Cardiovascular disease prevention in the slums of Kenya

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CHAPTER 1

General introduction
CARDIOVASCULAR DISEASE: GLOBALLY, IN LOW AND MIDDLE INCOME COUNTRIES, AND IN AFRICA

Cardiovascular diseases (CVD) are the leading cause of death worldwide. In 1990 more than 25% of all global death was attributed to CVD, and this has grown in the last decades to more than 30% in 2013 [1]. It is estimated that in 2030 more than 23 million people will die on a yearly basis due to CVD, which includes ischemic heart disease, stroke, hypertensive heart disease, cardiomyopathy, rheumatic heart disease, aortic aneurysms, atrial fibrillation, congenital heart disease, endocarditis, and peripheral artery disease, among others [2].

There are several risk factors identified for developing CVD which includes: high blood pressure, diabetes, obesity, smoking, insufficient physical exercise and unhealthy diet. The burden of most CVD risk factors has increased significantly on a global scale in the last few decades [3]. For example the burden of high blood pressure, otherwise known as hypertension, has increased 27% in the period between 1990 and 2010, leading to close to one million casualties. The growth was even stronger for other risk factors like diabetes or high glucose levels being 58%, and overweight or obesity even reaching 82% [3].

Until recently, CVD was mainly associated with more affluent regions of the world. However, more than 80% of the overall burden of CVD is situated in low and middle-income countries (LMICs) [4, 5]. Mortality of CVD is decreasing in high income countries, like for example Denmark, Israel, Norway, UK and South Korea where death due to ischaemic heart disease reduced by more than 65%. However CVD is rising in almost every LMIC, where health resources are scarce and stretched by a high burden of infectious diseases such as HIV, malaria and tuberculosis [4].

Traditionally in Africa, communicable diseases and maternal, perinatal and nutritional conditions accounted for the greatest burden of morbidity and mortality [6]. This burden is fast shifting towards non-communicable diseases (NCDs), particularly CVDs. This phenomenon is what is being termed as a “double burden
of disease”[7]. Between 1990 and 2013 the mortality burden of CVD in SSA has increased 81% [8]. While in other continents ischaemic heart disease is the main contributor to CVD deaths, stroke is causing most deaths in SSA. This is mainly due to hypertension and its related complications [9, 10], of which the population in SSA is more at risk partly due to their (epi) genetic background [11].

Whereas high blood pressure was estimated to be almost non-existent in African societies in the first half of the twentieth century [12], studies now show that in some settings in Africa close to 40 percent of adults have hypertension [13]. Similar trends are seen with other cardiovascular risk factors. As the continent has always been associated with hunger and malnutrition, the percentages of adults being underweight are now heavily outnumbered by Africans with overweight or obesity [14]. In some settings this has even led to populations where the majority is overweight or obese, especially among women [15]. Diabetes shows an identical situation where prevalence rates in some regions have even reached 12%, and the total amount of people with diabetes on the continent is expected to increase from 12.1 million in 2010, towards 23.9 million in 2030 [16].

**EPIDEMIOLOGICAL TRANSITION**

Health and disease patterns change over time in societies depending on the population structure and the rate of economic development, to result in the so-called epidemiological transition [17]. As societies develop, although communicable diseases such as tuberculosis prevail, NCDs become more prevalent. This is a result of changes in environmental and behavioral determinants such as increasing tobacco use, increasing fat and calorie consumption, and decreasing physical activity and longer periods of exposure to these determinants because of longer life expectancy. Whereas European and North American populations experienced similar changes in demography, determinants, and disease rates over the
course of a century, African populations are passing through sim-
lar transitions in just a few decades [18].

While the rates of morbidity and mortality vary considerably
across the African continent, at least one clear pattern is emerging
that holds across most of Africa: a steady rise in NCDs, and more
specifically CVD, in the presence of significant, long-standing in-
fecious disease prevalence. The epidemiological transition is re-
lated as well to the urbanization with acculturation and modern-
ization of lifestyle and therefore increasing CVD risk factors like
hypertension as observed in Kenyan studies [19].

**URBANIZATION IN AFRICA**

In 2007 it was the first time that the majority of the global popu-
lation was living in cities. This trend of urbanization will contin-
ue in the nearby future as 95% of the projected increase of 1.9 bil-
lion in the world population by 2025, will be living in cities [20].
Urbanization is happening on a global scale, with Africa having
the highest rate of all continents [21]. The African urban popula-
tion is expected to triple from 395 million in 2009 to 1.23 billion
in 2050. Some African capitals like Nairobi, Kampala and Niamey
will grow around 50% in the current decade, with exceptions like
Ouagadougou’s projected 81% increase from 1.9 million in 2010
to 3.4 million in 2020 [21].

Globally the amount of people living in slums is estimated to be
close to one billion [22], with a relatively high contribution from
the African continent where currently between 60-70% of the ur-
ban population is living in slums [23]. The proportion of slum
dwellers on the continent might even get higher than the current-
ly estimated as the slum growth rate is higher than the overall ur-
ban rate [21]. The living conditions in poor urban settlements have
a major impact on health and health care [24]. Besides changes in
diet and physical activity there are also the psychosocial constraints
of violence, insecurity and stress which leads to an increased risk
of cardiovascular disease [25, 26]. The levels of risk factors like hy-
Pertension are higher in urban than in rural settings on the African continent [27, 28] mainly because of earlier mentioned contextual and behavioral factors associated with urban environments. However, there is not much research on the health problems and cardiovascular risk in the slum settings [29]. As Africa becomes more urbanized, likewise the burden of CVD will increase, and the need for effective interventions.

**PREVENTION AND INTERVENTION PROGRAMS**

For a long time, the priority in most African health care systems has been the prevention and control of communicable diseases. With the earlier mentioned shift in disease burden, the attention has begun to shift to the control and prevention of NCDs like CVD. Within the context of limited resources due to double burden of disease, the greatest gains in controlling the CVD epidemic lie in its prevention, or at least early detection and adequate control of relevant risk factors. For most countries in the region the major obstacle to the control and management of CVD and related risk factors is the absence of appropriate services at the primary health care levels of the health service delivery system. One of the solutions might be placed in the community based approach and its community health workers (CHWs) who are well represented on the continent and are showing some encouraging results already [30].

The Institute of Medicine Report on cardiovascular health in the developing world stresses the need for evidence and best practices for cost-effective and sustainable community based strategies for prevention and control of cardiovascular risk factors [31]. Although several documents have been published on recommendations and advice for cardiovascular prevention in LMICs ([32, 33]), they have often lacked practical real-life application, specifically for the growing slum settings in Africa. Therefore, it is essential to develop, implement, and evaluate effective strategies for prevention of CVD for the urban poor on the continent. We hoped to
address this knowledge gap with our SCALE UP Study (Sustainable model for Cardiovascular health by Adjusting Lifestyle and treatment with Economic perspective in settings of Urban Poverty). This is a collaborative study of the Amsterdam Institute for Global Health and Development (AIGHD) and the African Population and Health Research Center (APHRC).

RESEARCH SETTING AND STUDY POPULATION

The SCALE UP study took place in two slum communities in Nairobi, the capital of Kenya. Both slums, Korogocho and Viwandani are located on the eastern side of town. Korogocho is situated more in the north-eastern part of Nairobi with a distance of 12 kilometers of the city center, whereas Viwandani is in the south-eastern region of town with a distance of 7 kilometers from the city center.

Korogocho covers an area of less than 1 square kilometer but has a population of around 35,000 inhabitants which makes it one of the most densely populated slums in Nairobi. Korogocho has a stable population and majority of its residents have lived in the area for many years. Viwandani is slightly smaller than Korogocho with approximately 30,000 residents of whom most of them are young and highly mobile, working or seeking jobs within the nearby industrial area.

As most other slums in Nairobi, the two communities are characterized by lack of social amenities, relatively high crime rates, high unemployment rates and extreme poverty. Most inhabitants in Korogocho and Viwandani are dependent on private health care facilities, which are unregulated and often run by unqualified personnel, as public health facilities are rare [34]. Access to private health facilities in turn increases patient’s out of pocket expenditures since 90% of the slum population do not have health insurance cover [35].

Both communities are situated within the Nairobi Urban Health and Demographic Surveillance System (NUHDSS), which
was founded by the APHRC almost fifteen years ago. It was set up as the first urban-based longitudinal health and demographic surveillance platform in Africa [36]. The NUHDSS was set up to provide a platform to investigate the inter-linkages between urban poverty and health, monitor and evaluation of intervention programs implemented within the study communities and provide a sampling frame for nested studies.

RESEARCH OBJECTIVES

The aim of this thesis was to study the burden of cardiovascular risk factors in the urban slums, and the development and implementation of an intervention for prevention of CVD.

The research objectives of the thesis were:
- To assess the burden of cardiovascular risk factors like hypertension, diabetes, obesity among others in the urban slums of Nairobi
- To define and design a sustainable and cost-effective community-based intervention for prevention of CVD in the urban slums
- To implement and evaluate the newly designed CVD intervention in the urban slums

OUTLINE OF THE THESIS

The thesis comprises three parts that include a background of studies on the burden of CVD risk factors (Part I), the development of the intervention (Part II) and the implementation and evaluation of the intervention (Part III).

Part I Background
The first part of the thesis describes the burden of CVD risk factors on the African continent and more specifically the urban slums of Nairobi, in four chapters. We start in Chapter 2 with an
overview of the definition, prevalence and management of hypertension and other related risk factors like diabetes, obesity among others in Africa. In Chapter 3 we focus on the slums of Nairobi and assess the prevalence, awareness, treatment and control of hypertension among the population. Subsequently in Chapter 4 we study the prevalence of diabetes and its association with obesity in the same settings. In Chapter 5 we assess the situation of overweight and obesity and its relationship with the perception of body image in the slums of Nairobi.

Part II Intervention
The second part focuses on the development of a sustainable and cost-effective CVD intervention in urban slums. In Chapter 6 we review a variety of community-based interventions for prevention of CVD in LMICs. Chapter 7 describes the development of our multi-component community-based intervention through the integration of a public health and private-sector approach. In Chapter 8 we describe the study protocol of our study in which we aim to evaluate the impact of our intervention. Part III Implementation and evaluation

The third part expands on the implementation and evaluation of the intervention for prevention of CVD in the urban slums. In Chapter 9 we discuss the challenges with health programs in urban slums, with some specific examples from our intervention. In Chapter 10 we present the outcomes of the process evaluation including the costs of the CVD intervention. We report in Chapter 11 the outcomes of our impact evaluation of the intervention on hypertension and other CVD risk factors among slum dwellers. We demonstrate in Chapter 12 how our intervention designed for the urban slums in Nairobi might of use for migrants in Amsterdam.

Finally, Chapter 13 is a summary and general discussion of the main research findings of this thesis, followed by concluding remarks.
REFERENCES