Cardiovascular health in urban Suriname

The Healthy Life in Suriname (HEGISUR) study

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CHAPTER 1
General introduction and outline of the thesis
INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death worldwide.\(^1\) Annually, 17.7 million people die from CVD, which is equal to the entire population of the Netherlands.\(^1,2\) However, the vast majority (>80%) of all CVD-related deaths occurs in low- and middle-income countries (LMIC)\(^3\), and, in contrast to the declining trend seen in high-income countries (HIC), the burden of CVD in LMIC continues to rise.\(^4,5\) In order to combat this epidemic, large-scale preventive measures need to be taken. Unfortunately, in many LMIC, the lack of data hampers the design and implementation of effective prevention strategies. Both the United Nations General Assembly as well as the World Heart Federation therefore recognized the importance of collecting reliable region-specific data on risk factors for cardiovascular disease.\(^6,7\) The work presented in this thesis is a response to these calls.

Well-established differences in cardiovascular risk and CVD exist between ethnic groups. People of Asian ancestry are disproportionately affected by coronary heart disease, whereas Africans have an increased risk of hypertension-related organ damage, such as left ventricular hypertrophy and stroke.\(^8,9,10\) The reasons behind these ethnic differences in CVD are complex and remain incompletely elucidated. In addition, most studies on ethnic differences in CVD are conducted in high-income countries in (descendants of) migrants from African, Asian, and Caribbean countries. They may not be applicable for LMIC where socioeconomic and environmental conditions as well as health care systems and policies are different.\(^11\)

Suriname is a middle-income country in South-America with a multi-ethnic population of mainly African and Asian ancestry. Despite large similarities in socioeconomic status between the ethnic groups, substantial ethnic differences exist in cardiovascular mortality.\(^12\) Differences in underlying cardiovascular risk factors and asymptomatic organ damage might explain these ethnic disparities in CVD mortality. Yet, data on cardiovascular risk factors and asymptomatic organ damage were virtually absent at the start of our research.

The main aim of this thesis is to expand the evidence on cardiovascular health and related risk factors in urban Suriname, with a primary focus on ethnicity. Ethnicity is a multi-faceted concept that includes the different dimensions that defines a person’s identity. More specifically, members of an ethnic group have a shared history, ancestry, and identity, and share characteristics such as a geographical affiliation, culture and traditions, language, and religion.\(^13\) This is in contrast to ‘race’, which merely refers to common hereditary physical features, such as skin, hair and eye colour.\(^14\) Ethnic variations in
cardiovascular risk may therefore relate to underlying differences in biology, behaviour, or the exposure to environmental factors. Therefore, collecting data on ethnicity might be important to monitor and understand differences in outcomes for different population groups. There are different ways to classify people into ethnic groups, for example, by self-reported ethnicity, observer-selected ethnicity, country of birth, nationality or surname.\textsuperscript{15} Self-report, which reflects how individuals view themselves, is the generally agreed-upon best way to define a person’s ethnic identity.\textsuperscript{16,17} In addition, self-report respects “individual dignity” by allowing an individual to decide how he or she classifies himself or herself as opposed to classification being assigned by another person.\textsuperscript{18} Therefore, in this thesis, self-reported ethnicity of the participant was used.

This introductory chapter is composed of two parts. In the first part, the study area and the study aims are outlined. The second part describes the overall cardiovascular risk profile and ethnic differences in cardiovascular health, with a focus on hypertension, obesity, and increased pulse wave velocity as a manifestation of early asymptomatic organ damage. In the third part, a comparison with Surinamese living in the Netherlands is made to gain insight into how to reduce the hypertension burden in urban Suriname. This chapter ends with a general outline of the thesis.

\textbf{PART I | PROTOCOL AND FEASIBILITY}

\textbf{Suriname}

The Republic of Suriname is situated in the north-eastern part of South-America, and borders north to the Atlantic Ocean, south to Brazil, east to French Guyana, and west to Guyana. Ninety percent of the country is covered by tropical rainforest.\textsuperscript{19} The population consists of roughly 570,000 people, with almost half of its citizens residing in Paramaribo, the capital of Suriname.\textsuperscript{20,21} With a gross national income per capita of $6,990 US dollars in 2016, Suriname is classified as a middle-income country.\textsuperscript{20} However, since 2015, Suriname is in steep recession with inflation rates rising from 3.4\% in 2014 to almost 60\% by year-end 2016.\textsuperscript{22}

The present demographic composition of Suriname is among the most varied in the world, as a result of historical migrations of people from different geographic areas. From the 17\textsuperscript{th} to 19\textsuperscript{th} century, enslaved people from predominantly West-Africa were brought to Suriname to work on coffee and sugar plantations. The working and living conditions were harsh and a large group of enslaved men and women fled the plantations and created new settlements in the rain forest. They continued to live in the interior and are now referred to as Maroons. Only recently Maroons are migrating to the urban areas for
work and educational opportunities. The descendants of African enslaved people who remained in the capital are referred to as the Creole. After the abolishment of slavery in 1863, people from India and the island of Java migrated to Suriname as indentured labourers. Nowadays, the population of Suriname is among the most varied in the world, with the capital being populated by 26% Creole, 23% South-Asians, 16% Maroons, and 10% Indonesians. The remaining 26% are mostly people of mixed ancestry, Chinese or Amerindians, the original inhabitants of Suriname.

As a consequence of the independence of Suriname in 1975 and military rule in the 1980s, about half of the Surinamese population migrated to the Netherlands. The Surinamese are one of the largest groups with a migration background in the Netherlands.

**Cardiovascular health in Suriname**

As most other LMIC, Suriname is going through an epidemiologic transition, from predominantly infectious diseases to predominantly non-communicable diseases. Nowadays, CVD are the leading cause of mortality among the Surinamese population, accounting for 27% of all deaths. The underlying factors for this transition are indicative of economic development and led to the adoption of a different, more westernized lifestyle, particularly in urban areas. Such lifestyle is perceived to be more desirable and modern and marked by an increase in the consumption of processed foods high in fat, salt, and sugar, a decrease in physical activity with sedentary lifestyles, increased tobacco smoking and harmful use of alcoholic beverages. These are in turn strongly linked to the development of cardiovascular risk factors, such as hypertension, diabetes mellitus type 2, dyslipidaemia, and obesity.

To combat the high cardiovascular mortality in Suriname, it is imperative to develop an extensive evidence base, consisting of multiple large-scale studies. Therefore, we designed the Healthy Life in Suriname (HElisur) study, an observational cross-sectional study on cardiovascular health among different ethnic groups in the capital of Suriname. The primary aim of the study was to assess the cardiovascular risk profile of the urban population of Suriname. As a secondary outcome, ethnic differences in cardiovascular risk were assessed. Figure 1 illustrates the natural history of CVD, together with the cardiovascular health data collected within the HELISUR study.

In the first part of this thesis, the protocol of the HELISUR study is illustrated, including the study aims, (Chapter 2) and the feasibility of the HELISUR study is tested (Chapter 3).
CHAPTER 1

PART II | ETHNIC DIFFERENCES IN CARDIOVASCULAR HEALTH

Marked ethnic differences exist in CVD mortality. People of Asian ancestry have a two-fold increased CHD risk compared to people of European ancestry. On the other hand, people of African ancestry enjoy significant protection of CHD, but have substantial higher stroke mortality rates. Reasons behind these ethnic differences in mortality are multifactorial and have not been fully explained yet.28,29,30

Overall and ethnic-specific cardiovascular risk profile

In Suriname, substantial ethnic differences exist in cardiovascular mortality as well. For example, 37% of deaths in South-Asians were due to CVD, whereas this was only 10% in Maroons.12 Differences in cardiovascular risk factors may in part be responsible for the difference in CVD mortality. These risk factors are modifiable and can be controlled.
or their effect may be reduced by making long-term lifestyle changes. However, little is known regarding the cardiovascular risk profile, including asymptomatic organ damage, of urban Surinamese. In Chapter 4, the epidemiology of cardiovascular risk factors, asymptomatic organ damage, and established CVD in the urban population of Suriname is described, and ethnic differences in cardiovascular health status are assessed.

**Obesity**

Obesity is an important risk factor for CVD, promoting atherosclerosis. Once considered a problem only in HIC, obesity is now dramatically on the rise in LMIC, particularly in urban settings, as urban living is usually associated with a lower energy expenditure and a higher intake of energy-dense foods compared to rural life. There are different ways to measure obesity. Most frequently used is the body mass index (BMI), computed as height/weight\(^2\), and waist measures, such as waist circumference, waist-hip ratio, and waist-to-height ratio. Waist measures capture the distribution of fat rather than the overall amount of adipose tissue in the body (of which BMI is a proxy). In addition to measuring the fat distribution, one can also distinguish between fat mass and fat-free mass.

Previous studies showed that the fat distribution and body composition differs across ethnic groups. For example, at the same level of BMI, Asian populations have more total body fat and more abdominal fat, whereas African populations showed higher fat-free mass and body fat compared to Caucasians. As a consequence, lower cut-off values for BMI, waist circumference and waist-hip ratio were formulated that correspond to an increased risk for CVD.

It is vital to accurately identify people at high CVD risk. A recent study in Suriname showed that waist circumference had more discriminatory power than BMI in the relation with hypertension, diabetes, and an adverse cardiometabolic risk profile. However, it remains unclear if more complex body composition measures such as fat mass or low fat-free mass together with a high fat mass (i.e. sarcopenic obesity) are superior to the simple anthropometric measures, such as BMI and waist measures. Therefore, in Chapter 5, we examined whether body composition measures are superior to the simple anthropometric measures in the association with CVD risk.

Physical activity is a key element in the management of obesity. International guidelines recommend that adults should do at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity throughout the week. However, uncertainties remain regarding the importance of the individual physical activity characteristics, i.e. domain, duration or intensity that determines optimal weight control. In
addition, although these recommendations apply to the population at large, irrespec-
tive of sex or ethnicity, these recommendations are based on studies conducted in
predominantly Caucasian populations living in HIC. Yet, several small studies showed
that the response to physical activity interventions might be different across ethnic
groups. Furthermore, evidence suggests that different exercise recommendations
are required when different risk factors are targeted. Given that the prevalence of
cardiovascular risk factors differs among ethnic groups further supports the potential
need for ethnic-specific physical activity recommendations. In Chapter 6, the associa-
tion between obesity and physical activity characteristics (i.e. domain, duration, and
intensity) is explored within an Asian and African ancestry population.

**Pulse wave velocity**
Evidence suggests that differences between ethnic groups are not fully explained by
traditional cardiovascular risk factors. One way to address the issue of ethnic
variability in CVD risk is to shift the focus from risk assessment to diagnosing early
asymptomatic organ damage, for example in blood vessels.

Increased arterial stiffness, estimated non-invasively by pulse wave velocity (PWV),
has emerged as an important predictor of cardiovascular events. It is a type of
asymptomatic organ damage, characterized by a reduced arterial compliance. Previous
studies showed that arterial stiffness progresses with age and can be accelerated
by different cardiovascular risk factors, hypertension being one of the most important.
Given that African and Asian ancestry populations bear a disproportionately high card-
iovacular risk factor burden, the association between PWV and cardiovascular risk
factors may differ within these ethnic groups. Furthermore, there are conflicting results
regarding ethnic differences in PWV after adjustment for cardiovascular risk factors.
Therefore, in Chapter 7, we studied differences in PWV between African and Asian-
Surinamese, taking traditional cardiovascular risk factors into account.

**PART III | A COMPARISON WITH SURINAMESE IN THE NETHERLANDS**

Hypertension is the main preventable cause of CVD mortality worldwide. With many
effective and inexpensive treatments available, hypertension control and prevention
of subsequent hypertension-related diseases should be achievable. Nevertheless, hy-
pertension continues to rise in LMIC with little improvement in the levels of awareness,
treatment, and control. In contrast to LMIC, the prevalence of hypertension slightly
decreased and the level of hypertension control substantially increased in HIC. This
indicates there is still considerable room for improvement for LMIC. A comparison with
a HIC, especially within populations with similar ethnicity, may give insight on where that “room” is, thereby providing a scientific basis for the development of public health interventions.

The unprecedented mass migration of Surinamese to the Netherlands offers a unique opportunity to study differences in the prevalence, awareness, treatment, and control of hypertension between LMIC and HIC. Therefore, in Chapter 8, we compare hypertension prevalence, awareness, treatment and control between Surinamese living in Suriname and first and second generation Surinamese migrants living in the Netherlands. Differences in the underlying determinants of hypertension between the two countries were explored as a secondary aim.

The HELISUR vs HELIUS study
The HELISUR study was based on the Health Life in an Urban Setting (HELIUS) study, using similar methodology. The HELIUS study is conducted in Amsterdam, the Netherlands among six ethnic groups, including among individuals with a Surinamese background. Surinamese living in the Netherlands were identified based on their country of birth. A person was identified as Surinamese if he or she fulfills one of two criteria: he or she was born in Suriname and has at least one parent who was born in Suriname (first generation); or he or she was born in the Netherlands and both parents were born in Suriname (second generation). Persons aged 18 to 70 years were randomly sampled from the municipality registry of Amsterdam. The registry contains data on the country of birth of the subject and his/her parents, which made stratification by ethnicity possible. In this paper, further classification into ethnic subgroup (i.e. African or South-Asian) was based on self-reported ethnicity. However, a person who reported to be of mixed/other origin which included an African ancestry term (e.g. Creole, Maroon, or African) was classified as African, whereas in other chapters presented in this thesis such a person would be classified as mixed/other.

OUTLINE OF THE THESIS

The first part of this thesis focuses on the HELISUR study protocol (Chapter 2) and the feasibility of the HELISUR study (Chapter 3).

The focus in the second part of the thesis is on ethnic differences in cardiovascular health. Chapter 4 presents the epidemiology of cardiovascular risk factors, asymptomatic organ damage, and established CVD in the HELISUR study population. It also highlights ethnic differences in the cardiovascular risk profile of urban Surinamese.
Chapter 5 deals with ethnic differences in body composition and the association with cardiovascular risk. Chapter 6 aimed to describe ethnic differences in physical activity and its relation with obesity. In Chapter 7, ethnic differences in pulse wave velocity are studied, taking traditional cardiovascular risk factors into account.

In the third part of this thesis, a comparison with Surinamese living in the Netherlands is made to gain insight into how to reduce the hypertension burden in urban Suriname. In Chapter 8, we compared hypertension prevalence, awareness, treatment, and control in Surinamese from Suriname (HELISUR) with migrated Surinamese living in the Netherlands (HELIUS), and compared the underlying determinants of hypertension in both populations.

The general discussion of the main findings is presented in Chapter 9, which also highlights the implications for practice and future research.
REFERENCES


