SOCIOECONOMIC INEQUALITIES AND INEQUITIES IN THE SCREENING AND TREATMENT OF DIABETES AND HYPERTENSION IN KENYA

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University of Cape Town

Student name and number

Robinson Oyando Omondi OMNROB001

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Supervisors

Associate Professor John Ataguba[1]

Professor Edwine Barasa[2]

[1]Health Economics Unit, University of Cape Town, Cape Town, South Africa

[2]Health Economics Research Unit, KEMRI-Wellcome Trust Research Programme, Nairobi, Kenya

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Dedication

This dissertation is dedicated to my father, who has always taught me to “better my best”.

Abstract

The burden of non-communicable diseases (NCDs) is on a disproportionate rise in low-and middle-income countries (LMICs). Equity in the utilisation of screening and treatment services for NCDs is important in reducing associated disease burden. For instance, the 2030 Sustainable Development Goal 3.4 that aims to reduce by one-third premature NCDs mortality, has adopted prevention and treatment as critical interventions for achieving this target. However, little is known about equity in the use of screening and treatment services for major NCDs like diabetes and hypertension in Kenya. This dissertation assesses horizontal equity (i.e. equal treatment for equal need) in the screening and treatment for diabetes and hypertension. Further, it examines factors contributing to inequality.

Data from the 2015 STEPwise cross-sectional survey on NCDs risk factors were used in the analysis. Concentration curves, concentration indices and horizontal inequity index were used to assess socioeconomic inequality and inequity in the screening and treatment for diabetes and hypertension. The Wagstaff decomposition approach was used to examine factors contributing to socioeconomic inequality in screening and treatment. For a granular presentation of inequity and inequality findings, analyses were conducted across the wealth and regional divides in Kenya.

Overall, the rich benefited disproportionately more in the utilisation of screening and treatment services, given their population share of need. Of note, inequalities in the use of screening and treatment interventions for diabetes and hypertension were observed in the geographic regions. In general, non-need factors such as educational attainment, area of residence, exposure to media, employment, and wealth status were the largest contributors to inequality in both screening and treatment. By contrast, need factors like sex also significantly contributed to inequality in diabetes and hypertension screening. After controlling for need, a statistically significant pro-rich inequity in the use of diabetes and hypertension screening was observed. Both the use of diabetes and hypertension treatment were pro-rich though a statistically significant result was only seen for the former.

For equity in the screening and treatment for diabetes and hypertension in Kenya, demand enhancing mechanisms such as health education through the mass media and free NCD screening in the public sector should be implemented. Also, given the interplay of factors beyond the health sector that affect utilisation of healthcare services, there is a need for multi-sectoral approaches at various levels to address drivers of social inequality with a critical focus in rural and marginalised areas.

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Table of Contents

SECTION 0: PREAMBLE ii
Dedication iii
Abstract iv
Acknowledgements iv
List of Tables ix
List of Figures x
List of Abbreviations xi
PART A: PROTOCOL 1
1.1 Introduction 2
1.2 Problem statement and justification for the study 4
1.3 Aim and objectives 5
1.3.1 Aim 5
1.3.2 Objectives 5
1.4 Literature review 6
1.5 Theoretical review 6
1.6 What is health equity and how does it differ from equality? 6
1.7 Theories of equity 7
  1.7.1 Utilitarianism 7
  1.7.2 Egalitarianism 8
  1.7.3 Libertarianism 8
  1.7.4 Rawls' maximin theory of justice 9
1.8 Conceptualisation of need in healthcare 10
  1.8.1 Need as ill-health 10
  1.8.2 Need as the capacity to benefit 10
  1.8.3 Need as expenditure required to exhaust capacity to benefit 10
1.9 Methodological review 10
2.0 Methodology 11
2.1 Study setting 11
2.2 Study design 12
2.3 Description of sampling in STEPs 12
2.4 Ethical considerations for the proposed study 13
2.5 Data collection methods 13
2.6 Data analysis 16
2.6.1 Measuring the need for screening and treatment 16
2.6.2 Measuring the utilisation of screening and treatment services 17

2.6.3 Measuring inequity in screening and treatment 17
2.6.4 Assessing socioeconomic status 18
2.6.5 Comparing the distribution of healthcare utilisation according to need 18
2.6.6 Decomposing the concentration index in screening and treatment of diabetes and hypertension 18
2.7 Study Timeframe 21
References 22
PART B: LITERATURE REVIEW 29
2.0 Introduction 30
2.1 Theoretical review 30
2.2 What is equity? 30
2.3 Vertical and horizontal equity 31
2.4 What is the distinction between equity and equality? 31
2.5 Theories of justice 32
2.5.1 Utilitarian theory of justice 32
2.5.2 Libertarian theory of justice 33
2.5.3 Rawls theory of justice 35
2.5.4 Egalitarian theory of justice 36
2.6 What theory of justice has been adopted in this study? 36
2.7 Summary and Discussion 36
2.8 What is need? 38
2.9 Methodological Review 39
3.1 The range 40
3.2 The Lorenz curve and the Gini coefficient 40
3.3 The pseudo-Lorenz curve and the pseudo-Gini coefficient 40
3.4 The Index of dissimilarity 41
3.5 The slope and relative index of inequality 41
3.6 The concentration curve and the concentration index 42
3.7 Decomposing the concentration index 42
3.8 Methodological approaches to measuring horizontal equity 44
3.8.1 Le Grand's inter-group comparison 44
3.8.2 The regression method 44
3.8.3 Concentration curve/index 44
3.8.4 Direct standardisation 45
3.8.5 Indirect standardisation 45
3.9 Empirical review 45

3.9.1 Introduction 45
3.9.2 Literature search strategy 46
3.9.3 Inclusion criteria 46
3.9.4 Studies reviewed 46
4.0 Empirical review from LMICs 47
5.0 Empirical review from HICs 62
6.0 Summary and discussion of empirical review 77
References 80
PART C: JOURNAL MANUSCRIPT 92
Abstract 94
Background 95
Methods 97
Results 102
Discussion 122
Study strengths and limitations 125
Conclusion 125
References 127
PART D: POLICY BRIEF 132
PART E: APPENDICES 138
APPENDIX 1: Plagiarism Declaration 139
APPENDIX 2: Terms and conditions for using STEPs dataset 140
APPENDIX 3: Human Research Ethics Approval 141
APPENDIX 4: Journal Manuscript Instructions 142

List of Tables

PART A: PROTOCOL

Table 1 Variables to be included in the analysis....................15

Table 2 Screening and treatment interventions....................17

PART B: LITERATURE REVIEW

Table 1 Summary of empirical review from low-and middle-income countries (2012-2018)....................51

Table 2 Summary of empirical studies from high-income countries (2005-2018)....................66

PART C: JOURNAL MANUSCRIPT

Table 1 Definitions of variables used in the analysis 99

Table 2 Descriptive statistics grouped by wealth quintile 103

Table 3 Concentration indices for need and use of screening services for diabetes and hypertension in Kenya (STEPs 2015) 104

Table 4 Concentration indices for need and use of treatment services for diabetes and hypertension in Kenya (STEPs 2015) 106

Table 4 Inequity in the utilisation of screening and treatment services for diabetes and hypertension in Kenya (STEPS 2015).................... 108

Table 5 Decomposition analysis of inequality in the utilisation of screening services in Kenya (STEPs 2015).................... 119

Table 6 Decomposition analysis of inequality in the utilisation of treatment services in Kenya (STEPs 2015)....................120

List of Figures

PART C: JOURNAL MANUSCRIPT

Figure 1 Concentration curves for need and use of diabetes and hypertension screening in Kenya 104
Figure 2 Distribution of share of need and use of screening services by wealth quintile in Kenya (STEPs 2015) 105
Figure 3 Distribution of need and use of screening services in Kenyan regions (STEPs 2015) 105
Figure 4 Concentration curves for need and use of diabetes and hypertension treatment in Kenya 106
Figure 5 Distribution of share of need and use of treatment services by wealth status in Kenya (STEPs 2015) 107
Figure 6 Distribution of share of need and use of treatment services in Kenyan regions (STEPs 2015).. 107
Figure 7 Summary contributions to SES inequality in the utilisation of screening services for diabetes and hypertension in Kenya (STEPs 2015).. 108
Figure 8 Summary contributions to SES inequality in the utilisation of treatment services for diabetes and hypertension in Kenya (STEPs 2015).. 109

PART D: POLICY BRIEF

Fig. 1 A comparison of need and use of diabetes and hypertension screening in Kenya 135

List of Abbreviations

BMI	Body Mass Index
BP	Blood Pressure
CC	Concentration Curve
CI	Concentration Index
CVDs	Cardiovascular Diseases
CHE	Catastrophic Health Expenditure
EAs	Enumeration Areas
FBS	Fasting Blood Sugar
HICs	High-income countries
HI	Horizontal Inequity Index
KNBS	Kenya National Bureau of Statistics
LMICs	Low-and middle-income countries
NASSEP	National Sample Survey and Evaluation Programme
NCDs	Non-communicable Diseases
PCA	Principal Component Analysis
SSA	Sub-Saharan Africa
SDGs	Sustainable Development Goals
SES	Socioeconomic Status
UHC	Universal Health Coverage
WHO	World Health Organisation

PART A: PROTOCOL

1.1 Introduction

Globally, non-communicable diseases (NCDs) account for 71% of all deaths, killing 41 million people annually (1). More than three-quarters (32 million) of these deaths occur in low-and middle-income countries (LMICs) (1). The four major types of NCDs include cardiovascular diseases (CVDs) that account for most NCD deaths (19 million), followed by all forms of cancer (9 million), chronic respiratory disease (3.9 million) and diabetes (1.6 million) (1). In spite of the premature NCD-related deaths (i.e. occur below 70 years) that lead to more than 100,000 lives being lost daily (2), there are proven population-wide and individual-level cost-effective policies and interventions that if implemented, can significantly reduce the rising burden of NCDs (3).

Given the unprecedented rise in the burden of NCDs, the 2014 World Health Organisation (WHO) global status report labelled NCDs as "one of the major health and development challenges of the 21st century" and that "no government can afford to ignore the rising burden of NCDs" (World Health Organization, 2014 p.11). Indeed, this position is supported by abundant empirical evidence from studies conducted in both high-income countries (HICs) and LMICs over the years (4-11). Diabetes and hypertension tend to occur concurrently. They both represent significant risk factors for CVDs (3, 12). The global age-standardised diabetes and hypertension prevalence was estimated at 9.3% in 2019 and 22% in 2014, respectively (3, 13). However, an increasing body of evidence has shown that the levels of prevention, screening, treatment, and control are comparatively low, especially in LMICs (14-17). For instance, in sub-Saharan Africa (SSA) alone, it is estimated that more than half (59.7%) of people with diabetes remain undiagnosed (13). Similarly, a systematic review of 33 studies on the burden of undiagnosed hypertension in SSA has indicated that almost three-quarters (73%) of hypertensive individuals are unaware of their hypertensive status. Further, only 18% of hypertensive patients receive treatment, with approximately 7% having their blood pressure controlled (18).

At the individual level, there is compelling evidence to suggest that relative to population-wide screening, early or targeted screening among people at risk and initiation of treatment are cost-effective strategies for reducing the burden associated with diabetes and hypertension (19-23). However, given the epidemiologic and demographic transition that has resulted in the "double burden" of communicable and non-communicable diseases, weak health systems in most LMICs, among other reasons, little progress has been made in implementing interventions targeted at NCDs at both national and global levels (24). Given the context of a shift in priority by the global health community for all countries to pursue universal health coverage (UHC) (i.e. use of health services according to need, financial risk protection and quality health services), the

unprecedented rise in the burden of NCDs has been identified as a significant threat to attaining UHC by 2030, especially in most resource-constrained settings (3, 25, 26). Additionally, the existence of the *inverse care law* (a worrisome situation where those with the greatest need for healthcare utilise the least amount of health services) (27) for NCDs has been corroborated by evidence from studies conducted in England (28, 29), Brazil (30), China (31), and South Africa (32).

In Kenya, NCDs account for more than 50% of hospital admissions and over 55% of hospital deaths (33). A nationally representative study in Kenya found an age-standardised prevalence of hypertension and diabetes to be 24.5% and 2.4%, respectively (34, 35). Besides, the level of awareness of diabetes and hypertension status among screened patients was arguably low (i.e. 43.7% and 15.6%, respectively) in both studies (*ibid*). More importantly, significant health, social, and economic consequences have been associated with NCDs in Kenya. For instance, a cost-of-illness study found that annual treatment costs for stage III breast and cervical cancer are substantially high in the private sector (US$ 7,500) compared to the public sector (US$ 1,500) (36). Also, hypertension and diabetes treatment costs lead to catastrophic healthcare payments in Kenya, primarily due to medicine and transport-related costs (37, 38). Besides, other studies done in Kenya have shown that incurring catastrophic health spending is two times as likely in households with a member who has a chronic illness (e.g. diabetes and hypertension) relative to households with no chronic illness (39, 40). Also, a recent study utilising the most recent nationally-representative household health expenditure and utilisation survey has indicated that chronic conditions are disproportionately concentrated among higher socioeconomic groups in Kenya (41).

While these previous studies suggest significant gaps in financial risk protection for NCDs in Kenya, little is known about the extent of inequities for NCDs interventions such as screening and treatment—based on need—at the population-level. Among other things, equity in service coverage is a crucial aspect of UHC (42). Kenya has made a political commitment to implement health financing reforms to attain UHC by 2022. Whereas previous studies (43-45) have assessed the progress towards UHC in Kenya using service coverage and financial risk protection indicators, there are still gaps in knowledge as these studies did not include NCD-related indicators in their assessment as recommended in the WHO/World Bank framework for tracking UHC progress at country and global levels (46). Given the rising NCDs burden in Kenya, evidence on inequities in the screening and treatment of diabetes and hypertension interventions are critical inputs to guide policymakers in designing and implementing mechanisms to ensure equitable NCDs service coverage in line with the UHC goals.

1.2 Problem statement and justification for the study

While all countries experience the economic, social and human consequences of NCDs, the poor and vulnerable populations are the most devastated (3). Equitable access to personal interventions such as screening and treatment, especially at the primary care level is needed to tackle NCDs like diabetes and hypertension that remain asymptomatic until the onset of organ damage (47, 48). Compared to HICs where 20% of those with hypertension remain unaware, about 25% are not on treatment, and only 50% have their blood pressure controlled (49); in LMICs, 56% of patients are unaware of being hypertensive, only 37% are on treatment and more than three quarters do not have their blood pressure controlled (50, 51). Further, these screening and treatment gaps are predominant among the poor (3).

A critical health sector policy goal that is characteristic of health agendas globally is the equitable use of healthcare services according to people's needs and not according to their ability to pay (52). Whereas there is abundant empirical evidence that suggests that healthcare delivery in SSA is highly inequitable (41, 44, 52-59), the extent to which the unprecedented rise in NCDs has exacerbated the existing inequities in most African health systems is yet to be comprehensively documented (52). Nevertheless, there are reasons to believe that inequities/inequalities in health or health outcomes may have been exacerbated by the rise in NCDs burden in many African countries (15, 32, 60, 61).

Equitable provision of needed healthcare is at the core of UHC. Accordingly, over the years, equity has been established as a crucial healthcare goal (62). Despite being frequently used as synonyms, *equity* and *equality* are not similar concepts. The former is rather normative (i.e. based on social justice) whereas the latter is not necessarily so (see literature review section for a detailed discussion) (63). For ease of operationalisation and measurement, Braveman and Gruskin (2003 p.254) have defined equity in health as "the absence of systematic disparities in health (or in the major social determinants of health) between groups with different levels of underlying social advantages/disadvantages — that is, wealth, power, or prestige." In the literature, equity is assessed in terms of how healthcare is financed, the allocation of healthcare resources, access or utilisation of health services and quality of health services (63).

In a bid to improve financial risk protection and subsequently, equity in access to needed health services, especially by the poor and vulnerable groups, the government of Kenya has implemented a good deal of health policy reforms since the attainment of independence. Although not explicitly targeted at NCDs, these reforms include: 1) user fee removal at public primary healthcare facilities that has been implemented since 2013 (64), 2) free provision of maternal health services which was

adopted following the election of a new government into office in 2013 (65), and 3) health insurance subsidy programme for the poor that has been implemented since 2014 (66). Despite these policy reforms, it is apparent that the Kenyan health system is still inequitable in several fronts: in service coverage, i.e. maternal and child health services (44) and selected prevention and treatment services (41, 45); in providing health insurance coverage (67, 68); and in the financing of the health system (45, 69), among others, for example. On the contrary, the Kenyan constitution stipulates that access to the highest standard of health is a right to all citizens of Kenya, thus highlighting the importance of equity in access to health services (70).

From the preceding, it is evident that little research attention has focused on inequities in NCDs in the Kenyan context, especially inequities in the screening and treatment for diabetes and hypertension. Therefore, this study attempts to address this gap in research and knowledge by examining the level of (in)equity in the screening and treatment of diabetes and hypertension in Kenya. Further, this study will contribute to policy dialogue and inform initiatives that would steer progress in attaining the Sustainable Development Goals (SDGs) (goal 3.4—focused on reducing premature mortality due to NCDs through prevention and treatment; and goal 3.8—achieve universal health coverage, of which health equity is among the goals) (71). Specifically, by using the most recent nationally-representative data on risk factors for NCDs, the study will provide policymakers with information to take stock of the level of (in)equity in the screening and treatment for diabetes and hypertension in the Kenyan population and provide a benchmark for future assessment. Also, using decomposition analysis, the study will explore socioeconomic factors associated with inequality in the screening and treatment of diabetes and hypertension in Kenya. Identifying these factors will provide policy levers that decision-makers can target in improving equality in screening and treatment for diabetes and hypertension in Kenya. Specifically, this is based on the recognition that there is a paucity of context-specific evidence on the socioeconomic factors associated with inequalities in screening and treatment for both conditions (52).

1.3 Aim and objectives

1.3.1 Aim

The study aims to assess inequities in the screening and treatment of diabetes and hypertension in Kenya.

1.3.2 Objectives

1. To assess inequities in the screening for diabetes and hypertension in Kenya.

2. To assess inequities in the treatment of diabetes and hypertension in Kenya.
3. To decompose socioeconomic inequalities in the screening and treatment of diabetes and hypertension in Kenya.

1.4 Literature review

1.5 Theoretical review

In this section, an overview of the concept of health equity, differences between equity and equality in the utilisation of healthcare services, and theories of equity as used in health economics are explored. Further, the conceptualisation of the need for healthcare is undertaken.

1.6 What is health equity, and how does it differ from equality?

Whereas the discourse on equity in the health sector has attracted considerable debate in the literature over the years, justice or fairness in the distribution of healthcare resources, irrespective of socioeconomic status or geographical location seems to be the point of consensus (72). Since fairness is a value-judgment construct, that is, what is considered as equitable by one individual may not necessarily be the case for another (73). Evans et al. (2001 p.26) argue that "health equity is best thought of not as a social goal in and of itself, but inherently embedded in a more general pursuit of social justice" and defines *inequities* as inequalities that are deemed unfair given that they are avoidable. He goes further and defines *inequalities* in health as differences in health between groups irrespective of their fairness. Stated differently, equity in healthcare can be defined as equal access for those with equal needs whereas equality in health can be defined as a situation where individuals in the population have the same health status (74). Mooney (72) has suggested seven potential definitions of equity as follows:

- *Equal access for equal need* – while access is a multidimensional concept, this definition of equity is based on the notion that healthcare should be distributed to individuals based on their need. Nevertheless, Culyer and Wagstaff (75), have criticised this definition as what constitutes "need" is not explicitly clear.
- *Equal expenditure per capita* — as is typical in most countries' budget allocation formula, this definition aims to attain equitable distribution of resources based on the number of people in a given geographical area. Failing to consider the differences in need while allocating resources has been the point of criticism for this definition (75).
- *Equal quality of healthcare* — to offer high-quality health services to everyone in need, health providers should have the same level of commitment when providing health services irrespective of the severity of illness.

- *Distribution according to ability to pay* — an individual's ability and willingness to pay for healthcare services is the key determining factor under this definition. As would be anticipated, this definition has been criticised based on its pro-rich bias that causes the health needs of the poor to be side-lined hence raising equity concerns (76).
- *Equality of health* — when there is equality of health status, then equity in healthcare is attained under this definition. Given the multiplicity in the determinants of health status such as genetic factors or personal habits such as unhealthy diets, for example, this definition has been considered unrealistic (74).
- *Equal marginal met need* — based on the cost-benefit approach, this definition aims to improve geographical allocation.
- *Equal inputs for equal need* — in this definition, variations in need (i.e. beyond population size) for healthcare services are considered.

1.7 Theories of equity

In as much as equity can be defined in more than one way, the bottom line is that equity is an ethical principle underpinned by justice or fairness (77). Nevertheless, there is no immediately agreed basis for judging what is deemed fair or just. The debates notwithstanding, there are philosophical approaches, albeit which tend to conflict, that can guide in unpacking equity in health (75, 78). Utilitarianism, egalitarianism, libertarianism, and Rawls' maximin theory of justice, among others, are some of the fundamental philosophical theories that are described in this section.

1.7.1 Utilitarianism

As a moral philosophical theory of justice (79), the goals of utilitarianism can be summed up as "serving the greatest good for the greatest number" (Pereira, 1995 p.43). More specifically, originating from the pioneering work of Jeremy Bentham and John Stuart Mill in the eighteenth and nineteenth centuries, utilitarianism generally requires a combination of four principles (80-82): 1) utility, that is happiness, benefit, or level of satisfaction that an individual derives from using a given good or service and is the single thing that should be maximised while disutility should be minimised; 2) consequentialism, that is the end-result or goodness of a consequent state of affairs should be solely judged by every choice (of actions, rules, institutions, etc.); 3) welfarism, that is, utility information regarding a particular state is the only function of the goodness of that state; and 4) sum-ranking, that is in assessing the utility information concerning any state, the sum-total of all the utilities in that state should be the only thing looked at. Thus, utilitarians judge an action as right on the proviso that it enhances the welfare or utility overall than any alternative action

(79). Nevertheless, one common criticism of utilitarianism is its failure to address issues of distributive justice given that it has a biased focus of efficiency yet equity is concerned with the fair distribution of resources without necessarily maximising utility (83).

1.7.2 Egalitarianism

Essentially, the notion under egalitarianism theory is that all human beings are equal and hence form the basis on which resources need to be equally distributed or well-being equally enhanced (82). As noted by Olsen (78), however, this might lead to undesirable outcomes given that different levels of resources are suitable for different kinds of people. Likewise, given that this notion specifically relates to traditional egalitarianism, it fails to consider individual freedom or the differences among people (84). Egalitarianism can either be *general* (i.e. the most preferred situation where the *distribuendum* (e.g. resources or entity to be shared) is most equally distributed) or *specific* (i.e. where the distribuendum is more limited yet a most equal distribution is preferred) (78).

Furthermore, as put forward by Elster (85), egalitarianism can be distinguished under two forms — strong and Rawls-type egalitarianism. According to Ataguba (82), everyone gets an equal share of the distribuendum regardless of other considerations under strong-type egalitarianism. By contrast, for Rawls-type egalitarianism, inequality in the distribution of a good/service is allowed provided that the neediest or worst-off are the ones who benefit most from such a distribution (78, 86). In a broader sense, therefore, egalitarian principles involve ensuring that people have equal rights and freedoms due to the equitable distribution of resources or opportunities (84, 87). In the context of health and healthcare, operationalisation of egalitarianism can be different based on the meaning given to equality, i.e. it can aim at equal use of healthcare services for those with equal health needs, equal health status for the entire population, equal welfare/well-being for all, or equal access to healthcare services.

1.7.3 Libertarianism

Libertarianism is founded on the philosophical ideology that everyone has the right to personal freedom and private property provided that they are obtained legally (88). Given the emphasis placed on due respect for individual freedom by libertarians, there can be no forceful redistribution of private property (89). Further, for libertarians, equity is judged based on the right to maintain self-ownership and the right to freedom while at the same time recognising that there are positive and negative freedoms[1] given to individuals (90). Therefore, a health system founded on

[1] Positive freedom refers to facilitating awareness to an individual in the attainment of a private goal in a certain manner whereas negative freedom refers to eliminating hindrances to enable an individual to attain any goal.

libertarianism relies heavily on free-market forces and assumes that the allocation of resources through the market is fair (91). An individual-oriented healthcare system is archetypal of a libertarian model where the focus is placed on individual health needs. For instance, in such a system, financing of healthcare is based on the ability to pay with little government intervention for the indigent (92). However, given that different societies have varying meanings of the value of a good and hence how it should be distributed, critics of this philosophical view argue that community rather than individual rights should be emphasised (93). Of note, having individual rights or freedom under libertarian ideology does not necessarily translate to the availability of goods or services, for example, to improve well-being (90).

1.7.4 Rawls' maximin theory of justice

The egalitarian principle and the Rawlsian maximin principle of justice are more or less related, given that John Rawls, like other philosophers, acknowledges the existence of inequality (82). Under this theory, the primary aim is to maximise the benefit of the least advantaged or the worse-off, given that maximum goods/services are directed towards those with minimal endowments (94). Rawls (94) argues that if rational people operate under the "veil of ignorance" where their position in society is not known, preference would be given to the worst-off in the distribution of social services. He further argues that what would drive people to make such a decision is not necessarily a concern for the least privileged but rather the fear that they would potentially turn-out to be the worst-off members of the society once the veil of ignorance is lifted. However, Rawls' propositions have been criticised by economists like Gavin Mooney who contend that it is only the welfare of the worst-off in society that is considered under the maximin theory without necessarily considering other groups in the society whose needs are as relevant or equally important when justice or fairness is being defined and operationalised (95). Also, given that the worse-off are the primary focus under Rawls' theory of justice, one would immediately wonder the practicality of identifying the least advantaged, especially in low-resource settings. For example, it is a well-documented fact that identification of the poor for exclusion from paying user fees during the neo-liberal structural adjustment programmes in the early 1990s and 2000s was one of the key bottlenecks experienced by most African countries (96).

In summary, the structuring of a country's health system is mostly influenced by the ideological perspective embraced (91). However, as Reagon (1997) noted, most countries tend to adopt a combination of the philosophical ideologies outlined above in their health policies and plans — mainly due to changes in governments over time. Similarly, as suggested in the literature, equality in health services delivery can be assessed from different perspectives. The next section provides

an overview of the conceptualisation of need in healthcare and methodological approaches that can be used to assess equity/equality.

1.8 Conceptualisation of need in healthcare

Equity in healthcare can either be vertical or horizontal. Therefore, the need for healthcare can either be vertical (i.e. unequal utilisation of healthcare for those with unequal needs) or horizontal (i.e. equal utilisation of healthcare for those with equal needs) (75). Need, like equity, has multiple definitions which will be considered below.

1.8.1 Need as ill-health

Overall, the concept of need for healthcare is linked to ill-health. Williams (92) suggests that ill people have a greater need for healthcare than others who are not sick. Also, people with similar health status have been argued to have the same health need, whereas those with different health status have different health needs (97). "Healthy" people, however, should also be recognised to need health services as is the case for preventive health services. Hence, being sick is not the only basis for seeking healthcare.

1.8.2 Need as the capacity to benefit

According to this view, healthcare may be needed if the ultimate goal is to improve health (75). Consequently, the consumption of resources should lead to an enhanced capacity to benefit. Though not a sufficient condition for a need to exist, a positive marginal product is necessary. However, a person cannot be said to need healthcare if their health cannot be improved or health deterioration prevented by the available technology (98). Culyer (98) argues that such individuals may need comfort, medical research or at best, they need health and not healthcare.

1.8.3 Need as expenditure required to exhaust capacity to benefit

Potentially the most appealing view of need since there is a direct relationship between healthcare and health improvement (the main outcome of health) — which other conceptualisations of need did not cover. Need is adopted as the minimum resources required to exhaust an individual's capacity to benefit from healthcare in this alternative view proposed by Culyer and Wagstaff (75). They argue that need is zero if the marginal capacity to benefit is zero (or need is the expense required to reduce an individual's capacity to benefit to zero). Yet, though rarely available in LMICs, information about specific diseases as well as expenditure for various illnesses may be required under this definition (75).

1.9 Methodological review

Several methodological approaches for assessing inequality in health or healthcare utilisation have been proposed. First, the range, the simplest of the measures, basically compares experiences in the utilisation of healthcare between the richest and poorest wealth quintiles. However, the range has the disadvantage of failing to take into account the size of the two groups under comparison. At the same time, the range overlooks the potential health or health utilisation gaps in the intermediate wealth quintiles (97). Second, the Lorenz curve which plots the cumulative proportion of the population (beginning with the lowest users of healthcare to the highest) against a cumulative proportion of healthcare use, is the other approach for assessing inequality. The Lorenz curve has the limitation of failing to show the extent to which inequalities in healthcare use are systematically related to socioeconomic status (97).

Gini coefficient, which is a ratio of the area that lies between the Lorenz curve and the line of equality is the third approach for assessing inequality. Like the Lorenz curve, the Gini coefficient has the limitation of not showing the extent to which inequalities in health are systematically related to socioeconomic status (97). Fourth, the index of dissimilarity which measures the extent to which a group's share of health is different from population share. It is computed by taking the absolute value after halving the difference between a group's share of the population healthcare use and that groups' population share, which is then summed across all groups. The index of dissimilarity shares the same weaknesses as the Lorenz curve and the Gini coefficient (97). Fifth, the slope index of inequality which is a linear regression depicting the relationship between the level of health in each socioeconomic groups' healthcare use and the hierarchical ranking of socioeconomic categories. However, the slope index of inequality is sensitive to the population's mean health status (97). Lastly, the concentration curve, which is a plot showing the cumulative proportion of the population (ranked from poorest to richest) ranked against the population's cumulative proportion of healthcare use. Relatedly, the concentration index, which is calculated as twice the area between the concentration curve and the line of equality can also be used in assessing inequality in healthcare use. Nevertheless, the concentration curve (or index) lacks a straightforward interpretation (97).

2.0 Methodology

2.1 Study setting

Kenya is a lower-middle-income country located in the East African region. Kenya has a Gross Domestic Product of USD 1,710 per capita (99) and a population of 47.56 million people (100). Kenya's population is predominantly rural (63%), and 36.1% are reported to be living below the national poverty line (101, 102). There are two levels of governance in Kenya: the national

government and 47 semi-autonomous county governments (70). Kenya's health system is pluralistic with almost a near 50-50% split in the provision of healthcare services by the public and private providers. Whereas the national government (Ministry of Health) is responsible for policy and regulatory roles in the health system, the county governments are responsible for service delivery (103).

Furthermore, Kenya's health system is organised into four tiers: Tier 1 is at the community level and is concerned with community-based demand creation activities as stipulated in the community health strategy; Tier 2 is at the primary care level that incorporates services provided by dispensaries, clinics, and health centres; Tier 3 is the first secondary referral hospitals (consisting of both primary and secondary hospitals); and Tier 4 comprises tertiary referral hospitals under the direct management of the Ministry of Health (103). Private providers mimic a similar structure, albeit with a weak referral system. Diabetes and hypertension services are typically offered at Tier 3 hospitals in specialised dedicated clinics. However, in some cases, though an exception rather than the norm, patients can access medication from Tier 2 health facilities (38).

2.2 Study design

The proposed study will use publicly available secondary data from the 2015 Kenya STEPs survey conducted by the Kenya National Bureau of Statistics (KNBS) (33). Developed by the WHO, STEPs is a standardised yet flexible framework for countries to monitor the risk factors for NCDs (104). This was the first nationally representative cross-sectional household survey on NCD risk factors among Kenyan adults aged 18-69 years. The survey used the fifth National Sample Surveys and Evaluation Programme (NASSEP V) developed by the KNBS. The sample frame was developed using the Enumeration Areas (EAs) generated from the 2009 Kenya Population and Housing Census to form 5,360 clusters split into four equal sub-samples.

A three-stage cluster sampling design was used in the selection of clusters, households, and eligible individuals. In the first stage, a total of 200 clusters (100 rural and 100 urban) were selected systematically from the NASSEP V sampling frame using the equal probability selection method to ensure the resulting sample retained the properties of probability proportional to size as was used in the creation of the frame. The second stage of sampling involved a uniform selection of 30 households from the listed households in each cluster. In the third stage, one eligible participant was randomly selected from listed household members using a programmed KISH method of sampling (33).

2.3 Description of sampling in STEPs

The survey covered a universe of the non-institutionalised population of men and women aged 18-69 years. An interval of 12 years was used per age band, resulting in eight groups. At the household level, one individual within the age group of interest was randomly selected for interviews and measurements (33). A total of 6,000 participants were sampled to allow for national representativeness by residence (urban and rural) and sex (male and female) of which 4,754 (or 79.2%) gave consent to participate in the survey (33).

Sample weights were calculated as the reciprocal of all selection probabilities in every stage to produce unbiased estimates. The weights were derived from the NASSEP V sampling frame and the selection of individuals. Besides, the weights were adjusted to cover individual non-response. Post-stratification adjustments were made to align with the population projections according to age-sex categories (33).

The STEPs survey had two inclusion criteria: 1) consent given; 2) age between 18 and 69 years. The exclusion criteria were not giving consent or falling outside the stated age brackets (i.e. below 18 years or above 69 years) (33).

2.4 Ethical considerations for the proposed study

The study will utilise individual de-identified secondary data from the STEPs survey that is publicly available on the KNBS website. As such, the study will not require consent from study participants but will instead be guided by the terms and conditions stipulated by KNBS in analysing and reporting findings using the data set (see Appendix 2). Nevertheless, ethical approval will be sought from the Human Research Ethics Committee of the University of Cape Town.

2.5 Data collection methods

A detailed description of the data collection procedures and data safety measures can be obtained from the STEPs report (33). Briefly, for hypertension screening, an automated blood pressure (BP) measuring instrument (OMRON®) was used to measure BP and pulse rate three times at an interval of 3-5 minutes with the third reading being recorded as the participant's BP. To screen for diabetes, a laboratory technician collected blood samples to assess fasting blood glucose levels (on the second day after giving instructions on day one) using a Cardiocheck machine with test strips. To ensure the accuracy of measurements taken by the equipment, control strips were used at recommended intervals (33).

Characterisation of variables included in the analysis is summarised in Table 1. These variables will be selected based on 1) their availability in the STEPs data set and 2) following after previous studies on inequalities/inequities in the prevalence and/or utilisation of NCDs services (31, 105-108).

Table 1 Variables to be included in the analysis

Variable	Scale	Categories
Participant characteristics		
Sex	Categorical - binary	1 if Female; 0 if otherwise
Need for diabetes screening	Categorical - binary	1 if an individual (man or woman) is aged at least 40 years; 0 if otherwise
Need for hypertension screening	Categorical - binary	1 if an individual (man or woman) is aged at least 40 years; 0 if otherwise
Education	Categorical - ordinal	No formal schooling, Primary, Secondary and Tertiary
Residence	Categorical - binary	Urban, Rural
Employment status	Categorical - nominal	Formal employment, Self-employment, and Unemployed
Marital status	Categorical - binary	Married (currently married, cohabiting), Not married (never married, separated, divorced, widowed)
Socioeconomic status	Categorical - ordinal	Quintile 1 (poorest), Quintile 2, Quintile 3, Quintile 4, Quintile 5 (richest)
Body Mass Index (kg/m^2)	Categorical - ordinal	Underweight ($<18.5kg/m^2$), Normal ($18.5-24.9kg/m^2$), Overweight ($25.0-29.9kg/m^2$), Obese ($\geq 30.0kg/m^2$)
History of hypertension screening and treatment		
Blood pressure ever measured	Categorical - binary	Yes, No
Ever told by doctor or health worker that you have high blood pressure	Categorical - binary	Yes, No

Took prescribed medical treatment for hypertension (2 weeks before the survey)	Categorical - binary	Yes, No
Heart Rate Reading -Third systolic/diastolic reading (mmHg)	Categorical - binary	≥ 140 mmHg or ≥ 90 mmHg
History of diabetes screening and treatment		
Blood sugar ever measured	Categorical - binary	Yes, No
Ever told by a doctor or health worker that you have high blood glucose	Categorical - binary	Yes, No
Currently using insulin prescribed by a doctor or health worker	Categorical - binary	Yes, No
Took oral hypoglycaemics prescribed by a doctor or health worker (2 weeks before the survey)	Categorical - binary	Yes, No
Fasting blood glucose level (mmol/l)	Categorical - binary	<7.0 mmol/L or ≥ 7.0 mmol/L

2.6 Data analysis

2.6.1 Measuring the need for screening and treatment

Two critical interventions will be assessed: screening and treatment. The need for screening in the study will refer to respondents who were eligible for diabetes/hypertension screening in the general population. In this study, "need" for diabetes, and hypertension screening will be based on age (above 40 years for both men and women) as stipulated in Kenya's diabetes (109) and cardiovascular treatment guidelines (110). On the other hand, "need" for diabetes treatment will be based on participants who were diagnosed with diabetes in the survey (i.e., a fasting blood sugar (FBS) ≥ 7.0 mmol/L). On the other hand, "need" for hypertension treatment will be defined as participants diagnosed with hypertension in the survey (i.e., systolic or diastolic blood pressure readings of ≥ 140 mmHg or ≥ 90 mmHg, respectively). The thresholds for defining the need for diabetes and hypertension treatment will be informed by the national treatment guidelines for both conditions in Kenya (*ibid*).

2.6.2 Measuring the utilisation of screening and treatment services

The utilisation of screening services will be defined as respondents who reported having received a screening service for diabetes and hypertension from a formal health provider (i.e. doctor or health worker). Similarly, utilisation of diabetes treatment will be defined as the respondents who reported utilisation of either insulin and/or oral hypoglycaemics. Likewise, utilisation of hypertension treatment will be defined as the number of participants who reported utilisation of prescribed medication two weeks before the survey. Table 2 summarises the numerator and denominator definitions of screening and treatment interventions.

Table 2 Screening and treatment interventions

Interventions	Type of NCD	Numerator (definition of use)	Denominator (definition of need)
Screening	Diabetes	Respondents reporting ever utilising diabetes screening service	Respondents aged 40 years and above
	Hypertension	Respondents reporting ever utilising hypertension screening service	Respondents aged 40 years and above
Treatment	Diabetes	Respondents reporting utilisation of treatment	Respondents diagnosed with diabetes in the survey
	Hypertension	Respondents reporting utilisation of treatment	Respondents diagnosed with hypertension in the survey

2.6.3 Measuring inequity in screening and treatment

In this study, horizontal equity analysis in the utilisation of screening and treatment services for diabetes and hypertension will be conducted. Horizontal equity entails equal utilisation of healthcare services among those with equal needs. Conversely, vertical equity entails unequal utilisation of healthcare services among those with unequal needs (63). The measurement of horizontal equity in the utilisation of healthcare services involves assessing the extent to which healthcare utilisation is (or is not) distributed according to need, regardless of people's socioeconomic status (76).

Inequity can be assessed using two approaches. First, inequity can be measured by running either logistic or probit regression models where the dependent variable represents healthcare

utilisation and is regressed against need variables (97). Second, the use of concentration curves and concentration indices after ranking individuals according to their socioeconomic status beginning with the poor to the rich (on the x-axis) and the cumulative percentage of a health service utilised (on the y-axis) (111). To account for need when using concentration indices, this dissertation will use the approach that takes each individual separately and estimates the healthcare that an individual would receive if treated in the same way as those with the same need characteristics (111).

2.6.4 Assessing socioeconomic status

Principal component analysis (112) will be conducted to generate standardised weight scores of assets such as type of dwelling, who owns the dwelling and certain household goods or possessions, and household amenities (i.e. drinking water source, type of cooking fuel, type of sanitary facility, etc.). The weighted scores will be used to measure the socioeconomic status of households and rank households into five quintiles from quintile one (representing the most deprived households) to quintile five (representing the wealthiest households).

2.6.5 Comparing the distribution of healthcare utilisation according to need

The extent of horizontal (in)equity is measured by comparing each socioeconomic group's share of need with its share of healthcare utilised. In this study, the deviation in the extent to which utilisation of screening and treatment interventions according to need will be estimated using the horizontal inequity index (HI) (113). Defined as twice the area between healthcare utilisation and need concentration curves, HI estimates socioeconomic related inequality in healthcare utilisation after adjusting for differences in healthcare need (111). The HI will be computed by obtaining the difference of the Wagstaff normalised and age-sex standardised need concentration index (C_N), that is need-predicted use, from the Wagstaff normalised healthcare utilisation concentration index (C_H) as indicated in Equation 1.

$$HI = C_H - C_N \tag{1}$$

After standardisation, the HI is interpreted as any residual inequality in utilisation, for example, by income. The derived HI can either be positive(negative) suggesting a pro-rich(pro-poor) distribution (114). Otherwise, when HI is zero, healthcare utilisation and need are distributed equally across the socioeconomic groups (115).

2.6.6 Decomposing the concentration index in screening and treatment of diabetes and hypertension

While concentration indices and concentration curves show the extent of socioeconomic related inequalities in screening and treatment for diabetes and hypertension, as noted earlier, they lack straightforward interpretation as they do not account for the factors responsible for the inequalities observed. Unpacking these factors is critical for policy interventions in addressing the underlying "causes" of inequality in the screening and treatment for diabetes and hypertension in Kenya. Decomposing the concentration index (C_H) is therefore useful in addressing this limitation and explaining the factors "causing" socioeconomic inequality in the screening and treatment of diabetes and hypertension. Originally informed by the work of Oaxaca and Blinder in the early 1970s, decomposition analysis is a technique that explains the gap in the means of an outcome variable between two different groups (e.g. between the rich and the poor) (111, 116). Stated differently, a health variable's concentration index can be computed as the total contribution of the various determinants of that health variable, together with residual (unexplained) component (i.e. the concentration index can be additively decomposed) (117). This study will use the decomposition method outlined by Wagstaff et al.(117) that shows the concentration index can be decomposed as:

$$C_H = \underbrace{\sum_{j=1}^{J} Cj \left(\beta_j \bar{Z}_j / \mu_H\right)}_{\text{Deterministic}} + \underbrace{(GC\varepsilon/\mu_\mathrm{H})}_{\text{Unexplained}} \quad (2)$$

where Cj $(\bar{Z}_j)$ is the concentration index (mean) of the *j*th contributing factor, $GC\varepsilon$ is the generalised concentration index of the error term (ε) and β_j is obtained from the below linearly additive equation related to the contributing factors (*z*) to the screening or treatment variable (*h*). The equation is given as:

$$h_i = \alpha + \sum_j \beta_j Z_{ij} + \varepsilon_i \quad (3)$$

where α and β_j are the coefficients to be estimated and ε_i is the error term.

The deterministic portion of the concentration index in Equation 2 can be interpreted as the contribution of each contributing factor (*z*) to the concentration index (C_H), which consists of two parts. It is a product of the concentration index of each contributing factor (Cj) and the elasticity of h_i with respect to z_j (i.e. $\eta j = \beta_j \bar{Z}_j / \mu_H$). The unexplained portion is the part of socioeconomic inequality in screening and treatment computed as a residual of Equation 2 However, the residual cannot be analytically explained by differences in the contributing factors across socioeconomic groups (117). The variables to be included in the decomposition analysis will be guided by previous

studies (14, see, e.g. 31, 118, 119). These variables, based on their availability in the STEPs data set and their relevance in understanding inequality in screening and treatment of diabetes and hypertension in Kenya include gender, age, educational attainment, exposure to media, employment status, and geographical location.

Given that it is impossible to compute standard errors (SEs) for the components in the decomposition in Equation 2 (i.e. elasticities and the contribution of each factor to the concentration index), bootstrap methods (120, 121) will be used to obtain such SEs in the analysis. Bootstrapping allows for the assessment of sampling variability and in obtaining statistical inference from decomposition results (122). To avoid inconsistencies in the estimation of bootstrapped SEs, the sampling structure of the data will be taken into account as applied by Ataguba et al., (59). A total of 1,000 replications will be used to estimate the SEs for each estimate. All statistical analyses will be undertaken using Stata (version 15.1).

2.7 Study Timeframe

	Jan 20					Jun 20
Activity	1	2	3	4	5	6
Protocol development and ethics approval						
Literature review						
Data analysis, write-up and submission of mini-dissertation sections to supervisors						
Mini-dissertation corrections based on supervisors' comments						
Submission of mini-dissertation						

References

ABEGUNDE, D. O., MATHERS, C. D., ADAM, T., ORTEGON, M. & STRONG, K. 2007. The burden and costs of chronic diseases in low-income and middle-income countries. *The Lancet,* 370**,** 1929-1938.

AIKINS, A. D.-G. & AGYEMANG, C. 2015. *Chronic Non-communicable Diseases in Low and Middle-income Countries*, cabi.

AIKINS, A. D.-G., KUSHITOR, M., KORAM, K., GYAMFI, S. & OGEDEGBE, G. 2014. Chronic non-communicable diseases and the challenge of universal health coverage: insights from community-based cardiovascular disease research in urban poor communities in Accra, Ghana. *BMC public health,* 14**,** S3.

ANDERSON, G. F. & CHU, E. 2007. Expanding priorities-confronting chronic disease in countries with low income. *New England Journal of Medicine,* 356**,** 209.

ATAGUBA, J. E. 2012. *Distributional impact of healthcare finance in South Africa.* University of Cape Town.

ATAGUBA, J. E., AKAZILI, J. & MCINTYRE, D. 2011. Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. *International journal for equity in health,* 10**,** 48.

ATAGUBA, J. E., OJO, K. O. & ICHOKU, H. E. 2016. Explaining socioeconomic inequalities in immunization coverage in Nigeria. *Health policy and planning,* 31**,** 1212-1224.

ATAKLTE, F., ERQOU, S., KAPTOGE, S., TAYE, B., ECHOUFFO-TCHEUGUI, J. B. & KENGNE, A. P. 2015. Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. *Hypertension,* 65**,** 291-298.

BACHMANN, M., EACHUS, J., HOPPER, C., DAVEY SMITH, G., PROPPER, C., PEARSON, N., WILLIAMS, S., TALLON, D. & FRANKEL, S. 2003. Socio-economic inequalities in diabetes complications, control, attitudes and health service use: a cross-sectional study. *Diabetic Medicine,* 20**,** 921-929.

BAKER, J., MITCHELL, R., LAWSON, K. & PELL, J. 2013. Ethnic differences in the cost-effectiveness of targeted and mass screening for high cardiovascular risk in the UK: cross-sectional study. *Heart,* 99**,** 1766-1771.

BARASA, E., NGUHIU, P. & MCINTYRE, D. 2018a. Measuring progress towards sustainable development goal 3.8 on universal health coverage in Kenya. *BMJ global health,* 3**,** e000904.

BARASA, E., ROGO, K., MWAURA, N. & CHUMA, J. 2018b. Kenya National Hospital Insurance Fund Reforms.

BARASA, E. W., MAINA, T. & RAVISHANKAR, N. 2017. Assessing the impoverishing effects, and factors associated with the incidence of catastrophic healthcare payments in Kenya. *International journal for equity in health,* 16**,** 31.

BOERMA, T., ABOUZAHR, C., EVANS, D. & EVANS, T. 2014. Monitoring intervention coverage in the context of universal health coverage. *PLoS medicine,* 11**,** e1001728.

BOMMER, C., HEESEMANN, E., SAGALOVA, V., MANNE-GOEHLER, J., ATUN, R., BÄRNIGHAUSEN, T. & VOLLMER, S. 2017. The global economic burden of diabetes in adults aged 20–79 years: a cost-of-illness study. *The lancet Diabetes & endocrinology,* 5**,** 423-430.

BONFRER, I., VAN DE POEL, E., GRIMM, M. & VAN DOORSLAER, E. 2013. Does the distribution of healthcare utilization match needs in Africa? *Health Policy and Planning,* 29**,** 921-937.

BRAVEMAN, P. & GRUSKIN, S. 2003. Defining equity in health. *Journal of Epidemiology & Community Health,* 57**,** 254-258.

CHOW, C. K., RAMASUNDARAHETTIGE, C., HU, W., ALHABIB, K. F., AVEZUM JR, A., CHENG, X., CHIFAMBA, J., DAGENAIS, G., DANS, A. & EGBUJIE, B. A. 2018. Availability and affordability of essential medicines for diabetes across high-income, middle-income, and low-income countries: a prospective epidemiological study. *The lancet Diabetes & endocrinology,* 6**,** 798-808.

CHOW, C. K., TEO, K. K., RANGARAJAN, S., ISLAM, S., GUPTA, R., AVEZUM, A., BAHONAR, A., CHIFAMBA, J., DAGENAIS, G. & DIAZ, R. 2013. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *Jama,* 310**,** 959-968.

CHUMA, J. 2001. *Resource allocation in the Kenyan health sector: a question of equity.* University of Cape Town.

CHUMA, J. & MAINA, T. 2014. Free maternal care and removal of user fees at primary-level facilities in Kenya. Monitoring the implementation and impact: Baseline report.

CHUMA, J., MAINA, T. & ATAGUBA, J. 2012. Does the distribution of healthcare benefits in Kenya meet the principles of universal coverage? *BMC public health,* 12**,** 20.

CISSÉ, B., LUCHINI, S. & MOATTI, J. P. 2007. Progressivity and horizontal equity in healthcare finance and delivery: What about Africa? *Health policy,* 80**,** 51-68.

CULYER, A. J. & WAGSTAFF, A. 1993. Equity and equality in health and healthcare. *J Health Econ,* 12**,** 431-57.

CULYER, A. J. A. W., A., 1991. Need, Quality and Social Justice. University of York Centre for Health Economics

DALL, T. M., YANG, W., HALDER, P., PANG, B., MASSOUDI, M., WINTFELD, N., SEMILLA, A. P., FRANZ, J. & HOGAN, P. F. 2014. The economic burden of elevated blood glucose levels in 2012: diagnosed and undiagnosed diabetes, gestational diabetes mellitus, and prediabetes. *Diabetes care,* 37**,** 3172-3179.

DENIER, Y. 2007. *Efficiency, justice and care*, Springer.

EFRON, B. 1987. Better bootstrap confidence intervals. *Journal of the American statistical Association,* 82**,** 171-185.

EFRON, B. & TIBSHIRANI, R. 1986. [Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy]: rejoinder. *Statistical science,* 1**,** 77-77.

ELSTER, J. 1992. *Local justice: How institutions allocate scarce goods and necessary burdens*, Russell Sage Foundation.

ELWELL-SUTTON, T. M., JIANG, C. Q., ZHANG, W. S., CHENG, K. K., LAM, T. H., LEUNG, G. M. & SCHOOLING, C. 2012. Inequality and inequity in access to healthcare and treatment for chronic conditions in China: the Guangzhou Biobank Cohort Study. *Health policy and planning,* 28**,** 467-479.

EVANS, T., WHITEHEAD, M. & DIDERICHSEN, F. 2001. *Challenging inequities in health: from ethics to action*, Oxford University Press.

GAUS, G. F. & KUKATHAS, C. 2004. *Handbook of political theory*, Sage.

GOVERNMENT OF KENYA 2010. The Constitution of Kenya. Nairobi: Government of Kenya.

GUAN, W. 2003. From the help desk: bootstrapped standard errors. *The Stata Journal,* 3**,** 71-80.

HANSSON, S. O. 2004. What are opportunities and why should they be equal? *Social Choice and Welfare,* 22**,** 305-316.

HART, J. T. 1971. The inverse care law. *The Lancet,* 297**,** 405-412.

HELLER, O., SOMERVILLE, C., SUGGS, L. S., LACHAT, S., PIPER, J., AYA PASTRANA, N., CORREIA, J. C., MIRANDA, J. J. & BERAN, D. 2019. The process of prioritization of non-communicable diseases in the global health policy arena. *Health policy and planning*.

HENDRIKS, M. E., WIT, F. W., ROOS, M. T., BREWSTER, L. M., AKANDE, T. M., DE BEER, I. H., MFINANGA, S. G., KAHWA, A. M., GATONGI, P. & VAN ROOY, G. 2012. Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. *PloS one,* 7.

HORTON, R. 2017. Offline: NCDs—why are we failing? *The Lancet,* 390**,** 346.

HOWARD, K., WHITE, S., SALKELD, G., MCDONALD, S., CRAIG, J. C., CHADBAN, S. & CASS, A. 2010. Cost-effectiveness of screening and optimal management for diabetes, hypertension, and chronic kidney disease: A modeled analysis. *Value in health,* 13**,** 196-208.

ILINCA, S., DI GIORGIO, L., SALARI, P. & CHUMA, J. 2019. Socioeconomic inequality and inequity in use of healthcare services in Kenya: evidence from the fourth Kenya household health expenditure and utilization survey. *International Journal for Equity in Health,* 18**,** 196.

INTERNATIONAL DIABETES FEDERATION 2019. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: International Diabetes Federation.

ISARANUWATCHAI, W., ARCHER, R. A., TEERAWATTANANON, Y. & CULYER, A. J. 2019. Non-Communicable Disease Prevention: Best Buys, Wasted Buys and Contestable Buys.

IWELUNMOR, J., AIRHIHENBUWA, C. O., COOPER, R., TAYO, B., PLANGE-RHULE, J., ADANU, R. & OGEDEGBE, G. 2014. Prevalence, determinants and systems-thinking approaches to optimal hypertension control in West Africa. *Globalization and health,* 10**,** 42.

JANN, B. 2008. The Blinder–Oaxaca decomposition for linear regression models. *The Stata Journal,* 8**,** 453-479.

JOFFRES, M., FALASCHETTI, E., GILLESPIE, C., ROBITAILLE, C., LOUSTALOT, F., POULTER, N., MCALISTER, F. A., JOHANSEN, H., BACLIC, O. & CAMPBELL, N. 2013. Hypertension prevalence, awareness, treatment and control in national surveys from England, the USA and Canada, and correlation with stroke and ischaemic heart disease mortality: a cross-sectional study. *BMJ open,* 3**,** e003423.

KABIA, E., MBAU, R., OYANDO, R., ODUOR, C., BIGOGO, G., KHAGAYI, S. & BARASA, E. 2019. "We are called the et cetera": experiences of the poor with health financing reforms that target them in Kenya. *International Journal for Equity in Health,* 18**,** 98.

KAHN, R., ALPERIN, P., EDDY, D., BORCH-JOHNSEN, K., BUSE, J., FEIGELMAN, J., GREGG, E., HOLMAN, R. R., KIRKMAN, M. S. & STERN, M. 2010. Age at initiation and frequency of screening to detect type 2 diabetes: a cost-effectiveness analysis. *The Lancet,* 375**,** 1365-1374.

KAYIMA, J., WANYENZE, R. K., KATAMBA, A., LEONTSINI, E. & NUWAHA, F. 2013. Hypertension awareness, treatment and control in Africa: a systematic review. *BMC cardiovascular disorders,* 13**,** 54.

KAZUNGU, J. S. & BARASA, E. W. 2017. Examining levels, distribution and correlates of health insurance coverage in Kenya. *Tropical Medicine & International Health,* 22**,** 1175-1185.

KNBS 2018. Economic Survey. Nairobi, Kenya.

KNBS 2019. Kenya Population and Housing Census. Nairobi, Kenya.

LI, R., ZHANG, P., BARKER, L. E., CHOWDHURY, F. M. & ZHANG, X. 2010. Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review. *Diabetes care,* 33**,** 1872-1894.

LIM, S. S., VOS, T., FLAXMAN, A. D., DANAEI, G., SHIBUYA, K., ADAIR-ROHANI, H., ALMAZROA, M. A., AMANN, M., ANDERSON, H. R. & ANDREWS, K. G. 2012. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet,* 380**,** 2224-2260.

LITTENBERG, B., GARBER, A. M. & SOX, H. C. 1990. Screening for hypertension. *Annals of internal medicine,* 112**,** 192-202.

LOPEZ, A. D., MATHERS, C. D., EZZATI, M., JAMISON, D. T. & MURRAY, C. J. 2006. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *The Lancet,* 367**,** 1747-1757.

MAINA, T. & KIRIGIA, D. 2015. Annual Evaluation of the Abolition of User Fees at Primary Healthcare Facilities in Kenya. Washington DC: Futures Group. *Health Policy Project*.

MATHERS, C. D. & LONCAR, D. 2006. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS medicine,* 3**,** e442.

MAYOSI, B. M., FLISHER, A. J., LALLOO, U. G., SITAS, F., TOLLMAN, S. M. & BRADSHAW, D. 2009. The burden of non-communicable diseases in South Africa. *The lancet,* 374**,** 934-947.

MCGUIRE, A., HENDERSON, J. & MOONEY, G. 1988. *The economics of healthcare: an introductory text*, Routledge & Kegan Paul.

MINISTRY OF HEALTH 2014. Kenya Health Policy 2014-2030.

MINISTRY OF HEALTH 2015. Kenya STEPwise survey for non-communicable diseases risk factors 2015 report. Available at: http://aphrc.org/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf [Accessed 8 August 2019].

MINISTRY OF HEALTH 2018. Kenya National Guidelines for Cardiovascular Diseases Management. Nairobi, Kenya.

MINISTRY OF PUBLIC HEALTH AND SANITATION 2010. National Clinical Guidelines for Management of Diabetes Mellitus. Nairobi, Kenya.

MOHAMED, S. F., MUTUA, M. K., WAMAI, R., WEKESAH, F., HAREGU, T., JUMA, P., NYANJAU, L., KYOBUTUNGI, C. & OGOLA, E. 2018a. Prevalence, awareness, treatment and control of hypertension and their determinants: results from a national survey in Kenya. *BMC public health,* 18**,** 1219.

MOHAMED, S. F., MWANGI, M., MUTUA, M. K., KIBACHIO, J., HUSSEIN, A., NDEGWA, Z., OWONDO, S., ASIKI, G. & KYOBUTUNGI, C. 2018b. Prevalence and factors associated with pre-diabetes and diabetes mellitus in Kenya: results from a national survey. *BMC Public Health,* 18**,** 1215.

MOODY, A., COWLEY, G., FAT, L. N. & MINDELL, J. S. 2016. Social inequalities in prevalence of diagnosed and undiagnosed diabetes and impaired glucose regulation in participants in the Health Surveys for England series. *BMJ open,* 6**,** e010155.

MOONEY, G. H. 1983. Equity in healthcare: confronting the confusion. *Effective healthcare,* 1**,** 179-185.

MOONEY, G. H. 1994. Key issues in health economics, New York, Harvester Wheatsheaf.

MUNGE, K. & BRIGGS, A. H. 2013. The progressivity of health-care financing in Kenya. *Health policy and planning,* 29**,** 912-920.

MUTYAMBIZI, C., BOOYSEN, F., STOKES, A., PAVLOVA, M. & GROOT, W. 2019. Lifestyle and socioeconomic inequalities in diabetes prevalence in South Africa: A decomposition analysis. *PloS one,* 14.

NEVES, R. G., DURO, S. M. S., FLORES, T. R., WENDT, A., COSTA, C. D. S., NUNES, B. P., WEHRMEISTER, F. C., MUÑIZ, J., CASTRO, T. R. P. & TOMASI, E. 2018. Social inequalities in care for the elderly with diabetes in Brazil. *Revista Panamericana de Salud Pública,* 42**,** e88.

NGUHIU, P. K., BARASA, E. W. & CHUMA, J. 2017. Determining the effective coverage of maternal and child health services in Kenya, using demographic and health survey data sets: tracking progress towards universal health coverage. *Tropical Medicine & International Health,* 22**,** 442-453.

NIESSEN, L. W., MOHAN, D., AKUOKU, J. K., MIRELMAN, A. J., AHMED, S., KOEHLMOOS, T. P., TRUJILLO, A., KHAN, J. & PETERS, D. H. 2018. Tackling socioeconomic inequalities and non-communicable diseases in low-income and middle-income countries under the Sustainable Development agenda. *The Lancet,* 391**,** 2036-2046.

NOZICK, R. 1974. *Anarchy, state, and utopia*, New York: Basic Books.

O'DONNELL, O., VAN DOORSLAER, E., WAGSTAFF, A. & LINDELOW, M. 2008. *Analyzing health equity using household survey data: a guide to techniques and their implementation*, The World Bank.

OLSEN, J. A. 1997. Theories of justice and their implications for priority setting in healthcare. *Journal of health economics,* 16**,** 625-639.

OLSEN, M. H., ANGELL, S. Y., ASMA, S., BOUTOUYRIE, P., BURGER, D., CHIRINOS, J. A., DAMASCENO, A., DELLES, C., GIMENEZ-ROQUEPLO, A.-P. & HERING, D. 2016. A call to action and a lifecourse strategy to address the global burden of raised blood pressure on current and future generations: the Lancet Commission on hypertension. *The Lancet,* 388**,** 2665-2712.

OYANDO, R., NJOROGE, M., NGUHIU, P., KIRUI, F., MBUI, J., SIGILAI, A., BUKANIA, Z., OBALA, A., MUNGE, K. & ETYANG, A. 2019. Patient costs of hypertension care in public healthcare facilities in Kenya. *The International journal of health planning and management,* 34**,** e1166-e1178.

OYANDO, R., NJOROGE, M., NGUHIU, P., SIGILAI, A., KIRUI, F., MBUI, J., BUKANIA, Z., OBALA, A., MUNGE, K. & ETYANG, A. 2020. Patient costs of diabetes mellitus care in public healthcare facilities in Kenya. *The International Journal of Health Planning and Management,* 35**,** 290-308.

PEREIRA, J. A. C. G. 1995. *Equity, health and healthcare: an economic study with reference to Portugal.* University of York.

PETERS, M., HUISMAN, E., SCHOONEN, M. & WOLFFENBUTTEL, B. 2017. The current total economic burden of diabetes mellitus in the Netherlands. *Neth J Med,* 75**,** 281-297.

PHIRI, J. & ATAGUBA, J. E. 2014. Inequalities in public healthcare delivery in Zambia. *International journal for equity in health,* 13**,** 24.

RAWLS, J. 1971. A theory of justice, Harvard, MA, Harvard University Press.

REAGON, G., MAKAN, B. & MCINTYRE, D. 1997. Resource Allocation Mechanisms within the District Health System: A Literature Review. *Health Economics Unit, department of Community Health, University of Cape Town*.

RILEY, L., GUTHOLD, R., COWAN, M., SAVIN, S., BHATTI, L., ARMSTRONG, T. & BONITA, R. 2016. The World Health Organization STEPwise approach to non-communicable disease risk-factor surveillance: methods, challenges, and opportunities. *American journal of public health,* 106**,** 74-78.

ROEMER, J. E. 1996. *Egalitarian Perspectives: Essays in philosophical economics*, Cambridge University Press.

SALARI, P., DI GIORGIO, L., ILINCA, S. & CHUMA, J. 2019. The catastrophic and impoverishing effects of out-of-pocket healthcare payments in Kenya, 2018. *BMJ Global Health,* 4.

SANDEL, M. 2009. Justice: What's the right thing to do? New York, NY: Farrar, Straus & Giroux.

SCARRE, G. 2002. *Utilitarianism*, Routledge.

SEN, A. 1985. Capabilities and commodities. *Amsterdam and New York: North-Holland*.

SEN, A. 1987. *On Ethics and Economics,* Oxford and New York, Basil Blackwell.

SOZMEN, K. & BELGIN, U. 2014. Socioeconomic inequalities in non-communicable diseases and self assessed health in Turkey. *Iranian journal of public health,* 43**,** 736.

SÖZMEN, K. & ÜNAL, B. 2016. Explaining inequalities in healthcare utilization among Turkish adults: findings from health survey 2008. *Health Policy,* 120**,** 100-110.

SU, M., SI, Y., ZHOU, Z., SHEN, C., DONG, W., FAN, X., WANG, X. & WEI, X. 2018. Comparing the income-related inequity of tested prevalence and self-reported prevalence of hypertension in China. *International journal for equity in health,* 17**,** 82.

SUBRAMANIAN, S., GAKUNGA, R., KIBACHIO, J., GATHECHA, G., EDWARDS, P., OGOLA, E., YONGA, G., BUSAKHALA, N., MUNYORO, E. & CHAKAYA, J. 2018. Cost and affordability of non-communicable disease screening, diagnosis and treatment in Kenya: Patient payments in the private and public sectors. *PloS one,* 13**,** e0190113.

UNITED NATIONS 2015. Transforming Our World - the 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals (Accessed 14 November 2019).

VAN DE VIJVER, S., AKINYI, H., OTI, S., OLAJIDE, A., AGYEMANG, C., ABODERIN, I. & KYOBUTUNGI, C. 2014. Status report on hypertension in Africa-Consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. *Pan African Medical Journal,* 16.

VAN DER HOOG, M. 2010. Measuring equity in healthcare delivery: a new method based on the concept of aristotelian equality. *Netherlands: Network for studies on pensions, aging and retirement*.

VAN DOORSLAER, E., WAGSTAFF, A., VAN DER BURG, H., CHRISTIANSEN, T., DE GRAEVE, D., DUCHESNE, I., GERDTHAM, U.-G., GERFIN, M., GEURTS, J. & GROSS, L. 2000. Equity in the delivery of healthcare in Europe and the US. *Journal of health economics,* 19**,** 553-583.

VAN MALDEREN, C., OGALI, I., KHASAKHALA, A., MUCHIRI, S. N., SPARKS, C., VAN OYEN, H. & SPEYBROECK, N. 2013. Decomposing Kenyan socioeconomic inequalities in skilled birth attendance and measles immunization. *International journal for equity in health,* 12**,** 3.

VYAS, S. & KUMARANAYAKE, L. 2006. Constructing socioeconomic status indices: how to use principal components analysis. *Health policy and planning,* 21**,** 459-468.

WAGSTAFF, A., PACI, P. & VAN DOORSLAER, E. 1991. On the measurement of inequalities in health. *Social science & medicine,* 33**,** 545-557.

WAGSTAFF, A. & VAN DOORSLAER, E. 2000. Measuring and testing for inequity in the delivery of healthcare. *Journal of Human Resources***,** 716-733.

WAGSTAFF, A., VAN DOORSLAER, E. & WATANABE, N. 2003. On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. *Journal of Econometrics,* 112**,** 207-223.

WALLI-ATTAEI, M., JOSEPH, P., ROSENGREN, A., CHOW, C. K., RANGARAJAN, S., LEAR, S. A., ALHABIB, K. F., DAVLETOV, K., DANS, A. & LANAS, F. 2020. Variations between women and men in risk factors, treatments, cardiovascular disease incidence, and death in 27 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. *The Lancet*.

WHITEHEAD, M. 1991. The concepts and principles of equity and health. *Health promotion international,* 6, 217-228.

WILLIAMS, A. 1993. Equity in healthcare: the role of ideology. *Equity in the Finances and Delivery of Healthcare: An International Perspective, New York*.

WILLIAMS, J., ALLEN, L., WICKRAMASINGHE, K., MIKKELSEN, B., ROBERTS, N. & TOWNSEND, N. 2018. A systematic review of associations between non-communicable diseases and socioeconomic status within low-and lower-middle-income countries. *Journal of global health,* 8.

WORLD BANK 2018a. GDP per capita (current US$). Available: https://data.worldbank.org/indicator/ny.gdp.pcap.cd?name_desc=true (Accessed 18 November 2019).

WORLD BANK. 2018b. *Urban Population (% of total population). Available at: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS (Accessed 18 November 2019)* [Online]. [Accessed].

WORLD HEALTH ORGANIZATION 2003. Building on the user-fee experience: The African case. Geneva: World Health Organization.

WORLD HEALTH ORGANIZATION 2007. *Prevention of cardiovascular disease*, World Health Organization.

WORLD HEALTH ORGANIZATION 2012. Health systems financing: the path to universal coverage. Geneva: World Health Organization.

WORLD HEALTH ORGANIZATION 2013. A global brief on hypertension: silent killer, global public health crisis: World Health Day 2013. World Health Organization.

WORLD HEALTH ORGANIZATION 2014. Global status report on noncommunicable diseases 2014. World Health Organization.

WORLD HEALTH ORGANIZATION 2016. Global report on diabetes: executive summary. World Health Organization.

WORLD HEALTH ORGANIZATION 2020. Non-communicable Diseases - Key Facts. Available at https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases [Accessed on 6 September 2020].

ZERE, E. & MCINTYRE, D. 2003. Inequities in under-five child malnutrition in South Africa. *International journal for equity in health,* 2, 7.

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, 78.

ZERE, E., OLUWOLE, D., KIRIGIA, J. M., MWIKISA, C. N. & MBEELI, T. 2011. Inequities in skilled attendance at birth in Namibia: a decomposition analysis. *BMC pregnancy and childbirth,* 11, 34.

PART B: LITERATURE REVIEW

"I do not mean that others should be eased and you burdened, but that as a matter of equality your abundance at the present time should supply their want, so that their abundance may supply your want, that there may be equality" (2 Corinthians 8:13-14, RSV)

2.0 Introduction

This chapter is divided into three main sections. In the first section, a theoretical literature review is undertaken where inequity and inequality are distinguished. In the second section, the theoretical debates around the methodologies used to assess inequity and inequality in health and healthcare are discussed. Thereafter, an explanation of the theory and methodology that will guide this study is provided. The third section contains an empirical review of the literature on inequity and inequality in non-communicable diseases in both low-and middle-income (LMICs) and high-income countries (HICs). To give the reader a clear and succinct perspective on the research to be undertaken, this chapter provides a critical and detailed review on concepts such as equity, equality and need that underpin this study as well as provide gaps in knowledge and shortcomings from previous empirical studies on inequity or socioeconomic inequality in non-communicable diseases.

2.1 Theoretical review

2.2 What is equity?

Over the years, considerable attention has been drawn to equity in health and healthcare by researchers and policymakers (123-125). Indeed, it has been conjectured that the modern interest in health inequalities dates back to the nineteenth century from the pioneering work of Engels in 1845 (125). Yet, as portrayed in the scholarly literature, a lot of confusion and sharp debates have characterised the conceptualisation of equity. Hence, no agreement has been arrived at regarding its definition and measurement (74, 126-129). Overall, "fairness" or "justice" in the distribution of a good or service among and between groups or individuals of different socioeconomic standing in the society have nonetheless been conceded to as the key underpinning definition of equity (63, 72, 123).

That *fairness* and *justice* are subjective terms and hence open to multiple interpretations by different people in different settings or times (63) are what belie the contestation surrounding the definition of equity. Furthermore, the various attempts by several researchers to define equity confirms the myriad views surrounding the concept. Regarding the measurement of equity in the health sector, measures using concepts such as utilisation, access, expenditures, distribution of

resources, and health status have been used (123, 130). Two dimensions of equity: vertical and horizontal, have been distinguished in the literature (72, 131). These are discussed next.

2.3 Vertical and horizontal equity

Vertical equity refers to "unequal, but equitable treatment of equals" — implying that individuals with different health needs should be treated according to the differences in their needs. Similarly, vertical equity can also be viewed as matching treatment to the level of need (132). Moreover, this unequal treatment of unequals, in principle, has been argued to be sensible in the context of healthcare delivery (131). Horizontal equity, by contrast, has been defined as the "equal treatment of equals" — suggesting that those with the same level of health need (irrespective of how need is defined) should receive equal treatment despite their age, sex, race, socioeconomic status among other possible stratifiers (72, 133).

The difference between vertical and horizontal equity is that the former disregards equal treatment for those with equal needs. Also, whereas vertical equity recognises that individuals may have the same level of need, they nonetheless have other characteristics that determine their treatment in an unequal manner (134). As a result, those who have seemingly higher needs are given preferential treatment from the vertical equity perspective. In this study, the horizontal principle of equity is employed. This is motivated by the fact that this study is concerned with equal treatment of persons with an equal health need (non-communicable diseases) regardless of their underlying characteristics (135).

Moreover, vertical equity has arguably limited application in service availability or utilisation and is instead more relevant in policy scenarios concerned with healthcare financing. Conversely, horizontal equity finds application in the context of universal access and utilisation of healthcare services (136). Indeed, policy and other official legal documents of many countries attest to the prioritisation given to the principle of equitable distribution of health and thus somewhat imply horizontal equity (137). Moreover, this study follows after previous empirical studies and theoretical discussions on equity that have commonly focused on horizontal rather than vertical equity (58, 97, 129, 138-140).

To provide some insight into the various perspectives of equity, a review of philosophical theories of justice is necessary. The theories of justice reviewed (among others) include Rawl's theory of justice, the utilitarian, the libertarian, and the egalitarian perspectives of justice. Before this review, however, it is important to note the distinction between equity and equality.

2.4 What is the distinction between equity and equality?

Although closely related, equity and equality are not similar concepts (128). Equity is about fairness, and it has been considered an ethical principle (63). As such, the term "inequity" may come across as judgemental, accusatory, or in a morally charged tone. On the other hand, equality concerns itself with equal distribution of shares (or any other entity), which may not necessarily be fair (131). For instance, in healthcare, an equal distribution of access to, say, a screening service for hypertension may not be fair unless socioeconomically disadvantaged groups or those that need the services more, relative to the well-off groups are given greater access for such a distribution to be considered equitable (72). Therefore, there is a possibility for inequality in the distribution of a good or service to be considered fair and thus equitable. In many countries, equity has been established as a key policy focus in health given the overwhelming evidence that indicates that those in lower socioeconomic groups (who are least able to afford healthcare) carry a disproportionately higher burden of ill-health. Subsequently, they are kept in a vicious cycle where poverty leads to ill-health, and ill-health maintains or further exacerbates poverty (141-144). This status of affairs has been considered unfair (145).

2.5 Theories of justice

2.5.1 Utilitarian theory of justice

The *utilitarian* theory of justice aims at maximising welfare or happiness for the greatest number (126, 127, 146, 147). Three common features characterise utilitarianism. First, *welfarism* which requires the evaluation of consequences of actions in terms of the utility or welfare that individuals derive from such actions. Second, *consequentialism* requires the evaluation of actions in terms of their consequences; and third, *sum-ranking* which requires that overall, the evaluation of actions must consider the total sum of utilities that individuals in a given population derive from such actions (126). In the context of health, it can be argued from these three features that any pattern of distribution of healthcare resources to be equitable when it maximises the health status within a population. Furthermore, potentially due to ease of implementation, these three features have made the utilitarian perspective of justice reflected in many policy decisions in healthcare. However, some critics of this theory of justice have argued that strictly speaking, utilitarianism makes no reference to finite resources. Hence, "the greatest good for the greatest number" may not be easily attainable particularly from the economist's efficiency perspective (148). Failure by utilitarians to consider the distribution of utility across different individuals or socioeconomic groups is another point of criticism for this perspective (127, 149). Also, the utilitarian view has been criticised, with respect to equity in health, for not putting into special consideration the poorest and most vulnerable (150). Furthermore, it is important to note that in any case, the overall health

status of any population can be improved without necessarily or with the least improvement in the health status of the poorest (145). Stated differently, even when the health status of the worst-off in the general population declines, there still can be an improvement in overall health gains. Also, as put forward by Olsen (78), the utilitarian perspective ignores actions that though unjust — from a common-sense viewpoint, improves the overall utility since it is only the consequences that matter. Of interest, if one assumes diminishing marginal utility of a good or service, the utilitarian perspective makes a case for the redistribution of that good or service (126). Therefore, given that the marginal utility gained by those with fewer of a good or service will be higher, for maximisation of their utility, redistribution of that good or service will be necessary.

2.5.2 Libertarian theory of justice

Natural rights, such as the right to life and possessions — if legally acquired, are particularly emphasised in the *libertarian* theory of justice (131). In other words, according to libertarians (see, e.g., Locke (151) and Nozick (89)), justice is viewed as a matter of enforcing private property rights, including the "rights to the fruits of your own labour" (126). Also, in the distribution of healthcare resources or benefits, libertarians regard the maintenance of respect for consumer sovereignty and market forces as just and acceptable (131). Accordingly, the utopian ideals of perfect competition where there is freedom for market entry and exit for providers while consumers express their preferences in open markets and consequently determine the goods and services supplied have been incessantly espoused by libertarians (125). While most schools of thought may accept this view regarding the distribution of most economic goods, it may not be appealing to others when the distribution of healthcare resources is not based on medical merit (150). This may not at all be surprising given that an individual cannot flourish while he or she is diseased or dead and because healthcare is essential for a good life (Culyer (128). As such, as suggested by Culyer (2001, p.276) (128), "If it is felt that all residents of a political jurisdiction ought to have equal opportunities for their lives to flourish, then it follows that *healthcare* is one of the goods and services whose *right* distribution must be ensured".

However, libertarians argue that the role of the state should be confined to ensuring law and order and no more than that (126). Furthermore, at minimal, the state's role should include safeguarding property, detecting force or fraud in private contracts, and compelling criminals to pay commensurate financial compensation to their victims (126). Additionally, the state should refrain from raising taxes or interfering with individual liberty for any cause. That is, the provision of public goods, redistribution of wealth, and health from the rich to the poor and regulation of the markets should not be within the state's purview (126). To the contrary, libertarians have advised that the

state's involvement in healthcare should not only cease but be replaced by the privatisation of healthcare insurance and that the healthcare needs of the vulnerable (e.g. the poor, the elderly and the disabled etc.) should be catered for by private charity (126). Therefore, equality before the law is held as the critical concept from the libertarian perspective. Hence, whenever there is a conflict between personal freedom and equality, the former is given clear precedence (125). Taken together, libertarians insist that the state has no business in the violation of one's right for the sake of someone else's. Indeed, according to Nozick (89), this "meddling" would amount to what he calls "utilitarianism of rights". However, it seems that libertarians downplay ubiquitous problems such as monopolies or cartelisation and other market imperfections that undermine competitive markets (125). While some have outrightly regarded libertarianism as selfishness (148), others view it as epitomizing a capitalist society where the "haves" are under no obligation whatsoever to give to the "have-nots" (152). Nevertheless, let it suffice to say that the ravaging impacts of implementing libertarian ideas in many LMICs particularly in sub-Sharan Africa (where structural adjustment policies were mainly implemented) during the neoliberal era from the 1980s to early 2000s are well documented (96, 125, 153-157). Key among the negative effects of neoliberal policies was the inability of the poor to access needed healthcare due to the imposition of user fees.

2.5.3 Rawls theory of justice

In the *Rawlsian* theory of justice, two principles are suggested (126, 149, 150). First, that basic principles such as right to property, freedom of speech, right to vote, and eligibility for public office should be such that they are equally distributed to the maximum level that is acceptable to everyone and that they are enjoyed on the same level by all. Second, the least advantaged members of society are the ones to benefit the most when there are economic or social inequalities — a view that is of interest to this study. An index of primary basic goods (i.e., opportunities, power, income, and wealth) — that is to be satisfied sequentially is used to judge whether the benefits are equally distributed (126, 149). In sum, according to the Rawlsian view, equity or justice is attained when a society is arranged — from any possible number of arrangements — to the benefit of the disadvantaged (78). It, therefore, goes without saying that according to Rawl's theory of justice, justice or fairness is undermined when a society is arranged in a manner where sacrifices are made by the worst-off groups to favour the better-off groups in terms of social, economic and political institutions (127). Nevertheless, health is not considered as one of the primary or "natural" goods such as intellect in this philosophical view of justice. Thus, primary goods considered under this view are those that are distributed by societal structures such as income, freedom of association or religion, etc. Even so, healthcare can be seen as an essential institution to achieve a just distribution of these primary goods (131).

Despite the exclusion of health as a primary social good, in the context of equity in health and healthcare, the *Rawlsian* theory of justice would advocate for the worst-off in a society to be prioritised. For instance, as suggested by Gilson (150), this would entail providing the worst-off with a decent minimum level of healthcare resources that would consequently promote the minimum level of health possible. However, the Rawlsian notion of justice has been criticised by egalitarians, who contend that it is insufficient to achieve the absolute minimum level of health services for the worse-off (126). This is particularly so because the better-off members of a population would still have the opportunity to not only maintain their access to health services but also relatively increase their utilisation of the same. Furthermore, Okorafor (145) criticises the Rawlsian view by arguing that it is an indirect approach to health equity since this (Rawlsian) theory of justice merely considers as unjust the gender, socioeconomic class, or geographic factors as inequalities in health that originate from the basic structure of the society. For example, this may include how labour is divided socially, which could lead to the benefit of the rich at the expense of the poor. As such, he posits that the distribution of health outcomes in society would be considered just if the basic societal structure is just. Indeed, given the multiplicity of factors outside

the scope of the health sector, that directly or indirectly influence equity in health and health outcomes (74, 77, 125, 144, 158), Okorafor's views are agreeable.

2.5.4 Egalitarian theory of justice

The *egalitarian* theory of justice advocates that need should be taken into consideration when distributing healthcare resources (131). In other words, the egalitarian view does not allow wealth and income to influence the distribution of healthcare resources or in people's access to healthcare services. Thus, the distribution of healthcare resources according to need and the financing of healthcare according to the ability to pay are some of the criteria used by egalitarians to assess equity (146, 150). As indicated earlier, a large body of evidence has consistently shown that the socioeconomically disadvantaged groups relative to the well-off groups — in both HICs and LMICs — bear a disproportionate burden of ill-health, have inadequate access to high-quality health services and have poor health outcomes in general (141, 143, 144, 159-163). In part, it is the emergence of this evidence that has contributed to the egalitarian perspective gaining popularity and the attention of policymakers globally (145).

2.6 What theory of justice has been adopted in this study?

Noting that several studies (41, 43-45, 57, 164-168) have shown a marked disparity in health and healthcare across the socioeconomic and geographical divide since the attainment of independence in Kenya more than 50 years ago, the egalitarian perspective is considered appropriate for assessing inequity and socioeconomic inequality in the screening and treatment of diabetes and hypertension in Kenya. Furthermore, the choice of the egalitarian perspective is informed by two factors. One, the Kenyan constitution (70) explicitly states that "the highest attainable standard of health" is the right of every Kenyan — thus suggesting, among other possible interpretations, that utilisation of health services or the distribution of health resources should be based on need. Additionally, the Kenya health policy (2014-2030) (103), is pro-egalitarian by espousing equity as its overarching and guiding principle regarding the distribution of health services or interventions. Consequently, being informed by universal health coverage goals, access to health and related services should be based on "people's legitimate needs" and not the ability to pay. Two, the egalitarian perspective of justice has been employed in assessing equity in health in previous studies with similar objectives as the present one (41, 58). To this end, critical to the egalitarian view in this study is that the distribution of both screening and treatment interventions for diabetes and hypertension should be based on need.

2.7 Summary and Discussion

As is apparent from the foregoing, despite the theory of justice adopted as a guiding principle in the attainment of equity in any health system, the identification of an appropriate operational definition of equity, based on a measurable criterion remains a challenge (63). Consequently, to attempt to resolve this, defining "what" is to be distributed fairly is a starting point. For instance, for maximisation of health status, should a healthcare system concern itself with an equal distribution of "health", "healthcare", or "opportunity"? As argued by Culyer (128), there is no consensus as to "what" should be distributed equally.

Contingent on the context within which a good or service needs to be equally distributed, the various perspectives of justice reviewed provide a good starting point from which a suitable operational definition of equity can be arrived at. Relative to the better-off, favouring the worse-off members of a population in the distribution of a good or service is advocated for by the Rawlsian and egalitarian views of justice. Also, if one assumes diminishing marginal utility of a good or service that is to be distributed, a similar conclusion can be arrived at from the utilitarian view.

Whereas it is generally agreed that the enjoyment of the highest standard of health is everyone's right, libertarians may consider it injustice, for instance, any action by the government to place mandatory taxes to ensure progressive health financing so that everyone's health — both rich and poor — is improved. As such, it is critical that regarding the attainment of equity in health, that those who are disadvantaged either on socioeconomic or need basis should be considered (i.e., given more support to attain their highest standard of health). Consequently, this would lead to the equalisation of opportunities to maximise their health status. This study adopts the egalitarian perspective of equity which is best captured by Whitehead's (1991 p.220) definition of equity where she suggests that "equity in health implies that ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that none should be disadvantaged from achieving this potential, if it can be avoided".

Akin to debates surrounding "equity", "need" has also attracted considerable debate in the literature (especially regarding the distribution of healthcare resources) and is thus worthy of in-depth discussion. The next section illustrates how need has been conceptualised in the literature.

2.8 What is need?

Whereas the conceptualisation and definition of "need" have been subject to much debate in the literature (169), confusion still abounds regarding its application in research and practice (148). Although it is all too common for "need" to be identified with ill-health (170), Bradshaw's (171) seminal work is potentially useful in unpacking the definition of "need". In his "taxonomy of social need", Bradshaw suggested four possible definitions of need. First, he defined need as *normative*. In this scenario, an expert would define need by setting an ideal standard and compare it to the existing practice. Second, need is defined as *"felt need"* where need is assessed by asking either an individual or a population whether they require a certain good or service. This definition has also been equated with "want". Third, need could be defined as *"expressed need"*. In this case, felt need is turned into effective demand (i.e., an action). Fourth, need is defined as *comparative*. In this scenario, the need of one population that does receive a particular good or service is compared with another one that does not. The comparative definition can be used to assess the needs of both individuals and populations in different geographical settings (148, 169). These notions of need, therefore, are still relevant in the present debates regarding the definition of need in the health sector.

From the clinician's point of view, need has been commonly defined as an individual's health status before receiving any treatment. Based on this perspective of need, it has been argued that it would imply that individuals with greater ill-health would have a higher need for healthcare. Put another way, individuals with the same health status would be considered as having the same level of need (123, 169). Given that there are circumstances under which the existing medical technology may not be in a position to improve an ill person's health, this definition has been extensively criticised. Culyer and Wagstaff (1993 p.434) contest that:

"The difficulty with this definition is that it is hard to see why someone who is sick can sensibly be said to need healthcare, irrespective of the latter's ability to improve the person's health".

Furthermore, they argue that given that someone may still need healthcare even when not ill (e.g. as is the case for preventive health services), this definition is unsuitable. Besides, Peter (127) and Waters (129) have argued that health is a complex concept to grasp and as such, challenging to measure with precision. Let us take two individuals, Mbuli and Lichodi, for example. If Mbuli complains of back pain and Lichodi complains of a headache, who among these two individuals would be considered as being more ill and consequently in need of healthcare? Indeed, it can even be more puzzling to tell who is more ill and thus in need of healthcare between individuals suffering from the same illness. Personal attributes such as age, sex, race, underlying health conditions,

socioeconomic status, etc. would significantly influence the severity of their illness and the need for healthcare as a result.

According to Culyer and Wagstaff (123), need can also be defined as "capacity to benefit". In this definition, need is embodied as an instrumental concept. That is, the need for healthcare is regarded as an end, whereas the improvement of health as the ultimate objective. As a result, in scenarios where healthcare cannot improve the ultimate objective (i.e., health), healthcare cannot, therefore, be said to be needed (123). Because of this, Okorafor (145) concludes that the simple definition of need as the capacity to benefit is insufficient in and of itself because it fails to provide the basis for the quantification of a population's healthcare resource needs. He further contends that given equity in health, the definition and conceptualisation of need for healthcare should not be an end in itself. Rather, primacy should be given to the quantification of the levels of healthcare resources to be allocated to different individuals and populations.

The other proposed definition of need, based on the notion of "capacity to benefit", is "expenditure required to exhaust capacity to benefit" (123). In this definition, monetary value is attached to an individual's level of need. For instance, in this definition, the assessment of marginal benefits derived from the utilisation of competing for health interventions is allowed for by financial quantification of need. Of note, health economists and health planners may find this definition repugnant given that resources are scarce and have competing uses (145). Also, Culyer (128) cautions that in as much as two individuals' capacity to benefit can be exhausted by an equal amount of expenditure, their capacities to benefit may nonetheless be different. As a result, they have different capacities to benefit, despite having the same resource needs.

McIntyre and colleagues (172) have suggested that given the subjective nature of the concept of need, that is, it can be viewed from various perspectives; the perceptions, interpretations, and values of those defining need will always come to play. Because of this argument, this study defines the need for screening and treatment of diabetes and hypertension as stipulated in the standard treatment guidelines for both conditions in Kenya (i.e., according to Bradshaw's *normative* definition of need) (109, 110).

2.9 Methodological Review

To date, researchers have proposed several methods to measure inequalities in health. These methods that either measure absolute or relative inequality include the range, the Lorenz curve,

Gini coefficient, pseudo-Gini coefficient, pseudo-Lorenz curve, index of dissimilarity, the slope index, and relative index of dissimilarity, the concentration curve and the concentration index. These are critically appraised in this section.

3.0 Methodological approaches for assessing equality in healthcare

3.1 The range

The range is essentially the basic measure used to assess inequality in health. It compares the experiences of the wealthiest and the poorest socioeconomic groups (97). To assess inequality, a ratio of both extreme groups is presented. Two main shortcomings have been associated with the range approach (97). Firstly, the range measure fails to take into consideration the intermediate socioeconomic groups (or the changes therein) and as such it does not show the distribution of the population along with all the socioeconomic groups. Secondly, it fails to consider the sizes of the socioeconomic groups under comparison, and thus it is insensitive to changes in the population distribution across the socioeconomic groups. Consequently, the range can give misleading results, especially when inequality in health is compared across populations or countries over time (97).

3.2 The Lorenz curve and the Gini coefficient

The Lorenz curve is used to plot the cumulative proportion of the population (from the sickest and to the healthiest) against a cumulative proportion of health (97). Gini coefficient, on the other hand, is computed as a ratio of the area that lies below the line of equality and the Lorenz curve. The Gini coefficient ranges from 0 (indicating complete equality in health) and 1 (indicating perfect inequality in health) (97). The Lorenz curve has been considered a meritorious approach by its proponents given that unlike the range approach, it reflects the experiences of all individuals and not just two extreme socioeconomic groups (97). Besides, since the Lorenz curve avoids the problems associated with dividing individuals into socioeconomic groups (including changing of class sizes), it has been considered a more relevant measure (97). The insensitivity of the Lorenz curve to socioeconomic status, nevertheless, has been the point of criticism by others who argue that socioeconomic status is one of the determinants of health (159, 160). Further, the application of health inequalities findings computed from the Gini coefficient and the Lorenz curve may not be relevant for policy action as they would fail to show to what extent the observed disparities are distributed according to socioeconomic position (111).

3.3 The pseudo-Lorenz curve and the pseudo-Gini coefficient

The pseudo-Lorenz curve and the pseudo-Gini coefficient are, respectively, a modified version of the Lorenz curve and the Gini coefficient in that these measures factor in some sort of grouping

(97). Yet, using occupational class to order health status rather than ordering health status variables according to socioeconomic groups limits its ability to reflect the socioeconomic dimension to inequality in health (97).

3.4 The Index of dissimilarity

The index of dissimilarity (ID) is a measure that assesses the extent to which a group's share of health is different from its population share (97). More specifically, the ID involves assessing (1) the share of healthcare use by each socioeconomic group, for example, and (2) the share of each socioeconomic group in the population. Therefore, to compute the level of inequality in healthcare use, an absolute difference between (1) and (2) is obtained, summed up across all the socioeconomic groups, and is then divided by two (97). The ID suffers similar shortcomings as the Lorenz curve and the Gini coefficient in that it does not show the extent that inequalities in health are systematically related to socioeconomic status (97).

3.5 The slope and relative index of inequality

Unlike other measures of inequality discussed thus far, the slope and relative index of inequality reflect the socioeconomic dimension of inequality in health (97). In this approach, each socioeconomic group's mean health status is calculated then ranked by each socioeconomic class (97). Bars whose heights represent mean healthcare use, for example, and whose widths represent the proportion of each socioeconomic group in the population are erected. Thereafter, to show the relationship (which can be graphically illustrated) between a socioeconomic group's healthcare use and its relative rank in the socioeconomic distribution, a slope index of inequality (SII) is defined (97). In other words, SII is a linear regression depicting the relationship between each socioeconomic category's level of healthcare use and the hierarchical ranking of socioeconomic groups.

One feature of SII that is noteworthy is its sensitivity to mean healthcare use of the population, making it suitable for assessing absolute differences in health status (97). Consequently, suppose everyone's healthcare use were to double or triple, then inequality in healthcare use would increase correspondingly. As such, it would be inconsequential whether inequality has doubled or tripled, given that *relative* differences will remain the same, whereas *absolute* differences would widen (97). If on the other hand, we were to concern ourselves with the *relative* changes, the SII would be divided by the mean healthcare use. This would result in an index known as the *relative index of inequality* (RII) (173). SII has been criticised as being only applicable to socioeconomic variables that can be ordered hierarchically. In contrast, the weakness of RII is that it can be easily misconstrued as a measure of association, e.g. an odds ratio (174).

3.6 The concentration curve and the concentration index

The concentration curve and the resultant concentration index are robust measures for health inequality assessment and are potentially the most preferred in the health economics literature (175-179). The concentration curve plots the cumulative proportion of a health variable on the y-axis against the aggregate proportion of the population ranked by socioeconomic status (starting from the poorest) on the x-axis (97, 111). If the health variable of interest is distributed equally across the socioeconomic groups, the concentration curve coincides with the 45-degree diagonal line (i.e., line of equality). On the contrary, if the concentration curve lies above (below) the line of equality, the health variable of interest is concentrated among the poor (rich) (97, 111). Of note, the further the concentration curve lies beneath the line of equality, the more the health variable of interest is concentrated among the rich, and vice versa (111). Whereas the concentration curve is suitable for identifying the presence of inequality in health and whether it is more pronounced at one-time point than another, one of its shortcomings is that it does not quantify the magnitude of inequality for convenient comparison across regions, countries, periods, etc. (111).

The concentration index — a directly related measure to the concentration curve is used to overcome the weakness of the concentration curve. The concentration index (CI) is computed as twice the area between the concentration curve and the line of equality, and it ranges between -1 and +1 with a negative value connoting a pro-poor concentration of the health variable and a positive value meaning the opposite (97). When the concentration index is zero, there is no inequality (97). Unlike the range, the concentration index has the key strengths of (1) reflecting the experience of the entire population rather than two extreme groups on the socioeconomic scale (and because of this, it is sensitive to changes in the population distribution across the socioeconomic groups), and (2) it considers the socioeconomic dimension of inequality in health (97). Despite criticisms such as not having a direct interpretation that could lead to misunderstandings (178, 180), this study will use the concentration curve and the concentration index to measure inequality in the utilisation of screening and treatment interventions for diabetes and hypertension based on need in Kenya.

3.7 Decomposing the concentration index

In as much as the concentration curve and the corresponding concentration index are useful in showing the existence of socioeconomic inequality in any given health variable, they are limited in the sense that they do not go further to explain the factors contributing to the observed inequality. Yet, for policy action, identifying these factors are critical in addressing the underlying "causes" of inequality. Consequently, the concentration index of a health variable is decomposed to address this concern. That is, for this study, decomposing the concentration index for screening and

treatment to show the factors contributing to the observed inequality in the use of both interventions for diabetes and hypertension.

Here, the decomposition approach proposed by Wagstaff *et al.* (117) is used. The relationship between screening and treatment and relevant determinants is expressed as:

$$h_i = \alpha + \sum_j \beta_j Z_{ij} + \varepsilon_i \qquad (1)$$

where h_i is the health variable (i.e. screening or treatment), α and β_j are the coefficients to be estimated and ε_i is the error term. β_j measures the relationship between each explanatory variable (z).

The concentration index C_H for health variable h_i can be written as:

$$C_H = \underbrace{\sum_{j=1}^{J} Cj\left(\beta_j \bar{Z}_j/\mu_H\right)}_{\text{Deterministic}} + \underbrace{(GC\varepsilon/\mu_H)}_{\text{Unexplained}} \qquad (2)$$

where μ_H is the mean of screening/treatment and $\beta_j \bar{Z}_j/\mu_H$ denotes the elasticity of h_i to marginal changes in concentration index of the *j*-th contributing factor, while $GC\varepsilon$ denotes the concentration index of the error term. The first term $Cj\left(\beta_j \bar{Z}_j/\mu_H\right)$ in Equation (2) which constitutes the deterministic component of the concentration index represents the contribution of factor *j* to socioeconomic inequality in screening/treatment. The second term $GC\varepsilon/\mu_H$ captures the residual or unexplained component and should approach zero in a well-specified model (111). Equation 2 can be easily computed in Stata, and bootstrapping methods can be used to obtain the standard errors of various components of the concentration index (111).

To sum-up, the decomposition analysis of the concentration index can be conducted using the following steps:

1) A regression model is fitted to obtain the coefficients of explanatory variables (z).
2) The mean of the health variable (μ_H) as well as for each explanatory variable ($\bar{Z}_j$) is calculated.
3) The concentration indices of the health variable (C_H), each determinant (Cj) and the error term ($GC\varepsilon$) are estimated.
4) The absolute contribution of each determinant is obtained by multiplying the elasticity of each determinant with its concentration index (i.e. $Cj\left(\beta_j \bar{Z}_j/\mu_H\right)$).

5) To obtain the relative contribution of each determinant to the observed inequality, the results from (4) is divided by the concentration index for the health variable (i.e. $(Cj\ (\beta_j \bar{Z}_j/\mu_H))$/ C_H.

3.8 Methodological approaches to measuring horizontal equity

3.8.1 Le Grand's inter-group comparison

Suggested by Le Grand (181), the inter-group approach to horizontal equity assessment involves the estimation and comparison of cost per person reporting ill-health in each socioeconomic group. Alternatively, it involves estimating the share of expenditure in each socioeconomic class which is then compared with each class's share of ill-health (181). To an extent, Le Grand's inter-group approach is similar to the range approach given that it compares the wealthiest and the poorest socioeconomic groups in measuring inequity. As such, it has been criticised for both ignoring the size of each socioeconomic group and other intermediate socioeconomic groups that are as relevant in inequity assessment (182). Also, Le Grand's inter-group approach commits ecological fallacy (183) in that it assumes that it is only the ill who seek healthcare while in reality, those who are receiving healthcare and the ill population may not necessarily be the same.

3.8.2 The regression method

Puffer (184) has proposed a regression approach that links healthcare use to measures of need (e.g. health status), socioeconomic status, and other demographic variables. His approach involves using a single regression line to estimate equity for all socioeconomic groups together or separately. Thus, equity is assessed using regression coefficients. Therefore, inequity is said to be present when the intercept for the coefficients are different for all income groups (76). The defects of this approach are that whereas a comparison of the regression coefficients would indicate the presence of inequity, it is impossible to determine whether the inequity is pro-rich or the opposite (76, 182). Furthermore, it is also critical to note Puffer's definition of equity, that is, equal access to healthcare (184). Yet, his suggested approach involves assessing equity based on equal treatment for equal need (182). This is somewhat inconsistent.

3.8.3 Concentration curve/index

As earlier indicated, the concentration curve and index measures health inequity by plotting the cumulative proportion of healthcare use on the y-axis against the cumulative proportion of the population ranked by socioeconomic status (beginning from poorest to richest) on the x-axis. Up to this point, however, healthcare need (e.g. age and sex variations in reported screening and treatment interventions) has not been adjusted for. To adjust for need, two main approaches for standardisation have been proposed in the literature. These are discussed below.

3.8.4 Direct standardisation

In this method of standardisation, the population is divided into socioeconomic groups after which need standardised healthcare is computed. Specifically, this entails characterising need factors of the sample to mean healthcare in each socioeconomic group (76, 182). Need standardised healthcare use is critical in showing how much care that would be received by people in each socioeconomic group if they all had the same level of need as the entire sample (76). Standardised concentration curves can be obtained from this information by plotting the cumulative proportion of need-standardised healthcare against the cumulative proportion of the population ranked by socioeconomic status (76). To obtain a direct standardised horizontal inequity index, the area between the standardised concentration curve and the 45-degree line of equality is computed. The weakness of standardising need through the direct approach is that it always involves the use of grouped data. Thus, Wagstaff and van Doorslaer (76) conclude that the direct standardisation approach is not useful since the computed direct standardised horizontal equity index is highly dependent on the number of socioeconomic groups.

3.8.5 Indirect standardisation

The indirect approach of standardisation has the advantage of being used for both individual and grouped data (76). In this approach, after separating determinants of care use by a group that reflects need factors (i.e., age and sex that are both correlated with health and socioeconomic status) and non-need factors (i.e., other socioeconomic characteristics such as employment status), a logistic regression model is used to estimate the quantity of healthcare that each individual or group would have obtained had they been treated equally with others in the same level of need (76). Therefore, indirect standardisation was used in the study to obtain the horizontal inequity (HI) index (defined as twice the area between the need and health service use concentration curves) by subtracting the age-sex standardised concentration index from the actual concentration index of utilising screening and treatment (76). A positive (negative) HI value implies a pro-rich (pro-poor) distribution of screening and treatment for diabetes and hypertension. In contrast, a HI value of zero shows no horizontal inequity in the utilisation of services across the socioeconomic distribution.

3.9 Empirical review

3.9.1 Introduction

In this section, a critical review of the empirical literature on inequity and socioeconomic inequality in non-communicable diseases is provided. The objectives of the empirical review are threefold. First, to give an overview of inequity or socioeconomic inequality in either the risk factors,

incidence, prevalence, or mortality due to non-communicable diseases. Second, the literature on screening, diagnosis, and treatment of non-communicable diseases is identified and appraised. Third, a critique of different methodological approaches for assessing inequity and socioeconomic inequalities — including measures of socioeconomic status — in reviewed empirical studies is undertaken. This section also identifies the gaps or limitations that exist in the available literature.

3.9.2 Literature search strategy

Reviewed literature came from studies published from 1980 to 2019. The following key search terms were used in various combinations: 1) Equity (equity, equality or inequity(ies) or inequality(ies) or disparity(ies) or horizontal inequality or socioeconomic inequality); 2) NCDs (non-communicable diseases, chronic disease(s) or diabetes or type 2 diabetes or diabetes mellitus or hypertension or high blood pressure); 3) NCDs occurrence (prevalence or incidence or morbidity or mortality); 4) Screening (screening, testing or diagnosis); 5) treatment (treatment or management); 6) countries' level of economic development (developed countries or high-income countries or developing countries, or low-and middle-income countries). The databases searched were PubMed, Medline, EconLit, Scopus, Web of Science, and Google Scholar. Furthermore, a manual search of references in the relevant articles that were identified was conducted. Other key institutional websites, including the World Bank, World Health Organisation, and Equinet Africa, were also searched for additional literature.

3.9.3 Inclusion criteria

Four guidelines informed the inclusion of studies. Firstly, studies were included if they were relevant to the objectives of the present study (i.e., assessed inequity or socioeconomic inequality in non-communicable diseases). Secondly, included studies also had to have assessed inequity or socioeconomic inequality in non-communicable diseases using the standard methodological approaches of assessing horizontal inequity or socioeconomic inequalities such as slope index of inequality, concentration index, etc. (see methodological review section). Thirdly, while studies conducted in LMICs were of main interest to the review, for comparison purposes, studies from HICs were also included. Fourthly, only studies published in English were reviewed. Due to the paucity of empirical studies on inequity and socioeconomic inequality in the screening and treatment of diabetes and hypertension, the review considered any type of NCD.

3.9.4 Studies reviewed

A total of twenty-nine studies were reviewed: thirteen from LMICs and sixteen studies from HICs. Of note, some of the reviewed studies used a mix of methodological approaches in assessing inequity or socioeconomic inequality in NCDs.

4.0 Empirical review from LMICs

Socioeconomic inequalities in awareness, treatment and control of NCDs

Treatment and care services offered to patients with NCDs were found to be markedly pro-rich in China (31) and Brazil (30). This pro-rich distribution was attributed to the fact that those in higher socioeconomic status had greater access to care services and could choose from a variety of care providers due to income and health insurance enrolment. These two studies were however not nationally representative, relied on self-reports, and solely recruited elderly respondents (i.e., ≥ 50 years). Additionally, one study used household assets (30), while the other used household income as a measure of socioeconomic status (31).

Also, findings from studies done in 21 HICs and LMICs in the Prospective Urban and Rural Epidemiology (PURE) study showed mixed pro-poor and pro-rich socioeconomic inequalities in the use of secondary prevention for cardiovascular disease as well as in the awareness, treatment, and control of hypertension. For instance, Murphy *et al*. (185) found a significant pro-rich inequality in the use of secondary prevention medicines for cardiovascular diseases in LMICs. However, pro-poor inequalities were observed in HICs. Similarly, Palafox *et al*. (186) in an attempt to describe socioeconomic inequalities in the awareness, treatment, and control of hypertension found a pro-rich inequality in the levels of hypertension awareness and treatment in LMICs. Furthermore, a similar pro-rich pattern in hypertension control was found in all countries at all levels of economic development, but HICs showed a pro-poor distribution in hypertension awareness. Of interest, HICs like Sweden and Poland had a pro-poor pattern for hypertension treatment, but pro-poor hypertension control was only observed in Sweden. These were notable findings since both studies used household assets as the measure of socioeconomic status and the concentration index in assessing inequality. Nevertheless, these findings should be interpreted cautiously as they were not nationally representative, they relied on self-reported measures and some countries had modest sample sizes (187, 188).

Socioeconomic inequalities in undiagnosed diabetes and hypertension

Several studies also assessed socioeconomic inequalities in undiagnosed NCDs such as diabetes (108, 189) and hypertension (105, 190). The findings suggested that while more than half of respondents with diabetes and hypertension remained undiagnosed, a pro-poor distribution of undiagnosed diabetes and hypertension was seen in Bangladesh and South Africa (108, 189, 190). Still, a pro-rich inequality for clinically diagnosed diabetes was found in South Africa (108). In addition, a pro-rich distribution was observed for cancer and diabetes in Turkey (105). It is worthy to note that universal health insurance in Turkey may not have necessarily facilitated equitable

access to needed health services (105). In South Africa, the use of both self-reported and clinical data for diabetes showed a pro-rich distribution (108), a finding that is supported by an earlier study that found a pro-rich distribution for diabetes but not for hypertension using self-reported data (191).

There are still debates, however, regarding the use of self-reported and clinically based data for assessing socioeconomic inequality for NCDs. For instance, using tested prevalence and self-reported prevalence for hypertension and to assess inequity between them in China, Su *et al.* (107) found a pro-rich inequity in the self-reported prevalence of hypertension and a pro-poor inequity in the tested prevalence of hypertension. However, a study by Vellakkal *et al.* (192) in India that aimed to compare the prevalence of five NCDs across socioeconomic status groups using self-reported versus standardised measures showed mixed findings. Overall, the prevalence of studied NCDs was generally higher when standardised measures of diagnosis were used compared to self-reported diagnoses.

Specifically, while using self-reported measures, the majority of studied NCDs were concentrated among richer socioeconomic groups. By contrast, when standardised measures were used, even though there was no strong socioeconomic gradient, the majority of studied NCDs were concentrated among lower socioeconomic groups. Interestingly, for hypertension, while using both self-reported and standardised measures, a pro-rich concentration was observed (192). Additionally, using symptom or criterion based measures for assessing NCD inequalities for conditions like hypertension, angina, visual impairment, and depression have shown a pro-poor distribution as compared to self-reported diagnoses that showed a pro-rich distribution in Ghana, India, China, South Africa, Mexico and Russia (193). These findings need to be validated further.

Socioeconomic inequalities in NCDs risk factors

There were mixed results regarding the pro-poor and pro-rich distribution of NCDs risk factors in LMICs. Studies that assessed socioeconomic inequalities in risk factors for NCDs found that risk factors such as smoking, low fruit and vegetable consumption, and hypercholesterolemia were significantly concentrated among lower socioeconomic groups. On the other hand, risk factors like physical inactivity, overweight or obesity, and high waist circumference (in both men and women) were concentrated in high socioeconomic groups (194-196). There was a mixed pattern observed for socioeconomic inequality regarding heavy episodic drinking in all countries and across different socioeconomic groups (196). The socioeconomic gradient observed in NCD risk factors was like the socioeconomic inequalities observed in the prevalence of most NCDs. For instance, in Bangladesh, a pro-rich prevalence in pre-hypertension, hypertension, pre-diabetes, and diabetes was observed,

especially in urban areas due to obesity (197). In Iran, while a pro-poor prevalence of diabetes was observed in 2005, a pro-rich inequality in diabetes prevalence was observed in 2009 (198). Similarly, in South Africa, a pro-poor distribution of hypertension prevalence was observed between 2005 and 2008 while a mixed pattern of pro-poor and pro-rich diabetes prevalence was observed in the same period with 2008 reporting a pro-rich prevalence (191). This finding was confirmed using clinical diagnosis data (108).

The major limitation that was common to these studies, however, was their over-reliance on self-reported measures that are prone to recall bias, among other shortcomings. Besides, some studies were not nationally representative in the countries where they were conducted hence limiting national inference of socioeconomic inequality findings. Nevertheless, most of the studies that assessed socioeconomic inequality in NCDs risk factors to a large extent used similar measures of socioeconomic status. For example, the concentration index (as well as slope index and relative indices of inequality) were the common measures used for assessing inequality.

Factors contributing to socioeconomic inequalities in NCDs risk factors

Evidence from reviewed studies showed that various need and non-need factors contributed to socioeconomic inequality in NCDs in LMICs. For instance, a study in China showed that income and non-need factors such as having health insurance, education and occupation largely contributed to inequality in the utilisation of treatment for hypertension, hyperglycaemia and dyslipidaemia (31). Although not focusing on the utilisation of screening or treatment intervention in China, a later study established that while economic status, educational attainment, and age were the key contributors to pro-poor inequality in tested hypertension prevalence; area of residence, socioeconomic status and age explained pro-rich inequality in the self-reported prevalence of hypertension (107).

By contrast, a South African study showed that area of residence, socioeconomic status and lifestyle factors as the key drivers of socioeconomic inequality in diabetes prevalence (108). Moreover, a Turkish study that decomposed the distribution of socioeconomic inequalities in self-assessed health (SAH) and 16 selected NCDs conditions established that factors such as residing in rural areas, lifestyle, higher education, and being of older age were responsible for observed inequalities in both undiagnosed and diagnosed diabetes and hypertension (105). Besides, a study by Murphy *et al.* (185) that aimed to estimate socioeconomic inequality in the use of secondary prevention for CVDs in 21 HICs and LMICs found that general use of secondary preventive medicines and public expenditure on health were the main health system predictors of socioeconomic inequality.

Conclusion

In conclusion, studies from LMICs showed mixed findings regarding the socioeconomic inequalities in NCDs. Nevertheless, a pro-rich inequality in care utilisation, treatment, and control of NCDs like cardiovascular diseases and hypertension was observed in most countries. On the other hand, a pro-poor inequality in the majority of NCDs risk factors (including disease prevalence) was more commonly identified in the low socioeconomic groups. Also, across all studies reviewed, it was convincingly and consistently shown that factors such as socioeconomic status, areas of residence, and to an extent having health insurance, education status and age, explained socioeconomic inequalities in NCDs. Table 1 summarises empirical findings of studies from LMICs.

Table 1 Summary of empirical review from low-and-middle-income countries (2012-2019)

Study	Country/Countries and year(s) of analysis	Objectives of the study	Type of analysis (inequality, inequity or both)	Methods used for socioeconomic inequality/inequity assessment	Findings and explanations (and conclusions)	Limitations
Elwell-Sutton *et al.* (2012)	China (2003-2008)	To examine inequality and inequity in general healthcare utilisation and treatment of chronic conditions in adults ≥ 50 years of age in Guangzhou province in China.	Inequality and inequity	Concentration index and horizontal inequity index	Inequity and inequality were found in the treatment of chronic conditions but not for the utilisation of general healthcare (i.e., doctor consultations and hospital admissions). The largest contributors to inequality were income and non-need factors (i.e. employment, education and health insurance).	The study was not nationally representative as it was carried out in one of China's richest provinces. Furthermore, the study relied on self-reports of healthcare utilisation and treatment, which could potentially be unreliable.

Biswas *et al.* (2016)	Bangladesh (2011)	To assess the relationship between three chronic non-communicable diseases (NCDs) and socioeconomic status (SES) among the Bangladeshi population.	Inequality	Concentration index	Pro-rich distribution of hypertension, diabetes, and obesity as these conditions were more prevalent among the rich compared to the poor.	The study could have conducted an additional analysis (i.e., decomposition analysis) to determine the factors contributing to the observed inequality.
Hosseinpoor *et al.* (2012)	48 LMICs (2002-2004)	To quantify the prevalence of health risk factors and compare them across wealth and education in LMICs groups.	Inequality	Slope index of inequality (SII) and Relative index of inequality (RII)	The study found that risk factors such as smoking and low fruit and vegetable consumption were significantly higher among lower socioeconomic groups. On the other hand, the prevalence of physical inactivity was prevalent in high socioeconomic groups, especially in low-income countries. There was a mixed pattern observed regarding heavy episodic drinking in all countries and across different wealth quintiles. Interventions to reverse the observed inequality in most of the	The selection of study countries is not representative of all LMICs as it was not based on probability. There was a low response rate in some countries hence increasing the risk of selection bias. Furthermore, measuring risk factor prevalence alone may not fully represent inequalities in the impact of the studied health risks.

					risk factors should be focused and sustained for high-risk populations.	
Moradi *et al*. (2016)	Iran (2005 and 2009)	To determine the socioeconomic status inequalities of diabetes and the share of determinants of these inequalities in Kurdistan province in Iran using two surveys.	Inequality	Concentration curve, concentration index, and logistic regression analysis	The prevalence of diabetes increased from 2005 to 2009. While diabetes was concentrated among the poor in 2005, a pro-rich inequality was observed in 2009 with low socioeconomic status and residing in a rural area being the major contributors to observed inequality.	It was not determinable from the paper whether reported diabetes was diagnosed at the time of the survey or was based on self-reports.
Hasan *et al*. (2019)	Bangladesh (2011)	To estimate the prevalence of undiagnosed diabetes among adult diabetic patients and associated inequalities.	Inequality and inequity	Concentration index	Among patients with diabetes, more than half remained undiagnosed. A significant proportion of those residing in rural areas and belonging to the lowest socioeconomic class were undiagnosed compared to the well-off groups. Higher education and being of older age increased the odds of being diagnosed with diabetes. The concentration index	The study could have considered decomposing the socioeconomic related factors to undiagnosed diabetes in Bangladesh.

					showed that undiagnosed diabetes was mainly concentrated among the poor.	
Murphy *et al*. (2018)	21 high-income and LMICs in the PURE study (2002-2012)	(i) To estimate socioeconomic inequality in the use of secondary prevention for cardiovascular disease (CVD) within 21 countries at different levels of economic development; and (ii) To investigate health system factors that might be correlated with this inequality.	Inequality	Concentration index	A mixed pro-poor and pro-rich socioeconomic inequalities were observed in the use of secondary prevention medicines for CVD in different countries. Public expenditure on health and general use of secondary preventive medicines were the major predictors of inequality.	The key limitation was that selected samples were not nationally representative with numbers of people who have cardiovascular disease being low in some countries.
Mutyambizi *et al*. (2019)	South Africa (2012)	(i) To estimate socioeconomic inequalities in undiagnosed, diagnosed, and total (undiagnosed + diagnosed) diabetes in South Africa; and (ii) To	Inequality	Concentration index	There was a pro-rich inequality in self-reported and total diabetes. On the other hand, undiagnosed diabetes was concentrated among the poor. Residence, socioeconomic status, and lifestyle factors were the main drivers of	The low proportion of respondents who provided blood samples for HbA1c testing is one limitation of the study. Social desirability bias could have led to

		examine the contribution of lifestyle factors to diabetes inequalities in South Africa.			the observed socioeconomic inequality in diabetes. In South Africa, using self-reported or clinical data, diabetes is more concentrated amongst the rich than the poor.	under-reporting of certain lifestyle risk factors such as smoking and alcohol consumption, for example.
Palafox *et al*. (2016)	21 high-income and LMICs in the PURE study (2002-2012))	To describe the scale and patterns of wealth-related inequalities in the awareness, treatment, and control of hypertension.	Inequality	Concentration indices, SII, and mixed-effects regression	Wealth-related inequalities in the awareness, treatment, and control were generally higher in poorer countries compared to richer countries. Considerable variations in hypertension management, even in countries at a similar level of economic development underscores the need for the health system to equitably improve hypertension management for all.	One of the limitations of this study was relying on self-reported data in its wealth-related inequality estimates. Also, the true hypertension prevalence, its detection, and control may be under-estimated given that the study only used participants aged between 35-70 years who are more at risk of cardiovascular disease.

Sozmen and Unal (2014)	Turkey (2008)	(i) To use the concentration index to quantify the socioeconomic distribution of self-reported chronic diseases and self-assessed health; (ii) To decompose these inequalities by quantifying the contributions of potential determinants such as age, gender, wealth, education level, marital status, and geographical area.	Inequality	Concentration index and RII	Several self-reported non-communicable diseases, including hypertension and poor self-assessed health, were concentrated among the less-wealthy. However, cancer, allergic reactions, and diabetes mellitus were disproportionately reported by the rich. Income and education were the major contributors to observed inequality. Universal coverage of health insurance in Turkey may not have necessarily facilitated access due to low income.	The use of self-reported measures, especially for chronic conditions, may under-estimate the true prevalence of these conditions in the Turkish population.
Su *et al.* (2018)	China (2011)	(i) To measure tested prevalence and self-reported prevalence of hypertension and compare inequity between them in China; and (ii) To analyse income-related horizontal	Inequality	Concentration index	There was a pro-poor inequity in the tested prevalence of hypertension and pro-rich inequity in the self-reported prevalence of hypertension. Economic status, education attainment, and age were the key factors for the pro-poor inequity in tested	Given the cross-sectional nature of this study, causality in observed factors explaining inequality cannot be inferred. Also, other additional variables than the ones studied could help

		inequity of tested and self-reported prevalence of hypertension using decomposition analysis.			hypertension prevalence. In contrast, economic status, area of residence, and age explained the pro-rich inequity in self-reported prevalence.	explain the wealth-related inequality in the self-reported and tested prevalence of hypertension in China.
Vellekkal *et al*. (2013)	India (2007)	To compare self-reported diagnoses versus standardised measures of five NCDs prevalence across socioeconomic status groups in India.	Inequality	Concentration index	Overall, the prevalence of assessed NCDs was higher when standardised measures of diagnosis were used compared to self-reported diagnoses. While using self-reported measures, a majority of studied NCDs were concentrated among higher socioeconomic groups and the highly educated. NCDs were concentrated among lower socioeconomic groups when using standardised measures.	There is still a need for more objective and reliable methods such as biomarkers of disease, or clinical examination are required to validate these findings.

De Silva *et al.* (2018)	Sri Lanka (year of analysis not given)	To assess the inequalities of diabetes mellitus and its risk factors in a suburban district of Sri Lanka.	Inequality	SII, RII and concentration index	The prevalence of diabetes was pro-rich in both females and males. Also, regarding diabetes risk factors, BMI and waist circumference showed a pro-rich distribution in both men and women. Other risk factors such as inadequate food intake and smoking were concentrated among the poor for both sexes. To prevent diabetes, interventions should be targeted at specific risk factors based on sex and socioeconomic class.	The findings of this study are not nationally representative as the study was conducted in a single district in Sri Lanka.
Ataguba (2013)	South Africa (2005-2008)	To assess socioeconomic inequality in multimorbidity in illness and disability in South Africa between 2005 to 2008.	Inequality	Concentration index	In the years of analysis, there was a disproportionate prevalence in the prevalence of multimorbidity and illness with the poor being most affected. A similar trend was observed for disability. Whereas there was a slight decrease in the pro-poor distribution in multiple	The main limitation of this study was reliance on self-reports for illnesses and disability conditions assessed.

					illnesses between 2005 and 2008, the pro-poor trend for disabilities remained constant. Of interest, a pro-poor distribution of hypertension was observed from 2005 to 2008.	
Ahmed *et al*. (2019)	Bangladesh (2011)	To assess inequalities in the prevalence of undiagnosed hypertension in Bangladesh.	Inequality	Concentration curve and concentration index	Undiagnosed hypertension was concentrated among lower socioeconomic group individuals. To reduce the burden of undiagnosed hypertension and associated inequalities, screening and awareness creation initiatives should be targeted particularly to the poor and those with low educational attainment.	Conducting a decomposition analysis could have explained the factors responsible for observed inequalities in undiagnosed hypertension in Bangladesh hence offering focus areas for policy action.

Neves *et al.* (2018)	Brazil (2013)	(i) To measure the prevalence of various care services offered to the elderly with diabetes in Brazil; and (ii) To assess the social inequalities in these services.	Inequality	SII and concentration index	For all the eight care services assessed, the rich reported a disproportionately higher prevalence. There was a marked pro-rich distribution for recommendations to measure blood glucose, to examine the feet, for a glycaemic curve request, and eye examination. These results can be explained by the differences in access to care and for a variety of services between the elderly who are rich and poor.	The main limitation of this study is that the evaluated care services were based on participant recall hence being prone to recall bias, especially for services that needed a one-year recall. Similarly, participants who had more frequent contact with their care providers may have potentially had better recall compared to others who had less frequent access.

Moradi *et al*. (2012)	Iran (2005 and 2009)	To determine socioeconomic inequalities in risk factors for non-communicable diseases (NCDs).	Inequality	Concentration index	Apart from physical inactivity, all the NCDs risk factors were concentrated among the poor. However, there was no overt socioeconomic inequality for other risk factors such as smoking, excess weight, and hypercholesterolemia. For the reduction of NCDs burden, healthcare policies must be targeted at the disparities in NCDs risk factors.	Social desirability bias is a limitation in the reporting of some of the assessed NCD risk factors. The small sample size in the 2009 survey also reduced the precision of the estimates. The findings of the study are not nationally generalisable as it was conducted in only one province in Iran.

5.0 Empirical review from HICs

Inequality in disease experience: severity and mortality

Evidence from studies conducted in HICs generally suggests that those in low socioeconomic position (regardless of the measure used for socioeconomic classification and the methodological approach for assessing inequality) tend to suffer a disproportionately higher burden of NCDs compared to those in high socioeconomic status (199-208). For example, using mortality data from repeated cohort studies conducted from 1981 to 2001 in New Zealand, Blakely *et al*. (209) found that while relative inequality in mortality initially increased before stabilizing from 1996 to 2001; cardiovascular diseases, as the driver of the observed disparities became less important as cancer increasingly contributed to the observed inequality in income mortality for both men and women. By contrast, a longitudinal study conducted in six European countries between 1981 to 1995 to assess whether the lower socioeconomic groups are more likely to experience unfavourable trends in stroke mortality compared to higher socioeconomic groups found that whilst there was a decrease in trends of stroke mortality by sex and socioeconomic groups in all countries, stroke-related mortality was nonetheless concentrated more among the lower socioeconomic groups, and this disparity tended to widen among men in most countries (200).

Moreover, though improved hypertension management (i.e., detection and treatment) was suggested to have contributed to declines in mortality in all socioeconomic groups, persistent disparities in stroke mortality indicated that unequal utilisation of healthcare remains (200). In as much as both studies by Blakely *et al*. and Avendano *et al*. were conducted in a relatively similar period, had similar study designs and used the same methodological approach (i.e., relative index of inequality) to assess socioeconomic inequalities in NCD mortality, their findings are not directly comparable. For instance, Blakely *et al*. used household income as the measure of socioeconomic status while Avendano *et al*. used educational level and occupational class. A study conducted in Sweden has revealed that the use of education and income as proxy measures of socioeconomic status show a critical difference in inequality estimates with educational measures being preferred as a more decisive measure than income in assessing inequality (210). Also, New Zealand was not among the six European studies included in Avendano *et al*.'s study. Yet, both studies showed the existence of a socioeconomic gradient in NCD mortality in Europe with cardiovascular disease as a major contributor to the observed inequality.

Socioeconomic inequality in the incidence, prevalence, and risk factors of NCDs

Studies that assessed socioeconomic inequality in the incidence and prevalence of NCDs and their risk factors found consistent results. For instance, studies carried out in Spain (202, 208), England

(204), Portugal (206) and 11 European countries (211) found significant socioeconomic inequalities in the prevalence and incidence of type 2 diabetes, chronic diabetic complications and cardiovascular risk factors. Those in low socioeconomic status shared a disproportionately higher burden. Albeit there were mixed findings, it was concerning to note that women were found to bear a higher burden, relative to men, in the socioeconomic inequality in diabetes prevalence (202, 204, 208) and incidence in some studies (211). However, there was no difference in socioeconomic inequality in diabetes prevalence for both men and women for a study in Portugal (206). The potential explanations for the observed socioeconomic inequality included improved case ascertainment in socioeconomically disadvantaged groups, increase in diabetes risk factors such as overweight or obesity especially in women and earlier onset and survival of individuals with diabetes (204, 208, 211). Pointing to the possibility of gaps in care received, it was worrisome to note that despite lower socioeconomic groups in Spain utilising primary care more, they still had an unequal burden in cardiovascular risk factors (202).

However, it is important to note that all studies that assessed socioeconomic inequality in diabetes prevalence relied on self-reports of diagnosed diabetes which only presents about 30-50% of diagnosed diabetes (212, 213). Therefore, there is a possibility of underestimation of the true socioeconomic inequality in the prevalence of diabetes in the studies reviewed given that the poor tend to under-report their disease conditions compared to the rich (192). Hence, there is a need for more objective measures, such as biomarker tests to validate these findings. Besides, it is important to keep in mind that different studies used different methods to assess socioeconomic status and inequality. For example, Larranga *et al*. (202) used area-based socioeconomic measures, Imkampe and Gulliford (204) used household income while others used educational attainment and income (206, 208, 211). Consequently, these findings are not directly comparable due to heterogeneity in employed methodological techniques. Though there are debates for and against the use of educational measures for socioeconomic classification, it has been criticised as being a less predictive measure of socioeconomic class compared to income or ownership of capital assets. Espelt *et al.* (2008) suggest that educational measures may not have a universal application due to its relatedness to age, sex, race, birth cohort, etc.

Socioeconomic inequalities in the utilisation of services

It has been argued that a health system provides universal health coverage when everyone irrespective of their socioeconomic status can access needed quality health services without undergoing undue financial hardship (214). Contrary to general expectations of equity in access or utilisation of healthcare services, it was somewhat surprising to note that even in many HICs (with

universal healthcare systems), socioeconomic inequalities and inequities in the utilisation of care services for NCDs exist (205, 207, 210, 215). Despite universal health coverage in Denmark, for example, it was found that utilisation of diabetes healthcare services differed according to socioeconomic status.

Specifically, services in primary care such as outpatient services showed marked inequalities in utilisation among the socioeconomic groups with wealthy diabetic patients benefiting the most (210). Further, morbidity outcomes such as "severe complications at diagnosis" and "years with severe complications" were concentrated among lower socioeconomic groups. In comparison, outcomes variables like "years without complications" and "duration with diabetes" were concentrated among the better-off socioeconomic groups (207). By contrast, in the United States, Colombia and Mexico, having health insurance strongly influenced receiving a diagnosis and effective management of diabetes (i.e., attainment of treatment targets for serum cholesterol, blood pressure, and blood glucose) (215). Therefore, this confirmed a pro-rich utilisations of needed diabetes care services and the failure of the health system to respond equally to the needs of diabetic patients.

Factors contributing to socioeconomic inequality in NCDs in HICs

Unlike studies reviewed in LMICs, it is important to note that many studies reviewed in HICs mainly relied on regression analysis to assess factors associated with or contributing to socioeconomic inequalities in NCDs (199-202, 215). Nevertheless, a Danish study used the decomposition approach to assess inequality in diabetes morbidity pattern throughout a patient's lifespan (207). This study found that factors like morbidity patters, healthcare costs, higher age, gender, occupational class, level of education, and region of residence to significantly explain inequality in utilisation of diabetes care.

Conclusion

In sum, whereas different methodological approaches for equality assessment as well as different variables were used in creating socioeconomic groups, there is substantial evidence to believe that there are socioeconomic inequalities in NCDs in HICs with those in low socioeconomic status and women, in particular, being most affected. Further, factors such as healthcare costs, occupational class, region of residence, among others, were found to explain the socioeconomic inequality in care utilisation for diabetes treatment. Table 2 summarises empirical findings of studies from HICs.

Table 2 Summary of empirical studies from high-income countries (2005-2018)

Study	Country/Countries and year(s) of analysis	Objectives of the study	Type of analysis (inequality, inequity or both)	Methods used for socioeconomic inequality/inequity assessment	Findings and explanations (and conclusions)	Limitations
Blakely *et al.* (2008)	New Zealand (1981, 1986, 1991, 1996 and 2001)	(i) To determine whether disparities between income and mortality changed during a period of major structural and macroeconomic reform; (ii) To estimate the changing contribution of different diseases to these disparities.	Inequality	Slope Index of Inequality (SII) and the Relative Index of Inequality (RII)	Pooled relative inequalities increased from 1981-4 to 1996-9. Absolute inequalities were stable over time, with a possible fall from 1996-9 to 2001-4. Cardiovascular diseases were the major contributor to the observed disparities between income and mortality but decreased in importance from 45% in 1981-4 to 33% in 2001-4 for males and from 50% to 29% for females. The corresponding contribution of	Despite being a full population study, statistical power was insufficient to detect small changes in trends in inequalities. Also, it is not possible to infer a causal link between structural or macroeconomic reform and trends in health inequalities in an observational study.

					cancer increased from 16% to 22% for males and 12% to 25% for females.	
Espelt *et al*. (2008)	10 European countries (1994 to 2004 for morbidity data and 1990 to 2003 for mortality data)	To determine and quantify socioeconomic position (SEP) inequalities in diabetes mellitus in different settings in Europe.	Inequality	Range, Regression models, and age-adjusted prevalence ratios and risk ratios	People with a disadvantaged SEP reported higher diabetes prevalence compared to people with an advantaged SEP. In all countries, lower socioeconomic position was related to a higher rate of mortality from diabetes, and a linear relationship was observed. Also, the risk ratio of dying from diabetes was higher among women in low SEP compared to men in the same class.	Information bias due to under-recording of self-reported diabetes morbidity and under-recording of diabetes mortality in death certificates.
Avendano *et al*. (2005)	Six European countries: Denmark, Finland England/Wales, Italy, Norway, Sweden	To assess whether there is a common tendency among lower socioeconomic groups to experience less	Inequality	RII, regression analysis, and rate ratio	Stroke-related mortality was concentrated more among the lower compared to the	A decline in the proportion of the population in the low educational category may have obscured or

	(1981 to 1985 and 1991 to 1995)	favourable trends in stroke mortality than do higher socioeconomic groups in European countries.			higher socioeconomic groups, and the disparities were particularly stark in Norway, especially among men. Socioeconomic differences in Ischemic heart disease (IHD) mortality, on the other hand, tended to widen among men in most countries apart from Italy. Increased mortality from IHD may have been because of a substantial increase in risk factors such as smoking and overweight, particularly in the lower socioeconomic groups.	inflated socioeconomic inequalities in stroke mortality.

Dalstra *et al*. (2005)	Eight European countries: Belgium, Denmark, Finland, France, Great Britain, The Netherlands, Italy and Spain (1991 to 1997)	To estimate educational inequalities in 17 different chronic disease groups in eight European countries.	Inequality	Regression analysis	Socioeconomic inequalities were observed for most chronic diseases such as stroke, diabetes, hypertension, arthritis, and diseases of the central nervous system. These inequalities were larger among women than men. The observed gender inequality can be explained by inequalities of risk factors like obesity and physical inactivity that are concentrated among women relative to men.	It was not possible to undertake cross-country comparisons due to differences in educational distribution (and its social meaning) - the measure used for socioeconomic classification across countries. Further, different sampling frames, response rates, and survey questions used across the countries hindered comparison.

Gakidou *et al.* (2011)	Three HICs: England, United States of America, and Scotland; and four LMICs: Thailand, Mexico, Colombia, and the Islamic Republic of Iran (2003-2007)	(i) To examine the effectiveness of the health system response to the challenges of diabetes across different settings; and (ii) To explore the inequalities in diabetes care that are attributable to socioeconomic factors.	Inequality	Regression analysis	Other than Thailand, the observed inequalities in the diagnosis and treatment of diabetes varied among countries due to differences in income and education. In low (Iran) and upper-middle-income (Thailand) countries, inequalities in diabetes diagnosis were as a result of living in urban areas. This was not a concern in other countries.	Data used in this study was based on self-reports in the population surveys. There are limitations of self-reports such as under-reporting of diabetes among the low socioeconomic groups

Larranga *et al.* (2005)	Spain (2000)	To establish the relationship between socioeconomic status and the prevalence of type 2 diabetes, cardiovascular risk factors, and chronic diabetic complications.	Inequality	Regression analysis	Socioeconomic inequalities in the prevalence of diabetes were observed. The lower socioeconomic status, especially among women, was mainly affected relative to those in high socioeconomic class. Additionally, cardiovascular risk factors were prevalent in the lower socioeconomic groups who utilised primary care more.	Since the study used area-based measures instead of individual-level socioeconomic variables, there is residual confounding in the association of socioeconomic status and observed association in diabetes prevalence in low socioeconomic status.
Borrel *et al.* (2007)	Spain (1992-2003)	To analyse trends in mortality inequalities by educational level for the main causes of death among men and women in Spain.	Inequality	RII	Inequality trends analysis showed that cause-specific mortality was higher among those with less education except for lung and breast cancer. Whereas diabetes-related mortality tended to increase over time,	The key shortcoming of this study was the missingness of educational level variable, which was used to categorise individuals into socioeconomic groups. This may have affected the assessment of inequality measures.

					inequality was observed as women compared to men had a higher distribution of deaths due to diabetes.	
Imkampe *et al*. (2011)	England (1994-2006)	To determine whether socioeconomic inequalities in diagnosed diabetes are reducing or increasing over time.	Inequality	SII and RII	There was increased diabetes inequality in social class and level of education in women while no inequality was observed in men. Improved case ascertainment in socioeconomically disadvantaged groups, an increase in diabetes risk factors in the population, especially among women, earlier onset of type 2 diabetes and longer survival of individuals with diabetes could explain the inequalities.	The validity of the self-reported diagnosis of diabetes is low and unreliable.

Mosquera *et al*. (2011)	Sweden (2008-2010)	(i) To estimate income-related inequalities in eight biological cardiovascular risk factors in Swedish middle-aged women and men; (ii) To examine the contributions of demographic, socioeconomic, behavioural and psychological determinants to the observed inequalities.	Inequality	Concentration indices	All eight cardiovascular risk factors were concentrated among the poor. Inequalities varied substantially for different cardiovascular risk factors, but women experienced a greater magnitude. Socioeconomic conditions and health behaviours were the main explanatory factors for both genders.	Potential for selection bias as men, immigrants, singles, and poorer people were underrepresented in the study area.
Santos *et al*. (2017)	Portugal (2014)	To describe socioeconomic inequalities in the distribution of diabetes in the population of Portugal.	Inequality	Concentration curve, concentration index, and RII	The prevalence of diabetes was found to be pro-poor in both men and women. These findings were confirmed with the relative index of inequality assessment. The findings suggest that improvement in the	The main limitation of this study was the use of self-reported diabetes in the assessment of socioeconomic inequalities as this may have potentially underestimated the true prevalence of diabetes in the population.

					level of education and income could potentially influence the adoption of healthy behaviours, reduce diabetes burden, and observed inequalities.	
Sortsø *et al*. (2018)	Denmark (2011-2013)	(i) To quantify inequality in diabetes morbidity patterns over patients’ entire life span; (ii) To decompose inequality by quantifying the contribution attributable to individual sociodemographic determinants; and (iii) To compare levels of inequality measured through income and educational level.	Inequality	Concentration curve, concentration index and decomposition analysis	Morbidity outcomes such as 'severe complications at diagnosis' and 'years with severe complications’ were concentrated among the lower socioeconomic groups. By contrast, outcome variables such as 'years without complications' and 'duration of diabetes' was concentrated among the better-off socioeconomic groups. To reduce the observed	A cohort study design would provide a more precise estimate of inequality in morbidity and mortality. Also, the inclusion of patients' lifestyle characteristics could have enhanced the interpretation of these findings

					inequality, it is vital to invest in efforts targeted toward socially vulnerable groups.	
Espelt *et al*. (2012)	Spain (1987-2006)	To analyse trends in socioeconomic inequality in the prevalence of self-reported diabetes among men and women aged ≥ 35 years in Spain from 1987 to 2006.	Inequality	SII and RII	Socioeconomic inequalities in diabetes increased over time (mainly in women). Diabetes prevalence was higher among those with lower education relative to the highly educated. Body mass index, lifestyle, and diet partly explains the inequality.	Self-reports tend to underestimate the true prevalence of diabetes, especially among the lower socioeconomic groups. Also, the use of educational attainment may not allow for universal application or comparison.
Sortsø *et al*. (2017)	Denmark (2011)	(i) To quantify inequality in diabetes healthcare service utilisation; (ii) to understand determinants of these inequalities in relation to sociodemographic and clinical morbidity factors; and (iii) to compare the empirical	Inequality	Concentration curve and concentration index	Despite Denmark's universal healthcare system, the use of diabetes services was pro-rich (especially among patients with higher educational level). Specifically, outpatient services, rehabilitation, and specialists in primary	Data on patients' lifestyles, patients' needs expressed through physicians, or self-assessed by the patient could have enhanced the study. Also, the use of household rather than individual income as a measure of SES would

		outcome of using income level and educational level as proxies for socioeconomic status (SES).			care showed marked disparities in utilisation among the socioeconomic groups. The use of education and income as proxies for patients' socioeconomic position showed important differences in inequality estimates with educational measures being the most preferred.	have been more precise in expressing inequality.

6.0 Summary and discussion of empirical review

The empirical evidence from studies reviewed in both LMICs and HICs increasingly confirms the existence of socioeconomic inequalities and inequities in NCDs with the poor bearing the brunt of this inequality. In general, and though there are exceptions, the evidence from both LMICs and HICs generally indicated that there are socioeconomic inequalities in the prevalence and risk factors for NCDs like diabetes and hypertension with low-income groups having a disproportionate burden, especially among women in some settings (191, 195, 196, 202, 206, 208, 211). Additionally, pro-rich utilisation of needed NCD services was also observed in HICs, where there was universal health coverage (210, 215). Similar pro-rich access to health services was also reported in some LMICs (30, 31, 105). While there were no studies on inequality in NCDs mortality from LMICs, a pro-poor distribution in NCD-related mortality was found in many HICs in Europe (200, 209).

Also, whereas studies conducted in Brazil (30), China (31) and other 21 HICs and LMICs (186) showed a pro-rich inequality in utilisation of needed care services and the treatment and control of hypertension and other NCDs, it is still evident from the reviewed literature, especially in LMICs, that there is still a dearth of evidence on the level of inequity and socioeconomic inequality for cost-effective interventions like screening and treatment based on need at the population-level. This is especially the case for two reasons. One, the studies conducted in China and Brazil not only excluded other age-groups by focusing on the elderly population, but they were also not nationally representative in their design. Two, the study by Palafox *et al.* (186) that assessed the scale and patterns of socioeconomic inequality in hypertension treatment in 21 HICs and LMICs did not include Kenya.

Among the reviewed empirical studies, no study in HICs assessed need-based (i.e., horizontal equity) inequity for NCDs. On the other hand, only one study in China (31), assessed horizontal equity (equal treatment for equal need) for access to treatment for chronic conditions. Elwell-Sutton *et al.* (31) using more objective and specific measures (i.e., age, sex, self-rated health, coronary heart disease risk score, and chronic obstructive pulmonary disease) to assess equity in needed chronic diseases services found a pro-rich inequity in the treatment of three main chronic conditions (hypertension, hyperglycaemia, and dyslipidaemia) but not in general healthcare utilisation. This study will add to this empirical evidence by using a horizontal equity index to assess the level of equity in needed screening and treatment interventions for diabetes and hypertension.

Overall, of the 29 empirical studies reviewed in this section, arguably few (four in LMICs and one in HICs) conducted a decomposition analysis to explain the factors contributing to socioeconomic inequality in NCDs. Nevertheless, need-factors such as age and gender significantly explained

inequalities in NCDs in both LMICs and HICs (105, 107, 207). On the other hand, non-need factors such as income, the region of residence, occupational status, and educational level were common to both LMICs and HICs in contributing to socioeconomic inequality in NCDs (31, 105, 107, 207). Of note, health system factors such as level of public health expenditure on health were also found to be the main contributor to socioeconomic inequality in the utilisation of secondary prevention for CVDs in 21 LMICs and HICs (185).

Increasingly, several studies have begun to incorporate methods such as the concentration index and decomposition analysis in an attempt to go beyond the mere demonstration of socioeconomic inequalities in health and healthcare and to understand what underpins such disparities (205). Decomposition analysis, as compared to conventional regression models, uses outcomes estimated and summarised at the population-level by the concentration index along with the wealth distribution. As such, the question of which factors explain inequality can be directly addressed by the decomposition analysis that estimates independent contributions of various factors to the computed concentration index (111).

On another note, it is critical to emphasise that in the context of health equity assessment, debates abound on the appropriate measure to use when categorising households into socioeconomic groups (216-219). Heterogeneity in the methodological approaches of socioeconomic class estimation in the reviewed studies from both HICs and LMICs attests to this fact. This notwithstanding, this mini-dissertation subscribes to the view that as has been demonstrated in previous empirical studies (218, 219), indeed the choice of socioeconomic status measure, depending on the context, does matter. As a result, entirely due to pragmatic reasons, the principal component analysis (see the next section for detailed elaboration) was employed in this study (112).

The main limitation that belies the studies reviewed in both LMICs and HICs was the use of self-assessed measures for socioeconomic inequalities in NCDs. For instance, it has been established that reporting a health condition, among other things, depends on the actual existence of the clinical condition, characteristics unique to respondents such as age, how frequently they have contact with a healthcare provider, their willingness to report the medical condition, their ability to recall whether they have the health problem or their knowledge about it (220-222). Whereas these factors may not be a major concern, say, for certain chronic conditions like cancer (223) compared to osteoarthrosis (224), they nonetheless raise reliability and validity queries regarding the use of self-reported measures. Studies conducted in six LMICs showed that a pro-rich distribution was observed when using self-reported measures. In contrast, a pro-poor distribution

was found when using standardised or symptomatic measures (193). Besides, these studies confirmed that self-reported measures underestimated the true prevalence for most NCDs compared to the use of clinical-based measures, especially among the poor (107, 192, 193). The proposed study will overcome this limitation by using data based on biomarker tests for diabetes and hypertension.

In conclusion, this study will add to the NCDs inequity and inequality literature by providing context-specific evidence on the level of horizontal equity and decomposing socioeconomic inequality in the screening and treatment of diabetes and hypertension. Also, unlike many previous studies, the present study will use data based on biomarker tests for both conditions. To the knowledge of the author, there is limited evidence of this nature in Kenya as well as other similar settings.

References

ABEGUNDE, D. O., MATHERS, C. D., ADAM, T., ORTEGON, M. & STRONG, K. 2007. The burden and costs of chronic diseases in low-income and middle-income countries. *The Lancet,* 370**,** 1929-1938.

ACHOKI, T., MILLER-PETRIE, M. K., GLENN, S. D., KALRA, N., LESEGO, A., GATHECHA, G. K., ALAM, U., KIARIE, H. W., MAINA, I. W. & ADETIFA, I. M. 2019. Health disparities across the counties of Kenya and implications for policy makers, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Global Health,* 7**,** e81-e95.

AHMED, S., TARIQUJJAMAN, M., RAHMAN, M. A., HASAN, M. Z. & HASAN, M. M. 2019. Inequalities in the prevalence of undiagnosed hypertension among Bangladeshi adults: evidence from a nationwide survey. *International journal for equity in health,* 18**,** 33.

AIKINS, A. D.-G. & AGYEMANG, C. 2015. *Chronic Non-communicable Diseases in Low and Middle-income Countries*, cabi.

AIKINS, A. D.-G., KUSHITOR, M., KORAM, K., GYAMFI, S. & OGEDEGBE, G. 2014. Chronic non-communicable diseases and the challenge of universal health coverage: insights from community-based cardiovascular disease research in urban poor communities in Accra, Ghana. *BMC public health,* 14**,** S3.

AKAZILI, J. 2010. *Equity in healthcare financing in Ghana.* University of Cape Town.

ANDERSON, G. F. & CHU, E. 2007. Expanding priorities-confronting chronic disease in countries with low income. *New England Journal of Medicine,* 356**,** 209.

ATAGUBA, J. E.-O. 2013. Inequalities in multimorbidity in South Africa. *International journal for equity in health,* 12**,** 64.

ATAGUBA, J. E. 2012. *Distributional impact of healthcare finance in South Africa.* University of Cape Town.

ATAGUBA, J. E., AKAZILI, J. & MCINTYRE, D. 2011. Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. *International journal for equity in health,* 10**,** 48.

ATAGUBA, J. E., OJO, K. O. & ICHOKU, H. E. 2016. Explaining socioeconomic inequalities in immunization coverage in Nigeria. *Health policy and planning,* 31**,** 1212-1224.

ATAKLTE, F., ERQOU, S., KAPTOGE, S., TAYE, B., ECHOUFFO-TCHEUGUI, J. B. & KENGNE, A. P. 2015. Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. *Hypertension,* 65**,** 291-298.

AVENDANO, M., KUNST, A. E., VAN LENTHE, F., BOS, V., COSTA, G., VALKONEN, T., CARDANO, M., HARDING, S., BORGAN, J.-K. & GLICKMAN, M. 2005. Trends in socioeconomic disparities in stroke mortality in six European countries between 1981–1985 and 1991–1995. *American journal of epidemiology,* 161**,** 52-61.

BACHMANN, M., EACHUS, J., HOPPER, C., DAVEY SMITH, G., PROPPER, C., PEARSON, N., WILLIAMS, S., TALLON, D. & FRANKEL, S. 2003. Socio-economic inequalities in diabetes complications, control, attitudes and health service use: a cross-sectional study. *Diabetic Medicine,* 20**,** 921-929.

BAKER, J., MITCHELL, R., LAWSON, K. & PELL, J. 2013. Ethnic differences in the cost-effectiveness of targeted and mass screening for high cardiovascular risk in the UK: cross-sectional study. *Heart,* 99**,** 1766-1771.

BAMBAS, A. & CASAS, J. A. 2001. Assessing equity in health: conceptual criteria. *Equity and health: Views from the Pan American Sanitary Bureau***,** 12-21.

BARASA, E., NGUHIU, P. & MCINTYRE, D. 2018a. Measuring progress towards sustainable development goal 3.8 on universal health coverage in Kenya. *BMJ global health,* 3**,** e000904.

BARASA, E., ROGO, K., MWAURA, N. & CHUMA, J. 2018b. Kenya National Hospital Insurance Fund Reforms.

BARASA, E. W., MAINA, T. & RAVISHANKAR, N. 2017. Assessing the impoverishing effects, and factors associated with the incidence of catastrophic healthcare payments in Kenya. *International journal for equity in health,* 16**,** 31.

BENTHAM, J. & BOWRING, J. 1843. *The Works of Jeremy Bentham*, W. Tait.

BISWAS, T., ISLAM, M. S., LINTON, N. & RAWAL, L. B. 2016. Socioeconomic inequality of chronic non-communicable diseases in Bangladesh. *PloS one,* 11.

BLAKELY, T., TOBIAS, M. & ATKINSON, J. 2008. Inequalities in mortality during and after restructuring of the New Zealand economy: repeated cohort studies. *Bmj,* 336**,** 371-375.

BOERMA, T., ABOUZAHR, C., EVANS, D. & EVANS, T. 2014. Monitoring intervention coverage in the context of universal health coverage. *PLoS medicine,* 11**,** e1001728.

BOMMER, C., HEESEMANN, E., SAGALOVA, V., MANNE-GOEHLER, J., ATUN, R., BÄRNIGHAUSEN, T. & VOLLMER, S. 2017. The global economic burden of diabetes in adults aged 20–79 years: a cost-of-illness study. *The lancet Diabetes & endocrinology,* 5**,** 423-430.

BONFRER, I., VAN DE POEL, E., GRIMM, M. & VAN DOORSLAER, E. 2013. Does the distribution of healthcare utilization match needs in Africa? *Health Policy and Planning,* 29**,** 921-937.

BORRELL, C., AZLOR, E., RODRIGUEZ-SANZ, M., PUIGPINOS, R., CANO-SERRAL, G., PASARIN, M., MARTÍNEZ, J., BENACH, J. & MUNTANER, C. 2008. Trends in socioeconomic mortality inequalities in a southern European urban setting at the turn of the 21st century. *Journal of Epidemiology & Community Health,* 62**,** 258-266.

BRADSHAW, J. 1972. Taxonomy of social need.

BRAVEMAN, P. & GRUSKIN, S. 2003. Defining equity in health. *Journal of Epidemiology & Community Health,* 57**,** 254-258.

BRAVEMAN, P. & TARIMO, E. 2002. Social inequalities in health within countries: not only an issue for affluent nations. *Social science & medicine,* 54**,** 1621-1635.

BRAVEMAN, P. A., CUBBIN, C., EGERTER, S., CHIDEYA, S., MARCHI, K. S., METZLER, M. & POSNER, S. 2005. Socioeconomic status in health research: one size does not fit all. *Jama,* 294**,** 2879-2888.

CARRIN, G., MATHAUER, I., XU, K. & EVANS, D. B. 2008. Universal coverage of health services: tailoring its implementation. *Bulletin of the World Health Organization,* 86**,** 857-863.

CHOW, C. K., RAMASUNDARAHETTIGE, C., HU, W., ALHABIB, K. F., AVEZUM JR, A., CHENG, X., CHIFAMBA, J., DAGENAIS, G., DANS, A. & EGBUJIE, B. A. 2018. Availability and affordability of essential medicines for diabetes across high-income, middle-income, and low-income countries: a prospective epidemiological study. *The lancet Diabetes & endocrinology,* 6**,** 798-808.

CHOW, C. K., TEO, K. K., RANGARAJAN, S., ISLAM, S., GUPTA, R., AVEZUM, A., BAHONAR, A., CHIFAMBA, J., DAGENAIS, G. & DIAZ, R. 2013. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *Jama,* 310**,** 959-968.

CHUMA, J. 2001. *Resource allocation in the Kenyan health sector: a question of equity.* University of Cape Town.

CHUMA, J. & MAINA, T. 2014. Free maternal care and removal of user fees at primary-level facilities in Kenya. Monitoring the implementation and impact: Baseline report.

CHUMA, J., MAINA, T. & ATAGUBA, J. 2012. Does the distribution of healthcare benefits in Kenya meet the principles of universal coverage? *BMC public health,* 12**,** 20.

CHUMA, J., MOLYNEUX, C. J. H. P. & PLANNING 2009. Estimating inequalities in ownership of insecticide treated nets: does the choice of socioeconomic status measure matter? 24**,** 83-93.

CHUMA, J. & OKUNGU, V. 2011. Viewing the Kenyan health system through an equity lens: implications for universal coverage. *International journal for equity in health,* 10**,** 22.

CISSÉ, B., LUCHINI, S. & MOATTI, J. P. 2007. Progressivity and horizontal equity in healthcare finance and delivery: What about Africa? *Health policy,* 80**,** 51-68.

CLARKE, P. & VAN OURTI, T. 2009. Correcting the bias in the concentration index when income is grouped.
COLLINS, E. & KLEIN, R. 1980. Equity and the NHS: self-reported morbidity, access, and primary care. *Br Med J,* 281**,** 1111-1115.
CULYER, A. J. 2001. Equity-some theory and its policy implications. *Journal of medical ethics,* 27**,** 275-283.
CULYER, A. J. & WAGSTAFF, A. 1993a. Equity and equality in health and healthcare. *Journal of health economics,* 12**,** 431-457.
CULYER, A. J. & WAGSTAFF, A. 1993b. Equity and equality in health and healthcare. *J Health Econ,* 12**,** 431-57.
CULYER, A. J. A. W., A., 1991. Need, Quality and Social Justice. University of York Centre for Health Economics
CULYER, T. J. & WAGSTAFF, A. 1992. Need, equity and equality in health and healthcare.
DALL, T. M., YANG, W., HALDER, P., PANG, B., MASSOUDI, M., WINTFELD, N., SEMILLA, A. P., FRANZ, J. & HOGAN, P. F. 2014. The economic burden of elevated blood glucose levels in 2012: diagnosed and undiagnosed diabetes, gestational diabetes mellitus, and prediabetes. *Diabetes care,* 37**,** 3172-3179.
DALSTRA, J. A., KUNST, A. E., BORRELL, C., BREEZE, E., CAMBOIS, E., COSTA, G., GEURTS, J. J., LAHELMA, E., VAN OYEN, H. & RASMUSSEN, N. K. 2005. Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries. *International journal of epidemiology,* 34**,** 316-326.
DE SILVA, A. P., DE SILVA, S. H. P., HANIFFA, R., LIYANAGE, I. K., JAYASINGHE, S., KATULANDA, P., WIJERATNE, C. N., WIJERATNE, S. & RAJAPAKSA, L. C. 2018. Inequalities in the prevalence of diabetes mellitus and its risk factors in Sri Lanka: a lower middle income country. *International journal for equity in health,* 17**,** 45.
DENIER, Y. 2007. *Efficiency, justice and care*, Springer.
DONALDSON, C. & GERARD, K. 1993. *Economics of healthcare financing: The Visible Hand*, Springer.
DOORSLAER, E. V., WAGSTAFF, A. & RUTTEN, F. 1992. *Equity in the finance and delivery of healthcare: an international perspective*, Oxford University Press.
EFRON, B. 1987. Better bootstrap confidence intervals. *Journal of the American statistical Association,* 82**,** 171-185.
EFRON, B. & TIBSHIRANI, R. 1986. [Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy]: rejoinder. *Statistical science,* 1**,** 77-77.
ELSTER, J. 1992. *Local justice: How institutions allocate scarce goods and necessary burdens*, Russell Sage Foundation.
ELWELL-SUTTON, T. M., JIANG, C. Q., ZHANG, W. S., CHENG, K. K., LAM, T. H., LEUNG, G. M. & SCHOOLING, C. 2012. Inequality and inequity in access to healthcare and treatment for chronic conditions in China: the Guangzhou Biobank Cohort Study. *Health policy and planning,* 28**,** 467-479.
ESPELT, A., BORRELL, C., PALÈNCIA, L., GODAY, A., SPADEA, T., GNAVI, R., FONT-RIBERA, L. & KUNST, A. E. 2013. Socioeconomic inequalities in the incidence and prevalence of type 2 diabetes mellitus in Europe. *Gaceta Sanitaria,* 27**,** 494-501.
ESPELT, A., BORRELL, C., ROSKAM, A.-J., RODRIGUEZ-SANZ, M., STIRBU, I., DALMAU-BUENO, A., REGIDOR, E., BOPP, M., MARTIKAINEN, P. & LEINSALU, M. 2008. Socioeconomic inequalities in diabetes mellitus across Europe at the beginning of the 21st century. *Diabetologia,* 51**,** 1971.
ESPELT, A., KUNST, A. E., PALENCIA, L., GNAVI, R. & BORRELL, C. 2012. Twenty years of socioeconomic inequalities in type 2 diabetes mellitus prevalence in Spain, 1987–2006. *The European Journal of Public Health,* 22**,** 765-771.
EVANS, T., WHITEHEAD, M., BHUIYA, A., DIDERICHSEN, F. & WIRTH, M. 2001a. *Challenging inequities in health: from ethics to action*, Oxford University Press.

EVANS, T., WHITEHEAD, M. & DIDERICHSEN, F. 2001b. *Challenging inequities in health: from ethics to action*, Oxford University Press.
FILMER, D. & PRITCHETT, L. H. J. D. 2001. Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. 38, 115-132.
FRANSE, L. V., DI BARI, M., SHORR, R. I., RESNICK, H. E., VAN EIJK, J. T., BAUER, D. C., NEWMAN, A. B. & PAHOR, M. 2001. Type 2 Diabetes in older well-functioning people: Who is undiagnosed?: data from the Health, Aging, and Body Composition Study. *Diabetes care,* 24, 2065-2070.
GAERTNER, W. 1994. Distributive justice: Theoretical foundations and empirical findings. *European Economic Review,* 38, 711-720.
GAKIDOU, E., MALLINGER, L., ABBOTT-KLAFTER, J., GUERRERO, R., VILLALPANDO, S., RIDAURA, R. L., AEKPLAKORN, W., NAGHAVI, M., LIM, S. & LOZANO, R. 2011. Management of diabetes and associated cardiovascular risk factors in seven countries: a comparison of data from national health examination surveys. *Bulletin of the World Health Organization,* 89, 172-183.
GAUS, G. F. & KUKATHAS, C. 2004. *Handbook of political theory*, Sage.
GILSON, L. 1998. Re-addressing equity: the search for the holy grail. *The importance of*.
GOLDMAN, N., LIN, I.-F., WEINSTEIN, M. & LIN, Y.-H. 2003. Evaluating the quality of self-reports of hypertension and diabetes. *Journal of clinical epidemiology,* 56, 148-154.
GOVERNMENT OF KENYA 2010. The Constitution of Kenya. Nairobi: Government of Kenya.
GRAVELLE, H., MORRIS, S. & SUTTON, M. 2006. 18 Economic studies of equity in the consumption of healthcare. *The Elgar companion to health economics*, 193.
GUAN, W. 2003. From the help desk: bootstrapped standard errors. *The Stata Journal,* 3, 71-80.
HAAPANEN, N., MIILUNPALO, S., PASANEN, M., OJA, P. & VUORI, I. 1997. Agreement between questionnaire data and medical records of chronic diseases in middle-aged and elderly Finnish men and women. *American journal of epidemiology,* 145, 762-769.
HAJIZADEH, M., CAMPBELL, M. K. & SARMA, S. 2014. Socioeconomic inequalities in adult obesity risk in Canada: trends and decomposition analyses. *The European Journal of Health Economics,* 15, 203-221.
HANSSON, S. O. 2004. What are opportunities and why should they be equal? *Social Choice and Welfare,* 22, 305-316.
HART, J. T. 1971. The inverse care law. *The Lancet,* 297, 405-412.
HASAN, M., TASNIM, F., TARIQUJJAMAN, M. & AHMED, S. 2019. Socioeconomic Inequalities of Undiagnosed Diabetes in a Resource-Poor Setting: Insights from the Cross-Sectional Bangladesh Demographic and Health Survey 2011. *International journal of environmental research and public health,* 16, 115.
HELLER, O., SOMERVILLE, C., SUGGS, L. S., LACHAT, S., PIPER, J., AYA PASTRANA, N., CORREIA, J. C., MIRANDA, J. J. & BERAN, D. 2019. The process of prioritization of non-communicable diseases in the global health policy arena. *Health policy and planning*.
HENDRIKS, M. E., WIT, F. W., ROOS, M. T., BREWSTER, L. M., AKANDE, T. M., DE BEER, I. H., MFINANGA, S. G., KAHWA, A. M., GATONGI, P. & VAN ROOY, G. 2012. Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. *PloS one,* 7.
HORTON, R. 2017. Offline: NCDs—why are we failing? *The Lancet,* 390, 346.
HOSSEINPOOR, A. R., BERGEN, N., MENDIS, S., HARPER, S., VERDES, E., KUNST, A. & CHATTERJI, S. 2012. Socioeconomic inequality in the prevalence of noncommunicable diseases in low- and middle-income countries: results from the World Health Survey. *BMC public health,* 12, 474.
HOWARD, K., WHITE, S., SALKELD, G., MCDONALD, S., CRAIG, J. C., CHADBAN, S. & CASS, A. 2010. Cost-effectiveness of screening and optimal management for diabetes, hypertension, and chronic kidney disease: A modeled analysis. *Value in health,* 13, 196-208.

ILINCA, S., DI GIORGIO, L., SALARI, P. & CHUMA, J. 2019. Socioeconomic inequality and inequity in use of healthcare services in Kenya: evidence from the fourth Kenya household health expenditure and utilization survey. *International Journal for Equity in Health,* 18**,** 196.

IMKAMPE, A. K. & GULLIFORD, M. C. 2011. Increasing socioeconomic inequality in type 2 diabetes prevalence—repeated cross-sectional surveys in England 1994–2006. *The European Journal of Public Health,* 21**,** 484-490.

INTERNATIONAL DIABETES FEDERATION 2019. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: International Diabetes Federation.

ISARANUWATCHAI, W., ARCHER, R. A., TEERAWATTANANON, Y. & CULYER, A. J. 2019. Non-Communicable Disease Prevention: Best Buys, Wasted Buys and Contestable Buys.

IWELUNMOR, J., AIRHIHENBUWA, C. O., COOPER, R., TAYO, B., PLANGE-RHULE, J., ADANU, R. & OGEDEGBE, G. 2014. Prevalence, determinants and systems-thinking approaches to optimal hypertension control in West Africa. *Globalization and health,* 10**,** 42.

JAMES, M. 1999. Towards an integrated needs and outcome framework. *Health Policy,* 46**,** 165-177.

JANN, B. 2008. The Blinder–Oaxaca decomposition for linear regression models. *The Stata Journal,* 8**,** 453-479.

JEPPSSON, A. & OKUONZI, S. A. 2000. Vertical or holistic decentralization of the health sector? Experiences from Zambia and Uganda. *The International journal of health planning and management,* 15**,** 273-289.

JOFFRES, M., FALASCHETTI, E., GILLESPIE, C., ROBITAILLE, C., LOUSTALOT, F., POULTER, N., MCALISTER, F. A., JOHANSEN, H., BACLIC, O. & CAMPBELL, N. 2013. Hypertension prevalence, awareness, treatment and control in national surveys from England, the USA and Canada, and correlation with stroke and ischaemic heart disease mortality: a cross-sectional study. *BMJ open,* 3**,** e003423.

KABIA, E., MBAU, R., OYANDO, R., ODUOR, C., BIGOGO, G., KHAGAYI, S. & BARASA, E. 2019. "We are called the et cetera": experiences of the poor with health financing reforms that target them in Kenya. *International Journal for Equity in Health,* 18**,** 98.

KAHN, R., ALPERIN, P., EDDY, D., BORCH-JOHNSEN, K., BUSE, J., FEIGELMAN, J., GREGG, E., HOLMAN, R. R., KIRKMAN, M. S. & STERN, M. 2010. Age at initiation and frequency of screening to detect type 2 diabetes: a cost-effectiveness analysis. *The Lancet,* 375**,** 1365-1374.

KAKWANI, N., WAGSTAFF, A. & VAN DOORSLAER, E. 1997. Socioeconomic inequalities in health: measurement, computation, and statistical inference. *Journal of econometrics,* 77**,** 87-103.

KAYIMA, J., WANYENZE, R. K., KATAMBA, A., LEONTSINI, E. & NUWAHA, F. 2013. Hypertension awareness, treatment and control in Africa: a systematic review. *BMC cardiovascular disorders,* 13**,** 54.

KAZUNGU, J. S. & BARASA, E. W. 2017. Examining levels, distribution and correlates of health insurance coverage in Kenya. *Tropical Medicine & International Health,* 22**,** 1175-1185.

KEATS, E. C., AKSEER, N., BHATTI, Z., MACHARIA, W., NGUGI, A., RIZVI, A. & BHUTTA, Z. A. 2018. Assessment of inequalities in coverage of essential reproductive, maternal, newborn, child, and adolescent health interventions in Kenya. *JAMA network open,* 1**,** e185152-e185152.

KEHOE, R., WU, S.-Y., LESKE, M. C. & CHYLACK JR, L. T. 1994. Comparing self-reported and physician-reported medical history. *American Journal of Epidemiology,* 139**,** 813-818.

KNBS 2018. Economic Survey. Nairobi, Kenya.

KNBS 2019. Kenya Population and Housing Census. Nairobi, Kenya.

KOOLMAN, X. & VAN DOORSLAER, E. 2004. On the interpretation of a concentration index of inequality. *Health economics,* 13**,** 649-656.

KRIEGSMAN, D. M., PENNINX, B. W., VAN EIJK, J. T. M., BOEKE, A. J. P. & DEEG, D. J. 1996. Self-reports and general practitioner information on the presence of chronic diseases in community dwelling elderly: a study on the accuracy of patients' self-reports and on determinants of inaccuracy. *Journal of clinical epidemiology,* 49**,** 1407-1417.

KUNST, A. E., GEURTS, J. J. & VAN DEN BERG, J. 1995. International variation in socioeconomic inequalities in self reported health. *Journal of Epidemiology & Community Health,* 49**,** 117-123.
LARRANAGA, I., ARTEAGOITIA, J., RODRIGUEZ, J., GONZALEZ, F., ESNAOLA, S., PINIES, J. & COUNTRY, S. P. N. O. T. B. 2005. Socio-economic inequalities in the prevalence of Type 2 diabetes, cardiovascular risk factors and chronic diabetic complications in the Basque Country, Spain. *Diabetic Medicine,* 22**,** 1047-1053.
LE GRAND, J. 1978. The distribution of public expenditure: the case of healthcare. *Economica,* 45**,** 125-142.
LI, R., ZHANG, P., BARKER, L. E., CHOWDHURY, F. M. & ZHANG, X. 2010. Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review. *Diabetes care,* 33**,** 1872-1894.
LIM, S. S., VOS, T., FLAXMAN, A. D., DANAEI, G., SHIBUYA, K., ADAIR-ROHANI, H., ALMAZROA, M. A., AMANN, M., ANDERSON, H. R. & ANDREWS, K. G. 2012. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet,* 380**,** 2224-2260.
LINDELOW, M. J. H. E. 2006. Sometimes more equal than others: how health inequalities depend on the choice of welfare indicator. 15**,** 263-279.
LITTENBERG, B., GARBER, A. M. & SOX, H. C. 1990. Screening for hypertension. *Annals of internal medicine,* 112**,** 192-202.
LOCKE, J. 1967. *Locke: Two treatises of government*, Cambridge University Press.
LOPEZ, A. D., MATHERS, C. D., EZZATI, M., JAMISON, D. T. & MURRAY, C. J. 2006. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *The Lancet,* 367**,** 1747-1757.
MACINKO, J. A. & STARFIELD, B. 2002. Annotated bibliography on equity in health, 1980-2001. *International Journal for Equity in Health,* 1**,** 1.
MACKENBACH, J. P. & KUNST, A. E. 1997. Measuring the magnitude of socioeconomic inequalities in health: an overview of available measures illustrated with two examples from Europe.
MAINA, T. & KIRIGIA, D. 2015. Annual Evaluation of the Abolition of User Fees at Primary Healthcare Facilities in Kenya. Washington DC: Futures Group. *Health Policy Project*.
MATHERS, C. D. & LONCAR, D. 2006. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS medicine,* 3**,** e442.
MAYOSI, B. M., FLISHER, A. J., LALLOO, U. G., SITAS, F., TOLLMAN, S. M. & BRADSHAW, D. 2009. The burden of non-communicable diseases in South Africa. *The lancet,* 374**,** 934-947.
MCGUIRE, A., HENDERSON, J. & MOONEY, G. 1988. *The economics of healthcare: an introductory text*, Routledge & Kegan Paul.
MCINTYRE, D. & MOONEY, G. 2007. *The economics of health equity*, Cambridge University Press.
MCINTYRE, D., MOONEY, G. & JAN, S. 2009. Need: what is it and how do we measure it? *Oxford textbook of public health, Volume 3: the practice of public health***,** 1535-1548.
MINISTRY OF HEALTH 2014. Kenya Health Policy 2014-2030.
MINISTRY OF HEALTH 2015. Kenya STEPwise survey for non-communicable diseases risk factors 2015 report. Available at: http://aphrc.org/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf [Accessed 8 August 2019].
MINISTRY OF HEALTH 2018. Kenya National Guidelines for Cardiovascular Diseases Management. Nairobi, Kenya.
MINISTRY OF PUBLIC HEALTH AND SANITATION 2010. National Clinical Guidelines for Management of Diabetes Mellitus. Nairobi, Kenya.
MOHAMED, S. F., MUTUA, M. K., WAMAI, R., WEKESAH, F., HAREGU, T., JUMA, P., NYANJAU, L., KYOBUTUNGI, C. & OGOLA, E. 2018a. Prevalence, awareness, treatment and control of

hypertension and their determinants: results from a national survey in Kenya. *BMC public health,* 18**,** 1219.
MOHAMED, S. F., MWANGI, M., MUTUA, M. K., KIBACHIO, J., HUSSEIN, A., NDEGWA, Z., OWONDO, S., ASIKI, G. & KYOBUTUNGI, C. 2018b. Prevalence and factors associated with pre-diabetes and diabetes mellitus in Kenya: results from a national survey. *BMC Public Health,* 18**,** 1215.
MOODY, A., COWLEY, G., FAT, L. N. & MINDELL, J. S. 2016. Social inequalities in prevalence of diagnosed and undiagnosed diabetes and impaired glucose regulation in participants in the Health Surveys for England series. *BMJ open,* 6**,** e010155.
MOONEY, G. & JAN, S. 1997. Vertical equity: weighting outcomes? or establishing procedures? *Health Policy,* 39**,** 79-87.
MOONEY, G. H. 1983. Equity in healthcare: confronting the confusion. *Effective healthcare,* 1**,** 179-185.
MOONEY, G. H. 1994. Key issues in health economics, New York, Harvester Wheatsheaf.
MORADI, G., MAJDZADEH, R., MOHAMMAD, K., MALEKAFZALI, H., JAFARI, S. & HOLAKOUIE-NAIENI, K. 2016. Is the status of diabetes socioeconomic inequality changing in Kurdistan province, west of Iran? A comparison of two surveys. *Medical journal of the Islamic Republic of Iran,* 30**,** 375.
MORADI, G., MOHAMMAD, K., MAJDZADEH, R., ARDAKANI, H. M. & NAIENI, K. H. 2013. Socioeconomic inequality of non-communicable risk factors among people living in Kurdistan Province, Islamic Republic of Iran. *International journal of preventive medicine,* 4**,** 671.
MORRIS, S., SUTTON, M. & GRAVELLE, H. 2005. Inequity and inequality in the use of healthcare in England: an empirical investigation. *Social science & medicine,* 60**,** 1251-1266.
MOSQUERA, P. A., SAN SEBASTIAN, M., IVARSSON, A. & GUSTAFSSON, P. E. 2018. Decomposition of gendered income-related inequalities in multiple biological cardiovascular risk factors in a middle-aged population. *International journal for equity in health,* 17**,** 102.
MUNGE, K. & BRIGGS, A. H. 2013. The progressivity of health-care financing in Kenya. *Health policy and planning,* 29**,** 912-920.
MURPHY, A., PALAFOX, B., O'DONNELL, O., STUCKLER, D., PEREL, P., ALHABIB, K. F., AVEZUM, A., BAI, X., CHIFAMBA, J. & CHOW, C. K. 2018. Inequalities in the use of secondary prevention of cardiovascular disease by socioeconomic status: evidence from the PURE observational study. *The Lancet Global Health,* 6**,** e292-e301.
MUSGROVE, P. 1986. Measurement of equity in health. *World health statistics quarterly 1986; 39 (4): 325-335.*
MUTYAMBIZI, C., BOOYSEN, F., STOKES, A., PAVLOVA, M. & GROOT, W. 2019. Lifestyle and socioeconomic inequalities in diabetes prevalence in South Africa: A decomposition analysis. *PloS one,* 14.
MWABU, G., MWANZIA, J. & LIAMBILA, W. 1995. User charges in government health facilities in Kenya: effect on attendance and revenue. *Health policy and Planning,* 10**,** 164-170.
MWESIGYE, R. F. 1995. Effects of user charges on quality of curative services: a perspective of Uganda's rural health units. *Health Planning Unit, Ministry of Health, Entebbe*.
NEVES, R. G., DURO, S. M. S., FLORES, T. R., WENDT, A., COSTA, C. D. S., NUNES, B. P., WEHRMEISTER, F. C., MUÑIZ, J., CASTRO, T. R. P. & TOMASI, E. 2018. Social inequalities in care for the elderly with diabetes in Brazil. *Revista Panamericana de Salud Pública,* 42**,** e88.
NGUHIU, P. K., BARASA, E. W. & CHUMA, J. 2017. Determining the effective coverage of maternal and child health services in Kenya, using demographic and health survey data sets: tracking progress towards universal health coverage. *Tropical Medicine & International Health,* 22**,** 442-453.
NIESSEN, L. W., MOHAN, D., AKUOKU, J. K., MIRELMAN, A. J., AHMED, S., KOEHLMOOS, T. P., TRUJILLO, A., KHAN, J. & PETERS, D. H. 2018. Tackling socioeconomic inequalities and non-

communicable diseases in low-income and middle-income countries under the Sustainable Development agenda. *The Lancet,* 391, 2036-2046.
NIKOLAOU, A. & NIKOLAOU, D. 2008. Income-related inequality in the distribution of obesity among Europeans. *Journal of Public Health,* 16, 403-411.
NOZICK, R. 1974. *Anarchy, state, and utopia*, New York: Basic Books.
O'DONNELL, O., VAN DOORSLAER, E., WAGSTAFF, A. & LINDELOW, M. 2008. *Analyzing health equity using household survey data: a guide to techniques and their implementation*, The World Bank.
OKORAFOR, O. A. 2009. *Fiscal federalism an equity in the financing of primary healthcare: The case of South Africa.* University of Cape Town.
OKUONZI, S. A. & MACRAE, J. 1995. Whose policy is it anyway? International and national influences on health policy development in Uganda. *Health policy and planning,* 10, 122-132.
OLIVER, A. & MOSSIALOS, E. 2004. Equity of access to healthcare: outlining the foundations for action. *Journal of Epidemiology & Community Health,* 58, 655-658.
OLSEN, J. A. 1997. Theories of justice and their implications for priority setting in healthcare. *Journal of health economics,* 16, 625-639.
OLSEN, M. H., ANGELL, S. Y., ASMA, S., BOUTOUYRIE, P., BURGER, D., CHIRINOS, J. A., DAMASCENO, A., DELLES, C., GIMENEZ-ROQUEPLO, A.-P. & HERING, D. 2016. A call to action and a lifecourse strategy to address the global burden of raised blood pressure on current and future generations: the Lancet Commission on hypertension. *The Lancet,* 388, 2665-2712.
OYANDO, R., NJOROGE, M., NGUHIU, P., KIRUI, F., MBUI, J., SIGILAI, A., BUKANIA, Z., OBALA, A., MUNGE, K. & ETYANG, A. 2019. Patient costs of hypertension care in public healthcare facilities in Kenya. *The International journal of health planning and management,* 34, e1166-e1178.
OYANDO, R., NJOROGE, M., NGUHIU, P., SIGILAI, A., KIRUI, F., MBUI, J., BUKANIA, Z., OBALA, A., MUNGE, K. & ETYANG, A. 2020. Patient costs of diabetes mellitus care in public healthcare facilities in Kenya. *The International Journal of Health Planning and Management,* 35, 290-308.
PALAFOX, B., MCKEE, M., BALABANOVA, D., ALHABIB, K. F., BAHONAR, A., ISMAIL, N., CHIFAMBA, J., CHOW, C. K., CORSI, D. J. & DAGENAIS, G. R. 2016. Wealth and cardiovascular health: a cross-sectional study of wealth-related inequalities in the awareness, treatment and control of hypertension in high-, middle-and low-income countries. *International journal for equity in health,* 15, 199.
PAMUK, E. R. 1985. Social class inequality in mortality from 1921 to 1972 in England and Wales. *Population studies,* 39, 17-31.
PEREIRA, J. A. C. G. 1995. *Equity, health and healthcare: an economic study with reference to Portugal.* University of York.
PETER, F. 2001. Health equity and social justice. *Journal of applied philosophy*, 159-170.
PETERS, M., HUISMAN, E., SCHOONEN, M. & WOLFFENBUTTEL, B. 2017. The current total economic burden of diabetes mellitus in the Netherlands. *Neth J Med,* 75, 281-297.
PHILLIMORE, P., BEATTIE, A. & TOWNSEND, P. 1994. Widening inequality of health in northern England, 1981-91. *Bmj,* 308, 1125-1128.
PHIRI, J. & ATAGUBA, J. E. 2014. Inequalities in public healthcare delivery in Zambia. *International journal for equity in health,* 13, 24.
POWER, C., MANOR, O. & FOX, J. 1991. *Health and class: the early years*, Chapman & Hall.
PUFFER, F. 1986. Access to Primary Healthcare: A Comparison of the US and the UK. *Journal of Social Policy,* 15, 293-313.
RATHMANN, W., HAASTERT, B., ICKS, A., LÖWEL, H., MEISINGER, C., HOLLE, R. & GIANI, G. 2003. High prevalence of undiagnosed diabetes mellitus in Southern Germany: target populations for efficient screening. The KORA survey 2000. *Diabetologia,* 46, 182-189.

RAWLS, J. 1971. A theory of justice, Harvard, MA, Harvard University Press.
REAGON, G., MAKAN, B. & MCINTYRE, D. 1997. Resource Allocation Mechanisms within the District Health System: A Literature Review. *Health Economics Unit, department of Community Health, University of Cape Town*.
REGIDOR, E. 2004. Measures of health inequalities: part 2. *Journal of epidemiology and community health,* 58**,** 900.
RILEY, L., GUTHOLD, R., COWAN, M., SAVIN, S., BHATTI, L., ARMSTRONG, T. & BONITA, R. 2016. The World Health Organization STEPwise approach to noncommunicable disease risk-factor surveillance: methods, challenges, and opportunities. *American journal of public health,* 106**,** 74-78.
ROEMER, J. E. 1996. *Egalitarian Perspectives: Essays in philosophical economics*, Cambridge University Press.
SALARI, P., DI GIORGIO, L., ILINCA, S. & CHUMA, J. 2019. The catastrophic and impoverishing effects of out-of-pocket healthcare payments in Kenya, 2018. *BMJ Global Health,* 4.
SANDEL, M. 2009. Justice: What's the right thing to do? New York, NY: Farrar, Straus & Giroux.
SANTOS, J., KISLAYA, I., ANTUNES, L., SANTOS, A. J., RODRIGUES, A. P., NETO, M. & DIAS, C. M. 2017. Diabetes: socioeconomic inequalities in the Portuguese population in 2014. *Acta medica portuguesa,* 30**,** 561-567.
SCARRE, G. 2002. *Utilitarianism*, Routledge.
SEN, A. 1985. Capabilities and commodities. *Amsterdam and New York: North-Holland*.
SEN, A. 1987. *On Ethics and Economics,* Oxford and New York, Basil Blackwell.
SMITH, G. D., BARTLEY, M. & BLANE, D. 1990. The Black report on socioeconomic inequalities in health 10 years on. *BMJ: British Medical Journal,* 301**,** 373.
SORTSØ, C., LAURIDSEN, J., EMNEUS, M., GREEN, A. & JENSEN, P. B. 2017. Socioeconomic inequality of diabetes patients' healthcare utilization in Denmark. *Health economics review,* 7**,** 21.
SORTSØ, C., LAURIDSEN, J., EMNEUS, M., GREEN, A. & JENSEN, P. B. 2018. Social inequality in diabetes patients' morbidity patterns from diagnosis to death–A Danish register-based investigation. *Scandinavian journal of public health,* 46**,** 92-101.
SOZMEN, K. & BELGIN, U. 2014. Socioeconomic inequalities in non-communicable diseases and self assessed health in Turkey. *Iranian journal of public health,* 43**,** 736.
SÖZMEN, K. & ÜNAL, B. 2016. Explaining inequalities in healthcare utilization among Turkish adults: findings from health survey 2008. *Health Policy,* 120**,** 100-110.
STANSFELD, S., MARMOT, M. & WILKINSON, R. G. 1999. Social determinants of health.
SU, M., SI, Y., ZHOU, Z., SHEN, C., DONG, W., FAN, X., WANG, X. & WEI, X. 2018. Comparing the income-related inequity of tested prevalence and self-reported prevalence of hypertension in China. *International journal for equity in health,* 17**,** 82.
SUBRAMANIAN, S., GAKUNGA, R., KIBACHIO, J., GATHECHA, G., EDWARDS, P., OGOLA, E., YONGA, G., BUSAKHALA, N., MUNYORO, E. & CHAKAYA, J. 2018. Cost and affordability of non-communicable disease screening, diagnosis and treatment in Kenya: Patient payments in the private and public sectors. *PloS one,* 13**,** e0190113.
SUTTON, M. 2002. Vertical and horizontal aspects of socio-economic inequity in general practitioner contacts in Scotland. *Health Economics,* 11**,** 537-549.
TEO, K., CHOW, C. K., VAZ, M., RANGARAJAN, S. & YUSUF, S. 2009. The Prospective Urban Rural Epidemiology (PURE) study: examining the impact of societal influences on chronic noncommunicable diseases in low-, middle-, and high-income countries. *American heart journal,* 158**,** 1-7. e1.
THOMSON, M., KENTIKELENIS, A. & STUBBS, T. J. P. H. R. 2017. Structural adjustment programmes adversely affect vulnerable populations: a systematic-narrative review of their effect on child and maternal health. 38**,** 13.

TOWNSEND, P. & DAVIDSON, N. 1982. *Inequalities in health: the Black report*, Penguin Harmondsworth.

UNITED NATIONS 2015. Transforming Our World - the 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals (Accessed 14 November 2019).

VAN DE VIJVER, S., AKINYI, H., OTI, S., OLAJIDE, A., AGYEMANG, C., ABODERIN, I. & KYOBUTUNGI, C. 2014. Status report on hypertension in Africa-Consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. *Pan African Medical Journal,* 16.

VAN DER HOOG, M. 2010. Measuring equity in healthcare delivery: a new method based on the concept of aristotelian equality. *Netherlands: Network for studies on pensions, aging and retirement*.

VAN DOORSLAER, E., WAGSTAFF, A., VAN DER BURG, H., CHRISTIANSEN, T., DE GRAEVE, D., DUCHESNE, I., GERDTHAM, U.-G., GERFIN, M., GEURTS, J. & GROSS, L. 2000. Equity in the delivery of healthcare in Europe and the US. *Journal of health economics,* 19**,** 553-583.

VAN MALDEREN, C., OGALI, I., KHASAKHALA, A., MUCHIRI, S. N., SPARKS, C., VAN OYEN, H. & SPEYBROECK, N. 2013. Decomposing Kenyan socioeconomic inequalities in skilled birth attendance and measles immunization. *International journal for equity in health,* 12**,** 3.

VELLAKKAL, S., MILLETT, C., BASU, S., KHAN, Z., AITSI-SELMI, A., STUCKLER, D. & EBRAHIM, S. 2015. Are estimates of socioeconomic inequalities in chronic disease artefactually narrowed by self-reported measures of prevalence in low-income and middle-income countries? Findings from the WHO-SAGE survey. *J Epidemiol Community Health,* 69**,** 218-225.

VELLAKKAL, S., SUBRAMANIAN, S., MILLETT, C., BASU, S., STUCKLER, D. & EBRAHIM, S. 2013. Socioeconomic inequalities in non-communicable diseases prevalence in India: disparities between self-reported diagnoses and standardized measures. *PloS one,* 8.

VYAS, S. & KUMARANAYAKE, L. 2006. Constructing socioeconomic status indices: how to use principal components analysis. *Health policy and planning,* 21**,** 459-468.

WAGSTAFF, A. 2001. Poverty and Health. CMH Working Paper Series, paper No. WG1: 5, Prepared for WHO's Commission on Macroeconomics and Health. *Paper*.

WAGSTAFF, A. 2002. Poverty and health sector inequalities. *Bulletin of the world health organization,* 80**,** 97-105.

WAGSTAFF, A., DOORSLAER, V. E. & WATANABE, N. 2003. *On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam*, J Hum Resour. 112: 207-23.

WAGSTAFF, A., PACI, P. & VAN DOORSLAER, E. 1991a. On the measurement of inequalities in health. *Social science & medicine,* 33**,** 545-557.

WAGSTAFF, A. & VAN DOORSLAER, E. 1993. Equity in the finance and delivery of healthcare: concepts and definitions. *Equity in the finance and delivery of healthcare: an international perspective***,** 7-19.

WAGSTAFF, A. & VAN DOORSLAER, E. 2000. Measuring and testing for inequity in the delivery of healthcare. *Journal of Human Resources***,** 716-733.

WAGSTAFF, A., VAN DOORSLAER, E. & PACI, P. 1991b. On the measurement of horizontal inequity in the delivery of healthcare. *Journal of health economics,* 10**,** 169-205.

WAGSTAFF, A. & WATANABE, N. 2003. What difference does the choice of SES make in health inequality measurement? *Health economics,* 12**,** 885-890.

WALLI-ATTAEI, M., JOSEPH, P., ROSENGREN, A., CHOW, C. K., RANGARAJAN, S., LEAR, S. A., ALHABIB, K. F., DAVLETOV, K., DANS, A. & LANAS, F. 2020. Variations between women and men in risk factors, treatments, cardiovascular disease incidence, and death in 27 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. *The Lancet*.

WATERS, H. R. 2000. Measuring equity in access to healthcare. *Social Science & Medicine,* 51**,** 599-612.

WERE, V., BUFF, A. M., DESAI, M., KARIUKI, S., SAMUELS, A., TER KUILE, F. O., PHILLIPS-HOWARD, P. A., KACHUR, S. P. & NIESSEN, L. 2018. Socioeconomic health inequality in malaria indicators in rural western Kenya: evidence from a household malaria survey on burden and care-seeking behaviour. *Malaria journal,* 17**,** 166.

WHITEHEAD, M. 1991. The concepts and principles of equity and health. *Health promotion international,* 6**,** 217-228.

WILKINSON, R. G. 1986. Socioeconomic differences in mortality: interpreting the data on their size and trends. *Class and health: Research and longitudinal data***,** 1-20.

WILKINSON, R. G. & MARMOT, M. 2003. *Social determinants of health: the solid facts*, World Health Organization.

WILLIAMS, A. 1993. Equity in healthcare: the role of ideology. *Equity in the Finances and Delivery of Healthcare: An International Perspective, New York*.

WILLIAMS, A. & COOKSON, R. 2000. Equity in health. *Handbook of health economics,* 1**,** 1863-1910.

WILLIAMS, J., ALLEN, L., WICKRAMASINGHE, K., MIKKELSEN, B., ROBERTS, N. & TOWNSEND, N. 2018. A systematic review of associations between non-communicable diseases and socioeconomic status within low-and lower-middle-income countries. *Journal of global health,* 8.

WORLD BANK 2012. Health Equity and Financial Protection Report – Kenya. Washington, DC: World Bank. http://documents.worldbank.org/curated/en/875011468047742115/pdf/712540WP00PUBL0Country0Report0Kenya.pdf (Accessed on 28th March 2020).

WORLD BANK 2018a. GDP per capita (current US$). Available: https://data.worldbank.org/indicator/ny.gdp.pcap.cd?name_desc=true (Accessed 18 November 2019).

WORLD BANK. 2018b. *Urban Population (% of total population). Available at: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS (Accessed 18 November 2019)* [Online]. [Accessed].

WORLD HEALTH ORGANIZATION 2003. Building on the user-fee experience: The African case. Geneva: World Health Organization.

WORLD HEALTH ORGANIZATION 2007. *Prevention of cardiovascular disease*, World Health Organization.

WORLD HEALTH ORGANIZATION 2012. Health systems financing: the path to universal coverage. Geneva: World Health Organization.

WORLD HEALTH ORGANIZATION 2013. A global brief on hypertension: silent killer, global public health crisis: World Health Day 2013. World Health Organization.

WORLD HEALTH ORGANIZATION 2014. Global status report on noncommunicable diseases 2014. World Health Organization.

WORLD HEALTH ORGANIZATION 2016. Global report on diabetes: executive summary. World Health Organization.

WORLD HEALTH ORGANIZATION 2020. Non-communicable Diseases - Key Facts. Available at https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases [Accessed on 6 September 2020].

YANG, W. 2013. *An analysis of inequities and inefficiencies in health and healthcare in China.* The London School of Economics and Political Science (LSE).

YUSUF, S., ISLAM, S., CHOW, C. K., RANGARAJAN, S., DAGENAIS, G., DIAZ, R., GUPTA, R., KELISHADI, R., IQBAL, R. & AVEZUM, A. 2011. Use of secondary prevention drugs for cardiovascular disease in the community in high-income, middle-income, and low-income countries (the PURE Study): a prospective epidemiological survey. *The Lancet,* 378**,** 1231-1243.

ZERE, E. & MCINTYRE, D. 2003. Inequities in under-five child malnutrition in South Africa. *International journal for equity in health,* 2**,** 7.
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**,** 78.
ZERE, E., OLUWOLE, D., KIRIGIA, J. M., MWIKISA, C. N. & MBEELI, T. 2011. Inequities in skilled attendance at birth in Namibia: a decomposition analysis. *BMC pregnancy and childbirth,* 11**,** 34.

PART C: JOURNAL MANUSCRIPT

Proposed journal: International Journal for Equity in Health[2]

[2] Author instructions presented in Appendix 4

Socioeconomic inequality and inequity in the screening and treatment of diabetes and hypertension in Kenya: evidence from a national survey

Robinson Oyando[1*]

[1] Health Economics Unit, University of Cape Town, Cape Town, South Africa

*Corresponding author

Health Economics Unit, School of Public Health and Family Medicine, University of Cape Town
Observatory, Cape Town 7925, South Africa
robinoyando309@gmail.com

Abstract

Background:

The significant rise in the burden of non-communicable diseases (NCDs) presents a major public health challenge to all countries, especially low-and middle-income countries (LMICs). In Kenya, NCDs account for 50% of hospitalisations and 55% of inpatient deaths. Diabetes and hypertension are among the major NCDs in Kenya. Equitable access and utilisation of screening and treatment interventions are critical for reducing the burden of diabetes and hypertension. This study assessed horizontal equity (equal treatment for equal need) in the screening and treatment for both conditions and further decomposed socioeconomic inequalities in care use in Kenya.

Methods: Cross-sectional data from the 2015 NCDs risk factors STEPwise survey, covering 4,500 adults aged 18-69 years were analysed. Horizontal inequity (HI) index, concentration curves, and concentration indices were used to assess inequity and inequality. Contributions of need (age, sex, NCD comorbidity, and body mass index (BMI)) and non-need (wealth status, education, exposure to media, employment, and area of residence) factors to the observed inequality were evaluated using a standard decomposition method.

Results: The poor were the most in need of screening services. However, the rich were in greater need for treatment. After adjusting for need, a statistically significant pro-rich inequity in the use of diabetes (HI = 0.342; $p<0.001$) and hypertension (HI = 0.185; $p<0.001$) screening were observed. Similarly, the use of hypertension (HI = 0.095; $p<0.001$) and diabetes (HI = 0.009; $p>0.05$) treatment were pro-rich. Need factors such as sex and BMI were the largest contributors to inequalities in the use of screening services. By contrast, non-need factors like the area of residence, wealth, employment status and exposure to media mainly contributed to inequalities in the use of screening and treatment services.

Conclusion: For universal health coverage goals for NCDs to be realised in Kenya, among other things, the use of screening and treatment services should be according to need. Specifically, efforts to attain equity in healthcare use for diabetes and hypertension services should be multi-sectoral and focused on crucial inequality drivers such as regional disparities in care use, poverty and educational attainment. Also, to increase the use of screening services for NCDs, concerted awareness creation campaigns should be channelled through the mass media and other suitable avenues.

Keywords: Socioeconomic inequality, horizontal inequity, decomposition analysis, non-communicable diseases, Kenya.

Background

Non-communicable disease-related morbidity and mortality pose an increasing challenge globally, especially in low-and middle-income countries (LMICs) where most of the world's population live [1]. In 2016, for instance, approximately 40 million deaths globally were due to non-communicable diseases (NCDs) with LMICs accounting for 80% of the deaths [2]. LMICs also continue to struggle in containing the relatively high disease burden from maternal and child mortality and infectious diseases such as HIV/AIDS, tuberculosis, leading to a "double burden" of communicable and NCDs [3, 4]. This not only poses further resource constraints to the already overstretched healthcare resources in LMICs but is also a threat to the attainment of equity in health and healthcare between and within countries [5-7].

The major NCDs—cardiovascular diseases (CVDs), cancers, chronic respiratory diseases and diabetes—present a unique challenge to the global health agenda of attaining universal health coverage (UHC)[3] by 2030 [8]. Furthermore, recognition of the detrimental health, economic, and developmental consequences of NCDs has seen their inclusion in the 2030 Sustainable Development Goals (SDGs) [9]. SDG 3.4 explicitly aims to reduce by one-third premature mortality due to NCDs through prevention and treatment. To achieve this goal, reduction of shared NCDs risk factors such as physical inactivity, unhealthy diets, use of tobacco, and harmful use of alcohol have been prioritised [10]. Similarly, for diabetes and hypertension—which are major risk factors for CVDs [8], evidence shows that increasing access to preventive interventions such as timely screening among those at risk and providing treatment to those diagnosed are cost-effective measures of attaining the NCD pre-mature mortality target [11-14].

A well-functioning health system should ensure equity in the utilisation of health services, that is, based on need and not the ability to pay [15, 16]. Yet, there is convincing evidence that the poor (who bear the greatest NCDs burden and are most in need of screening and treatment) relative to the rich, utilise NCDs healthcare services the least [17-25]. This phenomenon is termed *the inverse care law* [26]. Demand and supply-side factors such as high levels of poverty, the substantial economic burden associated with the long-term care of NCDs, and insufficient health system capacity to handle NCDs (chiefly at the primary care level) are some of the reasons that contribute to the socioeconomic inequalities in NCDs [4, 8, 22, 23, 27-29].

Empirical evidence from previous studies that have assessed inequity and socioeconomic inequality in NCDs converge to the same conclusion: that the poor, relative to the wealthy, bear

[3] UHC aims to ensure utilisation of quality healthcare services by everyone based on need and without suffering financial hardship.

the brunt of inequality in the utilisation of care services for NCDs [18, 21-23, 30]. Elwell-Sutton *et al.* [23], for instance, have shown that in China, there are marked pro-rich inequality in the utilisation of treatment services for hypertension and dyslipidaemia. Likewise, pro-rich horizontal inequity in the utilisation of hypertension, hyperglycaemia and dyslipidaemia treatment were reported. Of interest, income and non-need factors (i.e., health insurance, education and longest-held occupation), mainly explained the observed inequality in NCDs treatment. These findings compare well with studies from other LMICs and high-income countries (HICs) which generally show that income, area of residence, level of education, occupational class, increasing age and lifestyle risk factors are significant contributors to the socioeconomic inequality in the prevalence or utilisation of NCDs care services [18, 20, 30-32].

In Kenya, NCDs account for 50% of hospitalisations and 55% of inpatient deaths, with estimates indicating that mortality due to NCDs are likely to increase by over 50% in the next decade [33]. Besides, there are stark disparities in the use of screening and treatment services for diabetes and hypertension, mostly affecting the disadvantaged groups. For example, 73% of the poorest quintile population have never been screened for hypertension compared to 38% in the richest quintile [33]. Also, there are geographic disparities in treatment, as only 28% of those in rural areas compared to 54% in urban areas reported utilisation of diabetes treatment [33]. Furthermore, a study has shown that Kenyan households with a member who has NCDs such as diabetes and hypertension, are twice as likely to incur catastrophic health expenditure (CHE)[4] compared to households that do not [34]. This finding has been corroborated by other studies that have suggested that diabetic and hypertensive patients in Kenya incur CHE primarily due to medication and transport-related costs, with the poorest quintile bearing the most significant burden [35, 36]. Furthermore, screening, diagnosis and treatment costs for NCDs like cervical and breast cancer are unaffordable to many Kenyans [37].

Although evidence suggests the existence of inequalities in NCDs in Kenya, there is still a gap in knowledge as no study has assessed horizontal equity (i.e., equal treatment for equal need) in the utilisation of screening and treatment for NCDs based on need. Also, to the knowledge of the author, no study has assessed the factors contributing to socioeconomic inequality in the use of both interventions for diabetes and hypertension in the Kenyan context. Therefore, using a nationally representative NCDs risk factors survey data set, this study assessed horizontal inequity

[4] CHE occurs when out-of-pocket payments made by a household to receive health services exceed a certain threshold (usually 40% of non-food expenditure) and thus threatening their ability to meet other basic living costs.

in the screening and treatment of diabetes and hypertension and decomposed socioeconomic inequalities in the screening and treatment of diabetes and hypertension in Kenya.

Methods

Data

This paper used the most recent and nationally representative cross-sectional STEPwise survey (STEPs) conducted by the Kenya National Bureau of Statistics (KNBS) between April and June 2015 in all the 47 counties in Kenya [33]. The survey used the fifth National Sample Survey and Evaluation Programme (NASSEP V) master sample frame developed by the KNBS. The sample frame was developed using the Enumeration Areas (EAs) generated from the 2009 Kenya Population and Housing Census to form 5,360 clusters split into four equal sub-samples. A three-stage cluster sample design was used to collect the STEPs data. In the first stage, a total of 200 clusters (100 rural and 100 urban) were selected systematically from the NASSEP V sampling frame using the equal probability selection method to ensure the resulting sample retained the properties of probability proportional to size as was used in the creation of the frame. The second stage of sampling involved a uniform selection of 30 households from the listed households in each cluster. In the third stage, one eligible participant was randomly selected from listed household members [33].

A total of 6,000 households were identified, but 4,754 gave consent (i.e. 79.2% response rate) and participated in the study. A total of 4,500 households were retained after data cleaning. A more detailed description of STEPs data collection methodology is contained elsewhere [33]. To ensure national representativeness of derived estimates, sample weights were included in the statistical analyses. De-identified data set from the STEPs survey (which is available upon request from KNBS) was used in this study. Additionally, ethics clearance was obtained from the Human Research Ethics Committee of the University of Cape Town (Ref: 186/2020).

Measuring socioeconomic status

Socioeconomic status (SES) can be measured using several approaches classified as "direct measures", that is, expenditure, income, consumption; and "proxy measures", including education, occupation or social class, but mainly asset indices [38]. It is important to note that there are debates on the right choice of SES measure when it comes to health inequality assessment. Some argue that the choice of welfare measure may not overly affect inequality findings [39, 40] while others contend that the computed health inequality results could be sensitive, in some contexts, to the choice of welfare measure [38, 41]. Primarily due to pragmatic

reasons and following similar studies [22, 31, 38, 42], principal component analysis (PCA) [43] was used in this paper to generate an index of SES.

Briefly, using a multivariable statistical approach, PCA reduces the number of variables in a data set into smaller dimensions [44]. Put another way, beginning with an initial set of correlated variables, PCA generates uncorrelated components in which case each component or index is a linear weighted combination of the original variables [43]. To construct household wealth, the first principal component provides the required welfare index — if it explains a substantial proportion of the variance, with larger weights being assigned to assets that vary most across households [39, 44]. Data on 15 selected variables (e.g. source of drinking water, type of sanitary facility, roof, floor and wall material, source of energy for cooking and lighting, and ownership of TV, radio, refrigerator, washing machine, bicycle, motorcycle, landline, and cell phone) were used to generate standardised weighted scores. These variables were used to create a dummy of each variable signifying the presence of each item given that categorical variables are converted into a meaningless scale in PCA [45]. The composite weighted index was used to rank the sample into five wealth quintiles when necessary.

Defining diabetes and hypertension

In this study, having diabetes was defined based on the presence of any or all the three criteria: 1) previous diabetes diagnosis by a health worker, 2) use of prescribed anti-diabetic medication, or 3) having a fasting blood sugar of ≥ 7.0 mmol/L in the survey [23, 48]. Similarly, having hypertension was defined based on any or all the three criteria: 1) previous hypertension diagnosis by a health worker, 2) use of prescribed anti-hypertensive medication or 3) having a systolic and/or diastolic blood pressure of ≥ 140/≥ 90 mmHg [23, 49].

Measuring need and use of diabetes and hypertension screening and treatment

The need for diabetes and hypertension *screening* was defined as any individual aged at least 40 years (for both men and women) as stipulated in Kenya's diabetes [46] and cardiovascular treatment guidelines [47]. The need for diabetes *treatment* was defined as those diagnosed with diabetes (i.e. fasting blood sugar (FBS) of ≥ 7.0 mmol/L) in the survey. Likewise, the need for hypertension *treatment* was defined as those diagnosed with hypertension in the survey (i.e. a third systolic and/or diastolic blood pressure of ≥ 140/≥ 90 mmHg, respectively). The diagnosis criteria for both conditions were informed by the national treatment guidelines [46,47].

The utilisation of screening services was assessed as having ever received a screening service for diabetes and hypertension from a formal health provider (i.e. doctor or other health workers)

before the survey. Similarly, utilisation of treatment was assessed as taking prescribed diabetes (i.e. insulin and/or oral hypoglycaemics) and hypertension treatment two weeks before the survey. For a granular presentation of inequality findings, the share of need and use of screening and treatment interventions were compared across the SES groups and regional divides in Kenya. Table 1 further summarises the definitions of variables used in the analysis.

Table 1 Definitions of variables used in the analysis

Intervention	Type of NCD	Need	Use
Screening	Diabetes Hypertension	Respondents aged at least 40 years.	Respondents reporting ever screened by a health worker.
Treatment	Diabetes	Respondents diagnosed with diabetes in the survey (i.e. FBS ≥7.0 mmol/L).	Respondents reporting the use of diabetes treatment (i.e. either prescribed insulin and/or oral hypoglycaemics).
	Hypertension	Respondents diagnosed with hypertension in the survey (i.e. systolic and/or diastolic blood pressure reading ≥ 140 mmHg or ≥ 90 mmHg).	Respondents reporting the use of prescribed anti-hypertensive treatment at least two weeks before the survey.

Analytical approaches

Measuring inequality in care utilisation

Inequality in screening and treatment can be assessed using various methodological approaches, as discussed by Wagstaff *et al.* [55]. This paper used the concentration curves and concentration indices to assess inequality in the screening and treatment of diabetes and hypertension. The rationale for using these measures is their consistency in ranking individuals according to their SES; sensitivity to changes in population distribution across SES and their ability to assess relative as opposed to absolute inequality [54, 55, 56]. The concentration curve (CC) plots the cumulative share of the use of screening or treatment services (y-axis) against the cumulative share of households, ranked from poorest to richest (x-axis). So, if everyone uses screening or treatment services irrespective of their SES rank, the CC will consistently lie on the equality (45-degree) line. If, by contrast, there is a pro-poor (pro-rich) distribution in the use of screening or treatment services, the CC will lie above (below) the line of equality, with the gap between the CC and equality line depicting the extent of inequality [50].

The concentration index (CI_H) was computed as twice the covariance between screening or treatment for diabetes and hypertension and an individual's socioeconomic rank divided by the

mean of the health variable. Theoretically, the CI_H lies between -1 (i.e. when the use of screening/treatment is concentrated on the poorest individual) and +1 (i.e. when the use of screening/treatment is concentrated on the richest individual). Overall, a positive (negative) CI_H corresponds to a pro-rich (pro-poor) distribution. For a binary variable, the concentration index does not lie within the usual bounds but rather between (μ_H - 1) and (1- μ_H) and thus requires normalisation [57]. Given that the health variable of interest in this study was binary (i.e. 1 = use of screening/treatment; 0 = otherwise), the Wagstaff's [57] proposed normalisation was used in this paper. However, there have been sharp debates between Wagstaff [57-59] and Erreygers [60, 61] regarding the appropriate normalisation approach. A detailed methodological discussion by Kjellsson and Gerdtham [62] informed the decision to use the Wagstaff's normalisation. Kjellsson and Gerdtham [62] argue that the decision to use either the normalisation approaches proposed by Wagstaff or Erreygers is pegged on whether the interest is for relative as opposed to absolute inequality measure and the researcher's judgement on the preferred index.

Decomposing the concentration index of screening and treatment

While the CC and the CI_H are relevant in examining the existence of socioeconomic inequalities in screening/treatment; they do not, however, explain the factors contributing to observed inequality. Consequently, to understand the factors contributing to relative inequality, the CI_H was further decomposed following the methodology suggested by Wagstaff *et al.* [63]. Identifying these factors is critical for policy decisions around addressing the "underlying causes of inequality". Thus, CI_H can be decomposed as:

$$CI_H = \underbrace{\sum_{j=1}^{J} Cj \left(\beta_j \bar{Z}_j / \mu_H\right)}_{\text{Deterministic}} + \underbrace{(GC\varepsilon/\mu_H)}_{\text{Unexplained}} \quad (1)$$

where Cj ($\bar{Z}_j$) is the concentration index (mean) of the jth contributing factor, $GC\varepsilon$ is the generalised concentration index of the error term (ε) and β_j is obtained from the linearly additive equation related to the contributing factors (z) to the screening or treatment variable (h) shown in Equation 2. The equation is given as:

$$h_i = \alpha + \sum_j \beta_j Z_{ij} + \varepsilon_i \quad (2)$$

where α and β_j are the coefficients to be estimated and ε_i is the error term. The deterministic portion of the concentration index in Equation 1 can be interpreted as the contribution of each contributing factor (z) to the concentration index (CI_H), which consists of two parts. It is a product of the concentration index of each contributing factor (Cj) and the elasticity of h_i with respect to

z_j (i.e. ŋj = $\beta_j \bar{Z}_j / \mu_H$). The unexplained portion is computed as the difference between CI_H and the deterministic portion. The residual cannot be systematically explained by variations in the contributing factors across socioeconomic groups [64]. The generalised linear model (with binomial family and identity link) was applied in the decomposition analysis [65]. Guided by well-established literature in the field [18, 23, 32, 50-53], determinants of care utilisation were separated into "need" (i.e. NCDs comorbidity, body mass index (BMI), age and sex for screening; age and sex only for treatment) and "non-need" (i.e. education level, exposure to media, employment status, rural or urban residence, and quintiles of SES) factors for both screening and treatment. A negative (positive) contribution suggests a given determinant contributes to inequality in the pro-poor (pro-rich) direction.

Given that it is impossible to compute standard errors (SEs) for the components in the decomposition in Equation 1 (i.e. elasticities and each contributing factor's contribution to the concentration index), the bootstrap method [66, 67] was used to obtain such SEs in the analysis. To avoid inconsistent estimates of bootstrap SEs, the sampling structure of the data was taken into account as applied by Ataguba et al., [68]. A total of 1,000 replications were used to estimate the SEs for each estimate.

Measuring horizontal inequity in care utilisation

Horizontal equity analysis assesses if there is a difference in care utilisation after standardising for health service utilisation based on need [50]. Inequity in care use estimated through the horizontal inequity (HI) index embodies the principle that healthcare should be utilised according to need (i.e. "equal treatment for equal need"). The HI was computed as the difference between the concentration index for actual (observed) care utilisation and need-expected utilisation. Indirect standardisation approach was used to predict need-expected utilisation of screening and treatment [50, 51]. HI lies within the range of -1 to +1 with a negative (positive) value indicating a pro-poor (pro-rich) inequity. HI value of zero means there is no inequity. To estimate how much care each individual would receive if they were treated equally to everyone in the sample with equal needs, we fitted a linear regression model [50]. All statistical analyses were conducted in Stata (version 15.1).

Results

Descriptive analysis

As shown in Table 2, a higher proportion of respondents were female (60%), were in the 20-39 years age category (29%) and had attained primary level of education (47%). Only 19% of respondents were not in any form of employment, and more than half (54%) resided in a rural area. The prevalence of hypertension was 30%, whereas that of diabetes was 4% (Table 2). About 2% of the population had both diabetes and hypertension. Notably, the richest quintile (3.76%) relative to the poorest quintile (1.11%) had the highest burden of both conditions in Kenya (Table 2).

Table 2 Descriptive statistics grouped by wealth quintile

	All	Household socioeconomic groups					*p*-value *
	Col %	Poorest quintile	2nd quintile	3rd quintile	4th quintile	Richest quintile	
N	4500	918	891	899	909	883	
Sex							
Female	60.02	65.25	60.38	58.40	61.02	54.81	
Male	39.98	34.75	39.62	41.60	38.94	45.19	< 0.01
Age (years)							
<19	4.53	5.02	5.52	4.36	4.20	3.52	
20-29	28.56	24.34	25.68	26.15	30.06	36.78	
30-39	27.96	28.71	29.39	27.93	24.64	29.17	
40-49	17.68	16.81	15.88	20.11	19.00	16.57	
50-59	12.06	13.53	13.06	11.96	12.82	8.85	
60+	9.21	11.57	10.47	9.50	9.28	5.11	< 0.01
Education level							
No formal schooling	16.76	50.87	11.00	9.12	8.47	3.40	
Primary	46.53	39.98	63.30	59.07	45.32	24.92	
Secondary	25.47	8.28	22.00	25.47	33.00	39.07	
Tertiary	11.24	0.87	3.70	6.34	13.20	32.61	< 0.01
Marital status							
Married/Cohabiting	67.86	72.55	65.21	68.19	69.97	63.15	
Not married	32.14	27.45	34.79	31.81	30.03	36.85	< 0.01
Employment status							
Unemployed	18.51	3.59	9.20	15.46	24.75	40.09	
Informal employment	39.71	33.88	42.98	43.94	39.49	38.39	
Formal employment	41.78	62.53	47.81	40.60	35.75	21.52	< 0.01
Residence							
Rural	53.67	77.89	76.54	56.28	42.46	14.27	
Urban	46.33	22.11	23.46	43.71	57.54	85.73	< 0.01
BMI (Kg/m^2)							
< 18.5 (underweight)	11.69	27.55	10.67	8.45	7.13	4.64	
18.5-24.9 (normal)	56.80	60.26	66.06	60.21	54.43	42.69	
25.0-29.9 (overweight)	20.97	9.73	17.32	22.54	23.01	32.46	
≥ 30.0 (obese)	10.54	2.46	5.96	8.80	15.42	20.21	< 0.01
Presence of NCD							
Has diabetes	3.52	3.40	1.31	2.38	5.23	5.57	
Has hypertension	30.15	24.70	28.39	30.94	32.74	34.09	
Has both diabetes and hypertension	2.08	1.11	1.01	1.23	3.33	3.76	< 0.01

**p*-value from Chi-squared test

Inequality in need and use of screening

Figure 1 shows that poorer individuals had a higher need for diabetes and hypertension screening (concentration curves lie above the equality line). In contrast, the use of diabetes and hypertension screening favoured the rich (concentration curves lie below the equality line). Both of these results were statistically significant. For example, the concentration indices for diabetes (CI = 0.362; $p < 0.01$) and hypertension (CI = 0.293; $p < 0.01$) screening were pro-rich (Table 3).

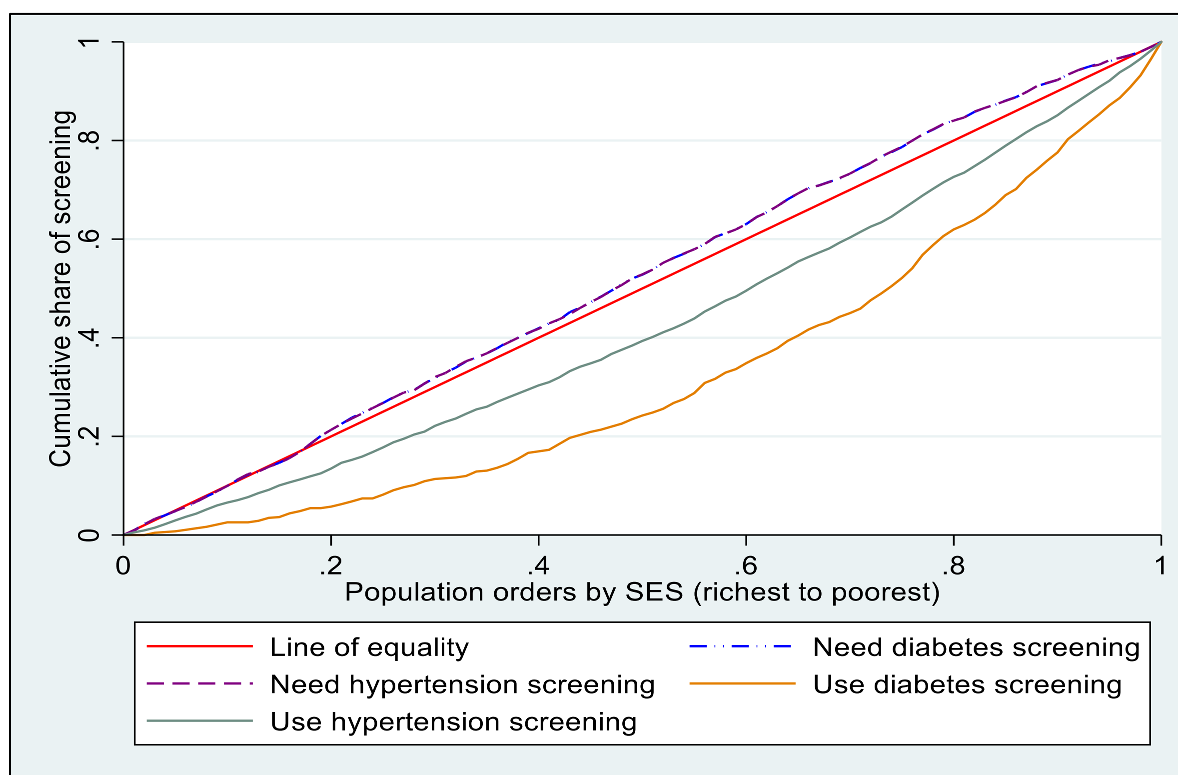

Figure 1 Concentration curves for need and use of diabetes and hypertension screening in Kenya

Table 3 Concentration indices for need and use of screening services for diabetes and hypertension in Kenya (STEPs 2015)

Intervention	Concentration index	Std. Error	*p-value*
Need diabetes screening	-0.077*	0.038	0.045
Need hypertension screening	-0.077*	0.038	0.045
Screening for diabetes	0.362**	0.074	0.000
Screening for hypertension	0.293**	0.041	0.000

Notes: *p<0.05, **p<0.01

A further breakdown of who benefits from diabetes and hypertension screening revealed that the wealthier quintiles benefited disproportionately more than they should given their share of need (Figure 2). Of interest, even for the richest quintiles, the disparity was higher for diabetes screening (38%) compared to hypertension screening (27%) (Figure 2).

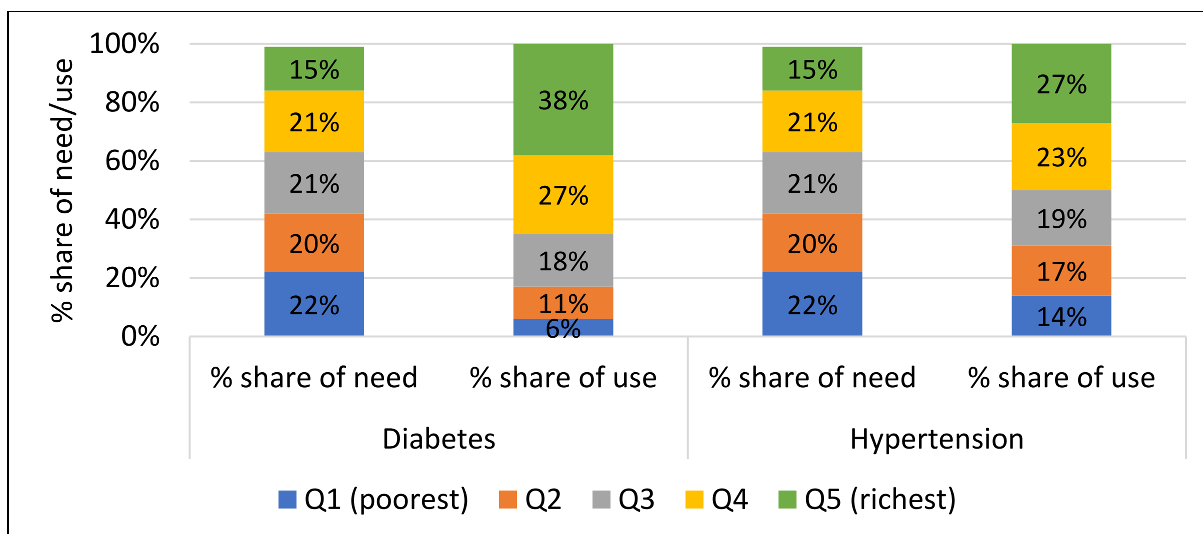

Figure 2 Distribution of share of need and use of screening services by wealth quintile in Kenya (STEPs 2015)

There were disparities in need and use of diabetes and hypertension screening in all the regions (Figure 3). For instance, the disparity between the share of need and use for diabetes screening was highest in the Central region (15% vs. 21%). In contrast, the highest disparity in need and use of hypertension screening was seen in the Rift Valley region (27% vs. 31%) (Figure 3).

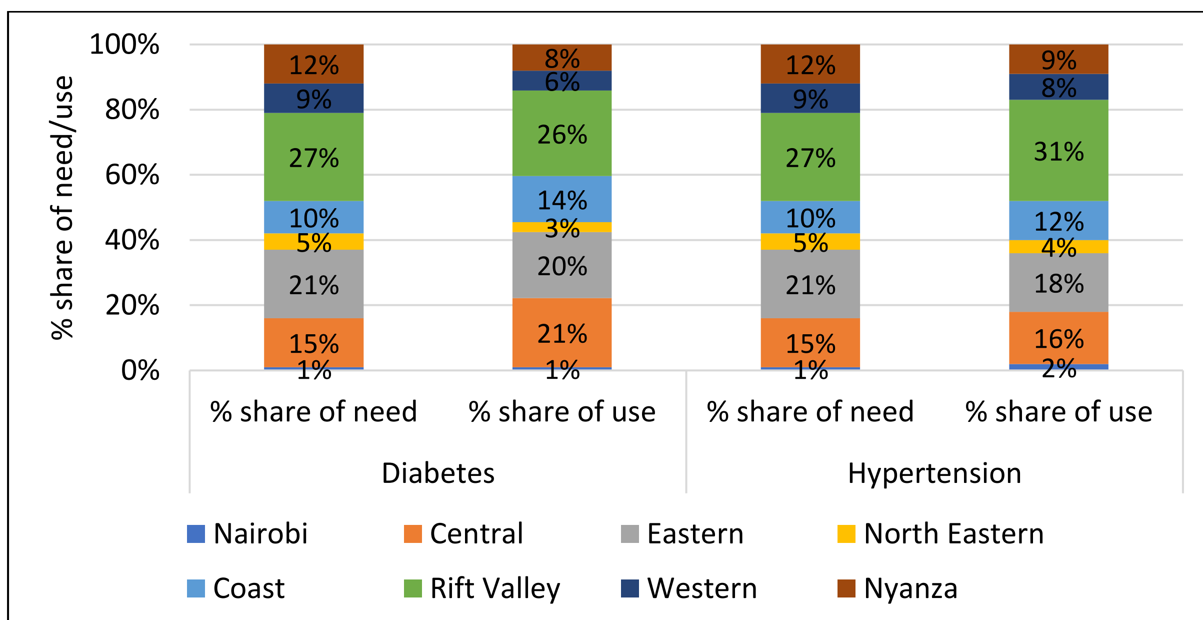

Figure 3 Distribution of need and use of screening services in Kenyan regions (STEPs 2015)

Inequality in need and use of treatment

Figure 4 shows a pro-rich distribution of need for diabetes and hypertension treatment, a finding that is confirmed by the concentration indices in Table 4. Interestingly, while the use of hypertension treatment was pro-rich (CI = 0.030; $p > 0.05$); the use of diabetes treatment was pro-poor (CI = -0.109; $p > 0.05$) (Table 4). Nevertheless, if broken down by the specific type of diabetes treatment used, the use of insulin favoured the rich (CI = 0.082; $p > 0.05$) while the use of oral hypoglycaemic favoured the poor (CI = -0.160; $p > 0.05$) (data not shown). However, none of the pro-rich or the pro-poor inequality findings was statistically significant at the conventional levels.

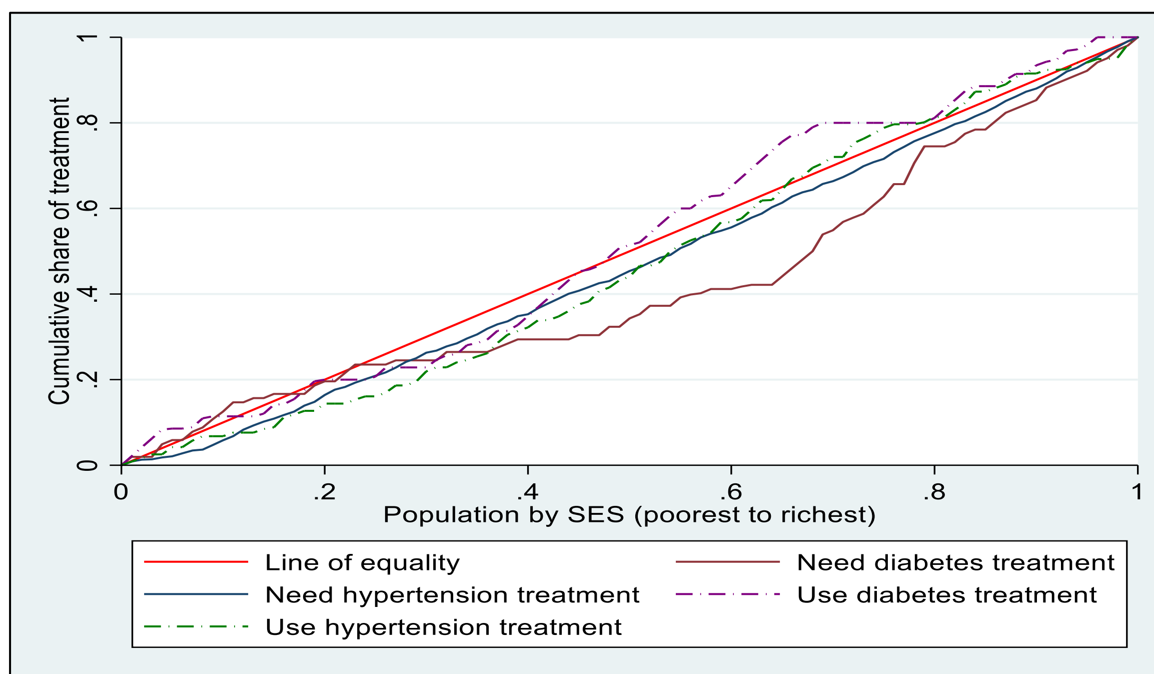

Figure 4 Concentration curves for need and use of diabetes and hypertension treatment in Kenya

Table 4 Concentration indices for need and use of treatment services for diabetes and hypertension in Kenya (STEPs 2015)

Intervention	Concentration index	Std. Error	*p-value*
Need diabetes treatment	0.164	0.122	0.182
Need hypertension treatment	0.026	0.044	0.552
Use diabetes treatment	-0.109	0.189	0.569
Use hypertension treatment	0.030	0.088	0.738

Figure 5 shows that the wealthier quintiles benefited disproportionately more in the use of diabetes and hypertension treatment compared to their population share of need. For instance, whereas 33% of respondents in the fourth richest quintiles needed diabetes treatment, 46% used diabetes treatment (Figure 5).

Overall, Figure 6 shows that there is a disproportionate share in the use of hypertension treatment, and to an extent, diabetes treatment in the Kenyan regions given the population share of need. Notably, the disparity in the need and use of diabetes (9% vs. 17%) and hypertension (28% vs. 20%) treatment were highest in Coast and Rift Valley regions, respectively (Figure 6).

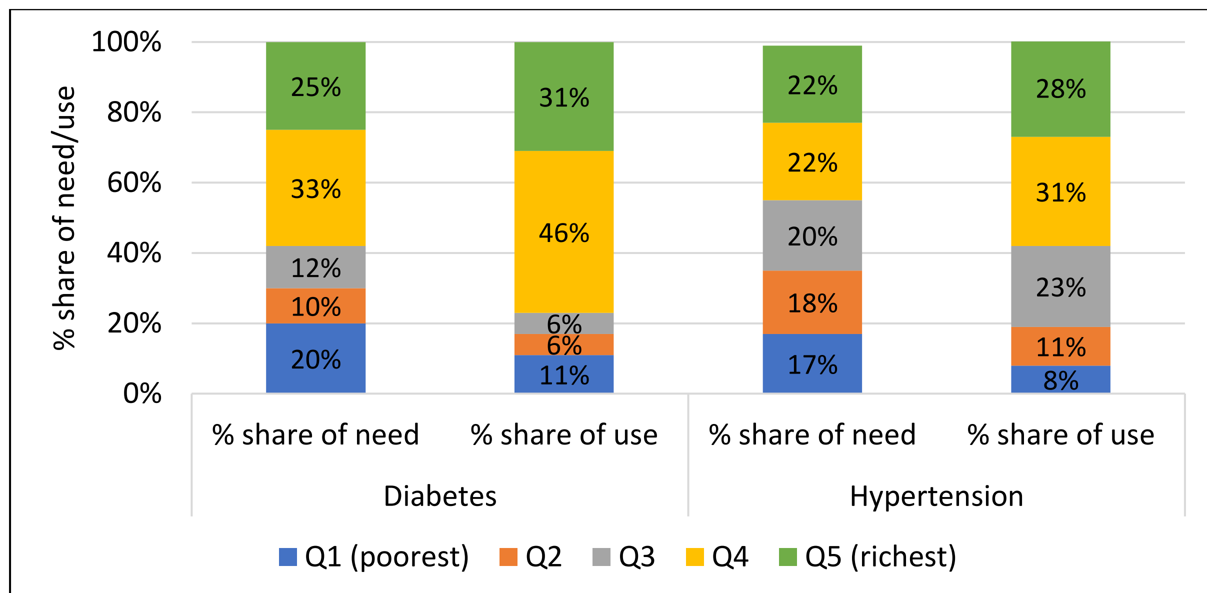

Figure 5 Distribution of share of need and use of treatment services by wealth status in Kenya (STEPs 2015)

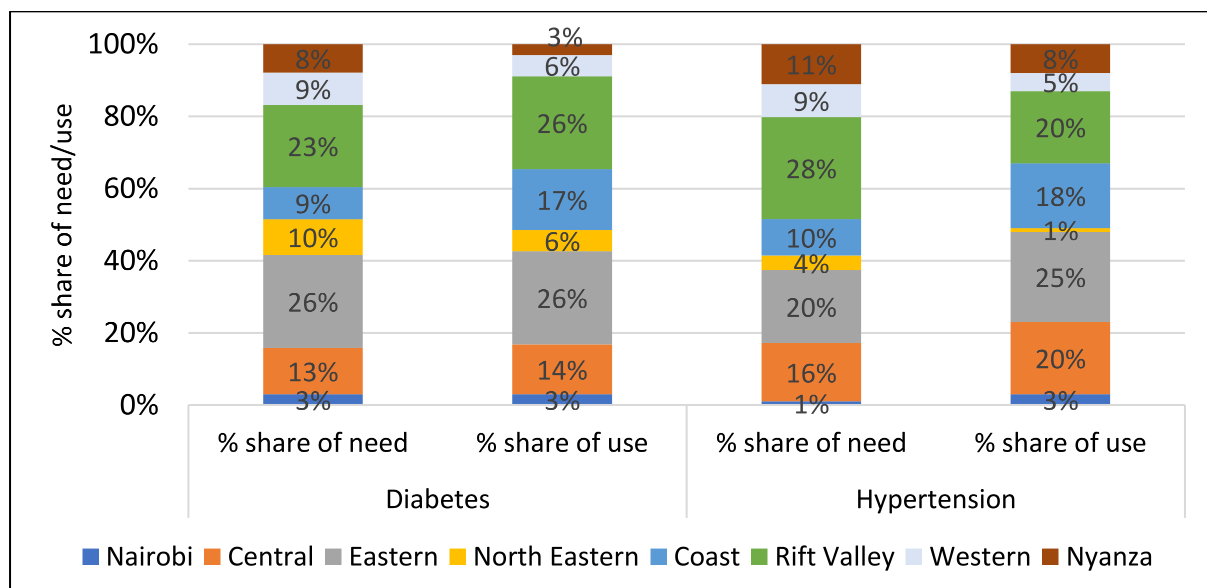

Figure 6 Distribution of share of need and use of treatment services in Kenyan regions (STEPS 2015)

Inequity in the use of screening and treatment

After controlling for need, a statistically significant pro-rich distribution in the use of diabetes (HI = 0.342; *p<0.001*) and hypertension (HI = 0.185; *p<0.001*) screening was observed. Except for diabetes treatment, a statistically significant pro-rich result in the distribution of hypertension treatment was found (Table 5).

Table 5 Inequity in the utilisation of screening and treatment services for diabetes and hypertension in Kenya (STEPS 2015)

Intervention	Horizontal equity index
Diabetes screening	0.342***(0.066)
Hypertension screening	0.185***(0.024)
Diabetes treatment	0.009(0.121)
Hypertension treatment	0.095***(0.074)

Note: standard errors reported in parentheses. *** $p < 0.001$

Decomposition of inequality in care use

Summary results of the decomposition analysis of inequality in screening and treatment are presented in Figures 7 and 8, showing an aggregate contribution of need and non-need factors. In general, the largest contribution to pro-rich inequality in screening and treatment was made by non-need factors. Specifically, wealth status, exposure to media, education, and area of residence contributed to the largest inequality in screening among the non-need factors for both diabetes and hypertension. Also, for both conditions, BMI explained inequality in the pro-rich direction for screening. Conversely, sex explained inequality in the pro-poor direction for hypertension and diabetes screening (Figure 7).

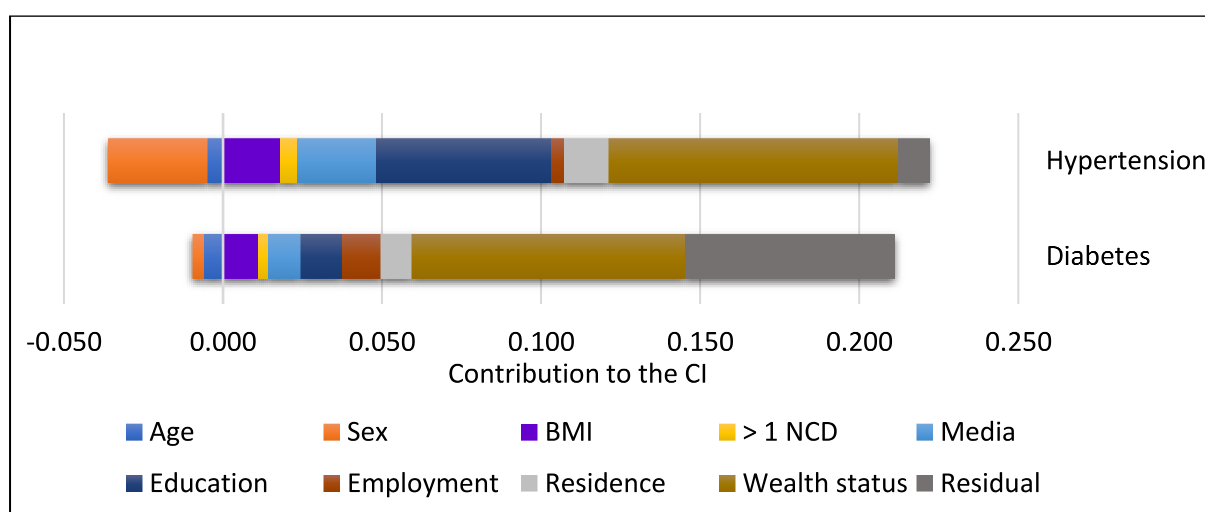

Figure 7 Summary contributions to SES inequality in the utilisation of screening services for diabetes and hypertension in Kenya (STEPs 2015)

The area of residence was the largest contributor (in the pro-rich direction) to the observed inequality in diabetes treatment. Conversely, non-need factors like wealth and employment status were the largest contributors (in the pro-rich direction) to the inequality in hypertension treatment (Figure 8). Additionally, though in the pro-poor direction, age and education status also contributed to inequality in hypertension treatment (Figure 8).

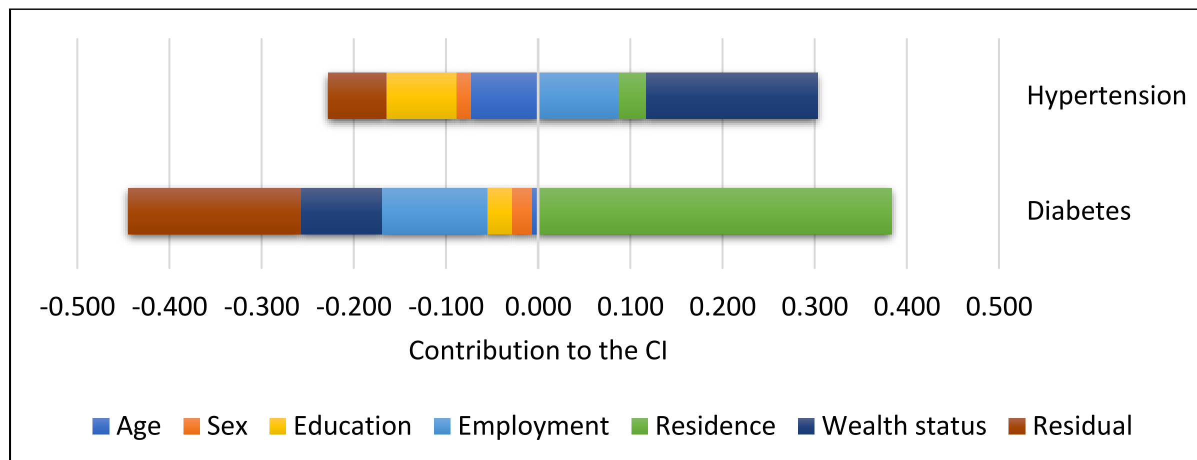

Figure 8 Summary contributions to SES inequality in the utilisation of treatment services for diabetes and hypertension in Kenya (STEPs 2015)

Given that the positive and negative contributions aggregated at the need and non-need factors may cancel each other out, disaggregated decomposition findings for screening and treatment are further presented in Tables 6 and 7. Two factors determine the magnitude of the contribution of each need and non-need factor to the observed inequality. One, how sensitive use of screening or treatment is to the variation in each factor (i.e. its elasticity with respect to healthcare use variable). Two, the concentration index of each contributing factor. That is, how equal the distribution of a factor is across the SES. As a result, the largest contributions to inequality in screening or treatment depends on the factors that are strongly associated with the use of healthcare and how unequally distributed those factors are. Positive (negative) contributions suggest a pro-rich (pro-poor) contribution.

As shown in Table 6, the contribution of need factors such as NCDs comorbidity was the only statistically significant contributors to inequality in diabetes and hypertension screening. However, although in the pro-poor direction, sex was also a significant contributor but only for hypertension screening. Among non-need factors, exposure to media was a statistically significant contributor (in the pro-rich direction) to inequality in the screening of both diabetes and hypertension. Table 7 shows that among the need factors, age explained the inequality in hypertension treatment but not for diabetes. Among the non-need factors, wealth status explained to a greater extent inequality in hypertension (in the pro-rich direction) and diabetes (in the pro-poor direction)

treatment (Table 7). However, none of the need and need contributors to inequality in diabetes and hypertension treatment were statistically significant at the conventional levels.

Table 6 Decomposition analysis of inequality in the utilisation of screening services in Kenya (STEPs 2015)

	Diabetes screening				Hypertension screening			
Determinants	**Elasticity**	**CI**	**Contribution**	**Tot. Contr.**	**Elasticity**	**CI**	**Contribution**	**Tot. Contr.**
NCDs comorbidity								
> 1 NCD	0.001	0.328**(0.099)	0.003**(0.002)	0.003	0.017	0.328**(0.099)	0.005**(0.002)	0.005
BMI								
Under_wght (Ref)								
Normal	0.053	-0.155***(0.014)	-0.008(1.455)	0.011	-0.004	-0.155***(0.014)	0.001(0.109)	0.019
Overweight	0.030	0.255***(0.032)	0.008(1.291)		0.030	0.255***(0.032)	0.008*(0.003)	
Obese	0.027	0.398***(0.036)	0.011***(0.003)		0.026	0.398***(0.036)	0.010**(0.002)	
Sex								
Male (Ref)								
Female	0.048	-0.078**(0.017)	-0.004(0.852)	-0.004	0.394	-0.078**(0.017)	-0.031**(0.006)	-0.031
Age								
<19 (Ref)								
20-29	0.060	0.115***(0.025)	0.007(0.622)	-0.006	0.089	0.115***(0.025)	0.010**(0.010)	-0.005
30-39	0.085	-0.019**(0.026)	-0.002(8.086)		0.118	-0.019**(0.026)	-0.002(0.687)	
40-49	0.070	0.024(0.028)	0.002(0.747)		0.100	0.024(0.028)	0.002(0.012)	
50-59	0.059	-0.083(0.044)	-0.005(0.004)		0.066	-0.083(0.044)	-0.006(0.004)	
60+	0.057	-0.135**(0.058)	-0.008**(0.004)		0.067	-0.135**(0.058)	-0.009**(0.004)	
Media								
TV/Radio	0.013	0.809***(0.023)	0.010**(0.024)	0.010	0.038	0.809***(0.023)	0.031**(0.009)	0.025
Residence								
Urban (Ref)								
Rural	-0.019	-0.539***(0.043)	0.010(8.092)	0.010	-0.026	-0.539***(0.043)	0.014(0.420)	0.014
Employment								

Formal emp. (Ref)								
Self-employment	-0.019	0.021(0.027)	-0.000(0.292)	0.012	-0.022	0.021(0.027)	-0.000(0.036)	0.004
Not employed	-0.035	-0.332***(0.022)	0.012(34.917)		-0.013	-0.332***(0.022)	0.004(0.966)	
Education								
No school (Ref)								
Primary school	0.020	-0.491***(0.033)	-0.009(0.472)	0.013	0.075	-0.149***(0.033)	-0.011(0.044)	0.055
High school	0.023	0.320***(0.029)	0.007(1.690)		0.077	0.320***(0.029)	0.025(4.573)	
Tertiary	0.023	0.621***(0.042)	0.015***(0.007)		0.066	0.621***(0.042)	0.041***(0.007)	
Wealth quintile								
Quintile 1 (Ref)								
Quintile 2	0.019	-0.491***(0.055)	-0.009(0.454)	0.086	0.024	-0.491***(0.055)	-0.012(1.783)	0.091
Quintile 3	0.043	0.005(0.069)	0.000(0.089)		0.034	0.005(0.069)	0.000(0.012)	
Quintile 4	0.054	0.508***(0.073)	0.028(1.759)		0.050	0.508***(0.073)	0.025(0.261)	
Quintile 5	0.067	1.000***(0.038)	0.067***(0.913)		0.078	1.000***(0.038)	0.078***(0.017)	
Residual				0.066				0.010

Notes: Bootstrapped standard errors in parentheses using 1,000 replications; CI - concentration index; *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table 7 Decomposition analysis of inequality in the utilisation of treatment services in Kenya (STEPs 2015)

	Diabetes treatment				Hypertension treatment			
Determinants	**Elasticity**	**CI**	**Contribution**	**Tot. Contr.**	**Elasticity**	**CI**	**Contribution**	**Tot. Contr.**
Sex								
Male (Ref)								
Female	0.258	-0.077(0.097)	-0.020(1.870)	-0.020	0.253	-0.078**(0.044)	-0.020(0.806)	-0.016
Age								
<19 (Ref)								
20-29	-0.101	0.115(0.365)	-0.012(0.030)	-0.008	-0.852	0.115(0.109)	-0.098(4.603)	-0.074

30-39	-0.005	-0.019**(0.195)	0.000(0.116)		-0.523	-0.019(0.084)	0.010(0.153)	
40-49	0.055	0.024(0.188)	0.001(1.827)		-0.223	0.024(0.062)	-0.005(0.016)	
50-59	-0.030	-0.083(0.116)	0.003(3.621)		-0.144	-0.083(0.062)	0.012(3.986)	
60+	0.000	-0.135(0.145)	0.000(0.373)		-0.054	-0.135(0.088)	0.007(0.013)	
Residence								
Urban (Ref)								
Rural	-0.698	-0.539**(0.099)	0.376(60.398)	0.384	-0.070	-0.539***(0.064)	0.038(6.075)	0.038
Employment								
Formal emp. (Ref)								
Self-employment	-0.045	0.021(0.093)	-0.001(0.166)	-0.115	-0.128	0.021(0.078)	-0.003(0.507)	0.088
Not employed	0.343	-0.332***(0.095)	-0.114(8.411)		-0.274	-0.332***(0.068)	0.091(8.301)	
Education								
No school (Ref)								
Primary school	0.035	-0.149(0.129)	-0.005(0.882)	-0.027	-0.247	-0.149***(0.061)	0.037(0.380)	-0.081
High school	0.036	0.320(0.173)	0.011(0.595)		-0.224	0.320*(0.084)	-0.072(1.753)	
Tertiary	-0.053	0.621***(0.125)	-0.033(22.310)		-0.074	0.621***(0.050)	-0.046(2.318)	
Wealth quintile								
Quintile 1 (Ref)								
Quintile 2	0.132	0.491***(0.118)	-0.065(0.077)	-0.079	0.015	0.491***(0.059)	-0.007(1.694)	0.200
Quintile 3	-0.145	0.005***(0.134)	-0.001(7.694)		0.130	0.005**(0.083)	0.001(0.123)	
Quintile 4	0.154	0.508(0.137)	0.078(0.183)		0.198	0.508(0.099)	0.101(0.085)	
Quintile 5	-0.091	1.000***(0.087)	-0.091(11.370)		0.105	1.000***(0.053)	0.105(8.117)	
Residual				-0.189				-0.067

Notes: Bootstrapped standard errors in parentheses using 1,000 replications; CI - concentration index; *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Discussion

This study provides for the first time, empirical evidence that suggests the existence of socioeconomic inequality and horizontal inequity in the use of interventions for major NCDs in Kenya. These findings can serve as a baseline for future assessments of progress towards the attainment of the SDG 3.4 targeted at NCDs and UHC goals in Kenya. In general, the results confirm that need does not match the use of screening and treatment services for diabetes and hypertension across the SES groups as well as in the Kenyan regions.

As has been increasingly shown by recent studies that suggest that the Kenyan health system is unequal and inequitable [69-71], this paper's findings add to this evidence and suggest that policy interventions geared towards attaining equity in the Kenyan health system ought to pay special attention to NCDs. Among other policy options, it has been established that timely screening among those at risk and treatment among those diagnosed as cost-effective strategies for combating the burden of diabetes and hypertension [11, 14]. However, our findings reveal that there are huge gaps in meeting the population need for both interventions in Kenya.

The poor need more diabetes and hypertension screening than the rich while the rich benefit more from screening services than their share of need. This finding could, in part, be explained by the unaffordability of NCDs screening services in Kenya. For instance, a previous study has shown that screening services for NCDs like diabetes are not affordable to many Kenyans, with healthcare costs being disproportionately higher in the private relative to the public sector [37]. Sex was the main "need" factor that contributed to socioeconomic inequality in the screening for diabetes and hypertension. Therefore, this finding suggests that females are more likely to seek screening services for NCDs. A similar finding has been reported in a similar study that assessed socioeconomic inequality for diabetes and hypertension screening in South Africa [74]. Also, given that "non-need" determinants such as exposure to media and education contributed to inequality in the screening for diabetes and hypertension in the pro-rich direction, unawareness of the importance of timely screening may also provide some insights into the possible reasons for underutilisation of screening among the poor.

Whereas geographic spread of health facilities in Kenya has increased over time [72], other supply-side factors such as physical inaccessibility of health facilities in Kenya remain a barrier in the utilisation of screening services as the area of residence contributed to pro-rich inequality. Also, weak health system capacity to offer care for NCDs, particularly at the primary care level, could help explain the inequality in screening finding. Fragmented health service delivery structure that is biased towards offering curative rather than preventive healthcare services is among the

examples of health system weaknesses [73]. The inequality and inequity finding in the screening for diabetes and hypertension compare well with the findings of a South African study that has shown marked pro-rich inequality and inequity in the screening for diabetes, hypertension and cholesterol, with non-need factors (i.e. wealth status, health insurance, and education) mainly contributing to the inequality [74].

This study also found that the need for diabetes and hypertension treatment does not match how different SES groups use these services. The wealthier quintiles relative to the poorer ones benefited more than their share of need for treatment for both conditions, and this disparity pattern was also seen in the Kenyan regions. Similar patterns have been reported in previous studies in Kenya that have assessed inequality in health and healthcare use or access at the sub-national level [69, 75, 76]. In addition, similar findings are mirrored in a systematic review that assessed the progress towards equity in healthcare financing in LMICs. The evidence from the systematic review showed a consistent picture of the rich benefiting disproportionately more in the distribution of healthcare benefits than the poor [80]. Nevertheless, the pro-poor inequality finding for diabetes treatment was somewhat unexpected, given the economic burden associated with diabetes treatment in Kenya [36, 37]. However, it is important to note that the inequality findings for diabetes were not statistically significant at the conventional levels. Hence, it can be argued that the use of diabetes treatment is "equally" distributed in Kenya. Nevertheless, when the analysis was restricted to specific treatments, use of insulin favoured the rich (CI = 0.082) while the use of oral hypoglycaemics was pro-poor (CI = -0.160). The inconsistency in inequality findings for specific diabetes treatments might be explained by the fact that insulin is more expensive and could be affordable to wealthier individuals compared to poorer individuals. Furthermore, the possibility of underutilisation of diabetes treatment may not be ruled out. If anything, a cross-sectional study conducted in eight counties in Kenya to evaluate the availability and prices for NCDs medicines in both the public and private sectors suggests that there is limited access to various NCDs medicines mainly due to cost-related reasons [77]. Even so, given the arguably small number of respondents that reported insulin use (19 out 73, or 26%) and oral hypoglycaemics use (35 out of 72, or 48%) in this study, socioeconomic inequality in the use of diabetes treatment in Kenya should be evaluated further.

In the decomposition analysis of inequality in diabetes and hypertension treatment, non-need factors primarily contributed to the observed inequality. For instance, area of residence, wealth, employment and education status contributed to inequality in both diabetes and hypertension treatment. Similar findings have been reported in China where non-need factors such as income, area of residence, longest-held occupation, and level of education were significant contributors to

the socioeconomic inequality in the utilisation of hypertension, hyperglycaemia and dyslipidaemia treatment [23]. Furthermore, despite Denmark's universal healthcare system, a pro-rich inequality in the utilisation of diabetes treatment has been reported with morbidity outcomes such as "severe complications at diagnosis" and "years with severe complications" being concentrated among lower socioeconomic groups. In contrast, outcomes like "years without complications" and "duration with diabetes" were concentrated among the better-off socioeconomic groups [30]. Also, a Brazilian study has shown a pro-rich inequality in the utilisation of a core set of eight diabetes interventions among the elderly with income principally explaining the pro-rich bias in care use [18]. Unlike findings from other settings [20, 32], in this study, the prevalence of diabetes, hypertension and comorbidity with both conditions was higher among the rich compared to the poor. This disproportionate NCD burden may lead to differences in healthcare demand between the rich and the poor.

Several policy recommendations are imperative from the findings of this study. First, since service delivery falls within the docket of county governments, there is an urgent need to enhance the capacity of primary care facilities to implement cost-effective strategies such as timely screening so that need can match service use for this critical intervention. Second, for demand in the utilisation of screening services to be increased, national and county governments, including other relevant actors, should implement strategic awareness-raising campaigns to at-risk populations as age and sex contributed to the SES inequality in the screening of diabetes and hypertension. This can be done through targeted health education messages in the mass media and other appropriate channels. Additionally, unlike hypertension screening, laboratory fees are charged for diabetes screening in the public sector in Kenya [35,36]. As such, to improve equitable distribution, diabetes screening services should be offered free of charge in the public sector. Third, while recent efforts by the government of Kenya to attain UHC by 2022 are timely and commendable, more needs to be done to ensure equity in the use of NCDs services. Given the interplay of factors beyond the health sector that affect health as was seen in the role of non-need factors in contributing to inequality in screening and treatment, there is need for multi-sectoral approaches at various levels (i.e. local, national and regional) to address drivers of poverty and social inequality with a critical focus in marginalised areas. Some of the sectors that could collaborate with the health sector in addressing inequities/inequalities in NCDs include education and media sectors. For instance, for increased health education on NCDs, the educational sector can include NCDs in the curriculum. Also, various media channels can be used to raise awareness on the benefits of early NCDs screening as exposure to media was shown to contribute to SES inequality in diabetes and hypertension screening.

Study strengths and limitations

This study had strengths and limitations. One key strength was the national representativeness of the data set used in this study. This gave the national picture of socioeconomic inequality and inequity in the screening and treatment for major NCDs in Kenya. Nevertheless, the findings of this study cannot be generalised in settings beyond Kenya. Two, previous studies have mainly assessed inequalities in the prevalence of NCDs (and in most cases using self-reported data). However, this study examines inequity and socioeconomic inequality in key interventions using objective measures of need for screening and treatment. Third, this study used a novel methodological approach: the decomposition analysis, to determine factors contributing to socioeconomic inequality in screening and treatment.

This study also had limitations. The first limitation was data driven. As is common in studies on care utilisation, we relied on self-reported data in defining the use of both screening and treatment. This could potentially bias our inequality findings, especially if there were cases of misreporting. Likewise, although previous studies [78, 79] have reported no association between under-reporting of care utilisation and demographic characteristics, except for age, we cannot rule out under-reporting of care utilisation in the low SES groups. Second, the STEPs data set was cross-sectional in design and thus limiting the establishment of temporal trends in inequality and inequity in the use of screening and treatment. Furthermore, it is important to note that causality is not implied for the factors explaining observed inequality in screening and treatment.

Conclusion

Along with other low-and middle-income countries, Kenya faces a rising disease burden from non-communicable diseases. This paper provides the first empirical evidence on the existence of socioeconomic inequality and inequity in screening and treatment interventions for NCDs based on need. These findings provide a benchmark for future equity and equality assessments for NCDs in Kenya. In keeping with the global UHC agenda and other key NCDs targets, there is an urgent need for the implementation of concerted efforts to ensure equity in the provision of NCDs healthcare services in Kenya. Indeed, given the ongoing policy reforms to attain UHC in Kenya, a window of opportunity exists to avert inequity in NCDs, and this paper provides some of the critical issues for consideration.

Abbreviations: BMI: Body Mass Index; CC: Concentration Curves; CI: Concentration Index; CHE: Catastrophic Health Expenditure; CVDs: Cardiovascular Diseases; EA: Enumeration Area; FBS: Fasting Blood Sugar; HI: Horizontal Inequity Index; KNBS: Kenya National Bureau of Statistics; LMICs: Low-and middle-income countries; NASSEP: National Sample Survey and Evaluation Programme; NCDs: Non-communicable diseases; SES: Socioeconomic status; SDG: Sustainable Development Goal; PCA: Principal Component Analysis; UHC: Universal Health Coverage.

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References

1. World Health Organization, *Global status report on noncommunicable diseases 2014*. 2014: World Health Organization.
2. Naghavi, M., et al., *Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016.* The Lancet, 2017. **390**(10100): p. 1151-1210.
3. Kengne, A.P. and B.M.J.T.l.g.h. Mayosi, *Readiness of the primary care system for non-communicable diseases in sub-Saharan Africa.* 2014. **2**(5): p. e247-e248.
4. Aikins, A.d.-G. and C. Agyemang, *Chronic Non-communicable Diseases in Low and Middle-income Countries*. 2015: cabi.
5. Di Cesare, M., et al., *Inequalities in non-communicable diseases and effective responses.* 2013. **381**(9866): p. 585-597.
6. Bonfrer, I., et al., *Does the distribution of healthcare utilization match needs in Africa?* Health Policy and Planning, 2013. **29**(7): p. 921-937.
7. Aikins, A.d.-G., et al., *Chronic non-communicable diseases and the challenge of universal health coverage: insights from community-based cardiovascular disease research in urban poor communities in Accra, Ghana.* BMC public health, 2014. **14**(2): p. S3.
8. World Health Organization, *Global status report on noncommunicable diseases 2014*. 2014, World Health Organization.
9. United Nations, *Transforming Our World - the 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals (Accessed 14 November 2019)*. 2015.
10. World Health Organization, *From burden to "best buys": reducing the economic impact of non-communicable diseases in low-and middle-income countries*. 2011: Geneva, Switzerland.
11. Howard, K., et al., *Cost-effectiveness of screening and optimal management for diabetes, hypertension, and chronic kidney disease: A modeled analysis.* Value in health, 2010. **13**(2): p. 196-208.
12. Baker, J., et al., *Ethnic differences in the cost-effectiveness of targeted and mass screening for high cardiovascular risk in the UK: cross-sectional study.* Heart, 2013. **99**(23): p. 1766-1771.
13. Schmidt, H. and A.J.P.M. Barnhill, *Equity and noncommunicable disease reduction under the sustainable development goals.* 2015. **12**(9): p. e1001872.
14. Li, R., et al., *Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review.* Diabetes care, 2010. **33**(8): p. 1872-1894.
15. Carrin, G., et al., *Universal coverage of health services: tailoring its implementation.* Bulletin of the World Health Organization, 2008. **86**: p. 857-863.
16. World Health Organization, *Health systems financing: the path to universal coverage. Geneva: World Health Organization.* 2012.
17. Moody, A., et al., *Social inequalities in prevalence of diagnosed and undiagnosed diabetes and impaired glucose regulation in participants in the Health Surveys for England series.* BMJ open, 2016. **6**(2): p. e010155.
18. Neves, R.G., et al., *Social inequalities in care for the elderly with diabetes in Brazil.* Revista Panamericana de Salud Pública, 2018. **42**: p. e88.
19. Vellakkal, S., et al., *Are estimates of socioeconomic inequalities in chronic disease artefactually narrowed by self-reported measures of prevalence in low-income and middle-*

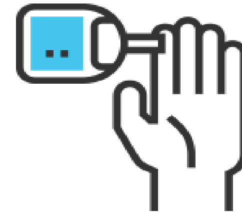
income countries? Findings from the WHO-SAGE survey. J Epidemiol Community Health, 2015. **69**(3): p. 218-225.
20. Sozmen, K. and U. Belgin, *Socioeconomic inequalities in non-communicable diseases and self assessed health in Turkey.* Iranian journal of public health, 2014. **43**(6): p. 736.
21. Sortsø, C., et al., *Socioeconomic inequality of diabetes patients' healthcare utilization in Denmark.* Health economics review, 2017. **7**(1): p. 21.
22. Murphy, A., et al., *Inequalities in the use of secondary prevention of cardiovascular disease by socioeconomic status: evidence from the PURE observational study.* The Lancet Global Health, 2018. **6**(3): p. e292-e301.
23. Elwell-Sutton, T.M., et al., *Inequality and inequity in access to healthcare and treatment for chronic conditions in China: the Guangzhou Biobank Cohort Study.* Health Policy and Planning, 2012. **28**(5): p. 467-479.
24. De Silva, A.P., et al., *Inequalities in the prevalence of diabetes mellitus and its risk factors in Sri Lanka: a lower middle income country.* International journal for equity in health, 2018. **17**(1): p. 45.
25. Mayosi, B.M., et al., *The burden of non-communicable diseases in South Africa.* The lancet, 2009. **374**(9693): p. 934-947.
26. Hart, J.T., *The inverse care law.* The Lancet, 1971. **297**(7696): p. 405-412.
27. World Health Organization, *Assessing national capacity for the prevention and control of noncommunicable diseases: report of the 2019 global survey.* 2020.
28. Kane, J., et al., *A systematic review of primary care models for non-communicable disease interventions in sub-Saharan Africa.* 2017. **18**(1): p. 46.
29. McIntyre, D., et al., *Challenges in financing universal health coverage in sub-Saharan Africa*, in *Oxford Research Encyclopedia of Economics and Finance*. 2018.
30. Sortsø, C., et al., *Social inequality in diabetes patients' morbidity patterns from diagnosis to death–A Danish register-based investigation.* Scandinavian journal of public health, 2018. **46**(1): p. 92-101.
31. Mutyambizi, C., et al., *Lifestyle and socioeconomic inequalities in diabetes prevalence in South Africa: A decomposition analysis.* PloS one, 2019. **14**(1).
32. Su, M., et al., *Comparing the income-related inequity of tested prevalence and self-reported prevalence of hypertension in China.* International journal for equity in health, 2018. **17**(1): p. 82.
33. Ministry of Health, *Kenya STEPwise survey for non-communicable diseases risk factors 2015 report. Available at: http://aphrc.org/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf [Accessed 8 August 2019]*. 2015.
34. Barasa, E.W., T. Maina, and N.J.I.j.f.e.i.h. Ravishankar, *Assessing the impoverishing effects, and factors associated with the incidence of catastrophic healthcare payments in Kenya.* 2017. **16**(1): p. 1-14.
35. Oyando, R., et al., *Patient costs of hypertension care in public healthcare facilities in Kenya.* The International journal of health planning and management, 2019. **34**(2): p. e1166-e1178.
36. Oyando, R., et al., *Patient costs of diabetes mellitus care in public healthcare facilities in Kenya.* The International Journal of Health Planning and Management, 2020. **35**(1): p. 290-308.

37. Subramanian, S., et al., *Cost and affordability of non-communicable disease screening, diagnosis and treatment in Kenya: Patient payments in the private and public sectors.* PloS one, 2018. **13**(1): p. e0190113.
38. Chuma, J., C.J.H.p. Molyneux, and planning, *Estimating inequalities in ownership of insecticide treated nets: does the choice of socioeconomic status measure matter?* 2009. **24**(2): p. 83-93.
39. Filmer, D. and L.H.J.D. Pritchett, *Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India.* 2001. **38**(1): p. 115-132.
40. Wagstaff, A. and N.J.H.e. Watanabe, *What difference does the choice of SES make in health inequality measurement?* 2003. **12**(10): p. 885-890.
41. Lindelow, M.J.H.e., *Sometimes more equal than others: how health inequalities depend on the choice of welfare indicator.* 2006. **15**(3): p. 263-279.
42. Palafox, B., et al., *Wealth and cardiovascular health: a cross-sectional study of wealth-related inequalities in the awareness, treatment and control of hypertension in high-, middle-and low-income countries.* International journal for equity in health, 2016. **15**(1): p. 199.
43. Vyas, S. and L. Kumaranayake, *Constructing socioeconomic status indices: how to use principal components analysis.* Health policy and planning, 2006. **21**(6): p. 459-468.
44. Howe, L.D., J.R. Hargreaves, and S.R. Huttly, *Issues in the construction of wealth indices for the measurement of socioeconomic position in low-income countries.* Emerging themes in epidemiology, 2008. **5**(1): p. 3.
45. McKenzie, D.J., *Measure inequality with asset indicators*. 2003, BREAD working paper.
46. Ministry of Public Health and Sanitation, *National Clinical Guidelines for Management of Diabetes Mellitus. Nairobi, Kenya.* 2010.
47. Ministry of Health, *Kenya National Guidelines for Cardiovascular Diseases Management. Nairobi, Kenya.* 2018.
48. Mohamed, S.F., et al., *Prevalence and factors associated with pre-diabetes and diabetes mellitus in Kenya: results from a national survey.* BMC Public Health, 2018. **18**(3): p. 1215.
49. Mohamed, S.F., et al., *Prevalence, awareness, treatment and control of hypertension and their determinants: results from a national survey in Kenya.* BMC public health, 2018. **18**(3): p. 1219.
50. O'Donnell, O., et al., *Analyzing health equity using household survey data: a guide to techniques and their implementation*. 2008: The World Bank.
51. Wagstaff, A. and E. Van Doorslaer, *Measuring and testing for inequity in the delivery of healthcare.* Journal of Human Resources, 2000: p. 716-733.
52. Niessen, L.W., et al., *Tackling socioeconomic inequalities and non-communicable diseases in low-income and middle-income countries under the Sustainable Development agenda.* The Lancet, 2018. **391**(10134): p. 2036-2046.
53. Williams, J., et al., *A systematic review of associations between non-communicable diseases and socioeconomic status within low-and lower-middle-income countries.* Journal of global health, 2018. **8**(2).
54. Ataguba, J.E., J. Akazili, and D. McIntyre, *Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys.* International journal for equity in health, 2011. **10**(1): p. 48.
55. Wagstaff, A., P. Paci, and E. Van Doorslaer, *On the measurement of inequalities in health.* Social science & medicine, 1991. **33**(5): p. 545-557.

56. Kakwani, N., A. Wagstaff, and E. Van Doorslaer, *Socioeconomic inequalities in health: measurement, computation, and statistical inference.* Journal of econometrics, 1997. **77**(1): p. 87-103.
57. Wagstaff, A., *The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality.* Health economics, 2005. **14**(4): p. 429-432.
58. Wagstaff, A., *Correcting the concentration index: a comment.* Journal of Health Economics, 2009. **28**(2): p. 516-520.
59. Wagstaff, A., *The concentration index of a binary outcome revisited.* Health economics, 2011. **20**(10): p. 1155-1160.
60. Erreygers, G., *Correcting the concentration index.* Journal of health economics, 2009. **28**(2): p. 504-515.
61. Erreygers, G. and T. Van Ourti, *Putting the cart before the horse: A reply to Wagstaff on inequality measurement in the presence of binary variables.* Health Economics, 2011. **20**(10): p. 1161.
62. Kjellsson, G. and U.-G. Gerdtham, *On correcting the concentration index for binary variables.* Journal of health economics, 2013. **32**(3): p. 659-670.
63. Wagstaff, A., v.E. Doorslaer, and N. Watanabe, *On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam*. 2003: J Hum Resour. 112: 207-23.
64. Wagstaff, A., E. van Doorslaer, and N. Watanabe, *On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam.* Journal of Econometrics, 2003. **112**(1): p. 207-223.
65. Yiengprugsawan, V., et al., *Decomposing socioeconomic inequality for binary health outcomes: an improved estimation that does not vary by choice of reference group.* BMC research notes, 2010. **3**(1): p. 57.
66. Efron, B. and R. Tibshirani, *[Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy]: rejoinder.* Statistical science, 1986. **1**(1): p. 77-77.
67. Efron, B., *Better bootstrap confidence intervals.* Journal of the American statistical Association, 1987. **82**(397): p. 171-185.
68. Ataguba, J.E., K.O. Ojo, and H.E. Ichoku, *Explaining socioeconomic inequalities in immunization coverage in Nigeria.* Health policy and planning, 2016. **31**(9): p. 1212-1224.
69. Ilinca, S., et al., *Socioeconomic inequality and inequity in use of healthcare services in Kenya: evidence from the fourth Kenya household health expenditure and utilization survey.* International Journal for Equity in Health, 2019. **18**(1): p. 196.
70. Barasa, E., P. Nguhiu, and D. McIntyre, *Measuring progress towards sustainable development goal 3.8 on universal health coverage in Kenya.* BMJ global health, 2018. **3**(3): p. e000904.
71. Nguhiu, P.K., E.W. Barasa, and J. Chuma, *Determining the effective coverage of maternal and child health services in Kenya, using demographic and health survey data sets: tracking progress towards universal health coverage.* Tropical Medicine & International Health, 2017. **22**(4): p. 442-453.
72. Noor, A.M., et al., *A spatial national health facility database for public health sector planning in Kenya in 2008.* International Journal of Health Geographics, 2009. **8**(1): p. 13.
73. Atun, R., et al., *Improving responsiveness of health systems to non-communicable diseases.* The Lancet, 2013. **381**(9867): p. 690-697.

74. Zulu, T., *Socioeconomic Inequalities in Non-Communicable Diseases in South Africa*, in *Health Economics Unit*. 2019, University of Cape Town.
75. Achoki, T., et al., *Health disparities across the counties of Kenya and implications for policy makers, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016.* The Lancet Global Health, 2019. **7**(1): p. e81-e95.
76. Njagi, P., J. Arsenijevic, and W. Groot, *Cost–related unmet need for healthcare services in Kenya.* BMC health services research, 2020. **20**: p. 1-12.
77. Ashigbie, P.G., et al., *Availability and prices of medicines for non-communicable diseases at health facilities and retail drug outlets in Kenya: a cross-sectional survey in eight counties.* BMJ open, 2020. **10**(5): p. e035132.
78. Tsui, E.L., et al., *Under-reporting of inpatient services utilisation in household surveys–a population-based study in Hong Kong.* BMC Health Services Research, 2005. **5**(1): p. 31.
79. Bhandari, A. and T. Wagner, *Self-reported utilization of healthcare services: improving measurement and accuracy.* Medical Care Research and Review, 2006. **63**(2): p. 217-235.
80. Asante, A., et al., *Equity in health care financing in low-and middle-income countries: a systematic review of evidence from studies using benefit and financing incidence analyses.* PloS one, 2016. **11**(4): p. e0152866.

How equitable are non-communicable diseases services in Kenya? The case of diabetes and hypertension screening and treatment



Key messages

- The poor have a relatively higher need for diabetes and hypertension screening than the rich. However, the rich use screening services more than their share of need.
- The rich need diabetes and hypertension treatment more than the poor. Except for diabetes treatment, the use of hypertension treatment favours the rich.
- Disparities in the screening and treatment for diabetes and hypertension were explained by where people live, work, their household's income level, whether they are educated and whether they have a radio or television.
- To ensure that those who need screening and treatment for diabetes and hypertension receive such services, the government should implement targeted health education messages. The capacity of primary care facilities to offer screening and treatment services for diabetes and hypertension should also be strengthened.

1. Introduction

The disproportionate rise in the burden of non-communicable diseases (NCDs) in low-and middle-income countries (LMICs) presents a major challenge to health systems. In 2019, for instance, more than three-quarters of the 41 million NCDs-related deaths occurred in LMICs. Besides, available evidence convincingly concludes that the poor, relative to the rich, in both LMICs and high-income countries, bear the brunt of this burden as they are disadvantaged in utilising needed care services.

Indeed, the World Health Organization alongside other global health actors have realised that the rapid rise of NCDs burden presents a unique challenge in the attainment of universal health coverage (UHC) goals by 2030. That is, utilisation of needed healthcare services that are of sufficient quality to be effective without suffering financial hardship. Use of health services based on need and not the ability of people to pay is a crucial UHC goal that has been established as the key policy focus in health systems globally. Use of health services based on need can be defined as the absence of avoidable difference among

groups of people, whether these groups are defined from the geographic, demographic, social or economic perspectives.

The recognition of the health, economic and development challenges associated with NCDs has seen their inclusion in the Sustainable Development Goals (SDGs). SDG 3.4 aims to reduce by one-third premature mortality due to NCDs through prevention and treatment. To achieve this goal, containment of NCDs risk factors such as unhealthy diets, physical inactivity, harmful consumption of alcohol and smoking have been prioritised. Also, individual-level interventions such as timely screening among those at risk and treatment among those diagnosed are cost-effective strategies for achieving the SDG 3.4 target.

2. About this study

In Kenya, NCDs lead to more than 50% of inpatient admissions and 55% of hospital deaths. Recent studies have revealed that patients with diabetes and hypertension in Kenya face access and utilisation barriers for needed treatment services, mainly due to medicine and transport-related costs. Worryingly, it is the poor that are the most affected. Moreover, a study has shown that screening, diagnosis and treatment of NCDs such as cervical and breast cancer, including diabetes and hypertension, are unaffordable to many Kenyans.

A study covering the entire country found that Kenyan households with a member who has an NCD are at a higher risk of experiencing financial hardship due to healthcare use compared to households that do not.

There are huge disparities in NCDs screening and treatment across the rural-urban divide as well as among the wealth quintiles, with the rich being disproportionately favoured.

Several studies have convincingly shown that the Kenyan health system remains vastly inequitable. However, little is known about fairness in the use of screening and treatment services for NCDs in Kenya based on need. Likewise, though necessary for policymaking, there is limited evidence on the factors contributing to disparities in the screening and treatment of diabetes and hypertension in Kenya based on household or individual income.

This study used the 2015 STEPwise survey to assess the level of disparity in the screening and treatment of diabetes and hypertension among Kenyan adults (18-69 years). Further, the study examined factors contributing to these disparities.

3. KEY FINDINGS

3.1 Who has the greatest need for diabetes and hypertension screening and treatment?

In general, the ideal situation is where the use of screening and treatment for diabetes and hypertension is based on need. The national policy guideline recommends that people aged at least 40 years should undergo diabetes and hypertension screening. "Need" for diabetes and hypertension treatment was defined as those diagnosed with either condition in the survey. The national treatment guidelines for diabetes and hypertension informed the diagnosis criteria used in this study. The population of Kenyans that need screening for diabetes and hypertension is mainly the poor, but, richer Kenyans use screening services more (Figure 1).

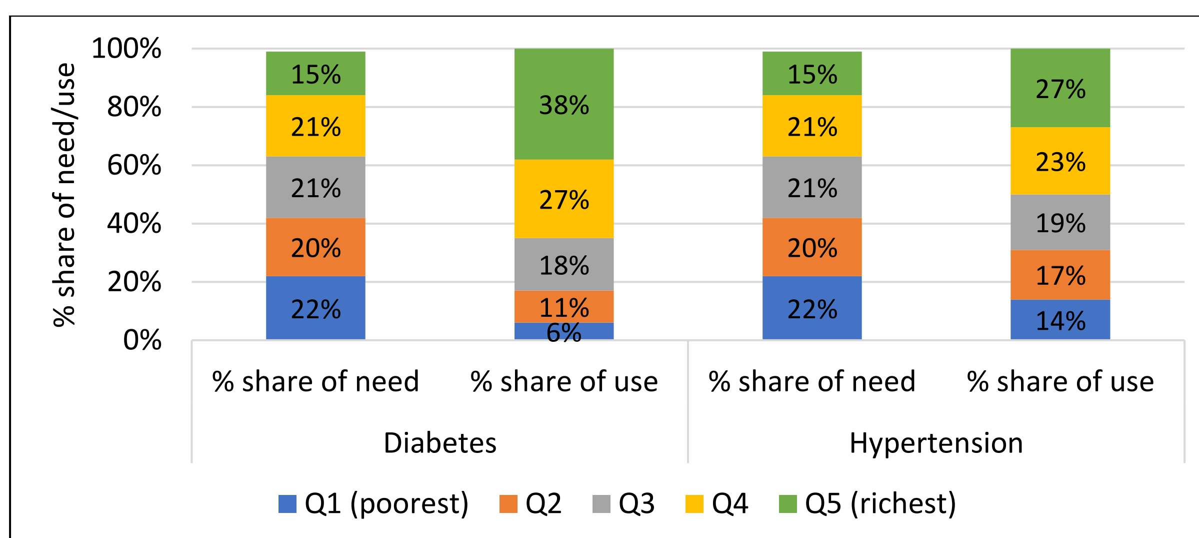


Fig. 1 A comparison of need and use of diabetes and hypertension screening in Kenya

3.2 Are there differences in the use of screening and treatment services for diabetes and hypertension between the rich and the poor?

This study found that the rich, compared to the poor, needed diabetes and hypertension treatment services more. However, the poor needed screening services more than the rich. Furthermore, the rich used diabetes and hypertension screening and treatment services more. Table 1 summarises the disparities in the use of diabetes and hypertension treatment services according to household income.

Table 1 Summary of who uses diabetes and hypertension screening and treatment services more based on need

Interventions	Who uses these interventions more?
Diabetes screening services	The rich
Hypertension screening services	The rich
Diabetes treatment services	The rich
Hypertension treatment services	The rich

3.3. What explains the disparities in the screening and treatment of diabetes and hypertension between the rich and the poor?

To advice the government of Kenya on necessary policy actions needed to ensure that those needing screening and treatment services for diabetes and hypertension receive them, it is important to identify the factors explaining the disparities in the of use of these services. Overall, where people live, work, their household's income level, whether they are educated and whether they have a radio or television affects the way they use diabetes and hypertension screening and treatment services.

4.0 What do these findings mean?

Taken together, the findings show for the first time that in Kenya, the poor relative to the rich are disproportionately disadvantaged in the utilisation of screening and treatment services for diabetes and hypertension. The poor need to use these services more than the rich, but they do not. The study revealed that it was mainly where people live, work, their household's income level, and whether they are educated, which affects how they use diabetes and hypertension screening and treatment services. Therefore, for the attainment of international targets set in the SDG 3.4, including UHC goals, there is an urgent need for policy action to ensure that the utilisation of NCDs services is according to need in Kenya. Given the ongoing UHC reforms in Kenya, a window of opportunity exists to avert this pattern.

5.0 Policy recommendations

- County governments in Kenya should strengthen the capacity of primary care facilities to ensure that those that need the screening and treatment services receive them.
- To increase the number of people utilising screening services for diabetes and hypertension, national and county governments should implement strategic measures to raise awareness on the benefits of early NCDs screening, especially among men. This can be done through targeted health education messages in the mass media and other appropriate channels.
- The government should intensify the provision of screening services to target those that need them the most, especially males. These services can be provided at primary healthcare facilities where health services are currently offered for free.

- The government of Kenya should implement measures to ensure diabetes and hypertension treatment services are intensified in primary healthcare facilities that are closer to where the majority of Kenyans live, thus facilitating access.
- There is a need to implement inter-sectoral partnerships between the health sector and other social and economic sectors to reduce the disparities in the treatment for diabetes and hypertension that is related to employment, education, where people live and their household wealth status. For instance, the educational sector can include NCDs in the curriculum to increase awareness of the health benefits of seeking early screening and treatment for diabetes and hypertension.

Bibliography

1. World Health Organization. Non-communicable Diseases - Key Facts. Available at https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases [Accessed on 6 September 2020]. 2020.
2. Isaranuwatchai W, Archer RA, Teerawattananon Y, Culyer AJ. Non-Communicable Disease Prevention: Best Buys, Wasted Buys and Contestable Buys. 2019.
3. World Health Organization. Global status report on noncommunicable diseases 2014. World Health Organization; 2014.
4. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS medicine. 2006;3(11):e442.
5. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. The Lancet. 2006;367(9524):1747-57.
6. Anderson GF, Chu E. Expanding priorities-confronting chronic disease in countries with low income. New England Journal of Medicine. 2007;356(3):209.
7. Abegunde DO, Mathers CD, Adam T, Ortegon M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. The Lancet. 2007;370(9603):1929-38.
8. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet. 2012;380(9859):2224-60.
9. Dall TM, Yang W, Halder P, Pang B, Massoudi M, Wintfeld N, et al. The economic burden of elevated blood glucose levels in 2012: diagnosed and undiagnosed diabetes, gestational diabetes mellitus, and prediabetes. Diabetes care. 2014;37(12):3172-9.
10. Bommer C, Heesemann E, Sagalova V, Manne-Goehler J, Atun R, Bärnighausen T, et al. The global economic burden of diabetes in adults aged 20–79 years: a cost-of-illness study. The lancet Diabetes & endocrinology. 2017;5(6):423-30.
11. Peters M, Huisman E, Schoonen M, Wolffenbuttel B. The current total economic burden of diabetes mellitus in the Netherlands. Neth J Med. 2017;75(7):281-97.
12. Olsen MH, Angell SY, Asma S, Boutouyrie P, Burger D, Chirinos JA, et al. A call to action and a lifecourse strategy to address the global burden of raised blood pressure on current and future generations: the Lancet Commission on hypertension. The Lancet. 2016;388(10060):2665-712.
13. International Diabetes Federation. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: International Diabetes Federation.; 2019.

14. Kayima J, Wanyenze RK, Katamba A, Leontsini E, Nuwaha F. Hypertension awareness, treatment and control in Africa: a systematic review. BMC cardiovascular disorders. 2013;13(1):54.
15. Aikins Ad-G, Agyemang C. Chronic Non-communicable Diseases in Low and Middle-income Countries: cabi; 2015.
16. World Health Organization. Global report on diabetes: executive summary. World Health Organization; 2016.
17. Chow CK, Ramasundarahettige C, Hu W, AlHabib KF, Avezum Jr A, Cheng X, et al. Availability and affordability of essential medicines for diabetes across high-income, middle-income, and low-income countries: a prospective epidemiological study. The lancet Diabetes & endocrinology. 2018;6(10):798-808.
18. Ataklte F, Erqou S, Kaptoge S, Taye B, Echouffo-Tcheugui JB, Kengne AP. Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. Hypertension. 2015;65(2):291-8.
19. Littenberg B, Garber AM, Sox HC. Screening for hypertension. Annals of internal medicine. 1990;112(3):192-202.
20. Kahn R, Alperin P, Eddy D, Borch-Johnsen K, Buse J, Feigelman J, et al. Age at initiation and frequency of screening to detect type 2 diabetes: a cost-effectiveness analysis. The Lancet. 2010;375(9723):1365-74.
21. Howard K, White S, Salkeld G, McDonald S, Craig JC, Chadban S, et al. Cost-effectiveness of screening and optimal management for diabetes, hypertension, and chronic kidney disease: A modeled analysis. Value in health. 2010;13(2):196-208.
22. Baker J, Mitchell R, Lawson K, Pell J. Ethnic differences in the cost-effectiveness of targeted and mass screening for high cardiovascular risk in the UK: cross-sectional study. Heart. 2013;99(23):1766-71.
23. Li R, Zhang P, Barker LE, Chowdhury FM, Zhang X. Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review. Diabetes care. 2010;33(8):1872-94.
24. Heller O, Somerville C, Suggs LS, Lachat S, Piper J, Aya Pastrana N, et al. The process of prioritization of non-communicable diseases in the global health policy arena. Health policy and planning. 2019.
25. Aikins Ad-G, Kushitor M, Koram K, Gyamfi S, Ogedegbe G. Chronic non-communicable diseases and the challenge of universal health coverage: insights from community-based cardiovascular disease research in urban poor communities in Accra, Ghana. BMC Public Health. 2014;14(2):S3.
26. Horton R. Offline: NCDs—why are we failing? The Lancet. 2017;390(10092):346.
27. Hart JT. The inverse care law. The Lancet. 1971;297(7696):405-12.
28. Bachmann M, Eachus J, Hopper C, Davey Smith G, Propper C, Pearson N, et al. Socio-economic inequalities in diabetes complications, control, attitudes and health service use: a cross-sectional study. Diabetic Medicine. 2003;20(11):921-9.
29. Moody A, Cowley G, Fat LN, Mindell JS. Social inequalities in prevalence of diagnosed and undiagnosed diabetes and impaired glucose regulation in participants in the Health Surveys for England series. BMJ open. 2016;6(2):e010155.
30. Neves RG, Duro SMS, Flores TR, Wendt A, Costa CdS, Nunes BP, et al. Social inequalities in care for the elderly with diabetes in Brazil. Revista Panamericana de Salud Pública. 2018;42:e88.
31. Elwell-Sutton TM, Jiang CQ, Zhang WS, Cheng KK, Lam TH, Leung GM, et al. Inequality and inequity in access to health care and treatment for chronic conditions in China: the Guangzhou Biobank Cohort Study. Health policy and planning. 2012;28(5):467-79.
32. Mayosi BM, Flisher AJ, Lalloo UG, Sitas F, Tollman SM, Bradshaw D. The burden of non-communicable diseases in South Africa. The lancet. 2009;374(9693):934-47.
33. Ministry of Health. Kenya STEPwise survey for non-communicable diseases risk factors 2015 report. Available at: http://aphrc.org/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf [Accessed 8 August 2019]. 2015.

34. Mohamed SF, Mutua MK, Wamai R, Wekesah F, Haregu T, Juma P, et al. Prevalence, awareness, treatment and control of hypertension and their determinants: results from a national survey in Kenya. BMC Public Health. 2018;18(3):1219.
35. Mohamed SF, Mwangi M, Mutua MK, Kibachio J, Hussein A, Ndegwa Z, et al. Prevalence and factors associated with pre-diabetes and diabetes mellitus in Kenya: results from a national survey. BMC Public Health. 2018;18(3):1215.
36. Subramanian S, Gakunga R, Kibachio J, Gathecha G, Edwards P, Ogola E, et al. Cost and affordability of non-communicable disease screening, diagnosis and treatment in Kenya: Patient payments in the private and public sectors. PLoS One. 2018;13(1):e0190113.
37. Oyando R, Njoroge M, Nguhiu P, Kirui F, Mbui J, Sigilai A, et al. Patient costs of hypertension care in public health care facilities in Kenya. Int J Health Plann Manage. 2019;34(2):e1166-e78.
38. Oyando R, Njoroge M, Nguhiu P, Sigilai A, Kirui F, Mbui J, et al. Patient costs of diabetes mellitus care in public health care facilities in Kenya. Int J Health Plann Manage. 2020;35(1):290-308.
39. Barasa EW, Maina T, Ravishankar N. Assessing the impoverishing effects, and factors associated with the incidence of catastrophic health care payments in Kenya. International journal for equity in health. 2017;16(1):31.
40. Salari P, Di Giorgio L, Ilinca S, Chuma J. The catastrophic and impoverishing effects of out-of-pocket healthcare payments in Kenya, 2018. BMJ Global Health. 2019;4(6).
41. Ilinca S, Di Giorgio L, Salari P, Chuma J. Socio-economic inequality and inequity in use of health care services in Kenya: evidence from the fourth Kenya household health expenditure and utilization survey. International Journal for Equity in Health. 2019;18(1):196.
42. World Health Organization. Health systems financing: the path to universal coverage. Geneva: World Health Organization.; 2012.
43. Chuma J, Maina T, Ataguba J. Does the distribution of health care benefits in Kenya meet the principles of universal coverage? BMC Public Health. 2012;12(1):20.
44. Nguhiu PK, Barasa EW, Chuma J. Determining the effective coverage of maternal and child health services in Kenya, using demographic and health survey data sets: tracking progress towards universal health coverage. Tropical Medicine & International Health. 2017;22(4):442-53.
45. Barasa E, Nguhiu P, McIntyre D. Measuring progress towards sustainable development goal 3.8 on universal health coverage in Kenya. BMJ global health. 2018;3(3):e000904.
46. Boerma T, AbouZahr C, Evans D, Evans T. Monitoring intervention coverage in the context of universal health coverage. PLoS medicine. 2014;11(9):e1001728.
47. World Health Organization. Prevention of cardiovascular disease: World Health Organization; 2007.
48. World Health Organization. A global brief on hypertension: silent killer, global public health crisis: World Health Day 2013. World Health Organization; 2013.
49. Joffres M, Falaschetti E, Gillespie C, Robitaille C, Loustalot F, Poulter N, et al. Hypertension prevalence, awareness, treatment and control in national surveys from England, the USA and Canada, and correlation with stroke and ischaemic heart disease mortality: a cross-sectional study. BMJ open. 2013;3(8):e003423.
50. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, et al. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. Jama. 2013;310(9):959-68.
51. Iwelunmor J, Airhihenbuwa CO, Cooper R, Tayo B, Plange-Rhule J, Adanu R, et al. Prevalence, determinants and systems-thinking approaches to optimal hypertension control in West Africa. Globalization and health. 2014;10(1):42.
52. Bonfrer I, van de Poel E, Grimm M, Van Doorslaer E. Does the distribution of healthcare utilization match needs in Africa? Health Policy and Planning. 2013;29(7):921-37.
53. Zere E, McIntyre D. Inequities in under-five child malnutrition in South Africa. International journal for equity in health. 2003;2(1):7.

54. Zere E, Moeti M, Kirigia J, Mwase T, Kataika E. Equity in health and healthcare in Malawi: analysis of trends. BMC Public Health. 2007;7(1):78.
55. Zere E, Oluwole D, Kirigia JM, Mwikisa CN, Mbeeli T. Inequities in skilled attendance at birth in Namibia: a decomposition analysis. BMC pregnancy and childbirth. 2011;11(1):34.
56. Ataguba JE, Akazili J, McIntyre D. Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. International journal for equity in health. 2011;10(1):48.
57. Van Malderen C, Ogali I, Khasakhala A, Muchiri SN, Sparks C, Van Oyen H, et al. Decomposing Kenyan socio-economic inequalities in skilled birth attendance and measles immunization. International journal for equity in health. 2013;12(1):3.
58. Phiri J, Ataguba JE. Inequalities in public health care delivery in Zambia. International journal for equity in health. 2014;13(1):24.
59. Ataguba JE, Ojo KO, Ichoku HE. Explaining socio-economic inequalities in immunization coverage in Nigeria. Health policy and planning. 2016;31(9):1212-24.
60. Hendriks ME, Wit FW, Roos MT, Brewster LM, Akande TM, De Beer IH, et al. Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. PLoS One. 2012;7(3).
61. van de Vijver S, Akinyi H, Oti S, Olajide A, Agyemang C, Aboderin I, et al. Status report on hypertension in Africa-Consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. Pan African Medical Journal. 2014;16(1).
62. Van Der Hoog M. Measuring equity in health care delivery: a new method based on the concept of aristotelian equality. Netherlands: Network for studies on pensions, aging and retirement. 2010.
63. Braveman P, Gruskin S. Defining equity in health. Journal of Epidemiology & Community Health. 2003;57(4):254-8.
64. Maina T, Kirigia D. Annual Evaluation of the Abolition of User Fees at Primary Healthcare Facilities in Kenya. Washington DC: Futures Group. Health Policy Project. 2015.
65. Chuma J, Maina T. Free maternal care and removal of user fees at primary-level facilities in Kenya. Monitoring the implementation and impact: Baseline report. 2014.
66. Kabia E, Mbau R, Oyando R, Oduor C, Bigogo G, Khagayi S, et al. "We are called the et cetera": experiences of the poor with health financing reforms that target them in Kenya. International Journal for Equity in Health. 2019;18(1):98.
67. Kazungu JS, Barasa EW. Examining levels, distribution and correlates of health insurance coverage in Kenya. Tropical Medicine & International Health. 2017;22(9):1175-85.
68. Barasa E, Rogo K, Mwaura N, Chuma J. Kenya National Hospital Insurance Fund Reforms. 2018.
69. Munge K, Briggs AH. The progressivity of health-care financing in Kenya. Health policy and planning. 2013;29(7):912-20.
70. Government of Kenya. The Constitution of Kenya. Nairobi: Government of Kenya2010.
71. United Nations. Transforming Our World - the 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals (Accessed 14 November 2019). 2015.
72. Mooney GH. Equity in health care: confronting the confusion. Effective health care. 1983;1(4):179-85.
73. Reagon G, Makan B, McIntyre D. Resource Allocation Mechanisms within the District Health System: A Literature Review. Health Economics Unit, department of Community Health, University of Cape Town. 1997.
74. Whitehead M. The concepts and principles of equity and health. Health promotion international. 1991;6(3):217-28.
75. Culyer AJ, Wagstaff A. Equity and equality in health and health care. J Health Econ. 1993;12(4):431-57.
76. Wagstaff A, Van Doorslaer E. Measuring and testing for inequity in the delivery of health care. Journal of Human Resources. 2000:716-33.

77. Evans T, Whitehead M, Diderichsen F. Challenging inequities in health: from ethics to action: Oxford University Press; 2001.
78. Olsen JA. Theories of justice and their implications for priority setting in health care. Journal of health economics. 1997;16(6):625-39.
79. Scarre G. Utilitarianism: Routledge; 2002.
80. Sen A. On Ethics and Economics. Oxford and New York: Basil Blackwell; 1987.
81. Pereira JACG. Equity, health and healthcare: an economic study with reference to Portugal: University of York; 1995.
82. Ataguba JE. Distributional impact of health care finance in South Africa: University of Cape Town; 2012.
83. McGuire A, Henderson J, Mooney G. The economics of health care: an introductory text: Routledge & Kegan Paul; 1988.
84. Sen A. Capabilities and commodities. Amsterdam and New York: North-Holland. 1985.
85. Elster J. Local justice: How institutions allocate scarce goods and necessary burdens: Russell Sage Foundation; 1992.
86. Roemer JE. Egalitarian Perspectives: Essays in philosophical economics: Cambridge University Press; 1996.
87. Hansson SO. What are opportunities and why should they be equal? Social Choice and Welfare. 2004;22(2):305-16.
88. Sandel M. Justice: What’s the right thing to do? New York, NY: Farrar, Straus & Giroux. 2009.
89. Nozick R. Anarchy, state, and utopia: New York: Basic Books; 1974.
90. Denier Y. Efficiency, justice and care: Springer; 2007.
91. Chuma J. Resource allocation in the Kenyan health sector: a question of equity: University of Cape Town; 2001.
92. Williams A. Equity in health care: the role of ideology. Equity in the Finances and Delivery of Health Care: An International Perspective, New York. 1993.
93. Gaus GF, Kukathas C. Handbook of political theory: Sage; 2004.
94. Rawls J. A theory of justice, Harvard, MA, Harvard University Press. 1971.
95. Mooney GH. Key issues in health economics, New York, Harvester Wheatsheaf. 1994.
96. World Health Organization. Building on the user-fee experience: The African case. Geneva: World Health Organization; 2003.
97. Wagstaff A, Paci P, Van Doorslaer E. On the measurement of inequalities in health. Social science & medicine. 1991;33(5):545-57.
98. Culyer AJaW, A., . Need, Quality and Social Justice. University of York Centre for Health Economics 1991.
99. World Bank. GDP per capita (current US$). Available: https://data.worldbank.org/indicator/ny.gdp.pcap.cd?name_desc=true (Accessed 18 November 2019). 2018.
100. KNBS. Kenya Population and Housing Census. Nairobi, Kenya; 2019.
101. World Bank. Urban Population (% of total population). Available at: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS (Accessed 18 November 2019) 2018 [
102. KNBS. Economic Survey. Nairobi, Kenya; 2018.
103. Ministry of Health. Kenya Health Policy 2014-2030. 2014.
104. Riley L, Guthold R, Cowan M, Savin S, Bhatti L, Armstrong T, et al. The World Health Organization STEPwise approach to noncommunicable disease risk-factor surveillance: methods, challenges, and opportunities. American journal of public health. 2016;106(1):74-8.
105. Sozmen K, Belgin U. Socioeconomic inequalities in non-communicable diseases and self assessed health in Turkey. Iranian journal of public health. 2014;43(6):736.
106. Walli-Attaei M, Joseph P, Rosengren A, Chow CK, Rangarajan S, Lear SA, et al. Variations between women and men in risk factors, treatments, cardiovascular disease

incidence, and death in 27 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. The Lancet. 2020.
107. Su M, Si Y, Zhou Z, Shen C, Dong W, Fan X, et al. Comparing the income-related inequity of tested prevalence and self-reported prevalence of hypertension in China. International journal for equity in health. 2018;17(1):82.
108. Mutyambizi C, Booysen F, Stokes A, Pavlova M, Groot W. Lifestyle and socio-economic inequalities in diabetes prevalence in South Africa: A decomposition analysis. PLoS One. 2019;14(1).
109. Ministry of Public Health and Sanitation. National Clinical Guidelines for Management of Diabetes Mellitus. Nairobi, Kenya. 2010.
110. Ministry of Health. Kenya National Guidelines for Cardiovascular Diseases Management. Nairobi, Kenya. 2018.
111. O'Donnell O, Van Doorslaer E, Wagstaff A, Lindelow M. Analyzing health equity using household survey data: a guide to techniques and their implementation: The World Bank; 2008.
112. Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. Health policy and planning. 2006;21(6):459-68.
113. Van Doorslaer E, Wagstaff A, Van der Burg H, Christiansen T, De Graeve D, Duchesne I, et al. Equity in the delivery of health care in Europe and the US. Journal of health economics. 2000;19(5):553-83.
114. Sözmen K, Ünal B. Explaining inequalities in health care utilization among Turkish adults: findings from health survey 2008. Health Policy. 2016;120(1):100-10.
115. Cissé B, Luchini S, Moatti JP. Progressivity and horizontal equity in health care finance and delivery: What about Africa? Health policy. 2007;80(1):51-68.
116. Jann B. The Blinder–Oaxaca decomposition for linear regression models. The Stata Journal. 2008;8(4):453-79.
117. Wagstaff A, Doorslaer vE, Watanabe N. On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam: J Hum Resour. 112: 207-23.; 2003.
118. Niessen LW, Mohan D, Akuoku JK, Mirelman AJ, Ahmed S, Koehlmoos TP, et al. Tackling socioeconomic inequalities and non-communicable diseases in low-income and middle-income countries under the Sustainable Development agenda. The Lancet. 2018;391(10134):2036-46.
119. Williams J, Allen L, Wickramasinghe K, Mikkelsen B, Roberts N, Townsend N. A systematic review of associations between non-communicable diseases and socioeconomic status within low-and lower-middle-income countries. Journal of global health. 2018;8(2).
120. Efron B, Tibshirani R. [Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy]: rejoinder. Statistical science. 1986;1(1):77-.
121. Efron B. Better bootstrap confidence intervals. Journal of the American statistical Association. 1987;82(397):171-85.
122. Guan W. From the help desk: bootstrapped standard errors. The Stata Journal. 2003;3(1):71-80.
123. Culyer AJ, Wagstaff A. Equity and equality in health and health care. Journal of health economics. 1993;12(4):431-57.
124. Evans T, Whitehead M, Bhuiya A, Diderichsen F, Wirth M. Challenging inequities in health: from ethics to action: Oxford University Press; 2001.
125. McIntyre D, Mooney G. The economics of health equity: Cambridge University Press; 2007.
126. Williams A, Cookson R. Equity in health. Handbook of health economics. 2000;1:1863-910.
127. Peter F. Health equity and social justice. Journal of applied philosophy. 2001:159-70.
128. Culyer AJ. Equity-some theory and its policy implications. Journal of medical ethics. 2001;27(4):275-83.
129. Waters HR. Measuring equity in access to health care. Social Science & Medicine. 2000;51(4):599-612.

130. Musgrove P. Measurement of equity in health. World health statistics quarterly 1986; 39 (4): 325-335. 1986.
131. Donaldson C, Gerard K. Economics of health care financing: The Visible Hand: Springer; 1993.
132. Macinko JA, Starfield B. Annotated bibliography on equity in health, 1980-2001. International Journal for Equity in Health. 2002;1(1):1.
133. Braveman PA, Cubbin C, Egerter S, Chideya S, Marchi KS, Metzler M, et al. Socioeconomic status in health research: one size does not fit all. Jama. 2005;294(22):2879-88.
134. Mooney G, Jan S. Vertical equity: weighting outcomes? or establishing procedures? Health Policy. 1997;39(1):79-87.
135. Gravelle H, Morris S, Sutton M. 18 Economic studies of equity in the consumption of health care. The Elgar companion to health economics. 2006:193.
136. Bambas A, Casas JA. Assessing equity in health: conceptual criteria. Equity and health: Views from the Pan American Sanitary Bureau. 2001:12-21.
137. Yang W. An analysis of inequities and inefficiencies in health and healthcare in China: The London School of Economics and Political Science (LSE); 2013.
138. Sutton M. Vertical and horizontal aspects of socio-economic inequity in general practitioner contacts in Scotland. Health Economics. 2002;11(6):537-49.
139. Morris S, Sutton M, Gravelle H. Inequity and inequality in the use of health care in England: an empirical investigation. Social science & medicine. 2005;60(6):1251-66.
140. Doorslaer Ev, Wagstaff A, Rutten F. Equity in the finance and delivery of health care: an international perspective: Oxford University Press; 1992.
141. Smith GD, Bartley M, Blane D. The Black report on socioeconomic inequalities in health 10 years on. BMJ: British Medical Journal. 1990;301(6748):373.
142. Wagstaff A. Poverty and health sector inequalities. Bulletin of the world health organization. 2002;80:97-105.
143. Braveman P, Tarimo E. Social inequalities in health within countries: not only an issue for affluent nations. Social science & medicine. 2002;54(11):1621-35.
144. Wilkinson RG, Marmot M. Social determinants of health: the solid facts: World Health Organization; 2003.
145. Okorafor OA. Fiscal federalism an equity in the financing of primary health care: The case of South Africa: University of Cape Town; 2009.
146. Wagstaff A, Van Doorslaer E. Equity in the finance and delivery of health care: concepts and definitions. Equity in the finance and delivery of health care: an international perspective. 1993:7-19.
147. Bentham J, Bowring J. The Works of Jeremy Bentham: W. Tait; 1843.
148. James M. Towards an integrated needs and outcome framework. Health Policy. 1999;46(3):165-77.
149. Gaertner W. Distributive justice: Theoretical foundations and empirical findings. European Economic Review. 1994;38(3-4):711-20.
150. Gilson L. Re-addressing equity: the search for the holy grail. The importance of. 1998.
151. Locke J. Locke: Two treatises of government: Cambridge University Press; 1967.
152. Akazili J. Equity in health care financing in Ghana: University of Cape Town; 2010.
153. Jeppsson A, Okuonzi SA. Vertical or holistic decentralization of the health sector? Experiences from Zambia and Uganda. Int J Health Plann Manage. 2000;15(4):273-89.
154. Mwesigye RF. Effects of user charges on quality of curative services: a perspective of Uganda's rural health units. Health Planning Unit, Ministry of Health, Entebbe. 1995.
155. Okuonzi SA, Macrae J. Whose policy is it anyway? International and national influences on health policy development in Uganda. Health policy and planning. 1995;10(2):122-32.
156. Mwabu G, Mwanzia J, Liambila W. User charges in government health facilities in Kenya: effect on attendance and revenue. Health policy and Planning. 1995;10(2):164-70.

157. Thomson M, Kentikelenis A, Stubbs TJPhr. Structural adjustment programmes adversely affect vulnerable populations: a systematic-narrative review of their effect on child and maternal health. 2017;38(1):13.
158. Stansfeld S, Marmot M, Wilkinson RG. Social determinants of health. 1999.
159. Townsend P, Davidson N. Inequalities in health: the Black report: Penguin Harmondsworth; 1982.
160. Wilkinson RG. Socio-economic differences in mortality: interpreting the data on their size and trends. Class and health: Research and longitudinal data. 1986:1-20.
161. Power C, Manor O, Fox J. Health and class: the early years: Chapman & Hall; 1991.
162. Phillimore P, Beattie A, Townsend P. Widening inequality of health in northern England, 1981-91. Bmj. 1994;308(6937):1125-8.
163. Wagstaff A. Poverty and Health. CMH Working Paper Series, paper No. WG1: 5, Prepared for WHO's Commission on Macroeconomics and Health. Paper. 2001(5).
164. Chuma J, Okungu V. Viewing the Kenyan health system through an equity lens: implications for universal coverage. International journal for equity in health. 2011;10(1):22.
165. World Bank. Health Equity and Financial Protection Report – Kenya. Washington, DC: World Bank. http://documents.worldbank.org/curated/en/875011468047742115/pdf/712540WP00PUBL0Country0Report0Kenya.pdf (Accessed on 28th March 2020). 2012.
166. Keats EC, Akseer N, Bhatti Z, Macharia W, Ngugi A, Rizvi A, et al. Assessment of inequalities in coverage of essential reproductive, maternal, newborn, child, and adolescent health interventions in Kenya. JAMA network open. 2018;1(8):e185152-e.
167. Were V, Buff AM, Desai M, Kariuki S, Samuels A, Ter Kuile FO, et al. Socioeconomic health inequality in malaria indicators in rural western Kenya: evidence from a household malaria survey on burden and care-seeking behaviour. Malaria journal. 2018;17(1):166.
168. Achoki T, Miller-Petrie MK, Glenn SD, Kalra N, Lesego A, Gathecha GK, et al. Health disparities across the counties of Kenya and implications for policy makers, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet Global Health. 2019;7(1):e81-e95.
169. Oliver A, Mossialos E. Equity of access to health care: outlining the foundations for action. Journal of Epidemiology & Community Health. 2004;58(8):655-8.
170. Culyer TJ, Wagstaff A. Need, equity and equality in health and health care. 1992.
171. Bradshaw J. Taxonomy of social need. 1972.
172. McIntyre D, Mooney G, Jan S. Need: what is it and how do we measure it? Oxford textbook of public health, Volume 3: the practice of public health. 2009(Ed. 5):1535-48.
173. Pamuk ER. Social class inequality in mortality from 1921 to 1972 in England and Wales. Population studies. 1985;39(1):17-31.
174. Regidor E. Measures of health inequalities: part 2. Journal of epidemiology and community health. 2004;58(11):900.
175. Nikolaou A, Nikolaou D. Income-related inequality in the distribution of obesity among Europeans. Journal of Public Health. 2008;16(6):403-11.
176. Hajizadeh M, Campbell MK, Sarma S. Socioeconomic inequalities in adult obesity risk in Canada: trends and decomposition analyses. The European Journal of Health Economics. 2014;15(2):203-21.
177. Kakwani N, Wagstaff A, Van Doorslaer E. Socioeconomic inequalities in health: measurement, computation, and statistical inference. Journal of econometrics. 1997;77(1):87-103.
178. Koolman X, Van Doorslaer E. On the interpretation of a concentration index of inequality. Health economics. 2004;13(7):649-56.
179. Clarke P, Van Ourti T. Correcting the bias in the concentration index when income is grouped. 2009.
180. Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. 1997.

181. Le Grand J. The distribution of public expenditure: the case of health care. Economica. 1978;45(178):125-42.
182. Wagstaff A, Van Doorslaer E, Paci P. On the measurement of horizontal inequity in the delivery of health care. Journal of health economics. 1991;10(2):169-205.
183. Collins E, Klein R. Equity and the NHS: self-reported morbidity, access, and primary care. Br Med J. 1980;281(6248):1111-5.
184. Puffer F. Access to Primary Health Care: A Comparison of the US and the UK. Journal of Social Policy. 1986;15(3):293-313.
185. Murphy A, Palafox B, O'Donnell O, Stuckler D, Perel P, AlHabib KF, et al. Inequalities in the use of secondary prevention of cardiovascular disease by socioeconomic status: evidence from the PURE observational study. The Lancet Global Health. 2018;6(3):e292-e301.
186. Palafox B, McKee M, Balabanova D, AlHabib KF, Bahonar A, Ismail N, et al. Wealth and cardiovascular health: a cross-sectional study of wealth-related inequalities in the awareness, treatment and control of hypertension in high-, middle-and low-income countries. International journal for equity in health. 2016;15(1):199.
187. Teo K, Chow CK, Vaz M, Rangarajan S, Yusuf S. The Prospective Urban Rural Epidemiology (PURE) study: examining the impact of societal influences on chronic noncommunicable diseases in low-, middle-, and high-income countries. American heart journal. 2009;158(1):1-7. e1.
188. Yusuf S, Islam S, Chow CK, Rangarajan S, Dagenais G, Diaz R, et al. Use of secondary prevention drugs for cardiovascular disease in the community in high-income, middle-income, and low-income countries (the PURE Study): a prospective epidemiological survey. The Lancet. 2011;378(9798):1231-43.
189. Hasan M, Tasnim F, Tariqujjaman M, Ahmed S. Socioeconomic Inequalities of Undiagnosed Diabetes in a Resource-Poor Setting: Insights from the Cross-Sectional Bangladesh Demographic and Health Survey 2011. International journal of environmental research and public health. 2019;16(1):115.
190. Ahmed S, Tariqujjaman M, Rahman MA, Hasan MZ, Hasan MM. Inequalities in the prevalence of undiagnosed hypertension among Bangladeshi adults: evidence from a nationwide survey. International journal for equity in health. 2019;18(1):33.
191. Ataguba JE-O. Inequalities in multimorbidity in South Africa. International journal for equity in health. 2013;12(1):64.
192. Vellakkal S, Subramanian S, Millett C, Basu S, Stuckler D, Ebrahim S. Socioeconomic inequalities in non-communicable diseases prevalence in India: disparities between self-reported diagnoses and standardized measures. PLoS One. 2013;8(7).
193. Vellakkal S, Millett C, Basu S, Khan Z, Aitsi-Selmi A, Stuckler D, et al. Are estimates of socioeconomic inequalities in chronic disease artefactually narrowed by self-reported measures of prevalence in low-income and middle-income countries? Findings from the WHO-SAGE survey. J Epidemiol Community Health. 2015;69(3):218-25.
194. Moradi G, Mohammad K, Majdzadeh R, Ardakani HM, Naieni KH. Socioeconomic inequality of non-communicable risk factors among people living in Kurdistan Province, Islamic Republic of Iran. International journal of preventive medicine. 2013;4(6):671.
195. De Silva AP, De Silva SHP, Haniffa R, Liyanage IK, Jayasinghe S, Katulanda P, et al. Inequalities in the prevalence of diabetes mellitus and its risk factors in Sri Lanka: a lower middle income country. International journal for equity in health. 2018;17(1):45.
196. Hosseinpoor AR, Bergen N, Mendis S, Harper S, Verdes E, Kunst A, et al. Socioeconomic inequality in the prevalence of noncommunicable diseases in low-and middle-income countries: results from the World Health Survey. BMC Public Health. 2012;12(1):474.
197. Biswas T, Islam MS, Linton N, Rawal LB. Socio-economic inequality of chronic non-communicable diseases in Bangladesh. PLoS One. 2016;11(11).
198. Moradi G, Majdzadeh R, Mohammad K, Malekafzali H, Jafari S, Holakouie-Naieni K. Is the status of diabetes socioeconomic inequality changing in Kurdistan province, west of

Iran? A comparison of two surveys. Medical journal of the Islamic Republic of Iran. 2016;30:375.
199. Espelt A, Borrell C, Roskam A-J, Rodriguez-Sanz M, Stirbu I, Dalmau-Bueno A, et al. Socioeconomic inequalities in diabetes mellitus across Europe at the beginning of the 21st century. Diabetologia. 2008;51(11):1971.
200. Avendano M, Kunst AE, van Lenthe F, Bos V, Costa G, Valkonen T, et al. Trends in socioeconomic disparities in stroke mortality in six European countries between 1981–1985 and 1991–1995. American journal of epidemiology. 2005;161(1):52-61.
201. Dalstra JA, Kunst AE, Borrell C, Breeze E, Cambois E, Costa G, et al. Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries. International journal of epidemiology. 2005;34(2):316-26.
202. Larranaga I, Arteagoitia J, Rodriguez J, Gonzalez F, Esnaola S, Pinies J, et al. Socio-economic inequalities in the prevalence of Type 2 diabetes, cardiovascular risk factors and chronic diabetic complications in the Basque Country, Spain. Diabetic Medicine. 2005;22(8):1047-53.
203. Borrell C, Azlor E, Rodriguez-Sanz M, Puigpinos R, Cano-Serral G, Pasarin M, et al. Trends in socioeconomic mortality inequalities in a southern European urban setting at the turn of the 21st century. Journal of Epidemiology & Community Health. 2008;62(3):258-66.
204. Imkampe AK, Gulliford MC. Increasing socio-economic inequality in type 2 diabetes prevalence—repeated cross-sectional surveys in England 1994–2006. The European Journal of Public Health. 2011;21(4):484-90.
205. Mosquera PA, San Sebastian M, Ivarsson A, Gustafsson PE. Decomposition of gendered income-related inequalities in multiple biological cardiovascular risk factors in a middle-aged population. International journal for equity in health. 2018;17(1):102.
206. Santos J, Kislaya I, Antunes L, Santos AJ, Rodrigues AP, Neto M, et al. Diabetes: socioeconomic inequalities in the Portuguese population in 2014. Acta medica portuguesa. 2017;30(7-8):561-7.
207. Sortsø C, Lauridsen J, Emneus M, Green A, Jensen PB. Social inequality in diabetes patients' morbidity patterns from diagnosis to death–A Danish register-based investigation. Scandinavian journal of public health. 2018;46(1):92-101.
208. Espelt A, Kunst AE, Palencia L, Gnavi R, Borrell C. Twenty years of socio-economic inequalities in type 2 diabetes mellitus prevalence in Spain, 1987–2006. The European Journal of Public Health. 2012;22(6):765-71.
209. Blakely T, Tobias M, Atkinson J. Inequalities in mortality during and after restructuring of the New Zealand economy: repeated cohort studies. Bmj. 2008;336(7640):371-5.
210. Sortsø C, Lauridsen J, Emneus M, Green A, Jensen PB. Socioeconomic inequality of diabetes patients' health care utilization in Denmark. Health Econ Rev. 2017;7(1):21.
211. Espelt A, Borrell C, Palència L, Goday A, Spadea T, Gnavi R, et al. Socioeconomic inequalities in the incidence and prevalence of type 2 diabetes mellitus in Europe. Gaceta Sanitaria. 2013;27(6):494-501.
212. Franse LV, Di Bari M, Shorr RI, Resnick HE, Van Eijk JT, Bauer DC, et al. Type 2 Diabetes in older well-functioning people: Who is undiagnosed?: data from the Health, Aging, and Body Composition Study. Diabetes care. 2001;24(12):2065-70.
213. Rathmann W, Haastert B, Icks A, Löwel H, Meisinger C, Holle R, et al. High prevalence of undiagnosed diabetes mellitus in Southern Germany: target populations for efficient screening. The KORA survey 2000. Diabetologia. 2003;46(2):182-9.
214. Carrin G, Mathauer I, Xu K, Evans DB. Universal coverage of health services: tailoring its implementation. Bulletin of the World Health Organization. 2008;86:857-63.
215. Gakidou E, Mallinger L, Abbott-Klafter J, Guerrero R, Villalpando S, Ridaura RL, et al. Management of diabetes and associated cardiovascular risk factors in seven countries: a comparison of data from national health examination surveys. Bulletin of the World Health Organization. 2011;89:172-83.
216. Filmer D, Pritchett LHJD. Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. 2001;38(1):115-32.

217. Wagstaff A, Watanabe N. What difference does the choice of SES make in health inequality measurement? Health economics. 2003;12(10):885-90.
218. Lindelow MJHe. Sometimes more equal than others: how health inequalities depend on the choice of welfare indicator. 2006;15(3):263-79.
219. Chuma J, Molyneux CJHp, planning. Estimating inequalities in ownership of insecticide treated nets: does the choice of socio-economic status measure matter? 2009;24(2):83-93.
220. Kunst AE, Geurts JJ, van den Berg J. International variation in socioeconomic inequalities in self reported health. Journal of Epidemiology & Community Health. 1995;49(2):117-23.
221. Kehoe R, Wu S-Y, Leske MC, Chylack Jr LT. Comparing self-reported and physician-reported medical history. American Journal of Epidemiology. 1994;139(8):813-8.
222. Goldman N, Lin I-F, Weinstein M, Lin Y-H. Evaluating the quality of self-reports of hypertension and diabetes. Journal of clinical epidemiology. 2003;56(2):148-54.
223. Kriegsman DM, Penninx BW, Van Eijk JTM, Boeke AJP, Deeg DJ. Self-reports and general practitioner information on the presence of chronic diseases in community dwelling elderly: a study on the accuracy of patients' self-reports and on determinants of inaccuracy. Journal of clinical epidemiology. 1996;49(12):1407-17.
224. Haapanen N, Miilunpalo S, Pasanen M, Oja P, Vuori I. Agreement between questionnaire data and medical records of chronic diseases in middle-aged and elderly Finnish men and women. American journal of epidemiology. 1997;145(8):762-9.

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Further information: robinoyando309@gmail.com

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3) This mini dissertation is my own work. I have not allowed and will not allow anyone to copy my work with the intention of passing it off as his/her own work.

Name: Robinson Oyando Omondi.

Signature:

Date: 8th February 2021.

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APPENDIX 3: Human Research Ethics Approval

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

06 July 2020

HREC REF: 186/2020

A/Prof J Ataguba
Division of Health Economics Unit, 1.08
School of Public Health & Family Medicine
Email: john.ataguba@uct.ac.za
Student: omnrob001@myuct.ac.za

Dear A/Prof Ataguba

PROJECT TITLE: INEQUITIES IN THE SCREENING AND TREATMENT OF DIABETES AND HYPERTENSION IN KENYA (Master's candidate-Mr Robinson Omondi)

Thank you for submitting your study to the the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020.

Approval is granted for one year until the 30 July 2021.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mr Robinson Omondi will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

HREC 186/2020a

APPENDIX 4: Journal Manuscript Instructions

International Journal for Equity in Health (International Journal for Equity in Health | Submission guidelines (biomedcentral.com))

Research Articles

Preparing your manuscript

The information below details the section headings that you should include in your manuscript and what information should be within each section.

Please note that your manuscript must include a 'Declarations' section including all of the subheadings (please see below for more information).

Title page

The title page should:

- present a title that includes, if appropriate, the study design e.g.:
    - "A versus B in the treatment of C: a randomized controlled trial", "X is a risk factor for Y: a case control study", "What is the impact of factor X on subject Y: A systematic review"
    - or for non-clinical or non-research studies a description of what the article reports
- list the full names and institutional addresses for all authors
    - if a collaboration group should be listed as an author, please list the Group name as an author. If you would like the names of the individual members of the Group to be searchable through their individual PubMed records, please include this information in the "Acknowledgements" section in accordance with the instructions below
- indicate the corresponding author

Abstract

The Abstract should not exceed 350 words. Please minimize the use of abbreviations and do not cite references in the abstract. Reports of randomized controlled trials should follow the CONSORT extension for abstracts. The abstract must include the following separate sections:

- **Background:** the context and purpose of the study
- **Methods:** how the study was performed, and statistical tests used
- **Results:** the main findings
- **Conclusions:** brief summary and potential implications

- **Trial registration:** If your article reports the results of a healthcare intervention on human participants, it must be registered in an appropriate registry and the registration number and date of registration should be in stated in this section. If it was not registered prospectively (before enrolment of the first participant), you should include the words 'retrospectively registered'. See our editorial policies for more information on trial registration

Keywords

Three to ten keywords representing the main content of the article.

Background

The Background section should explain the background to the study, its aims, a summary of the existing literature and why this study was necessary or its contribution to the field.

Methods

The methods section should include:

- the aim, design and setting of the study
- the characteristics of participants or description of materials
- a clear description of all processes, interventions and comparisons. Generic drug names should generally be used. When proprietary brands are used in research, include the brand names in parentheses
- the type of statistical analysis used, including a power calculation if appropriate

Results

This should include the findings of the study including, if appropriate, results of statistical analysis which must be included either in the text or as tables and figures.

Discussion

This section should discuss the implications of the findings in context of existing research and highlight limitations of the study.

Conclusions

This should state clearly the main conclusions and provide an explanation of the importance and relevance of the study reported.

List of abbreviations

If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

Declarations

All manuscripts must contain the following sections under the heading 'Declarations':

- Ethics approval and consent to participate
- Consent for publication
- Availability of data and materials
- Competing interests
- Funding
- Authors' contributions
- Acknowledgements
- Authors' information (optional)

Please see below for details on the information to be included in these sections.

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Ethics approval and consent to participate

Manuscripts reporting studies involving human participants, human data or human tissue must:

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Availability of data and materials

All manuscripts must include an ‘Availability of data and materials’ statement. Data availability statements should include information on where data supporting the results reported in the article can be found including, where applicable, hyperlinks to publicly archived datasets analysed or generated during the study. By data we mean the minimal dataset that would be necessary to interpret, replicate and build upon the findings reported in the article. We recognise it is not always possible to share research data publicly, for instance when individual privacy could be compromised, and in such instances data availability should still be stated in the manuscript along with any conditions for access.

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- The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
- All data generated or analysed during this study are included in this published article [and its supplementary information files].
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Supplementary material/private homepage

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