaria Site.* Retrieved from https://www.malariasite.com/immunity/. (Accessed 20/11/2019).

Karlberg, J. P. E., & Speers, M. A. (2010). *Reviewing clinical trials: a guide for the ethics committee*. Hong Kong: Karlberg Johan Petter Einar.

Kawachi, I., Subramanian, S. V., & Almeida-Filho, N. (2002). A glossary for health inequalities. *J Epidemiol Community Health, 56*(9), 647-652. doi:https://doi.org/10.1136/jech.56.9.647

Keeling, M., & Bellefleur, O. (2016). *'Principlism'and Frameworks in Public Health Ethics*. Montréal: National Collaborating Centre for Healthy Public Policy: http://www.ncchpp.ca/docs/2016_Ethics_Principlism_En.pdf (Accessed 28/05/2021).

Kim, P. J. (2019). Social Determinants of Health Inequities in Indigenous Canadians Through a Life Course Approach to Colonialism and the Residential School System. *Health Equity, 3*(1), 378-381. doi:https://doi.org/10.1089/heq.2019.0041

Kivunja, C. (2018). Distinguishing between Theory, Theoretical Framework, and Conceptual Framework: A Systematic Review of Lessons from the Field. *International Journal of Higher Education, 7*(6). doi:https://doi.org/10.5430/ijhe.v7n6p44

Kneipp, S. M., Schwartz, T. A., Drevdahl, D. J., Canales, M. K., Santacroce, S., Santos, H. P., Jr., & Anderson, R. (2018). Trends in Health Disparities, Health Inequity, and Social Determinants of Health Research: A 17-Year Analysis of NINR, NCI, NHLBI, and NIMHD Funding. *Nurs Res, 67*(3), 231-241. doi:https://doi.org/10.1097/NNR.0000000000000278

Koggel, C., & Orme, J. (2010). Care ethics: New theories and applications. In (Vol. 4, pp. 109-114): Taylor & Francis.

Koplan, J. P., Bond, T. C., Merson, M. H., Reddy, K. S., Rodriguez, M. H., Sewankambo, N. K., & Wasserheit, J. N. (2009). Towards a common definition of global health. *The Lancet, 373*(9679), 1993-1995. doi:https://doi.org/10.1016/S0140-6736(09)60332-9

Kouyate, B., Sie, A., Ye, M., De Allegri, M., & Muller, O. (2007). The great failure of malaria control in Africa: a district perspective from Burkina Faso. *PLoS Med, 4*(6), e127. doi:https://doi.org/10.1371/journal.pmed.0040127

Kroeger-Mappes, J. (1994). The Ethic of Care vis-à-vis the Ethic of Rights: A Problem for Contemporary Moral Theory. *Hypatia, 9*(3), 108-131. doi:https://doi.org/10.1111/j.1527-2001.1994.tb00452.x

Lachman, V. D. (2012). Applying the ethics of care to your nursing practice. *MEDSURG Nursing, 21*(2), 112.

Laflamme, S. (2011). Recherche interdisciplinaire et réflexion sur l'interdisciplinarité. *Nouvelles perspectives en sciences sociales: revue internationale de systémique complexe et d'études relationnelles, 7*(1), 49-64. doi:https://doi.org/10.7202/1007081ar

Lane, H., Sarkies, M., Martin, J., & Haines, T. (2017). Equity in healthcare resource allocation decision making: A systematic review. *Soc Sci Med, 175*, 11-27. doi:https://doi.org/10.1016/j.socscimed.2016.12.012

Leon, D. A., Walt, G., & Gilson, L. (2001). Recent advances: International perspectives on health inequalities and policy. *BMJ, 322*(7286), 591-594. doi:http://dx.doi.org/10.1136/bmj.322.7286.591

Liow, E., Kassam, R., & Sekiwunga, R. (2017). Investigating unlicensed retail drug vendors' preparedness and knowledge about malaria: An exploratory study in rural Uganda. *Acta Trop, 174*, 9-18. doi:http://dx.doi.org/10.1016/j.actatropica.2017.06.008

Lury, C. (2018). Introduction: Activating the present of interdisciplinary methods. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods*. New York: Routledge.

Macer, D. R. J. (2006). *A cross-cultural introduction to bioethics*: Eubios Ethics Institute Prakanong, BangkokThailand.

Mackenbach, J. P. (2006). *Health inequalities: Europe in profile*. Rotterdam: Department of Public Health-Erasmus MC / European Union.

Mackenzie, C., Rogers, W., & Dodds, S. (2014). Introduction: What is vulnerability and why does it matter for moral theory. In C. Mackenzie, W. Rogers, & S. Dodds (Eds.), *Vulnerability: New essays in ethics and feminist philosophy* (pp. 1-29). New York: Oxford University Press.

Macklin, R. (2003). Bioethics, Vulnerability, and Protection. *Bioethics, 17*(5-6), 472-486. doi:https://doi.org/10.1111/1467-8519.00362

Mantwill, S., Monestel-Umana, S., & Schulz, P. J. (2015). The Relationship between Health Literacy and Health Disparities: A Systematic Review. *PLoS One, 10*(12), e0145455. doi:https://doi.org/10.1371/journal.pone.0145455

Marder, S. R., Laughren, T., & Romano, S. J. (2017). Why Are Innovative Drugs Failing in Phase III? *American Journal of Psychiatry, 174*(9), 829-831. doi:http://dx.doi.org/10.1176/appi.ajp.2017.17040426

Marmot, M. (2020). Health equity in England: the Marmot review 10 years on. *BMJ, 368*, m693. doi:https://doi.org/10.1136/bmj.m693

Mboera, L. E., Mazigo, H. D., Rumisha, S. F., & Kramer, R. A. (2013). Towards malaria elimination and its implication for vector control, disease management and livelihoods in Tanzania. Retrieved from www.malariaworld.org. (Accessed 20/05/2017). (2214-4374). www.malariaworld.org. (Accessed 20/05/2017).

Mkandawire, P., Luginaah, I., & Baxter, J. (2014). Growing up an orphan: vulnerability of adolescent girls to HIV in Malawi. *Transactions of the Institute of British Geographers, 39*(1), 128-139. doi:https://doi.org/10.1111/tran.12002

Mkandawire, P., Richmond, C., Dixon, J., Luginaah, I. N., & Tobias, J. (2013). Hepatitis B in Ghana's upper west region: A hidden epidemic in need of national policy attention. *Health & Place, 23*, 89-96. doi:https://doi.org/10.1016/j.healthplace.2013.06.001

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery, 8*(5), 336-341. doi:https://doi.org/10.1016/j.ijsu.2010.02.007

Monageng, M. (2006). The use of documentary research methods in social research. *African sociological review, 10*(1), 221-230. doi:pdf: https://codesria.org/IMG/pdf/Research_Report_-_Monageng_Mogalakwe.pdf

Morgan, L. D. (2014). Pragmatism as a Paradigm for Mixed Methods Research. In *Integrating Qualitative and Quantitative Methods: A Pragmatic Approach*. doi:https://dx.doi.org/10.4135/9781544304533

Morris, M. C., & Morris, J. Z. (2016). The importance of virtue ethics in the IRB. *Research Ethics, 12*(4), 201-216. doi:https://doi.org/10.1177/1747016116656023

Muller, O., Ye, M., Louis, V. R., & Sie, A. (2009). Malaria in sub-Saharan Africa. *Lancet, 373*(9658), 122. doi:http://dx.doi.org/10.1016/S0140-6736(09)60033-7

Mwangoka, G., Ogutu, B., Msambichaka, B., Mzee, T., Salim, N., Kafuruki, S., . . . Abdulla, S. (2013). Experience and challenges from clinical trials with malaria vaccines in Africa. *Malar J, 12*(1), 86. doi:http://dx.doi.org/10.1186/1475-2875-12-86

Mwenesi, H., Mbogo, C., Casamitjana, N., Castro, M. C., Itoe, M. A., Okonofua, F., & Tanner, M. (2022). Rethinking human resources and capacity building needs for malaria control and

elimination in Africa. *PLOS Global Public Health, 2*(5), e0000210. doi:https://doi.org/10.1371/journal.pgph.0000210

Nair, I. (2005). Ethics of care. In M. Carl (Ed.), *Encyclopedia of Science, Technology, and Ethics*. Detroit, MI: Macmillan Reference USA.

Najera, R. (2019). Malaria and Malaria Vaccine Candidates. *The History of Vaccines: An Educational Resources by The College of Physicians of Philadelphia.* Retrieved from https://ftp.historyofvaccines.org/content/articles/malaria-and-malaria-vaccine-candidates (Accessed 23/01/2021).

Ndebele, P., & Musesengwa, R. (2012). View point: Ethical dilemmas in malaria vector research in Africa: making the difficult choice between mosquito, science and humans. *Malawi medical journal: Journal of Malawian Medical Association, 24*(3), 65-68. doi:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3576825/ (Accessed 25/02/2022)

Nyika, A., Kilama, W., Tangwa, G. B., Chilengi, R., & Tindana, P. (2009). Capacity building of ethics review committees across Africa based on the results of a comprehensive needs assessment survey. *Dev World Bioeth, 9*(3), 149-156. doi:https://doi.org/10.1111/j.1471-8847.2008.00243.x

O'Meara, W. P., Mangeni, J. N., Steketee, R., & Greenwood, B. (2010). Changes in the burden of malaria in sub-Saharan Africa. *Lancet Infect Dis, 10*(8), 545-555. doi:https://doi.org/10.1016/S1473-3099(10)70096-7

Oliver, A., & Mossialos, E. (2004). Equity of access to health care: outlining the foundations for action. *J Epidemiol Community Health, 58*(8), 655-658. doi:https://doi.org/10.1136/jech.2003.017731

Omumbo, J. A., Noor, A. M., Fall, I. S., & Snow, R. W. (2013). How well are malaria maps used to design and finance malaria control in Africa? *PLoS One, 8*(1), e53198. doi:http://dx.doi.org/10.1371/journal.pone.0053198

Onwuegbuzie, A. J., & Leech, N. L. (2007). Sampling designs in qualitative research: Making the sampling process more public. *The qualitative report, 12*(2), 238-254. doi:https://doi.org/10.46743/2160-3715/2007.1636

Onyango, E. O., & Kangmennaang, J. (2020). Wellbeing in Place. In A. Kobayashi (Ed.), *International Encyclopedia of Human Geography (Second Edition)* (pp. 265-272). Oxford: Elsevier.

Orbinski, J. (2013). Foreword. In A. D. Pinto & R. Upshur (Eds.), *An Introduction to Global Health Ethics*. New York: Routledge.

Ortmann, L. W., Barrett, D. H., Saenz, C., Bernheim, R. G., Dawson, A., Valentine, J. A., & Reis, A. (2016). Public Health Ethics: Global Cases, Practice, and Context. In B. Drue, L. Ortmann, A. Dawson, C. Saenz, A. Reis, & G. Bolan (Eds.), *Public Health Ethics: Cases Spanning the Globe* (pp. 3-35). Melbourne: Springer Open.

Palmer, S., & Torgerson, D. J. (1999). Definitions of efficiency. *BMJ, 318*(7191), 1136. doi:https://doi.org/10.1136/bmj.318.7191.1136

Papaioannou, I., Utzinger, J., & Vounatsou, P. (2019). Malaria-anemia comorbidity prevalence as a measure of malaria-related deaths in sub-Saharan Africa. *Scientific Reports, 9*(1), 11323. doi:http://dx.doi.org/10.1038/s41598-019-47614-6

Paul, M. (2011). Are we losing the fight against malaria one more time? *Clinical Microbiology and Infection, 17*(11), 1593-1596. doi:https://doi.org/10.1111/j.1469-0691.2011.03666.x

Penny, M. A., Maire, N., Bever, C. A., Pemberton-Ross, P., Briet, O. J., Smith, D. L., . . . Smith, T. A. (2015). Distribution of malaria exposure in endemic countries in Africa considering country levels of effective treatment. *Malar J, 14*(1), 384. doi:http://dx.doi.org/10.1186/s12936-015-0864-3

Peter, F. (2004). Health Equity and Social Justice. In A. Sen, S. Ahmed, & F. Peter (Eds.), *Public health, ethics, and equity* (pp. 93-106). Oxford: Oxford University Press.

Pettersen, T. (2011). The ethics of care: normative structures and empirical implications. *Health care analysis : HCA : journal of health philosophy and policy, 19*(1), 51-64. doi:https://doi.org/10.1007/s10728-010-0163-7

Pinto, A., & Upshur, R. (2013). *An introduction to global health ethics*. New York: Routledge.

Pinto, A. D., Birn, A.-E., & Upshur, R. E. (2013). The context of global health ethics. In A. D. Pinto & R. E. Upshur (Eds.), *An Introduction to Global Health Ethics* (pp. 3-15). New York: Routledge.

Pinto, A. D., & Upshur, R. E. G. (2009). GLOBAL HEALTH ETHICS FOR STUDENTS. *Developing World Bioethics, 9*(1), 1-10. doi:https://doi.org/10.1111/j.1471-8847.2007.00209.x

Plewes, K., Leopold, S. J., Kingston, H. W. F., & Dondorp, A. M. (2019). Malaria: What's New in the Management of Malaria? *Infectious Disease Clinics of North America, 33*(1), 39-60. doi:https://doi.org/10.1016/j.idc.2018.10.002

Poliquin, H. (2015). Analyse critique et dimensionnelle du concept de santéisation. *Aporia, 7*(1), 17-29.

Price, P., Jhangiani, R., & Chiang, I. (2015). *Research Methods of Psychology* (Vol. 2nd Canadian Edition). Victoria (B.C.): B.C. University Press.

Puppalwar, G., Mourya, M., Kadhe, G., & Mane, A. (2015). Conducting clinical trials in emerging markets of sub-Saharan Africa: review of guidelines and resources for foreign sponsors. *Open Access J Clin Trials, 7*, 23-34. doi:https://dx.doi.org/10.2147/OAJCT.S77316

Ratner, L. W. (2003). Part V - Philosophy and Logic of Physical Theory. In L. W. Ratner (Ed.), *Non-Linear Theory of Elasticity and Optimal Design* (pp. 155-261). Amsterdam: Elsevier Science.

Rawaf, S. (2017). Health Inequities: Can it be Addressed Through Health System Reforms? *Shiraz E-Medical Journal, 18*(11), e62554. doi:https://doi.org/10.5812/semj.62554

Rawls, J. (2005). *A theory of justice* (Original ed.). Cambridge: Belknap/Harvard University Press.

Recht, J., Siqueira, A. M., Monteiro, W. M., Herrera, S. M., Herrera, S., & Lacerda, M. V. G. (2017). Malaria in Brazil, Colombia, Peru and Venezuela: current challenges in malaria control and elimination. *Malar J, 16*(1), 273. doi:10.1186/s12936-017-1925-6

Resnik, D. (2002). Developing drugs for the developing world: an economic, legal, moral, and political dilemma. *Developing World Bioethics, 1*(1), 11-32. doi: https://doi.org/10.1111/1471-8847.00004

Resnik, D. (2004). Research Subjects in Developing Nations and Vulnerability. *The American Journal of Bioethics, 4*(3), 63-64. doi:http://dx.doi.org/10.1080/15265160490497155

Resnik, D. (2012a). Developing World Bioethics. In R. Chadwick (Ed.), *Encyclopedia of Applied Ethics (Second Edition)* (pp. 771-778). San Diego: Academic Press.

Resnik, D. (2012b). Ethical virtues in scientific research. *Accountability in Research, 19*(6), 329-343. doi:https://doi.org/10.1080/08989621.2012.728908

Resnik, D. (2014). Ethical issues in field trials of genetically modified disease-resistant mosquitoes. *Dev World Bioeth, 14*(1), 37-46. doi:http://dx.doi.org/10.1111/dewb.12011

Resnik, D. (2016). Ethics in Science. In P. Humphreys (Ed.), *The Oxford Handbook of Philosophy of Science* (pp. 25). Oxford: oxford University Press.

Reutter, L., & Kushner, K. E. (2010). 'Health equity through action on the social determinants of health': taking up the challenge in nursing. *Nurs Inq, 17*(3), 269-280. doi:http://dx.doi.org/10.1111/j.1440-1800.2010.00500.x

Richard, L., Furler, J., Densley, K., Haggerty, J., Russell, G., Levesque, J. F., & Gunn, J. (2016). Equity of access to primary healthcare for vulnerable populations: the IMPACT international online survey of innovations. *Int J Equity Health, 15*(1), 64. doi:https://doi.org/10.1186/s12939-016-0351-7

Ritvo, R., Ohlsen, J., & Holland, T. (2004). *Ethical Governance in Health Care*. Chicago: library of Congress.

Romeijn, J.-W. (2011). Statistics as Inductive Inference. In P. S. Bandyopadhyay & M. R. Forster (Eds.), *Philosophy of Statistics* (Vol. 7, pp. 751-774). Amsterdam: North-Holland.

Rondeau, D. (2007). Lieux et contextes de l'autorégulation en éthique. *Ethica, 16*(2), 9-23.

Rondeau, D. (2019). La vulnérabilité engendre-t-elle une obligation morale? *Revue des sciences religieuses, 93*(1-2), 17-36. doi:https://doi.org/10.4000/rsr.6091

Rondeau, D., Mineau, A., Hébert, L., Lemmens, K., Nguyen, T. A., Léger, D., . . . Goma-Gakissa, G. (2015). *Éthique et empathie: regards croisés dans une perspective transdisciplinaire*. Rimouski: Université du Québec à Rimouski, Groupe de recherche Ethos.

Ruger, J. P. (2004). Health and social justice. *Lancet, 364*(9439), 1075-1080. doi:http://dx.doi.org/10.1016/S0140-6736(04)17064-5

Sander-Staudt, M. (2020). Care Ethics. In J. Fieser & B. Dowden (Eds.), *Internet Encyclopedia of Philosophy*. Retrieved from https://www.iep.utm.edu/care-eth/#H10 (Accessed 18/5/2020).

Sauboin, C. J., Van Bellinghen, L. A., Van De Velde, N., & Van Vlaenderen, I. (2015). Potential public health impact of RTS,S malaria candidate vaccine in sub-Saharan Africa: a modelling study. *Malar J, 14*, 524. doi:https://doi.org/10.1186/s12936-015-1046-z

Schoonenboom, J., & Johnson, R. B. (2017). How to Construct a Mixed Methods Research Design. *Kolner Zeitschrift fur Soziologie und Sozialpsychologie, 69*(Suppl 2), 107-131. doi:https://doi.org/10.1007/s11577-017-0454-1

Sen, A. (2002). Why health equity? In A. Sen, S. Ahmed, & F. Peter (Eds.), *Public Health, Ethics, and Equity* (pp. 21-33.). Oxford: Oxford University Press.

Shantikumar, S. (2018). Validity, Reliability and Generalisability In H. K. Team (Ed.), *Public Health Textbook - Health Knowledge Education*. Retrieved from https://www.healthknowledge.org.uk/content/validity-reliability-and-generalisability (Accessed 10/02/2022).

Shorten, A., & Smith, J. (2017). Mixed methods research: expanding the evidence base. *Evidence Based Nursing, 20*(3), 74. doi:https://doi.org/10.1136/eb-2017-102699

Silal, S. P., Little, F., Barnes, K. I., & White, L. J. (2015). Hitting a Moving Target: A Model for Malaria Elimination in the Presence of Population Movement. *PLoS One, 10*(12), e0144990. doi:https://doi.org/10.1371/journal.pone.0144990

Sinnott-Armstrong, W. (2015). Consequentialism. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy*. Stanford University: Metaphysics Research Lab.

Sklar, D. P. (2018). Disparities, Health Inequities, and Vulnerable Populations: Will Academic Medicine Meet the Challenge? *Acad Med, 93*(1), 1-3. doi:http://dx.doi.org/10.1097/ACM.0000000000002010

Slote, M. (2007). *The ethics of care and empathy*. New York: Routledge.

Smith, J., & Noble, H. (2014). Bias in research. *Evidence Based Nursing, 17*(4), 100. doi:http://dx.doi.org/10.1136/eb-2014-101946

Snow, R. W., Craig, M. H., & le Sueur, D. (1999). A climate-based distribution model of malaria transmission in sub-Saharan Africa. *Parasitol Today, 15*(3), 105-111. doi:https://doi.org/10.1016/S0169-4758(99)01396-4

Teh, R. N., Sumbele, I. U. N., Meduke, D. N., Ojong, S. T., & Kimbi, H. K. (2018). Malaria parasitaemia, anaemia and malnutrition in children less than 15 years residing in different altitudes along the slope of Mount Cameroon: prevalence, intensity and risk factors. *Malaria Journal, 17*(1), 336. doi:https://doi.org/10.1186/s12936-018-2492-1

ten Have, H. (2016). *Vulnerability: challenging Bioethics*. New Yok, NY: Routledge.

Tompkins, A. M., & Thomson, M. C. (2018). Uncertainty in malaria simulations in the highlands of Kenya: Relative contributions of model parameter setting, driving climate and initial condition errors. *PLoS One, 13*(9), e0200638. doi:10.1371/journal.pone.0200638

Tosam, M. J., Chi, P. C., Munung, N. S., Oukem-Boyer, O. O. M., & Tangwa, G. B. (2018). Global health inequalities and the need for solidarity: a view from the Global South. *Dev World Bioeth, 18*(3), 241-249. doi:https://doi.org/10.1111/dewb.12182

Trape, J. F., Robert, V., & Rogier, C. (2011). Malaria parasites: elimination is not eradication. *Clinical Microbiology and Infection, 17*(11), 1597-1599. doi:https://doi.org/10.1111/j.1469-0691.2011.03657.x

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., . . . Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of internal medicine, 169*(7), 467-473. doi:https://doi.org/10.7326/m18-0850

Turcotte-Tremblay, A.-M., Fregonese, F., Kadio, K., Alam, N., & Merry, L. (2020). Global health is more than just 'Public Health Somewhere Else'. *BMJ global health, 5*(5), e002545. doi:https://doi.org/10.1136/bmjgh-2020-002545

Um, C., Ac, O., An, C., & Nwakwuo, G. (2015). Social Determinants of Malaria Treatment Seeking Time by Mothers for Children (0-5 Years) in South Eastern Nigeria. *Journal of Tropical Disease, 3*(1), 1-6. doi:http://dx.doi.org/10.4172/2329891X.1000154

UNO. (2015). United Nations Sustainable Development Goals. Retrieved from https://www.undp.org/sustainable-development-goals (Accessed 20/04/2021). Retrieved. from UNDP https://www.undp.org/sustainable-development-goals (Accessed 20/04/2021).

van Dijke, J., van Nistelrooij, I., Bos, P., & Duyndam, J. (2019). Care ethics: An ethics of empathy? *Nursing Ethics, 26*(5), 1282-1291. doi:https://doi.org/10.1177/0969733018761172

Varpio, L., Paradis, E., Uijtdehaage, S., & Young, M. (2020). The Distinctions Between Theory, Theoretical Framework, and Conceptual Framework. *Academic Medicine, 95*(7). doi:https://doi.org/10.1097/ACM.0000000000003075

Wahlberg, A., Rehmann-Sutter, C., Sleeboom-Faulkner, M., Lu, G., Doring, O., Cong, Y., . . . Rose, N. (2013). From global bioethics to ethical governance of biomedical research collaborations. *Soc Sci Med, 98*, 293-300. doi:http://dx.doi.org/10.1016/j.socscimed.2013.03.041

Wang, Y. H. (2000). Fiducial Intervals: What Are They? *The American Statistician, 54*(2), 105-111. doi:https://doi.org/10.2307/2686026

Way, C. (Ed.) (2015). *The Millennium Development Goals Report 2015*. New York: United Nations.

White, B. W. (2011). Le pouvoir de la collaboration. *Célébrer la collaboration. Art communautaire et art activiste,* 329-338.

White, B. W. (2017). *Intercultural Cities: Policy and Practice for a New Era*. Brussel: Springer.

White, B. W., Gratton, D., & Agbobli, C. (2017). Actes à poser en contexte interculturel : quelle place pour l'intervention? . *Alterstice–Revue Internationale de la Recherche Interculturalle, 7*(1), 7-12. Retrieved from http://www.alterstice.org (Accessed 20/02/2020)

WHO. (1978). Declaration of Alma Ata. Retrieved from https://www.who.int/teams/social-determinants-of-health/declaration-of-alma-ata (Accessed 21/05/2022). from WHO https://www.who.int/teams/social-determinants-of-health/declaration-of-alma-ata (Accessed 21/05/2022).

WHO. (2015). Global Health Ethics Key issues. Retrieved from https://www.who.int/ethics/publications/global-health-ethics/en/ (Accessed 04/05/2021). (924069403X). from World Health Organization https://www.who.int/ethics/publications/global-health-ethics/en/ (Accessed 04/05/2021)

WHO. (2016a). Weekly epidemiological record - 29 January 2016. *Weekly epidemiological record / Relevé épidémiologique hebdomadaire, 91*(4), 33-52. https://www.who.int/wer/2016/WER9104.pdf?ua=2011 (Accessed 2024/2002/2019).

WHO. (2016b). *World health statistics 2016: monitoring health for the SDGs – sustainable development goals*: World Health Organization: https://www.who.int/gho/publications/world_health_statistics/2016/en/ (Accessed 20/12/2018).

WHO. (2017a). Annex B: Tables of Health Statistics by Country: WHO Region and Globally. *Global Health Observatory (GHO) Report: https://www.who.int/gho/publications/world_health_statistics/2016/Annex_B/en/ (Accessed 10/02/2018).*

WHO. (2017b). *A framework of malaria elimination*. Retrieved from Geneva: WHO. Licence: CCBY-NC-SA 3.0 IGO. https://apps.who.int/iris/bitstream/handle/10665/254761/9789241511988-eng.pdf;jsessionid=42F5E78886B671E303B5BBBFCE2D0300?sequence=1 (Accessed 28/09/2019).

WHO. (2017c). World malaria report 2017. . Retrieved from https://www.who.int/malaria/publications/world-malaria-report-2017/en/ (Accessed 20/09/2018). WHO publication Retrieved 20 September 2018

https://www.who.int/malaria/publications/world-malaria-report-2017/en/ (Accessed 20/09/2018).

WHO. (2018a). Equity. *Health Systems: https://www.who.int/healthsystems/topics/equity/en/ (Accessed 24/03/2019).* Retrieved from https://www.who.int/healthsystems/topics/equity/en/

WHO. (2018b). Gender, Equity and Human Rights. *https://www.who.int/gender-equity-rights/en/ (Accessed 20/01/2018).* Retrieved from https://www.who.int/gender-equity-rights/en/

WHO. (2018c). Malaria. *Fact sheets: https://www.who.int/news-room/fact-sheets/detail/malaria (Accessed 12/02/2018).* .

WHO. (2018d). Update on the E-2020 initiative of 21 malaria-elimination countries: https://www.who.int/malaria/publications/atoz/e-2020-progress-report/en/ (Accessed 27/09/2019). [Press release]

WHO. (2019). Malaria. *Fact sheets.* Retrieved from https://www.who.int/news-room/fact-sheets/detail/malaria (10/12/2019)

WHO. (2021). World malaria report 2021. Retrieved from https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2021 (Accessed 20/04/2022). (CC BY-NC-SA 3.0 IGO.). from World Health Organization https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2021 (Accessed 20/04/2022)

WHO, & OHCHR. (2008). The Right to Health. Retrieved from https://www.who.int/gender-equityrights/knowledge/right-to-health-factsheet/en/ (Accessed 02/09/2017). from Office of the High Commissioner for Human Rights, and World Health Organization https://www.who.int/gender-equityrights/knowledge/right-to-health-factsheet/en/ (Accessed 02/09/2017).

WHO, & UNICEF. (2018). *Declaration of Astana*. Astana: World Health Organization/United Nation Children's Fund

Wildgen, A., & Denny, K. (2020). Health Equity's Missing Substance: (Re)Engaging the Normative in Public Health Discourse and Knowledge Making. *Public Health Ethics, 13*(3), 247-258. doi:https://doi.org/10.1093/phe/phaa019

Williams, H. A., & Jones, C. O. (2004). A critical review of behavioral issues related to malaria control in sub-Saharan Africa: what contributions have social scientists made? *Soc Sci Med, 59*(3), 501-523. doi:https://doi.org/10.1016/j.socscimed.2003.11.010

Willig, C., & Rogers, W. S. (2017). *The SAGE handbook of qualitative research in psychology*: Sage.

Winskill, P., Walker, P. G., Griffin, J. T., & Ghani, A. C. (2017). Modelling the cost-effectiveness of introducing the RTS,S malaria vaccine relative to scaling up other malaria interventions in sub-Saharan Africa. *BMJ Glob Health, 2*(1), e000090. doi:http://dx.doi.org/10.1136/bmjgh-2016-000090

Winstanley, P., Ward, S., Snow, R., & Breckenridge, A. (2004). Therapy of falciparum malaria in sub-saharan Africa: from molecule to policy. *Clinical microbiology reviews, 17*(3), 612-637. doi:http://dx.doi.org/10.1128/CMR.17.3.612-637.2004

Yé, M., Kagoné, M., Sié, A., Bagagnan, C., Sanou, H., Millogo, O., . . . Bibeau, G. (2018). Promoting access equity and improving health care for women, children and people

living with HIV/AIDS in Burkina Faso through mHealth. *Journal of Public Health, 40*(suppl_2), ii42-ii51. doi:10.1093/pubmed/fdy196

Yu, Y. (2021). Introduction to Statistical Inference. In *Biostatistics—Open Learning Textbook*. Retrieved from https://bolt.mph.ufl.edu/6050-6052/unit-4/ (Accessed 04/06/2021).

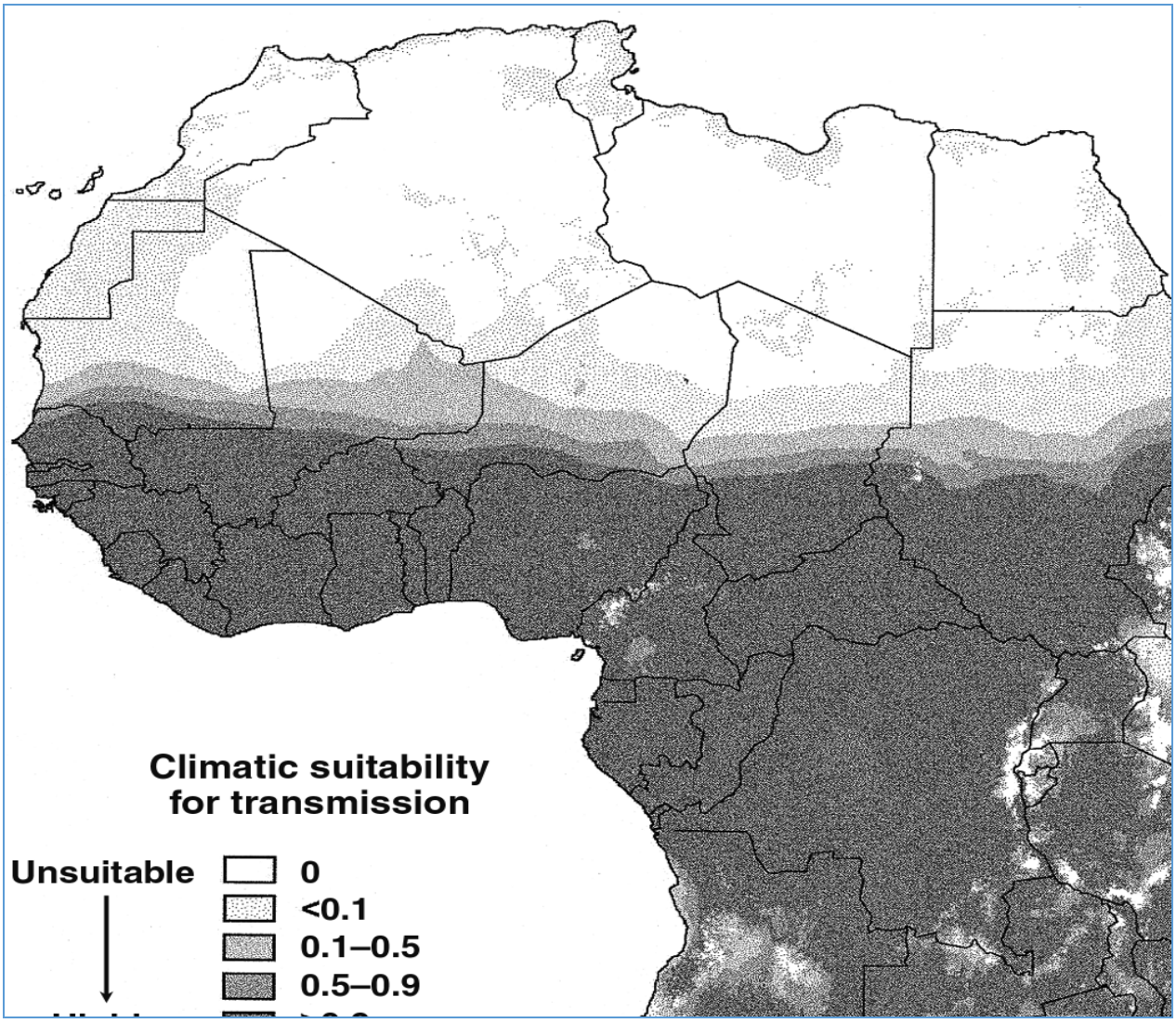
Zeng, W., & Resnik, D. (2010). Research integrity in China: problems and prospects. *Dev World Bioeth, 10*(3), 164-171. doi:http://dx.doi.org/10.1111/j.1471-8847.2009.00263.x

Zere, E., Moeti, M., Kirigia, J., Mwase, T., & Kataika, E. (2007). Equity in health and healthcare in Malawi: analysis of trends. *BMC Public Health, 7*(1), 78. doi:http://dx.doi.org/10.1186/1471-2458-7-78

Zhang, M., Wang, C., Otto, T. D., Oberstaller, J., Liao, X., Adapa, S. R., . . . Adams, J. H. (2018). Uncovering the essential genes of the human malaria parasite Plasmodium falciparum by saturation mutagenesis. *Science, 360*(6388). doi:http://dx.doi.org/10.1126/science.aap7847

Annexes

Annex 1

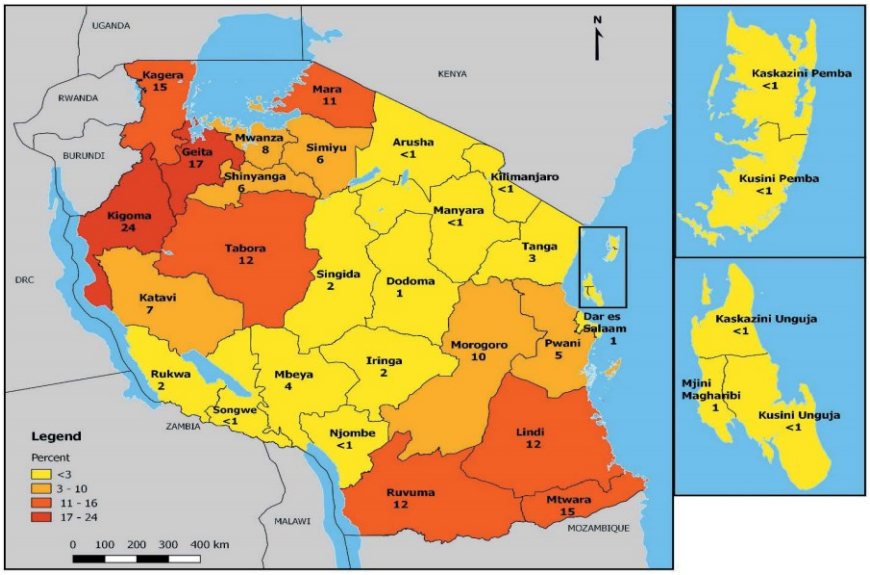


Source: Snow, R. W., Craig, M. H., & le Sueur, D. (1999). A climate-based distribution model of malaria transmission in sub-Saharan Africa. Parasitol Today, 15(3), 105-111. doi: https://doi.org/10.1016/S0169-4758(99)01396-4 (p. 108).

Annex 2

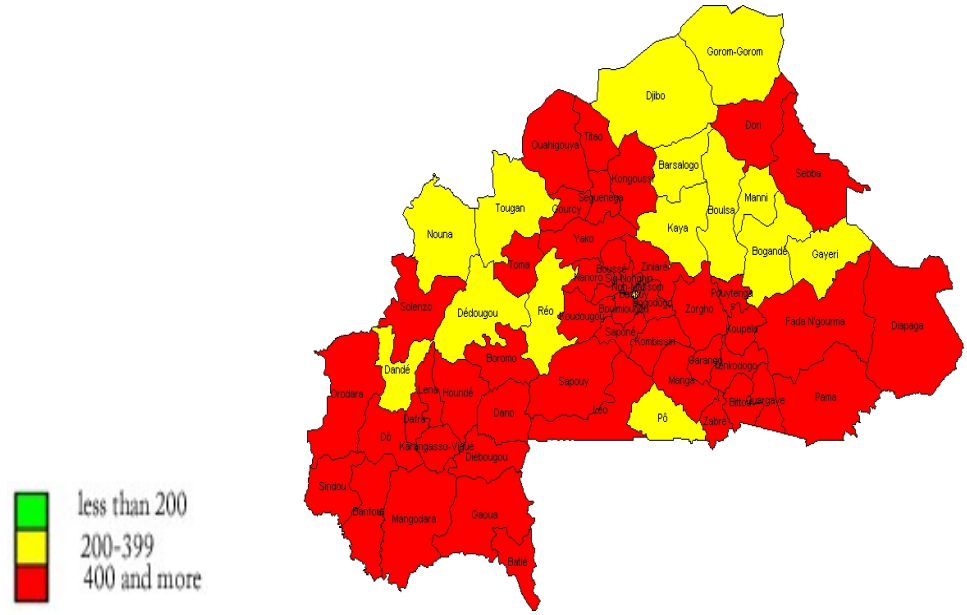
Comparing the malaria scenarios in Tanzania and Burkina Faso by 2017.

Diagram 1: Malaria prevalence rates/^{000} across health Regions in Tanzania by 2017



Source: Tanzania Malaria Indicator Survey (TMIS), Malaria Atlas for 2017, published in August 2018

Diagram 2: Malaria incidence rates/^{000} across Districts in Burkina Faso by 2017



Source: President's Malaria Initiative – Burkina Faso: Malaria Operational Plan FY 2017