DISPARITIES IN HYPERTENSION IN COLOMBIA: A MIXED-METHOD STUDY

by

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To my mother Sila Maria
To Ximena, a great woman, wife, and friend
To my grandmothers Angela and Lili and my grandfather Luis Felipe

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LIST OF ABBREVIATIONS

BMI   Body mass index

CVD   Cardiovascular disease

CHD   Coronary heart disease

DBP   Diastolic blood pressure

CNSH   Colombian National Survey of Health

HICs   High-income countries

GDP   Gross domestic product

HT   Hypertension

ICC   Intraclass correlation coefficient

LMICs   Low- and middle-income countries

IUBN   Index of unsatisfied/unmet basic needs

PHT   Prehypertension

SEP   Socioeconomic position

SBP   Systolic blood pressure

US   United States

ABSTRACT

Cardiovascular disease is the leading cause of death in Colombia. However, in Colombia both the prevalence and social distribution of hypertension, the main risk factor for cardiovascular disease, have been understudied. Likewise, although macroeconomic factors have been highlighted to explain the growing burden of hypertension in poorer countries, the contribution of these factors remains poorly explained and measured. Finally, although Colombian municipalities play an important role in addressing living conditions that may influence the risk and disparities in hypertension, no previous studies have aimed to understand how social and political actors include living conditions in how they frame hypertension. The frames of these actors are likely to structure the decisions they make or implement with regard to prevention of and disparities in hypertension.

This dissertation encompasses a mixed-methods study aimed at filling these research gaps. Chapter 1 describes the state of research on hypertension disparities in Latin American and proposes a broad conceptual model that guides this dissertation. Results of Chapter 2 suggest that education, markers of material resources, ethnicity/race and sex/gender are important in terms of shaping the social patterning of hypertension in the Colombian adult population. Chapter 3 examines the association between macroeconomic factors and hypertension and suggests that those adults who live in departments that for more than a decade have had high levels of income inequality are more likely to have hypertension than those living in less economically unequal departments. Chapter 4 describes a single-case study in which social and political actors identified that unemployment, unplanned urban space, and forced displacement, in combination

with processes of stratification and marginalization, shape living conditions of residents of Quibdó and influence the development of and disparities in hypertension in this municipality. Chapter 5 proposes comprehensive recommendations for preventing and eliminating hypertension disparities.

This dissertation provides evidence that the social patterning of hypertension in Colombia is linked to indicators of social position and income inequalities at the departmental level. These patterns and the role of living conditions are recognized by social actors, and inform both clinical and policy initiatives necessary to reduce hypertension risk and disparities in Colombia.

Chapter 1:

Introduction

Public Health Relevance of Hypertension

Worldwide, hypertension (HT) is the main risk factor for cardiovascular disease (CVD), with approximately 7.6 million premature deaths each year attributed to this condition (13.5% of global mortality) (1). Globally, strokes and coronary heart disease (CHD) are the most common manifestations of CVD and the largest contributors to all-cause global mortality in the world (2), with about 54% of strokes and 47% of CHD attributable to suboptimal blood pressure (systolic blood pressure (SPB) >115 mmHg) (3). Thus, the reduction of high blood pressure at the population level would have an important impact on CVD. For instance, it has been estimated that a decrease of 5 mm/Hg in the population distribution of diastolic blood pressure (DBP) may decrease the rate of stroke and CHD by 34% and 21%, respectively (4). HT is also an important cause of blindness and heart and renal failure.

The majority of CVD occurs in low- and middle-income countries (LMICs) (3), where 66% (639 million) of the 972 million of the adult population lives who are estimated to have HT (5). In these countries the proportion of the burden of HT among the younger age groups is greater than in high-income countries (HICs) (3). Similar to other LMICs, HT is a growing public health problem in Latin America. Over the past decade, the overall prevalence of HT in Latin American countries has ranged from 20% to 45% (6). In Latin America as a whole, the overall prevalence has been estimated to be 40.7% in men and 34.8% in women. This prevalence is similar to that estimated for market and former socialist economies, and it is higher than the

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prevalence in the world's other regions (5, 7). The increased prevalence is happening as a result of the increase in the levels of physical inactivity; the adoption of unhealthy food and beverages (e.g. processed foods and carbonated sugar beverages); growing prevalence of obesity associated with globalization, rapid urbanization, changes in storage and channels of distribution (e.g. economies of scale); and poor regulation of marketing and advertising in Latin American countries (6, 8, 9), as well as the aging of the population in this region (6). By 2025 the overall prevalence of HT in Latin America is expected to increase by 44.5% in men and 40.2% in women (5, 6); which would lead to a substantial increase in CVD mortality (10). Additionally HT has a negative economic impact on healthcare systems in Latin American countries. For instance, although the annual treatment of an individual case of HT could be $3000 USD less expensive in Latin America than in the US ($1117 USD and $4135, respectively) (11-13), in some Latin American countries the total treatment of HT can reach up to 2% of the national gross domestic product (GDP) and 5-8% of the country's health budget (11, 14).

PHT is recognized as a major predictor to incident HT and CVD (15, 16). Despite controversies about the use of clinical measures to lower blood pressure among pre-hypertensive individuals, population-based approaches for tackling behavioral risk factors and reducing blood pressure may make a contribution in decreasing the onset of HT and CVD. However, more evidence is needed of the effectiveness of a comprehensive public health approach for the prevention and management of PHT (15). Few studies have estimated the prevalence of PHT in Latin America. The prevalence of PHT in a regional study in Peru was estimated to be 30% (17), while in a Southern city of Brazil it was 36% (18). Similar findings have been reported in the Caribbean (19).

In Colombia, CVD is the leading cause of mortality (133 per 100,000) (20, 21),

exceeding the rate of external causes of death (79.1 per 100,000) and all communicable diseases

(32.1 per 100,000) (20). Nevertheless, the overall prevalence of PHT and HT in Colombia has

not been well established. Although in 2007 the prevalence of high blood pressure in the

Colombian population aged 18-69 years old was estimated to be 23.0% (95% CI 21.8-23.8) (22),

this estimate is problematic because the study only included untreated and uncontrolled cases --

that is, individuals whose blood pressure was measured as systolic blood pressure (SBP) >=140

mmHg or DBP >=90 mmHg at the time of the study, irrespective of whether they had been

previously treated -- and omitted controlled ones. Thus, this estimation of uncontrolled high

blood pressure in the population underestimates the overall prevalence of HT in Colombia.

Furthermore, this estimate of uncontrolled HT was likely influenced by factors such as a varying

access to medical care and rate of treatment, as well as differential prevalence across geographic

areas (23, 24). Having noted this limitation, Rodríguez found that the Pacific region had the

highest prevalence of uncontrolled high blood pressure (28.0%; 95% CI 25.4-30.6), whereas the

Amazon-Orinoco region had the lowest (14.7%; 95% CI 11.4-17.9) (22). These disparities

overlap to some extent with the geographic distribution of ethnic/racial minorities (25) and

Colombia's socioeconomic characteristics (26). For instance, the Pacific region, with the highest

prevalence of uncontrolled high blood pressure, is home to the country's largest population of

blacks (44.2% versus 10.8% in Colombia as a whole), and this region includes the department[1]

with the highest proportion of both blacks (82.1%) and unmet basic needs (Chocó: 79.2%;

Colombia:28.0%) (27).

Local social and political actors such as mayors, city council members, public officials,

community leaders, and service providers are involved in the selection of policy alternatives, the

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[1] Colombian departments are comparable to US states. Each department is formed by municipalities.

allocation of public resources, and the implementation of interventions to modify living conditions in their municipal jurisdictions (28). In fact, in Colombia, municipalities play an important role in addressing living conditions that may influence the risk and disparities in HT, such as public and social services, building and maintaining infrastructure, and health care and public health services (29). Thus, understanding the frameworks that municipal social and political actors bring to their decision making processes is an essential step to implement a more comprehensive approach for reducing HT risk and disparities at the local level. However, no previous studies in Colombia have aimed to understand how social and political actors involved in the making or implementing of public policies include living conditions in how they frame HT risk and disparities.

The relevance of considering and addressing PHT and HT as pervasive public health problems and the research gaps on both conditions in Colombian scientific literature highlights the importance of estimating the overall prevalence of both problems in this country. In addition, it is necessary to examine social and economic disparities in the distribution of PHT and HT in order to select appropriate interventions and target social groups that deserve more attention. Likewise, it is necessary to extend knowledge on how HT is understood at the local level and how circumstances at this level may contribute to shape resources, risks, and vulnerabilities that may lead to HT and its unequal social distribution.

Research on HT risk and disparities in Latin American

Research on the influence of social and economic factors on HT prevalence is abundant in the United States (US) and other high income countries. Findings from this research have consistently demonstrated that disparities in HT contribute to excess morbidity and mortality for CVD in racial and ethnic minorities and people with low socioeconomic position (SEP) (30, 31).

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Yet in Latin American countries, the accumulated evidence on social disparities in HT is more limited. Although extant evidence supports the role of behaviors in the development of chronic conditions such HT, these behaviors have failed in fully explaining the social disparities in mortality (32, 33), including those due to CVD (33). Thus, it is likely that these behaviors can only partly explain disparities in HT in Latin America. When markers of social position such as SEP have been incorporated into HT studies in Latin America, researchers usually do not provide explicit mediators or test mechanisms through which these markers can influence HT disparities. For instance, although in the literature stress has been considered a strong mediator of the relationship between SEP and health (34), studies in Latin America have suggested, but not formally tested, the contribution of stress to the relationship between SEP and HT (8, 35, 36). Similarly, this research has not tested the role of health-related behaviors as mediators of this relationship. The lack of this tests could be explained by either the lack of appropriate theoretical conceptualizations, the absence of the required measures in population surveys in this region, or paucity in the use of existing analytical techniques.

What follows is a review of the evidence of the relationship between social factors and PHT and HT in Latin America. Specifically in this section, I synthetize the state of the literature regarding the magnitude of the association and mechanisms that link PHT and HT to markers of social position such as ethnicity, race, education, income, and wealth. In addition, I highlight the limited evidence in Latin America on the role in HT of contextual indicators such as income inequality, economic development, poverty, and living conditions (e.g. social and physical factors) and suggest steps to extend knowledge in this area.

Ethnic/racial patterning of HT in Latin America: Populations of African descent in the United States have higher prevalence of HT than their European descent-counterparts. In

addition, they have a higher prevalence of HT than black populations living in many countries in Africa (37, 38), but their prevalence is lower than the population of some European countries (39). In general, few studies in Latin America have examined the relationship between ethnicity/race and HT (18, 35, 38, 40-43). Although these studies show a similar relationship to that observed in the US, that is, higher prevalence of HT among blacks, the differences in the prevalence between blacks and whites tends to be lower in Latin America (35). In addition, results of the subnational studies conducted in Latin America suggest gender differences in the association of ethnicity/race with HT. For example, studies in Cuba and Brazil found that black women, but not black men, have higher odds of HT than their mixed/white counterparts (31, 32). Finally, research on ethnic/racial disparities in PHT in Latin America is almost absent. An exception is a study in Southern Brazil that found that dark skinned blacks, but not lighter ones, were more likely to have PHT than their white counterparts.

In general, methodological limitations have characterized the research into black and white disparities in HT in Latin America. For instance, studies did focus on ethnicity/race, but were confined to limited geographic areas (e.g. cities) (27, 31-35). The use of subnational samples precludes making inferences at the national level on the distribution of HT in blacks. Beyond statistical considerations for avoiding the extrapolation of local or subnational findings to the national level, extrapolations should be avoided because factors attached to the social meaning of ethnicity and race may differ between regions within a given country. Research in the US, for example, has found an important variation in the prevalence of HT among blacks living in different geographic regions (36). Even in Brazil, where most regional studies have found a higher prevalence of HT among blacks, a study in the Southern region of the country found that the prevalence and odds of HT for black and mulattos were similar to that for the

white population, but higher for Asian immigrants in comparison with whites (34). This suggests potential within-country variability in this association.

Research on PHT and HT prevalence in indigenous communities in Latin America is more limited than for blacks. In Latin American countries, the direct comparison of the prevalence of HT between indigenous people and other groups of the population is limited due to the lack of nationally representative samples incorporating all ethnic/racial minorities and the mixed/white population. Few and small sample size studies carried out in indigenous communities tend to show a lower prevalence of HT in indigenous people living in their ancestral areas in comparison with those living in urban areas (44, 45), as well as the rest of the population in the same country (44, 46, 47). To explain these findings, scholars have proposed the low amount of salt in traditional foods, higher levels of physical activity, and low levels of obesity among indigenous people residing in ancestral areas (44, 45). Yet not all estimates support these explanations. For example, studies in indigenous communities in Brazil have found a prevalence of HT of 29.5% and 37.7% (48, 49), which is similar to or higher than the prevalence reported for the Brazilian general population (50).

In sum, in Latin American countries, national estimates are lacking on the prevalence of PHT and HT among ethnic/racial minorities, and studies are needed to examine the association of ethnicity/race with these outcomes after adjusting for other markers of social position. In addition, an examination using national samples is needed of gender differences in the prevalence of and social factors associated with PHT and HT in ethnic/racial minorities.

Socioeconomic patterning of HT in Latin America: Studies that have explored the relationship between SEP and HT in Latin America and the Caribbean have yielded conflicting results, as has research conducted in other LIMCs (51). Unlike high income countries, where

there is more consistent evidence of the inverse relationship between indicators of SEP and HT (51), in Latin America and in the Caribbean there is not an evident conclusive pattern for the magnitude and direction of these effects (8, 35, 41, 52, 53). These studies yielded other significant findings. The relationship between indicators of SEP and HT is more consistent for women than for men. It was especially observed in regards to education, which has an inverse association with HT in most studies for women but not for men. Regarding gender differences in income, the results were inconsistent. For instance, one study found a J-shaped distribution in the relationship between income and HT for women (53). That is, that the wealthiest women had significantly higher HT than women in the intermediate income groups, but no significant associations were found between the highest and lowest groups. In men, no statistically significant differences between income groups were found.

Two aspects are important to note regarding these findings. First, the lack of nationally representative samples restricts inferences of these results to each country as a whole. Indeed, a study using obesity as an outcome found that the direction of its relationship with education and income varied according to the level of economic development of the area within the same country (54). This finding suggests that the use of local samples for making inferences at the national level may be problematic in the context of economically heterogeneous countries in Latin America. Second, the heterogeneity of these findings may be in part associated with methodological differences, while the limitations for understanding these results are more fundamentally linked with the lack of explicit models that conceptualize the indicators of SEP and their potential pathways (8, 35). Moreover, the comparison of the effect of SEP across countries is somewhat limited by the different distribution, meanings, and reward of each indicator. For instance, a study in Cuba found that 61.6% of women had completed more than

higher education (35), whereas a study in seven poor Mexico states found that some secondary education, the highest educational attainment reported in this study, was completed for only 14.4% of the participants (8). Despite these differences, in both studies education was a protective factor, however.

   Contextual research on HT disparities in Latin America: Research on the role of contextual factors on HT disparities in Latin American countries is still in its infancy. Consequently, there is little empirical evidence of the contribution of contextual variables such as income inequality or poverty concentration, which are both plausible mechanisms for explaining HT disparities (55) and prevailing living conditions in Latin American countries (56, 57). In LIMCs, including those in Latin America, urbanization and economic development, measured through gross domestic product per capita, are usually believed to explain changes in the individual risk factors for and prevalence of HT (10, 58). However, more empirical evidence is needed on the association of these variables with HT. An exception to the dearth of research linking contextual factors to HT in Latin America is a recent study in Brazil that found an inverse association between income at the area level and high blood pressure in adults (59).

   The limited research in Latin America focused on the role of the context on HT contrast with the growing number of studies in North America and other high-income countries that emphasize the contribution of contextual level variables on the risk of and disparities in HT. This literature suggests that social, population, and environmental factors have important effects on CVD and its main risk factors (55). For instance, research at the neighborhood level, the basic geographic unit in many municipalities, has found that beyond individual characteristics the risk of HT is higher for residents from neighborhoods characterized by low walkability, land use mix

and lack of availability of healthy food (60-62), poor or few social interactions (60, 62, 63), noise pollution (64), and socioeconomic deprivation (65, 66).

This section has pointed out several issues that should be considered in further research on HT risk and disparities in Latin America. First, studies guided by integrative conceptual models that suggest specific research questions and mechanism are critical next steps in order to make explicit connections between factors measured at different levels and HT. Following a socio-ecological approach, these conceptual models may make explicit connections between structural, fundamental, behavioral, psychosocial and biological factors involved in the development and unequal distribution of HT. Moreover, integrative models would likely facilitate research and intervention, as well as more equitable prevention treatment, and control of HT (67). Second, multiple indicators should be used in order to capture the multidimensionality and multiple implications of SEP (68-70) and the other markers of social position such as ethnicity and race (71). Third, it is necessary to incorporate reliable and informative measures. For instance, the exclusive use of income in LMICs is problematic (8). Income may vary across the year (e.g. harvest period in rural areas), members of the household may contribute sporadically, or household size may vary. In addition, despite the importance of using a multilevel approach in public health research in order to account simultaneously for the effect of factors at different levels (72), the use of this approach in studies on HT remains uncommon in Latin America.

Previous studies have paid little attention to the use of qualitative approaches for understanding the role of living conditions in the risk and disparities in HT. Yet qualitative research involving social and political actors at the local level can make a critical contribution to examine; one, which frames are used by these actors for explaining HT as a social and public

health problem; two, the extent to which living conditions are included in the decisions that these actors consider for influencing HT risk and disparities in their municipality; and, three, which participants they consider should be involved in addressing the living conditions they believe relate to HT.

This dissertation makes a unique contribution to this field in Latin America as it proposes and partially tests a broad multilevel conceptual model. More specifically, I use this model to examine the social disparities of PTH and HT in Colombian adults, as well as to conduct a multilevel analysis aimed at examining the association between economic determinants and HT. Finally, this dissertation qualitatively examines how living conditions are incorporated into the understanding of HT and the decisions social and political actors at the local level consider relevant to address living conditions, and the actors that should be involved in this endeavor.

A Multilevel Conceptual Model for Hypertension Risk and Disparities

In Figure 1.1, I propose a multilevel conceptual model built on empirical research, extant evidence on HT, and prior conceptual contributions. In particular, I draw from previous models that describe fundamental factors that contribute to health inequalities (73) and disparities in cardiovascular disease (55); explanations of the relationship between income inequality and health (74-76); the influence of living conditions on health (28); and the processes of coping with stressors (77). The proposed model seeks to expand knowledge of factors that, at different levels and through multiple pathways, lead to HT. Moreover, it is aimed at informing interventions for preventing HT and reducing, and eventually eliminating, its social disparities in Colombia. The factors included in the model are grouped into three levels of analysis and intervention: macro, meso, and micro. Below, I will describe each piece of the conceptual model; however, in this dissertation I examine one simplified part of this theoretical device.

Macro level factors

The model posits that at the macro level, health is produced and reproduced through political, economic, social and cultural institutions, legal codes, and systems of inequality and social stratification (78). This stratification determines individuals' resources, exposures, and risks (79) that lead to HT and its unequal distribution across different groups in a society. In Colombia, for example, ideologies about racial and ethnic characteristics have played a direct and key role in creating and maintaining social and economic categories and discriminatory practices that disadvantage blacks and indigenous communities (80, 81). These driving forces not only determine the access to power, status, resources and opportunities needed for preventing HT, but they also condition the type and level of exposure to stressors. What follows is a description of the three constructs located at the macro level: economic development, income inequality, and social position. The latter construct includes ethnicity/race, socioeconomic position, and gender and age as social markers.

Economic development: Economic development is understood as the production of goods and services (82) and is usually measured through the GDP. Economic development is strongly associated with the rise in HT in LMICs (10, 58); however, its contribution has been poorly explained and measured. Social and individual level factors may help explain the role of economic development in HT. At the social level, economic development is expected to reduce poverty or economic deprivation through increasing incomes (82) and to influence higher spending on health-promoting social programs and public infrastructure (83, 84). Reduction of poverty and better living conditions would reduce the risks of HT as people are less exposed to the noxious physical and psychosocial factors that prevail in the poorest urban areas of LMICs (85, 86). At the individual level, economic development is supposed to improve access to

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economic resources to spend, for example, on healthy foods and medical care (83), which are expected to translate into a lower risk for HT. However, as noted below, the distribution of economic growth is not equal in societies (82). In addition, consistent with the Theory of Fundamental Causes (73), socioeconomic groups are in different positions to translate their resources into healthy or risky behaviors. Yet the decisions these socioeconomic groups make vary according to the country's stage of economic development (51). These conditions make it difficult to establish the actual relationship between economic development and HT in a given country.

Income Inequality: Historical conditions along with political, social and economic order and ideologies are the major driving forces that lead to income inequalities (74, 78). Income inequality is a societal or contextual characteristic that refers to the unequal distribution of economic resources among the members of a society (87-89). Particularly in the US, income inequality measured at the state level and higher units of analysis has been found to be directly associated with multiple health outcomes such as self-reported health status, mortality, homicide (76) and risk factors for cardiovascular conditions (90). In Latin America, the most economically unequal region in the world (57), the current evidence seems to support the hypothesis of the detrimental association between income inequality and health, as studies have found that high levels of income inequality are associated with different health outcomes (91-97). However, some exceptions in this literature have also been reported (83, 98).

States, that in the Colombian context are quite equivalent to departments, have shown to be conceptually and analytically the most appropriate level to examine the health effect of income inequality (76, 99) because of their political and economic roles and the ease of tracking the effect of social policies on health (100). Evidence of the relationship between income

inequality and health is almost absent in Colombia. However, by using integral variables such as income inequality and public spending in social services, an ecological study found profound inequalities between Colombian departments in specific causes of mortality such CHD (101), a cause of death strongly associated with HT (3).

Three theoretical explanations of the relationship between income inequality and health have been proposed: psychosocial, social capital, and neo-material (74, 102). Based on these theoretical explanations and empirical evidence, the conceptual model proposes six pathways through which income inequality may lead to HT. Two pathways are based on the psychosocial explanation, which posits that income inequality influences health through the perceptions of place in the social hierarchy (75, 76). Thus, the perception of a lower position in the social hierarchy relative to others will produce negative emotions and chronic stress (75). In addition, the chronic stress generated by the perception of one's social status influences coping mechanisms, such as the adoption of recognized behavioral risk factors for HT (e.g. excessive alcohol consumption) (75), or leads to increasing body weight, a strong predictor of HT (103).

Income inequality acts through the erosion of the social capital and community capacity (88); these resources are needed for undertaking collective action to provide health-promoting public goods and services fostering healthy behaviors and maintaining a healthy weight (104). In addition, people living in areas with low levels of social cohesion, a key component of social capital, are exposed to more stressful relationships and are less likely to access the required social support that protects against or modulates stressful events (63).

These last two mechanisms linking income inequality to HT are based on the neo-material explanation. According to the neo-material explanation, health inequalities are a product of the differential accumulation of exposures and experiences that have their sources in the

material world (74, 105). An unequal income distribution restricts access to human capital (e.g. education) and economic (e.g. income) and material (e.g. assets) resources held by the individuals (74). The effect of this unequal accumulation of resources on HT is mediated by proximal factors such as health-related behaviors, coping mechanisms, and stress. The last pathway posits that political and economic structures determine the unequal distribution of resources among departments (74), resulting in differential investment in sanitation, public services, recreation, and poverty concentration at the municipal level. While the existence of these resources influences health-related behaviors that protect against HT, living in physically disadvantaged areas is conducive to stress (106, 107). Although these six pathways have been presented by some scholars as distinct, they are likely connected and not mutually exclusive (108). For example psychosocial factors can be shaped by the access to material conditions and all material conditions in the daily life have a psychosocial meaning (108).

Social Position: Political, historical, economic, and social systems, process and ideologies create ethnic, racial, socioeconomic, and gender hierarchies in a society. These hierarchies determine the nature and meaning of the status occupied by individuals and influence their experience of and exposure to psychosocial and behavioral risks (79). Although usually measured at the individual level, the conceptual model posits that the ethnic and racial status, SEP, gender and age are markers of the system of social stratification that influences differences in the risk of HT in a given society (109).

There is an abundant, but still controversial literature on ethnic/racial disparities in HT. Although some studies have explained the high prevalence of HT among blacks as a consequence of genetic traits (110), genetic and epidemiological studies have extensively refuted the hypothesis of a large contribution of genes in the racial systematic differences that have been

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observed in HT prevalence between blacks and whites in the US (110, 111). The result of this research suggests that differences in the resources and exposures among blacks and whites play a more important role than exclusively biological factors. Yet the interaction among biological markers and the environment needs more clarification. Cooper and associates emphasized the relevance of context to explain the association between race and HT and demonstrated a wide variability in the prevalences of HT among European and African descent populations (39). Moreover, studies in England (23, 112) and Latin American have either found no association between being black and HT (18, 41), or that the association is weaker than in the US (35). The variability found in the prevalence of HT among blacks living in different areas of the US also suggests that differences in social and physical environmental exposures play a key role in explaining ethnic/racial disparities in HT (113, 114).

In Colombia, where the majority of the population is mixed, blacks and indigenous people are the largest minority ethnic/racial groups (25). Although the categories black and indigenous comprise multiple subcategories, their identity as specific groups is rooted in ethnic identification, the separation of people into in- and out-groups or "othering" dynamics, and the discourse of race and inferiority that emerged in Colombia during the colonial period and prevails based on physical appearance (e.g. skin color) (80). The differentiation of these ethnic/racial categories is also linked to a close interaction between spatial distribution, cultural geography, and phenotypical traits. For instance, the particular geographic localization of an ethnic group is in some circumstances an effect of the historical, social, and economic conditions that have shaped the life of their members, their means of survival and resistance, and their group members' identity (80). The structure of the Colombian racial order can be visualized as a triangle. The mixed/white apex is associated with power, wealth and civilization, while the

bottom two corners of the triangle are black and indigenous who are seen as primitive, dependent, uneducated, unprogressive, and inferior (81), as are conceived the peripheral areas where they tend to locate (115).

Epidemiological and laboratory research suggests that racism and ethnic/racial discrimination are likely to contribute to the development of HT (116, 117). Therefore, ethnicity/race could lead to disparities of HT in Colombia through two major pathways. First, ethnicity/race influences the access to social, economic, educational, and material resources (71, 117-119), which in turn determine health-related behaviors, coping resources, and the exposure to chronic stressors (71, 116, 117). In fact, institutional and interpersonal racism, as well as discrimination, may contribute to the development of HT through multiple mechanisms and trajectories acting as stressors or as barriers against health promotion (117). Second, racism and ethnic/racial discrimination increase the cardiovascular reactivity and blood pressure in racial and ethnic minorities (120). In general, research on the association between racisms and discrimination with HT has had several limitations, mainly related to the measurement of both predictors, lack of understanding of causal mechanisms, and scarcity of prospective cohort studies (116, 120, 121).

SEP is a multidimensional construct (69, 70). It determines one individual's position within society as well as his or her exposures, resources, and susceptibilities (69, 70, 119). In the conceptual model, SEP comprises social and economic indicators such as education, income, physical capital, and home ownership and is proposed to operate by influencing the exposure to stressors (119, 122, 123), the access to resources that enable an effective coping with stress (124), and the adoption of health-related behaviors (51, 125). Although studies in HICs have concluded that a high SEP is a protective factor for HT (126), in LIMCs the evidence of this

positive effect is conflicting (8, 51), and the basis for this inconsistency is unclear. The most accepted explanation argues that at the beginning of a period of economic growth, people with high SEP, especially income, have access to goods and products and adopt behaviors that increase their risk of HT (e.g. sedentary lifestyles). However, after a period of persistent economic development, people with high income tend to adopt much healthier patterns of consumption and behaviors (e.g. buy fruits). On the contrary, risk behaviors become more prevalent in low income groups once products such as processed food become more widely distributed and affordable, which leads to the inversion in the gradient of association (51).

The social meanings of gender/sex and age are discussed below in the micro level section in combination with their biological connotations.

Meso level factors

The meso or local level is the area where people experience the effect of and challenge detrimental higher-level factors, and where they may influence proximate factors that lead to health outcomes including HT (28, 78). In Colombia, this level is represented by municipalities, which are the basic sociopolitical jurisdictions of the country (29). In general, the infrastructure and social characteristics of municipalities influence the availability of resources such as facilities for physical activity, market places, and health services, which support community and individual health and quality of life (28). In addition to policy action and poverty concentration, the conceptual model posits that urbanicity, including population makeup, social dynamics and resources, physical infrastructure, and social services, is an important contributor to the development of and disparities in HT at the local level.

Policy Action: In the conceptual model, policy action encompasses the concepts of political will and political priority, as well as the processes that lead to and instruments used in

public policies. Political will relates to public understanding and the social and political support that is required to allocate intellectual, economic, and social resources to improving public health through public policies (127). Although the concept of political priority also incorporates the allocation of resources, it additionally includes the attention that the problem receives from political leaders and the actions of the system to address the problem (128). Three interconnected policy processes or phases have been identified: policy formulation, policy implementation, and policy modification (129). Policy instruments include service delivery, government spending and taxing, advocacy, and laws and regulations (130).

In addressing the prevention of, and disparities in, HT at the local level, public policies must play a fundamental role. These policies are defined as legislation or regulations that affect or were instituted by the set of institutions, organizations, and services (130, 131). These policies influence actions in the public and private sector that have an impact on health, as well as funding arrangements in the healthcare system (130). Despite the abundant knowledge of the high burden of disease and mortality associated with HT, it remains a neglected global public health problem (103, 132), while the contribution of policy actions to address conditions that lead to HT at the local level is underestimated (e.g. reducing poverty, upgrading disadvantaged areas). In part, these facts can be explained by how the problem is framed by political leaders (128), as the way an issue is framed is strongly associated with the range of selected solutions (133); the presence of competing factors, which is exacerbated in contexts with more limited resources (134); and the strategies used to generating political will and priority (128).

Poverty Concentration: The percentage of the population that lives below a given indicator of poverty in a geographic area comprises an interrelated set of deprivations (82). In Colombia, municipalities are relevant for conceptual and analytical reasons because they are the

units used to estimate and reduce poverty (135), a factor with a direct implication on the exposure to stressors and distribution of disease (78). Although there is no consensus on the best indicators to measure area-level poverty (82), different indicators show the same negative effects of poverty for a range of health-related outcomes including all-cause mortality (136), CVD and mortality (137, 138), and its major risk factors (139, 140). For instance, research in the US has found that neighborhood poverty, measured as area median housing value, was associated with a higher incidence of HT among women (141). Moreover, the association of area-level poverty and blood pressure becomes evident even early in life (142). Similarly, a study in Brazil found a statistically significant negative association between high blood pressure and contextual income after adjusting for individual-level characteristics (59).

There are several mechanisms by which higher area-level poverty may increase risk and disparities in HT. It has been found that living in an area with a high concentration of poverty reduces socioeconomic and political resources that may be used for preventing HT (55). Poorer residential areas may have less accessible recreational areas (e.g. parks), lack of or higher prices for healthy foods at grocery stores, lack of access to quality health care, or fewer supportive social resources (e.g. local networks) (65, 106, 114, 141, 143, 144). In addition, people living in disadvantaged areas experience more stress and have access to fewer resources to modulate their stress (107, 145).

Urbanicity: The rest of the constructs included at the meso or municipal level fall under the concept of urbanicity. This concept refers to the conditions and characteristics that are particular to urban areas (146). In the model it has been extended to incorporate the demographic characteristics that were previously used for measuring urbanization, such as population size and density (147, 148). Although urbanization has been considered one of the major driving forces of

the growing prevalence of HT in LIMCs (10, 58), its traditional use in the public health literature is problematic because it may be associated with misclassification errors due to the lack of theoretical precision in the conceptualization of this construct and the use of indicators that provide little information about it. In fact, the most common indicators used for measuring the effect of urbanization on health outcomes have been the urban/rural dichotomy or a single continuous indicator (e.g. population density) which does not totally capture the evolving features of urban and rural areas (146, 149, 150). As a result, urbanicity has been proposed as a more comprehensive concept for public health research and practice (146).

Based on the extended definition of urbanicity used in previous studies and the conceptual definition of social and physical environment proposed by Schulz et al (55) and Vlahov et al (146), the model considers three explicit dimensions: 1) population makeup (migration patterns, and changes in and current population size and density); 2) physical infrastructure (transportation, sanitation, housing, recreation and sport facilities) and social services (economic activity, education, health services, wellbeing programs); and 3) collective social functioning and practices (social capital and capacity and community empowerment). These dimensions influence the exposure to stressors and chronic stress (65). In addition, these dimensions play a role in shaping the opportunities for socioeconomic attainments, the access to resources needed for adopting protective health-related behaviors, and the characteristics and availability of the social network (28). Recently, studies using scales to generate a continuous indicator of urbanicity showed a positive association between urbanicity and HT. That is, higher levels of urbanicity were associated with higher blood pressure (148, 151). This finding has also been reported in relation to overweight and obesity, a main risk factor for HT (147, 148, 151).

Micro level factors

For the purpose of this dissertation, the micro level refers to the behavioral, psychosocial, and biological factors that characterize or are observed in the individuals. Factors at this level must ultimately be affected in order to influence health. According to the model, these factors have a bidirectional relationship with the factors at the macro and the meso level. Although the availability, accessibility, and quality of health care are considered intermediary determinants of health (meso level), I include health care in this section because it mainly focused on personal health service delivery. Similarly, although stressors may be external to individuals, they are described here as connectors of the social world with the biopsychosocial processes that more proximately lead to HT.

Health Care: In a comprehensive model of social determinants of health, the health system is considered an intermediate determinant (152). The health system should manage existing health problems to ensure that they do not lead to a further deterioration. The health system includes medical care and individual-based behavior change. In addition, the health system has to respond appropriately to the health care needs of different groups in society, and support wider and strategic approaches for healthy polices at different levels (152). Specifically for HT, the health system plays a key role in the screening, treatment and control of HT. Although attaining these fundamental goals is crucial for reducing complications, disability, and mortality associated with HT, evidence suggest that the prevalence of awareness, treatment, and control of HT are far from adequate in the US and LMICs, with important ethnic/racial, socioeconomic, and gender disparities (103). For example, a study in seven large cities of middle-income countries in Latin America, supposed to have a relatively good and accessible health system, found high level of screening of blood pressure in the population (overall 90%),

with an overall prevalence of awareness, treatment, and control in the treated of 64%, 47% ,and

51%, respectively (153). Estimates using subnational data from HICs and LMICs, including

Colombia, show that for middle income countries, the prevalence of awareness, treatment, and

control in the treated were somewhat different that those estimated in the study in the seven Latin

American cities: 43.6-52.5%, 36.9-48.3%, and 9.9-15.6, respectively (154).

Stressors: For the purpose of the conceptual model, stressors are external circumstances

or conditions that have the capacity to challenge or threaten, and produce an internal arousal

referred as stress (see below) (155, 156). Chronic stressors persist over time and in contrast to

more time-limited life-event changes provide several plausible mechanisms that lead to diseases

that have a gradual, long-term onset, such as CVD (157). Chronic stressors are socially

distributed (121, 155) and are likely to have a cumulative effect and cause a dysregulation of

multiple interrelated physiological systems known as allostatic load, which refers to the burden

placed on the organism and its biological functions as a consequence of the adaptation to chronic

external demands (158, 159).

Social position influences the probability of encountering stressors, which in turn differ

in their capacity to evoke stress. Chronic stressors are associated with living in a context with

high level of income inequality (75); the persistent exposure to social, economic and physical

disadvantage in the area of residence (107, 121); racial and ethnic discrimination (160); and a

low SEP (122, 144). Additional stressors are related to inadequate rewards relative to efforts

(155) and barriers in the achievement of life goals and status inconsistency (36). Importantly,

different sources of stress can act alone or in combination (161). The combination of different

types of stressors can generate overwhelming demands for coping and saturate it rapidly,

especially in those with limited coping resources (160, 161). A similar effect could occur as a

consequence of the cumulative effects of acute or sustained stress exposure (160). Thus, these conditions can alter the normal mechanisms for coping with stress and produce a direct physiological response associated with chronic stress or modify the response to future events.

Primary Appraisal: Primary appraisal is an assessment of an event by an individual who judges if the event or situation is stressful, irrelevant, positive, controllable, or challenging. In turn, secondary appraisal is focused on assessing the resources and coping options, as well as their effectiveness (77). In the study of HT these constructs have received little attention and their role remains unclear. However, it has been argued that perception of stress could be influenced by structural factors, contextual characteristics, ethnicity, and other personal attributes (144).

Coping: Coping refers to the deliberate attempt to manage specific demands (stressors) (77, 162), with both context and appraisal as the most potent determinants of coping behavior (155). Coping has two dimensions: problem management and emotional regulation (77). The former is focused on changing the stressful situation, whereas the latter is intended to change the feelings or thoughts associated with the situation (77). Coping behaviors are changing and volitional, and they can generate negative outcomes such as maladaptive behaviors (e.g. alcohol consumption) (162). Among the coping strategies, seeking social support, avoidance, and problem solving are the most frequently used (162). These strategies are situation-specific; thus, strategies successful with one problem may not be used with another (155). Coping is a mediator of the relationship between appraisal and health behaviors and HT (77, 163). Research suggests that the individual's social position influences the type of coping behavior adopted by the individual facing a particular stressor and the result that he or she obtains (164). For instance, one study found that speaking up about racism was associated with higher blood pressure among

working class individuals but not among executives (161). This difference could be explained by the less effective use of coping repertoires among people with lower level of income and education (155). On the other hand, although there is not conclusive evidence to support gender differences in the use of coping strategies (162), the use of passive coping strategies in women was found to be associated with HT prevalence, especially among the youngest (163). In turn, there is some discrepancy regarding the difference in the use of coping strategies at different ages, with most studies supporting the existence of such differences (162, 165).

The different types of coping strategies involve dissimilar physiological responses associated with HT. Active coping strategies are associated with a β_1-adrenergic response and SBP increase a result of central mechanisms (e.g. increased catecholamines). Conversely, passive coping is mediated by α-adrenergic pathways and DBP increases via vascular mechanisms associated with elevation of skeletal muscle vasoconstriction (163). In general, passive or more emotional coping strategies such as denial and avoidance coping have been associated with a poorer psychological and physical health (163).

Social Network and Social Support: Social network mainly refers to the social relationships that surround the individuals (166). Although there is no accepted universal definition of social support (166, 167), it is considered one of the most important functions of the social relationships with four explicit types of supportive behaviors: emotional, instrumental, informational, and appraisal support (166). Social network and support are influenced by material deprivation, residential turnover, and poor characteristics of social functioning. These conditions are more influential for women, as social networks and support are known to be protective for their cardiovascular health (65). Abundant epidemiological studies indicate that there is an inverse relationship between the levels of social support and mortality rates,

especially from CVD. Social support may influence health through two broad mechanisms. First, social support is considered health-promoting because it facilitates the adoption of health behaviors; however, some social relationships can be counterproductive for health as they set negative behaviors or promote risky health practices. The other major pathway involves a bidirectional relationship between social support and psychological process such as appraisal, emotions, and moods. Through these mechanisms, social support can have cardiovascular effects including the reduction of cardiovascular reactivity and a lower ambulatory blood pressure (167). The cardiovascular effect of social support has been mainly explained by its role as stress buffering (155, 166, 167).

Scholars have suggested that an excessive demand of support from the social network may correlate with higher blood pressure, particularly among women (8, 30), who may experience high level of stress associated with fulfilling multiple roles in their families and communities. In addition, those in poverty may experience different and more intense social stressors that the general population (145). More specifically, people with low SEP, involved in networks composed of individuals of similar low socioeconomic background, and living in disadvantaged contexts may have more limited resources to share and also be taxed due to the disproportionate demands for help and rapid depletion of their resources (167). For example, the finding of higher mean SBP among women with high status within their communities in poor Mexican states was speculated to be in part associated with the disproportionate demands for help that they may receive from other members of their communities (8). Similarly, the high prevalence of HT among black women in the US may be linked, in part, to the disproportionate support they have to provide to their families and communities (30).

Self-efficacy: Self-efficacy refers to one's confidence in performing a particular behavior (168). In the model, self-efficacy influences the belief in a person's ability to manage specific demands (169) through active coping strategies (155, 169). Thus, people with high coping self-efficacy are expected to use more active coping behaviors than those with low levels. Self-efficacy has a specific influence on adopting and maintaining each protective behavior against HT. A large body of literature supports the strong and positive relationship between self-efficacy and physical activity (170) and healthy diet (171), but the association is inverse with alcohol consumption (172). For instance, interventions aimed to increase individuals' exercise self-efficacy can increase adherence to regular exercise by enhancing the confidence to overcome barriers for this behavior. Although self-efficacy plays a key role in adopting and maintaining coping and health-related behaviors, its contribution to HT disparities in Latin American countries has been understudied.

Bio-Behavioral Factors: The literature on health-related behaviors associated with HT is well-established (103, 173). The main modifiable behavioral risk factors associated with HT are diet, especially salt intake, physical inactivity, and excessive alcohol intake. In addition to salt intake, a higher risk of HT has been associated with a low consumption of fruits and vegetables (103, 174), and potassium intake (103, 174, 175). Regarding alcohol consumption, studies suggest that in women it has a modest protective effect at lower doses, after which follows a linear dose-positive association (J-shaped relationship) (174, 176). This protective effect, however, is not grounds for advocating alcohol consumption as a protective measure (176). In contrast, no protective effect has been found in in men and the results suggest a linear, dose-response relationship between alcohol and HT (176). In addition to these behavioral factors, being overweight and obese, an anthropometric marker associated with physical inactivity, diet,

and stress (177), has the strongest association with HT, independent of other factors (103, 174, 175). Moreover, excessive weight and obesity partially account for the relationship between SEP and HT (51, 174). In general, risk behaviors increase the likelihood of HT through the modification of hormonal mechanisms, vascular and neural response, and impairment of the renal function. Although these health-related behaviors play a key role in HT, they are unable to fully explain the onset of and disparities in HT. A large body of literature, mostly from HICs, has demonstrated that the adoption and maintenance of most behavioral risk factors for HT is associated with the characteristics of the area of residence (55, 106).

Age (Social and Biological): In HT research, age has been traditionally considered a confounding variable. Although age has been a marker of the biologic processes that lead to HT (173), the uncommon age-related rise in blood pressure in some populations, including some indigenous groups in Latin American (178), highlights the relevance of considering social explanations of the role of age in the development of HT (126).

Age, as a social marker, is associated with HT through two mechanisms. First, age is a marker of the accumulation of socioeconomic resources (69) or adverse exposure over the life course (179). Although few studies have examined socioeconomic differences in effects of aging on HT, a longitudinal study found that regardless of the indicator used, the incidence of HT differed between individuals of low and high SEP as a result of the cumulative exposure to adverse socioeconomic conditions (126). Regarding the accumulation of adverse exposures, differences in HT prevalence among racial groups across age categories have been demonstrated in the US. Geronimus and associates found that black women at age 50 had the same probability of having HT that white men and women that were 17 and 13 years older, respectively. These results were explained by the accumulation of stressors related to being black and female in a

race-conscious and gender-stratified society (30), and support the weathering hypothesis that states that the accumulative exposure to stressful situations and environments is associated with health deterioration at earlier ages, particularly in blacks (180). Second, age is linked to changes in health-related behaviors associated with HT. For instance, the decline of physical activity with age is a well-documented and consistent finding in the literature (181). As a consequence of psychosocial changes across the lifetime, age is considered the best demographic marker to differentiate patterns of lifestyle (182). For instance, one study found that young adults displayed more positive changes in risk behaviors for CVD than older adults who were expected to engage in more positive behavior changes as a result of a higher perception of morbidity and mortality (183).

With increasing age come important changes in the pattern of blood pressure. While SBP continues increasing throughout life, DBP rises until approximately age 50. Then, it tends to decrease over the next decade, and may remain the same at more advanced ages. Until age 50 DBP is a more potent cardiovascular marker than SBP, but thereafter, SBP is more important. As consequence of these patterns, diastolic HT is the predominant condition before age 50, either alone or in combination with SBP elevation. Following the rise in SBP, the prevalence of systolic HT increases with age, with this condition being the most prevalent above 50 years of age (184).

Gender/Sex: Similar to age, gender/sex has a social and biological meaning in the model. The complex interaction between these two dimensions and the difficulties of teasing apart their contributions may in part explain the heterogeneity in the epidemiological studies examining the distribution of HT in men and women. In LMICs there is no clear pattern in the association between gender and HT. For example, while one study showed similar gender prevalence across

several countries (7), another international study found small differences (5). In the latter, the highest discrepancy in the prevalence of HT was found in Latin America and the Caribbean where the prevalence was 5.9% higher in men (5).

Gender disparities in HT in Latin America could be related to the differences in both SEP and prevalence of health-related behaviors. The effect of gender differences in SEP was corroborated for a review that found that, regardless of the country income level, the association between SEP and HT was stronger for women than for men (51). Similar findings have been obtained in studies in Latin American and the Caribbean (35, 52, 53). Studies in Colombia have found that women have high prevalences of overweight/obesity (185) and physical inactivity (186). A factor that has been little explored in Latin America is the effect on HT of gender differences in the exposures to stressors. In the US, women living in disadvantaged areas are exposed to multiple stressors associated with their gender, socioeconomic and ethnic condition (187). As noted, the highest prevalence of HT in black women in the US may be explained by the intersection of gender and race, which expose them to more stressful living conditions and social roles and interactions (30). Likewise, a study in Canada found that women living in disadvantaged neighborhoods were 10% more likely to report HT than men living the same residential area and women living in the least disadvantaged neighborhoods, which was explained by a more detrimental effect for women of the features and stressors of the neighborhood (65).

With regard to sex differences in HT, some hormonal and physiological conditions could reduce the likelihood of HT in women before menopause (188). Indeed, in young adults the prevalence of HT is higher in men; however, this relationship changes around the fifth decade of age when the prevalence among women becomes equal or higher than in men (5, 103). However,

contextual and individual attributes can easily outweigh the protection conferred by biological factors to women, leading them at younger ages to have a similar or higher prevalence of HT than men (163).

Chronic Stress: As depicted in the conceptual model, chronic stress is directly associated with HT. This conclusion is supported by substantial evidence from prospective studies included in an early systematic review (189) and meta-analysis (190) aimed at assessing the relationship between chronic stress and HT. Stress is in general is defined as an actual or perceived threat "resulting either from the presence of external demands that tax the ordinary adaptive capacity of the individual or from the absence of the resources to attain sought-after ends" (155). Importantly, perceived and actual stress can influence health outcomes independently or in combination (144). Stress is considered chronic when it persists for long time, "either because it occurs repeatedly, episodically, or continuously, or because it poses severe threats that are not easily adapted or overcome" (122). Directly, chronic stress leads to HT by influencing the sympathetic nervous activity and the concentration of neuroendocrine hormones such as norepinephrine and adrenocorticotropin, as well as an increased sodium retention and vasoconstriction resulting in high levels of blood pressure (173, 190). Indirectly, chronic stress is associated with the adoption of risk behaviors (e.g. excessive consumption of alcohol). However, the causal relationship between some health-related behaviors such as physical activity is less clear and seems to be bidirectional; exercise, for example, can moderate stress sensitivity by producing neurochemical changes in the body (125). Finally, stress may contribute to weight gain activating neuro-endocrine mechanisms (177).

Dissertation Goals

The overall goals of this dissertation are to: 1) examine the social patterning of PHT and HT prevalence among Colombian adults, 2) test whether macroeconomic factors at the departmental and municipal levels are associated with HT in Colombia after accounting for variables measured at the individual level, and 3) understand whether and how municipal social and political actors incorporate living conditions in how they frame HT risk and disparities. Finally, based on the empirical findings of the dissertation and the existent theoretical and empirical research, the dissertation seeks to provide recommendations in order to prevent HT and reduce HT disparities in Colombia.

Due to data limitation, it is not possible to test all the pathways showed in the broad conceptual model. Thus, building on this model, I propose specific and simplified conceptual models for guiding the quantitative analyses. What follows is a brief description of the conceptual and methodological characteristics of each individual chapter.

Overview of the Methodological Approach

In this dissertation, I conduct a mixed-method study (191, 192), which is a research approach theoretically guided by pragmatism. Pragmatism implies an applied and practical approach, which allows for matching the research question to the most appropriate research methods (192, 193). According to this view, qualitative and quantitative research are seen as complementary strategies, rather than competing and contradictory in addressing particular research questions (192, 194). More specifically, this mixed methods study seeks to answer different research questions and expand the breadth and range of inquiry by using different methods for estimating the prevalence and social and economic distribution of HT at the individual and contextual level in Colombia and understanding how at the local level social and

political actors frame the problem and its potential solutions, as well as the type of actors they consider should be involved in implementing these solutions.

In chapter 2, by using a nationally-representative sample of the Colombian adult population, I estimate gender/sex prevalences of PHT and HT across different indicators of social position. In addition, in a gender/sex stratified analysis I examine the association between markers or social position and PHT and HT by running multinomial logistic regression.

In chapter 3, I examine the association between macroeconomic determinants and HT in Colombia by using a multilevel logistic analysis in which individuals were nested within municipalities, nested within departments and the Capital District. For this analysis, I use an objective measure of blood pressure and time lag effects for all macroeconomic indicators, including income inequality.

In chapter 4, I report on a qualitative single-case study conducted through interviews in a marginalized municipality in Colombia located in the sub-region with the highest prevalence in the country of uncontrolled HT. In this study I examine which frames are used for social and political actors for explaining HT; how these frames guide the decisions that social actors make about the problem or its related conditions in their jurisdiction, and what actors they consider should be involved in addressing the problem.

In chapter 5, I combine quantitative and qualitative findings to discuss the main implications for policy, practice, and research and provide public policy recommendations in order to prevent and eliminate PHT and HT disparities in Colombia.

In sum, this dissertation benefits from previous literature and existing survey data to analyze a nationally-representative sample in Colombia in order to test specific pieces of the proposed conceptual model. In addition, it uses original qualitative data from a single-case study

in order to map meanings and processes related to HT in a Colombian locality. This mixed

method research approach addresses some limitations of using only one method of data

collection for capturing the complexity of the research problem. It thereby provides more

complete evidence and contributes to expanding the theoretical and empirical evidence of social

disparities in HT in the context of a middle income country in Latin America.

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Figure. 1.1 – Multilevel Conceptual Model for Hypertension Risk and Disparities

MACRO LEVEL   MESO LEVEL   MICRO LEVEL

Economic Development

Income Inequality

Historical Conditions Political, Social and Economic Order Ideologies and Culture

Race/Ethnicity

Socioeconomic Position

Gender & Age (Social)

Policy Action

Poverty Concentration

Urbanicity

Population Makeup

Physical, Social & Economy Infrastructure

Collective Social Functioning & Practices

Stressors

Health Care

Primary & Secondary Appraisal

Coping Behaviors

Chronic Stress

Social Support Self Efficacy

Bio-Behavioral Factors Sex & Age (Biological)

Hypertension (High Blood Pressure)

Note: Shaded boxes are addressed in this dissertation

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Chapter 2:

Social Patterning of Prehypertension and Hypertension in Colombian Adults

Introduction

Cardiovascular disease (CVD) is the leading cause of mortality in most Latin American countries (1), including Colombia (2). Hypertension (HT) is the main contributor to morbidity and mortality for CVD (3, 4). Prehypertension (PHT) has an independent effect on CVD (4-6) and those with PHT are at increased risk of progression to HT (7, 8). PHT and HT are not equally distributed among social groups. Consistent and abundant research, particularly from high-income countries (HICs), demonstrates that the prevalence of HT follows a social gradient (9), which means that those at the bottom of the social stratification have a higher risk for this condition. In this context, the higher prevalence of PHT and HT among disadvantaged groups such as ethnic and racial minorities as well as persons with lower socioeconomic position (SEP) could be explained by their limited access to resources to avoid risks, multiple social vulnerabilities, and exposure to material and psychosocial conditions that lead to disease (10, 11). Given the public health importance of PHT and HT, the study of their social distribution must be a primary goal in CVD research and intervention in Colombia and other Latin American countries, where the social patterning of PHT and HT has been understudied.

Studies demonstrate an uneven prevalence of HT among the black diaspora across the Americas (12). Although a racial-genetic model posits that the higher risk of HT among people of African ancestry is mainly linked to a genetic predisposition (13), this explanation has been widely contested since skin color is an imperfect marker of genetic

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characteristics, and genetic components have little capacity to explain complex diseases such as HT (13, 14). A more accepted explanation states that the association between race and ethnicity and HT is attached to the sociopolitical, economic, and cultural meanings of these social constructs and is a result of the psychosocial and physiological mechanisms through which they operate (13). A dark skin color is a marker of social subordination and exposure to discrimination, poverty, and other social stressors that increase the risk of PHT and HT (12, 15), as well as a marker of the access to and availability of socioeconomic resources. Although socioeconomic indicators can mediate the relationship between ethnicity and race and HT, it cannot fully account for the different mechanisms through which ethnicity and race may produce disparities in HT (16, 17). Additionally, even if SEP did fully account for the effect of ethnicity and race on HT, the conclusion about the presence of total mediation may be inaccurate due to the underrepresentation of ethnic and racial minorities in high SEP categories and excess representation in low SEP categories (17).

The soundness of skin color as a social, rather than biological, marker of HT risk has been strongly supported by prior research. For example, studies have shown a wide geographic variability in the prevalence of HT among blacks within and between countries (12, 18-20), a high prevalence of HT in some countries with a low proportion of people of African descent and high proportion of people of European descent (21), a lack of association between objective measures of skin pigmentation and blood pressure (15), and reduced disparities in HT prevalence when blacks and non-Hispanic whites live in a similar context (16).

Another historically marginalized population in Latin America are the indigenous communities (22, 23). This population has also experienced a growing acculturation process in every country in this region (23). The marginalization and acculturation of indigenous

communities suggest that, similar to the black diaspora, indigenous communities may experience

adverse exposures that increase their risk of PHT and HT. However, the epidemiological studies

on HT among communities indigenous in Latin American are still limited and inconsistent. It has

been posited that for environmental and behavioral factors indigenous communities have a lower

risk of HT than other groups in society (24, 25). Among the few studies conducted in Latin

American on HT in indigenous groups, those that found a low prevalence in these communities

attributed it to their propensity of maintaining traditional lifestyles (e.g. low salt intake), having a

low body mass index (BMI), and living in isolated areas with null or little exposure to urban

environments (24, 26).Yet the studies yield inconsistent results (24, 26-28) and are far from

conclusive because they have been characterized by the poor description of the sampling strategy

(26) and the use of small, non-nationally representative, and homogenous samples that constrain

the comparison between ethnic and racial groups in the same study (24, 26-28).

In addition to the role of SEP as a potential mediator of the relationship between

ethnicity/race and HT, disparities in PHT and HT may be a direct consequence of differences in

access to and availability of educational, economic, and material resources. Still, the role of SEP

and its association with HT are not uniform between and within countries. In HICs there is a

consistent and inverse association between indicators of SEP and HT (9), but the association is

less consistent for PHT particularly among blacks (29). In low- and middle-income countries

(LMICs) the evidence on the relationship between SEP and HT is limited and conflicting as to

the magnitude. Additionally, the direction of the association between indicators of SEP and HT

varies (18, 19, 30-32). For instance, the association between SEP and HT in low-income

countries is more consistent for women than men. This is especially true for education, which

has an inverse association with HT in most studies of women in middle-income countries, but

not in those of men (18, 19). For markers of material resources such as income, some studies show a positive association between income and systolic and diastolic blood pressure in women (30, 31). The fact that in low- and middle income countries income tends to be a marker of risk, and that education tends to be a protective factor, has also been found in research in Latin America looking at the social patterning of body weight (33, 34). This is relevant because obesity accounts for a significant reduction of the effect of SEP on HT (9), particularly in women, suggesting a mediating effect of this biological indicator. Briefly, this evidence suggest that in LMICs having a higher SEP may not always be a protective factor for HT (30). However, more research in this area is needed in order to extend evidence of those indicators of SEP for which a higher status is or is not protective for PHT and HT.

Social factors of PHT and HT have been relatively understudied in Colombia. For instance, conceptual models and studies are lacking in examining social disparities in PHT and HT and the pathways through which markers of social position contribute to these disparities. Building on the extensive literature in the field, I propose the conceptual model in Figure 2.1 to examine the social patterning of PHT and HT in Colombia by using data from a nationally representative survey. I hypothesize that the age-adjusted prevalence of PHT and HT will be higher for blacks and indigenous groups than for mixed population. Moreover, there will be inverse trends for education and positive trends for the other indicators of SEP (*hypothesis 1*); the odds of PHT and HT will be higher for black and indigenous groups than for mixed population (*hypothesis 2*); the association between ethnicity/race and PHT and HT will be attenuated after entering SEP indicators (*hypothesis 3*); the magnitude and direction of the association between SEP and PHT and HT will vary in that education will have an inverse and strong association, whereas it will be either positive or null for markers of material resources

(e.g. household income) (*hypothesis 4*); and the association between education and PHT and HT

will be reduced once markers of material resources (e.g. household income) and bio/behavioral

risk factors are entered into the model, suggesting a potential mediating effect (*hypothesis 5*).

Methods

Data sources

Data came from the 2007 Colombian National Survey of Health (CNSH) (35). CNSH

was a cross-sectional study based on a probabilistic, multistage, stratified cluster sampling

strategy aimed at studying the health status of the civilian non-institutionalized Colombian

population aged 0-69 years (35). Data for this study was drawn from a random subsample of

13,301 men and women aged 18-69 who participated in both the interview and clinical

component of the CNSH. Participants resided in all 32 departments (states) and Bogotá, the

country's capital district, and the rate of response of the subsample was 58.8 (35). The CNSH

followed Colombian ethical regulations (35). This study was reviewed by and granted exemption

from The University of Michigan IRB for Protection of Human Subjects in 2011.

Measures

Dependent variables: After participants were seated quietly, trained staff measured in

one single occasion systolic blood pressure (SBP) and DBP diastolic blood pressure (DBP) in the

left arm supported at heart level with the use of a digital sphygmomanometer Omron HEM 714®

with cuff-size adjustment made on the basis of arm circumference. Based on these

measurements, a three-category outcome was created: normal (SBP <120 mmHg and DBP

mmHg <80), PHT (SBP 120-139 mmHg and/or DBP 80-89 mmHg in persons who were not

taking antihypertensive medication), and HT (SBP ≥140 mmHg, DBP ≥90 mmHg, or use of

antihypertensive medication) (36). Normal blood pressure was defined as the reference category.

Independent variables: Based on self-reported information, ethnicity/race was grouped into indigenous groups, black (collapsing blacks and mulatos, natives of San Andres and Providence Archipelago, and Palenqueros[2]), and mixed or "mestizos" (those who did not self-identify with any ethnicity/race category). The gypsy population was not included in the analyses because of its small size in the clinical subsample (n=15). The defined categories embrace to some extent cultural, ancestral, and referential characteristics used to define ethnicity (13), as well as the phenotypical differences and historical meanings that have been used to build race as a social construction (37). Moreover, in Colombia, ethnic and racial categories overlap both for analytical purposes and in practice (22, 37).

SEP is a multidimensional construct measured through educational attainment, per capita household income, physical capital, and home ownership. Educational attainment was measured by a question on the highest completed educational degree, which was grouped into four categories according to the Colombian educational system: no formal schooling or less than primary education; completed primary education (up to five years); completed high school (11 years), and certificate, bachelor or higher (12 years or more). The income earned in the past month by the members of the household was added and divided by the total household size, which was then divided into quintiles. Physical capital, similar to other measures of household wealth, has been used in LMICs in response to the limitations in availability, reliability, and applicability associated with household income (30, 38, 39). Physical capital has been previously used in Colombia (38), and similar measures were used on HT and BMI research in Mexico (30, 33). In this study, physical capital was a summary measure of 15 household assets (e.g. refrigerator, car), 19 characteristics of housing quality (e.g. floor materials), and overcrowding.

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[2] People from the village of San Basilio of Palenque who maintain African traditions of escaped slaves in the sixteenth century.

The composite measured was the first component of a principal component analysis (39), which was then divided into tertiles. Home ownership was divided into house-owners (including those paying mortgage), renters, and people with other types of housing arrangements. In the multivariate analyses the reference categories were the highest educational level and physical capital and household income tertile, and house-owners.

Behavioral variables were obtained by self-report. Physical activity was grouped into regular and no regular activity. Alcohol consumption was categorized as never, none in the last month, 1-2 days in the last month, 3-5 days in the last month, and six or more days in the last month. Weight and height were obtained using objective and standardized measurements in the visit whenthe blood pressure was measured. Body mass index (BMI) was calculated by dividing the weight in Kg by height in meters squared and then clustered into four categories: underweight (<18 Kg/m^2), adequate weight (≥18-<25 Kg/m^2), overweight (≥25-<30 Kg/m^2), and obese (≥30 Kg/m^2). Age, in years, was grouped into five categories (18-29, 30-39, 40-49, 50-59, and 60-69).

Statistical Analysis

After preliminary exploration and summarization of the data, Spearman correlations among SEP variables were estimated. Then I estimated overall and sex/gender age-adjusted proportions of PTH and HT across ethnicity/race and SEP variables and conducted trend tests by including ordinal categories in the models as continuous variables and tests for independence for nominal variables (*hypothesis 1*). I assessed the interaction between sex/gender and indicators of SEP because prior studies found heterogeneity in the social patterning of HT among men and women (9, 18, 19). As some of these interactions were significant, I stratified the analyses by sex/gender. I used a sequential modeling approach for running multinomial logistic regression

for the three-level categorical dependent variable, using normal blood pressure as the reference. Results for point estimates PHT versus normal and HT versus normal are presented in different tables (Tables 2.2-2.3). After an unadjusted and bivariate model, all fitted models were age adjusted. The first model included race/ethnicity only (*hypothesis 2*). In models two and three, indicators of SEP were introduced, beginning with education in model 2 (*hypotheses 3-4*). Model 3 included markers of material resources (*hypotheses 3-5*). Per capita household income and physical capital were included in different models (3a and 3b, respectively). Model 4 was adjusted for bio/behavioral risk factors (*hypothesis 5*). To complete the test of the potential mediation proposed in hypotheses 3 and 5, I used models 2 and 5, respectively, as starting points for applying the criteria proposed by Baron and Kenny for mediation analysis (40). I evaluated the final fitted model performing a multiparameter Wald test of the overall significance of each of the predictors (41). Finally, I conducted a complementary analysis to estimate the predicted probability of PHT and HT examining the intersection of relevant predictors. Analyses were conducted in STATA Release 12 (College Station, TX: StataCorp), and the *svyset* command was used for accounting for sampling weights, clustering, and stratification. Results are presented in terms of odds ratios (OR) and 95% confidence intervals (CI).

Results

After cleaning the data and excluding implausible values, 12,878 respondents were available for analysis. Most men and women did not choose any ethnicity/race category and were thus classified as mixed/mestizos. The observed distribution of ethnicity/race mirrored the results of the last Colombian census (42). The majority of participants had completed high school or more and were home owners. Overall, almost 46% were overweight or obese, with 50% of

women either overweight or obese (Table 2.1). The Spearman's rho for all possible correlations among the indicators of SEP was low, ranging from -0.06 to 0.37 (data not shown).

The overall age-adjusted prevalence of PHT and HT were 37.1% and 25.1%, respectively. Both prevalences were higher in men than women (PHT: 45.3% vs. 30.2%, p<0.0001; HT: 29.0% vs. 21.8%, p <0.0001, respectively). Figures 2.2a and 2.2b show the age-adjusted prevalence of PHT and HT by sex/gender, ethnicity/race, and indicators of SEP. For PHT in men, the test of independence was statistically significant for home ownership only. Patterns were not clear and not statistically significant for the other indicators of SEP. These findings were similar for HT, except that education had a statistically significant trend and owners, instead of renters, had the highest prevalence. The patterns for PHT in women were the same as for men. However, for HT all trends, inverse for education and positive for income and physical capital, were statistically significant as well as the test of independence for home ownership. For both sexes and outcomes the tests of independence for ethnicity/race were not statistically significant.

According to the unadjusted and adjusted model, black and indigenous men were not more likely to have either PHT or HT than mixed men (Tables 2.2a and 2.2b). Among women, those who identified as black were more likely to have PHT than their mixed counterparts, but this association was marginally significant in all models (Table 2.3a). Relative to mixed women, black women had significantly higher (88% higher) odds of having HT when accounting for the other predictors (Table 3b). The magnitude of the association between ethnicity/race and PHT and HT remained constant after the subsequent inclusion of all indicators of SEP (Tables 2.2a-2.3b).

Except for renters, who have lower odds of PHT than owners, no other statistical association was found for this condition among men. However, in model 4, education showed a graded association with PHT, but the associations were not statistically significant (Table 2.2a). A similar pattern was found for HT in men, that is a lower odds of HT for renters relative to home owners and a graded inverse association with education, which was statistically significant for those men with less than primary education (OR: 2.10; CI 1.10-4.01) and marginally significant for those with completed primary education (OR: 1.49; CI: 0.94-1.40) (Table 2.3) in comparison with those with a high educational attainment. Among women, Table 2.3a shows that the significance of the association between the contrasts for education and PHT varied and was not graded. In the final model, only women who had completed primary education had higher odds of having PHT relative to those with more than high school. The association was marginally significant for those who completed high school, however. Women in the first and second tertile of physical capital had higher odds of having PHT that those in the highest tertile. Education showed a significant, inverse, and graded association with HT. That is, as education increases, women were less likely of having HT. The pattern for physical capital and home ownership was the same described for PHT.

Results in models 2 through 4 in Tables 2.2a and 2.2b do not support the hypothesis of potential mediation of the markers of material resources and bio-behavioral factors in the association between education and PHT and HT among men. Conversely, the findings of women showed that after the subsequent inclusion of the markers of material resources and bio-behavioral factors, the odds ratios of education were reduced for both outcomes (Tables 2.3a and 3b). For PHT the reduction ranged from 29.3 to 51.2% (e.g. (1.55-1.27)/(1.55-1) x 100). For HT this reduction ranged from 36% to 48%. Thus, these results suggest a partial mediation in the

association between education and PHT and HT. The specific examination of mediation showed that the effect of education on PHT was partially mediated by household income, whereas on HT this effect was partially mediated by physical capital. In turn, BMI was a partial mediator of the effect of education on both outcomes (data not shown). Figure 2.3 summarizes these findings.

Finally, the upper part of Figure 2.4 shows that the predicted probability of PHT is lower in both extremes of the educational categories. The lower part of this Figure shows that the predicted probability of having HT is highest for black women with the lowest level of education. But regardless of sex and ethnicity/race, the probability of HT was higher for people with the lowest educational attainment.

Discussion

To my knowledge, this is the first study that describes the social patterning of PHT and HT in Colombian adults using a nationally representative sample. This study seeks to advance our understanding of the social and economic patterning of PHT and HT in Colombia and expand our knowledge of the extent to which the magnitude and direction of the association between indicators of SEP and PHT and HT vary. From a practical standpoint, this research is critical for planning and implementing effective preventive interventions and tracking disparities in PHT and HT in this multi-ethnic and middle-income Latin American country.

This study yields key findings on the social patterning of PHT and HT in Colombia. First, 62% of the Colombian adult population had PHT or HT. For both outcomes the prevalence was higher in men, but there was a mosaic in the social distribution of PHT and HT with more clear patterns for both females and HT. Second, ethnicity/race was not a significant predictor of either PHT or HT for men. For women it was a significant predictor for HT in women. Specifically, black women had higher odds of HT than their mixed counterparts. This association was not

mediated by indicators of SEP. Third, education behaved in the expected direction, with lower educational attainment associated with increased risk of PHT and HT for both women and men. Similarly, physical capital was inversely associated with both PHT and HT, but only significant in women. That is, lower physical capital means higher odds of having PHT and HT. Home ownership behaved in the hypothesized direction. That is, relative to those who owned their homes, renters were less likely to have PHT and HT. Finally, the association between education and HT in women, but not in men, was mediated by markers of material resources and bio-behavioral risk factors. Each of these findings is discussed in greater detail below.

Overall prevalence and social distribution of PHT and HT: Prevalence of PHT varies geographically and by gender/sex. The overall prevalence of PHT found in this study was 37%, higher than in prior research in Jamaica and the United States (US) (30% and 31%, respectively) (43, 44), and lower than in Nigeria (59%) (3). Among studies in China, the prevalence of PHT has ranged between 22% and 55% (3). Differences in the prevalence of PHT have also been reported within countries. For instance, in a study with a high proportion of participants from the "stroke buckle" and the "stroke belt" in the US, the prevalence of PHT was 63% in blacks and 54% in whites (29). Beyond differences in the studies, this variation suggests that contextual factors may play a key role in the development of PHT between and within countries. Similar to the findings of this study, a higher prevalence of PHT among men has been previously reported in other world regions (3). For instance, in Jamaica, Peru and the US the prevalence of PHT in men ranged from 34%-40%, whereas in women it ranged from 23% to 27% (43-45). As PHT is an independent predictor to the progression to HT and CVD (8), interventions should be implemented to reduce its onset. Otherwise, the burden of morbidity and mortality associated with HT and CVD in Colombia may increase substantially over the next few years. Interventions

should focus on women and men both, although it may be important to particularly attend to factors driving PHT in men.

The results of this study highlight the relevance of HT as a public health problem in Colombia. A quarter of the Colombian population aged 18-69 years have diagnosed or undiagnosed HT. Although in the last national estimate (in 1999) this prevalence was estimated to be 12.3% (46), the comparison with the current study is limited because in the prior study the estimate was based on self-reporting of HT diagnosis. Using the information of the self-reporting of HT diagnosis in the CNSH, I found a similar overall prevalence of HT to that reported in 1999. However, there is good evidence that self-reported measures underestimate the prevalence of HT, failing to capture HT among those who are least likely to have access to health care and to being currently treated for HT (47). This emphasizes the relevance of using objective measures for estimating the population prevalence of HT. Results reported in this chapter for national prevalence fall within the range of results reported by regional studies in Colombia that used objective measures of blood pressure found lower (22.9% and 13.4%) and higher (37.5%) prevalences (48-50).

In Latin America, the overall and sex-specific prevalence of HT varies widely between countries (50, 51). In this region, the prevalence of HT among countries ranges from 20% to 43% (51, 52) and the differences among sexes may in part parallel the patterns of the bio-behavioral risk factors that characterize each country. For instance, the prevalence of HT in Colombia according to this study is similar to that in Mexico two decades ago (52), where the prevalence of overweight and obesity has risen rapidly in the last decades (33, 53). Colombia is experiencing transformations in its economy and health-related behavioral, morbidity, and mortality patterns (46, 54). Without effective population-based strategies for counteracting the

negative impact of these transformations, the country may soon reach the current prevalence of HT of Mexico (43%) (52).

The findings of this study suggest similarities and differences in the social distribution of PHT and HT among men and women. For men and women, no ethnic/racial differences in the prevalence of either PHT or HT were found. On the other hand, in this study the socioeconomic pattern in the prevalence of PHT and HT suggests important differences between men and women. The hypothesis of an inverse pattern for education and positive for the other SEP indicators was statistically significant only in HT for women. For PHT in women, the observed pattern was in the proposed direction but was only statistically significant for home ownership. For men the pattern in both outcomes was less clear in direction and significance. Both the ethnic/racial and socioeconomic patterns in the prevalence of PHT and HT among men and women were corroborated to great extent in the multivariate analysis and their implications are discussed in greater detail below.

Before discussing the implications of the social pattern of PHT and HT, I wish to highlight two important issues. First, literature on blood pressure has previously reported a clearer socioeconomic pattern for women than for men. A similar pattern has also been reported for obesity, a strong and proximal risk factor for PHT, HT and CVD. For instance, after an extensive review, Colhoun et al (1998) concluded that the effect of socioeconomic status on blood pressure is more often found, and is greater, in women compared to men. Contrary to the findings reported here, in HICs the pattern shows an inverse gradient regardless of the measure of socioeconomic position used (9). In obesity research, a clear and inverse association between SEP and body size has been found in women in HICs, but not in men (38, 55). In less economically developed countries, the findings have been mixed. That is, positive and inverse

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gradients have been found for blood pressure (9, 30) and body mass index (33, 38, 55), an important risk factor for high blood pressure. Regardless of the gradient observed in high-, middle-, and low-income countries, the patterns tend to be stronger in women. Yet, the reasons for these sex/gender differences in the socioeconomic pattern of these major risk factors for CVD remain poorly understood. A potential explanation derived from obesity research in high- and middle-income countries, is that women tend to change their diet and activity patterns more rapidly than do men (34), but is not clear how this intersects with the SEP of men and women. Second, the pattern of both a higher prevalence of HT for men and women with low educational attainment and higher prevalence for women rich in material resources may reflect an intermediate stage of economic transition where both types of indicators influence HT but in different directions. This pattern may be consistent with a hypothesis proposed in previous literature that states that as economic prosperity occurs the socioeconomic gradient of blood pressure inverts (9). The theory of fundamental social causes also suggests that those with the highest SEP use their resources to avoid risks and the consequences of diseases (11). Thus, as those at the top of a social hierarchy in middle income countries have the opportunity, they may start to use their resources to reduce the exposures and risks related to PHT and HT.

Association of ethnicity/race with PHT and HT: Studies in Latin America suggest that the risk of HT for populations of African descent is lower than for blacks in the US. But, as is evidenced in this and previous studies, gender differences should be taken into account. For instance, after accounting for relevant variables in the models, black women in the Americas seems to have higher odds of HT than white (mixed) men and women and black men (19, 56, 57). The current findings show differences in the role of ethnicity/race in the social patterning of PHT and HT between men and women. For men, I did not find any association between

ethnicity/race and PHT and HT. In women, the association was statistically significant for HT and marginally significant for PHT. Although I could not compare a fully adjusted model with other studies because data are not collected using standardized instruments, some comparisons are possible to the patterns observed in studies in Latin America. For instance, in a recent study the crude odds ratio of HT for black women, in comparison to their mixed/white counterparts, was higher for black Colombian women than for black Cuban women (1.55 and 1.20, respectively) (57). However, in both studies, the previously reported odds ratios for black compared to white women were statistically significant, and larger than the not statistically significant odds ratio for Colombian and Cuban black men (versus mixed/white men; 1.10 and 0.80, respectively). Furthermore, in both studies, after adjusting for different variables, the odds ratio for black women remained statistically significant. A prior study, in the same province of Cuba, yielded similar results (19).

The reasons for the ethnic/racial and gender differences in the likelihood of HT have not been totally elucidated. Ethnicity, race, and gender are historical, social and contextual constructs whose meanings and implications change in each society and over time, modifying the levels of marginalization, vulnerabilities and exposures of ethnic/race minorities and gendered groups. In comparison with the rest of Colombians, black populations experience higher levels of poverty and lower levels in almost all social indicators including, but not limited to, education, access to public services, housing quality, and health care access (58). In this context, the differences in the odds of HT for black men and women may be explained by the "double jeopardy" of being women and black in a socially stratified society that exposes them to more adverse and stressful living circumstances that lead to HT. Colombian black women have a history characterized by subordination, exclusion and resistance (59), and this history is visible in statistics illustrating the

current unequal conditions they experience. For example, in addition to fulfilling multiple social and economic roles in their families and communities, black women, more than any other Colombian social group, suffer the consequences of forced displacement (60). Life expectancy of black women is 11 years less than that of mixed women (58). Illiteracy is higher for black women than for mixed women (16.90% and 11.70% respectively), and only 13.5% of black women have access to higher education compared with 19.7% of the mixed women (60). Not surprisingly, in this study those who were black, female and less educated had a higher risk of HT. Education did not, however, entirely account for racial differences in odds of HT among women.

The remaining association between ethnicity/race and HT among women found in this study, after adjusting for some indicators of SEP, may result from different sources of residual confounding rather than for simply biological differences (61). Several explanations may support the conclusion that rather than strictly biological mechanisms, contextual and psychosocial factors play a key role in differences of HT among ethnic/racial groups. There is little plausibility to the argument that those biological factors that lead to HT act only for black women. As discussed before, the social subordination of black women provides a more plausible explanation for the observed differences, as this subordination may activate psychosocial and physiological mechanisms associated with HT. Although the full understanding of the role of neighborhood environment on HT remains elusive, there is evidence of the reduction in the likelihood of HT among blacks living in US metropolitan areas after accounting for neighborhood safety, social cohesion, walkability, and healthy food availability (20). Likewise, Thorpe and colleagues found that when blacks and whites live in similar social context the disparity in HT prevalence was lessened but not fully eliminated, suggesting that additional unmeasured aspects of SES and/or

social context may not have been accounted for (62). The abundant evidence of the variation of HT among those of African descent and whites or mixed-race populations at a larger geographical scale (12, 18, 21, 63, 64) also suggest that more structural factors may play a key role in explaining residual effects. In the meantime, evidence from countries that have implemented inclusive social policies yields important conclusions. Two consecutive studies in a Cuban province have consistently demonstrated that blacks are similar to whites in the odds of being hypertensive (19, 57). Interestingly, as noted above, these studies also found higher odds of HT among black women in comparison to their white counterparts. Finally, unmeasured factors such as ethnic/racial discriminations, additional indicators of SEP (e.g. occupation), and social support may also account for the observed residual effect of ethnicity/race among women.

Despite the evidence favoring socio-environmental and psychosocial explanations for the race differences in HT, epigenetic research may make important contributions in understanding the interactions between social and biological factors. However, the use of vague and generic statements about racial susceptibility for HT must be precluded in further research (57).

Contrary to what was hypothesized in this study, men and women members of indigenous communities were not more likely to have HT than their mixed counterparts. Despite the fact that the results did not reach statistical significance they were in the proposed direction, as demonstrated by the fact that in all the models, except for PHT in women, indigenous people had higher odds of PHT and HT than their mixed counterparts. This lack of statistical significance, despite the social stress and acculturation that indigenous communities have experienced across the Americas (23), may be due to the sampling approach of the CNSH which included indigenous participants from remote areas who could have maintained some of the

environmental and behavioral factors that have been proposed for explaining their lower risk of HT.

***Socioeconomic markers of PHT and HT*:** The results of this study show that education plays a key role in predicting HT, is a strong and consistent contributor of disparities in PHT and HT, has a clear gradient across almost all models, and shapes the vulnerability of excess blood pressure in Colombia. Prior research in Latin America and the Caribbean has found that people with lower education are more likely to have HT, but similar to this study, this association has been much stronger for women (18, 19). Many mechanisms have been proposed for explaining the association between education and health, but this association has not been completely elucidated (65-67). Although multiple mechanisms may be involved in explaining the findings of this study, based on the available data, I tested two specific mechanisms only to explain the association between educational attainment and PHT and HT: the socioeconomic and the behavioral mechanisms. Although all potential mechanisms were not covered in this study, this evidence is relevant bearing in mind the paucity of research on this area in Latin America (19, 53).

The socioeconomic mechanism suggests that the association between education and health is mediated by occupation, income, and other markers of material resources that, for example, shape what individuals can access or afford (65). In this study, the association between education and PHT and HT in women was in part mediated by household income and physical capital, respectively. Prior evidence from studies in Latin America is inconclusive. In some studies education was associated with HT after adjusting for other indicators of SEP (19, 30), but the studies do not provide strong proof of a mediating effect. Other studies in the region showed that in models that include other indicators of SEP the relationship between education and HT

was not statistically significant (68, 69). On the other hand, schooling also increases resources such as knowledge, critical thinking, efficacy, and ability to use information no matter what the risk and protective factor may be in a given context (70, 71). Thus, according to the behavioral mechanism, those with higher education have better health because they use the resources that education provides in adopting health promoting behaviors and reducing the risk of bio-behavioral risk factors (65, 71). For example, in this study BMI was a partial mediator of the relationship between education and PHT and HT in women. Previous research in Latin America has found that overweight and obesity are important contributors of HT, particularly in women, and in wealthier nations and regions in Latin America there is an inverse association between BMI and education (34, 72).

The fact that the tested mechanisms only partially explained the associations between education and PHT and HT supports the assumption that other mechanisms may be involved. For instance, contextual and psychosocial factors may play a key role in explaining this association. Evidence, particularly from high-income countries, shows that those with higher educational level have access to healthier food (73). Theory and empirical evidence posit that education increases a person's sense of control by developing analytic and communication skills which have positive health effects through enhancing healthy behaviors, whereas a low sense of control or a feeling of powerlessness may produce physiological consequences through the stress response (65, 74). The dataset did not include variables to test this mechanism; thus the contribution of these variables should be examined in the future. Additionally, based on the findings of prior research, further studies should assess the role of early life circumstances such as cognitive abilities, parental characteristics, and childhood and adolescent health in PHT and HT in adults (65).

The analysis found evidence of a low correlation between indicators of SEP and important heterogeneity in the association of markers of material resources with PHT and HT. These findings could be explained by a number of factors. As a country advances through economic transition, some indicators of SEP show an inverse association with health, while others remain positively associated. In addition to education, physical capital had an inverse association with PHT and HT with statistical significance in women but not men. Unlike the high variability and low reliability of income for the poorest segment of the population in LMICs (30, 39), physical capital could be a stable marker of material circumstances. Thus, those with less physical capital may experience more limitations for acquiring healthier products or they may be living in more stressful conditions characterized by the lack of basic assets and poor housing quality. The limitations of household income, evidenced here for the lack of a clear direction in its association with both outcomes, justified the use of additional measures of material resources as proposed and used in the prior literature (30, 38, 39). In contrast to the literature on housing and health in high-income countries (75), in this study renters were less likely to have PHT and HT. Although home owners tended to be older and women, the associations remained in the multivariate models adjusted for age and stratified by sex/gender. Thus, other explanations for this finding need to be considered. Housing is a means for accumulating wealth and prestige and is one of the resources to which income provides access (75, 76). In economies in transition, home owners may spend their additional resources on products that increase their risk of PHT and HT. On the contrary, those paying a monthly rent may have fewer resources for buying food products or other goods associated with higher odds of PHT or HT. Alternatively, this result may reflect aspects of the sample composition or a cohort effect. For example, home ownership may have different meanings across different age groups. In accordance with these findings, the use

of multiple indicators of SEP suggested for research on health disparities (77) should also be a regular practice in HT research.

Strengths

This study has several strengths. First, it is one of few studies in Latin America that has used a national probabilistic sample with an objective measure of blood pressure to examine the social patterning of PHT and HT. Second, the CNSH has a sufficient total sample size across categories to avoid the problem of unstable small cell sizes in some categories. This problem has probably affected much health disparities research (17); hence this study makes a particularly important contribution in this regard. Third, based on a conceptual model built on theory and empirical research, I was able to examine the association and magnitude of ethnicity/race as well as different but not interchangeable indicators of SEP (77-79). Therefore, this study supports the necessity of moving beyond adjusting for SEP in order to understand the complex pathways through which different indicators of SEP influence PHT and HT risk and disparities (80).

Limitations

The study also has important limitations. First, the cross-sectional nature of the study limits causal interpretations of the results and the presence of reverse causality is an issue that needs to be considered (81). However, though reverse causality may be particularly important for economic markers of social position such as income, it has been suggested it is less influential for education in the study of adult populations (62). Second, contrary to international standards, in the CNSH blood pressure was measured only once in each participant. The use of one measurement may result in $9\pm11\%$ points higher prevalence estimates compared to the combination of two additional measurements (82). Since blood pressure depends on multiple variables, there are not available methods to correct for the systematic error associated with one

reading. Therefore, appropriate caution must be exercised in interpreting the results of this study, as well as in its comparisons with future studies (83). However, it is important to note that from a public health perspective, those who have high blood pressure on an initial occasion have a greater cardiovascular risk than those with normal blood pressure (84). The potential systematic error introduced for the single measurement of blood pressure is unlikely to produce differential misclassification; thus; the associations found in this study would remain using the combination of a second and third blood pressure reading. Third, the absence of key variables in the data set restricted their inclusion in this study. For instance, the analysis did not include subjective social status which has been associated with high blood pressure in prior research in Latin America (30)

Additionally, this study did not account for the social and physical contexts where the different subpopulation groups live. These contexts can contribute to a substantial proportion of PHT and HT disparities (16) and should be considered in future studies. Finally, the CNSH did not collect information for testing the role of psychosocial factors and diet. However, the effect of diet was partially tested through BMI, which also encompasses other factors such as physical activity, and thus is an imperfect measure.

Implications for Policy, Practice, and Research

This study has several important public health implications. It highlights the seriousness of PHT and HT as public health problems in Colombia. The findings show that education has a strong and inverse association with PHT and HT, and in women its effect is partially mediated by indicators of material resources and BMI. In turn, ethnicity/race was statistically significant only in women. The social patterning of PHT and HT evidenced in this study is important to inform both better interventions and more specific research in this understudied area in

Colombia. In terms of policy implications, policies aimed at modifying fundamental causes such as education may produce a "cascade of effects" associated with the risk factors for CVD (85). Although the evidence is incomplete at this point, interventions aimed to expand education in the most disadvantaged groups of society should be endorsed. The effect of education on health may be more effective when schooling starts at earlier ages (67), but some benefits may be still obtained when people complete basic levels of education later in life. For example, it should be relevant to consider interventions that create lifelong learning opportunities such as vocational training for adults, especially among those with lower levels of education. Despite these policy interventions, a deeper understanding of the mechanisms by which education affect PHT and HT remains a priority policy task (86). Policies should also focus on the social circumstances that disadvantage black women and increase their odds of having hypertension. The alleviation of these social circumstances may include more educational, income and occupational opportunities, as well as the reduction of stereotypes and subordination.

Several authors have suggested the conduct of larger screening campaigns in LMICs to improve the rate of diagnosis of HT (87). However, it is necessary to identify critical indicators that are likely to maximize interventions effects (88, 89). Thus, an initial priority in LMICs is to distinguish the contribution of ethnicity/race and socioeconomic categories to social disparities in PHT and HT in the way that was done in this study. Based on these findings, population and high risk strategies need to be considered for the prevention and screening of PHT and HT. Population-based strategies should be implemented to reduce the high prevalence of PHT reported in this study, its potential of progression to HT, and its direct contribution to CVD. Thus, although the approaches for addressing PHT are still controversial, a population-based approach must be adopted to modify social and environmental factors that influence the adoption

and maintenance of healthy behaviors (e.g. physical activity, reduction in salt consumption, increased consumption of fruits and vegetables). This approach is consistent with the evidence of a dose-response of blood pressure and the impact of decreasing the population mean of systolic and diastolic blood pressure (90). For HT, in addition to the impact of the population-based approach for prevention, it is necessary to adopt early detection programs for the overall population. However, as part of the implementation of these programs, special consideration should be given to target more vulnerable populations such as people with low SEP and black women. Finally, an ongoing surveillance and monitoring of the country's data are critical for determining the burden of PHT and HT, characterizing their distribution among social groups, assessing changes in the prevalence, and selecting and evaluating interventions (90). In doing such work, repeated cross-sectional surveys in the Colombian population can play a key role. Despite the strengths of the CNSH mentioned above, its limitations should be considered to reduce measurement errors and increase validity and comparability with national or international surveys. In sum, the prevention of PHT and HT in Colombia, as well as the elimination of their disparities may be limited unless fundamental causes of disease, such as those examined in this study, are studied and modified as does not occur in many interventions exclusively aimed at changing behavioral risk factors (10, 11, 80).

Three specific implications for future research derive from this study. First, in addition to SEP, research in Colombia should identify how other factors at the contextual and individual level intervene to shape the social patterning of PHT and HT. For example, future research should examine the role of neighborhood environments, workforce conditions and experiences, and experiences of discrimination. Although this study does not provide direct evidence of the role of stress in the social disparities of HT in Colombia, the results and the accumulated

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literature in this area suggest that social and psychosocial stressors play a key role in the excess prevalence of HT, particularly among black and socioeconomically disadvantaged women (56). Thus, the study of the role of stress on HT in Colombia deserves further attention. Second, as the socioeconomic and behavioral mechanism did not fully explain the associations between education and PHT and HT in women and the mediating mechanisms were not identified in men, more research is needed to better understand the mechanisms that lead to the consistent association between education with both PHT and HT and inform interventions for preventing and eliminating disparities in these outcomes (67). Finally, the results suggest that rather than being influenced by a single factor, the odds of having HT are influenced by multiple conditions. This stresses the importance of considering in future research and interventions for PHT and HT the intersections between gender, race, and SEP (10, 55).

In sum, the findings in this chapter show that PHT and HT are important public health problems in Colombia and the complexity of the associations between the indicators of SEP and both conditions. However, the inverse association that was found for education and physical capital resembles the pattern observed in HICs. In terms of the social distribution of PHT and HT, this study shows that education plays a key role in predicting HT is a strong and consistent contributor of disparities for both conditions. In addition, regardless of other indicators, black women are more likely to have HT. In general, these results suggest that those in the bottom of the social hierarchy have more limited access to resources to avoid risks, multiple social vulnerabilities, and exposure to material conditions that lead to HT. These results must inform social policies focused on addressing the social patterning of HT and be a starting point for monitoring trends in social disparities of PHT and HT in Colombia.

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Table 2.1. Characteristics of participants in the Clinical Subsample of the National Survey of Health 2007 overall and by sex.

Variable	Overall		Men		Women	
	n	Weighted %	n	Weighted %	n	Weighted %
Total	12878	100.00	5307	45.84	7571	54.16
Pre-hypertensive	4665	37.12	2466	45.30	2199	30.20
Hypertensive	2970	25.05	1407	28.88	1563	21.81
Age (years)						
18-29	4232	33.13	1798	32.90	2434	33.32
30-39	3311	21.69	1274	21.02	2037	22.26
40-49	2648	21.37	1106	21.37	1542	21.36
50-59	1577	13.99	663	14.23	914	13.79
60-69	1110	9.82	466	10.48	644	9.27
	12878		*5307*		*7571*	
Ethnicity/Race						
Mixed	10284	84.16	4140	82.31	6,144	85.73
Indigenous group	1008	6.2	449	7.25	559	5.32
Black	1565	9.63	706	10.44	859	8.95
	12857		*5295*		*7,562*	
Educational attainment						
Less than primary	864	6.10	364	6.38	500	5.87
Primary	4500	33.30	1,902	33.50	2598	33.14
High school	6058	48.40	2,500	48.88	3558	47.99
Certificate/Bachelor/Graduate	1456	12.19	541	11.24	915	13.00
	12878		*5307*		*7571*	
Household income						
Poorest	4577	33.24	1700	30.19	2877	35.81
Middle	4526	34.96	1684	15.41	2842	38.04
Richest	3775	31.80	1923	38.48	1852	26.15
	12878		*5307*		*7571*	
Physical capital						
Poorest	5365	33.18	2322	34.97	3043	31.66
Middle	4174	33.41	1674	31.98	2500	34.62
Richest	3339	33.41	1311	33.05	2028	33.72
	12878		*5307*		*7571*	
Housing ownership						
Owners	7823	60.51	3256	61.43	4567	59.74
Renters	3995	31.92	1554	29.96	2441	33.57
Others	1060	7.57	497	8.61	563	6.69
	12878		*5307*		*7571*	
Alcohol consumption						
Never	1453	10.68	275	5.79	1178	14.82

Variable	Overall		Men		Women	
	n	Weighted %	n	Weighted %	n	Weighted %
No in the last 30 days	6063	46.09	1905	35.91	4158	54.71
1-2 days in the last 30 days	3569	28.7	1897	35.47	1672	22.98
3-5 days in the last 30 days	1029	8.25	739	13.79	290	3.57
6 or more days in the last 30 days	764	6.27	491	9.04	273	3.93
	12878		*5307*		*7571*	
Physical activity						
Regular	1884	14.94	4347	18.10	6647	12.26
No regular	10994	85.06	960	81.90	924	87.74
	12878		*5307*		*7571*	
BMI						
Normal	6320	49.77	184	54.31	327	45.92
Underweight	511	4.35	2828	3.74	3492	4.86
Overweight	4140	32.32	1699	31.58	2441	32.95
Obese	1907	13.56	596	10.37	1311	16.27
	12878		*5307*		*7571*	

Table 2.2a. Results for multinomial model for prehypertension versus normal with ethnicity/race and socioeconomic position indicators among Colombian adult men.

	Unadjusted		Model 1‡		Model 2‡		Model 3a‡		Model 3b‡		Model 4‡¥	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR)	(95% CI
Race/Ethnicity												
Indigenous group	1.07	.79- 1.56	1.10	.78-1.54	1.09	.78-1.54	1.07	0.76-1.52	1.06	0.75-1.50	1.05	0.73-1.50
Black	1.10	.81-1.45	1.08	.81-1.44	1.08	.81-1.44	1.06	0.80-1.40	1.05	0.79-1.39	1.01	0.76-1.34
Mixed	*Ref*		*Ref*		*Ref*		*Ref*		*Ref*		Ref	
Educational attainment												
Less than primary	1.41	.88-2.25			1.25	.77-2.02	1.22	0.75-1.97	1.18	0.71-1.98	1.35	0.79-2.31
Primary	1.27	.91-1.79			1.20	.85-1.70	1.18	0.83-1.69	1.17	0.80-1.71	1.25	0.84-1.86
High school	0.96	.70-1.32			0.98	.71-1.34	0.98	0.71-1.35	0.99	0.71-1.37	1.02	0.72-1.44
Certificate/Bachelor/Graduate	*Ref*						*Ref*		*Ref*		*Ref*	
Household income												
Poorest	1.06	0.83-1.34					1.01	0.78-1.29				
Middle	1.02	0.80-1.29					1.02	0.80-1.31				
Richest	*Ref*						*Ref*					
Physical capital												
Poorest	1.16	0.91-1.47							1.05	0.80-1.39	1.14	0.86-1.51
Middle	0.95	0.74-1.21							0.94	0.72-1.22	0.96	0.74-1.26
Richest	*Ref*								*Ref*			
Housing ownership												
Renters	*0.71*	*0.58-0.88*					*0.77*	*0.62-0.95*	*0.78*	*0.63-0.96*	*0.73*	*0.58-.091*
Other type	1.02	0.73-1.43					1.07	0.76-1.49	1.06	0.75-1.49	1.01	0.71-1.44
Owners	*Ref*						*Ref*		*Ref*		*Ref*	

‡ Adjusted for age

¥ Adjusted for physical activity, alcohol consumption and BMI.

Note: results were rounded to three digits.

Table 2.2b. Results for multinomial model for hypertension versus normal with ethnicity/race and socioeconomic position indicators among Colombian adult men.

	Unadjusted		Model 1‡		Model 2‡		Model 3a‡		Model 3b‡		Model 4‡¥	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR)	(95% CI
Race/Ethnicity												
Indigenous group	1.07	.72-1.58	1.11	.75-1.65	1.10	.74-1.63	1.07	0.72-1.60	1.09	0.73-1.64	1.05	0.69-1.60
Black	1.10	.78-1.57	1.15	.80-1.64	1.14	.80-1.64	1.11	0.78-1.59	1.12	0.78-1.61	1.06	0.74-1.52
Mixed	*Ref*		*Ref*		*Ref*		*Ref*		*Ref*		*Ref*	
Educational attainment												
Less than primary	*2.72*	*1.61-4.60*			1.66	.92-2.98	1.73	0.95-3.14	1.77	0.96-3.27	*2.10*	*1.10- 4.01*
Primary	*1.69*	*1.14-2.49*			1.30	.86-1.96	1.34	0.88-2.04	1.37	0.88-2.12	1.49	0.94-2.36
High school	0.74	.51-1.09			0.86	.57-1.29	0.89	0.59-1.33	0.89	0.59-1.35	0.92	0.60-1.40
Certificate/Bachelor/Graduate	*Ref*				*Ref*		*Ref*		*Ref*		*Ref*	
Household income												
Poorest	0.89	0.69-1.16					0.93	0.70-1.25				
Middle	0.77	0.59-1.00					0.88	0.67-1.17				
Richest	*Ref*						*Ref*					
Physical capital												
Poorest	1.10	0.84-1.44							0.89	0.65-1.22	1.05	0.76-1.46
Middle	0.95	0.72-1.25							0.96	0.72-1.28	1.02	0.76-1.38
Richest	*Ref*								*Ref*		*Ref*	
Housing ownership												
Renters	*0.48*	0 .38-0.62					*0.68*	*0.52-0.88*	*0.68*	*0.52-0.88*	*0.61*	*0.46-0.80*
Other type	0.76	0.53-1.11					0.94	0.65-1.36	0.96	0.66-1.39	*0.89*	0.60-1.31
Owners	*Ref*						*Ref*		*Ref*		*Ref*	

‡ Adjusted for age
¥ Adjusted for physical activity, alcohol consumption and BMI.
Note: results were rounded to three digits.

Table 2.3a. Results for multinomial model for prehypertension versus normal with ethnicity/race and socioeconomic position indicators among Colombian adult women.

	Unadjusted		Model 1‡		Model 2‡		Model 3a‡		Model 3b‡		Model 4‡¥	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR)	(95% CI
Race/Ethnicity												
Indigenous group	0.97	.72-1.29	0.93	.70-1.25	0.90	.68-1.20	0.89	0 .67-1.18	0.88	0.66-1.18	0.84	0.62-1.14
Black	1.23	*.95-1.60*	1.31	1.00-1.73	*1.32*	*1.00-1.75*	1.30	0.98-1.72	1.29	0.98-1.71	1.30	0.98-1.72
Mixed	*Ref*		*Ref*		*Ref*		*Ref*		*Ref*		Ref	
Educational attainment												
Less than primary	*2.12*	*1.44-3.13*			*1.55*	*1.03-2.34*	1.42	0.93-2.18	1.39	0.90-2.13	1.27	0.82-1.97
Primary	*2.23*	*1.72-2.89*			*1.86*	*1.43-2.43*	*1.72*	*1.31-2.28*	*1.68*	*1.27-2.22*	*1.52*	*1.15-2.02*
High school	1.28	.99-1.64			*1.42*	*1.09-1.84*	*1.37*	*1.05-1.78*	*1.35*	*1.04-1.75*	1.29	1.00-1.68
Certificate/Bachelor/Graduate	*Ref*				*Ref*		*Ref*		*Ref*		*Ref*	
Household income												
Poorest	1.05	0.86-1.28					1.25	1.00-1.55				
Middle	1.08	0 .89-1.31					*1.32*	*1.07-1.63*				
Richest	*Ref*						*Ref*					
Physical capital												
Poorest	1.20	1.00-1.45							*1.42*	*1.09-1.86*	*1.24*	*1.00-1.53*
Middle	*1.29*	*1.06-1.58*							*1.50*	*1.15-1.96*	*1.32*	*1.07-1.63*
Richest	*Ref*								*Ref*		*Ref*	
Housing ownership												
Renters	*0.74*	*0.62-0.87*					0.85	0.72-1.02	*0.78*	*0.63-0.98*	*0.83*	*0.69-1.00*
Other type	0.95	0.73-1.25					1.07	0.81-1.42	0.80	0.52-1.24	1.08	0.81-1.42
Owners	*Ref*						*Ref*		*Ref*		*Ref*	

‡ Adjusted for age
¥ Adjusted for physical activity, alcohol consumption and BMI.
Note: results were rounded to three digits.

Table 2.3b. Results for multinomial model for hypertension versus normal with ethnicity/race and socioeconomic position indicators among Colombian adult women.

	Unadjusted		Model 1‡		Model 2‡		Model 3a‡		Model 3b‡		Model 4‡¥	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR)	(95% CI
Race/Ethnicity												
Indigenous group	1.26	.90-1.75	1.21	.85-1.74	1.17	.81-1.67	1.12	0.78-1.62	1.10	0.76-1.58	1.03	0.70-1.51
Black	*1.55*	*1.16-2.06*	*1.89*	*1.35-2.66*	*1.92*	*1.37-2.68*	*1.88*	*1.34-2.63*	*1.84*	*1.30-2.58*	**1.88**	*1.33-2.67*
Mixed	*Ref*		*Ref*		*Ref*		*Ref*		*Ref*		*Ref*	
Educational attainment												
Less than primary	*8.02*	*5.41-11.89*			*3.17*	*1.96-5.10*	*2.98*	*1.81-4.92*	*2.61*	*1.57-4.34*	*2.34*	*1.39-3.95*
Primary	*4.44*	*3.27-6.03*			*2.56*	*1.81-3.63*	*2.45*	*1.70-3.53*	*2.18*	*1.50-3.17*	*1.82*	*1.25-2.65*
High school	1.33	.98- 1.81			*1.75*	*1.24-2.45*	*1.71*	*1.21-2.43*	*1.61*	*1.14-2.28*	*1.47*	*1.03- 2.09*
Certificate/Bachelor/Graduate	*Ref*				*Ref*		*Ref*		*Ref*		*Ref*	
Household income												
Poorest	0.85	0.69-1.04					1.20	0.92-1.56				
Middle	*0.71*	*0.57-0.88*					1.14	0.88- 1.48				
Richest	*Ref*						*Ref*				*Ref*	
Physical capital												
Poorest	*1.27*	*1.04-1.55*							*1.42*	*1.09-1.86*	*1.50*	*1.13-1.98*
Middle	*1.27*	*1.02-1.57*							*1.50*	*1.15-1.96*	*1.47*	*1.12-1.93*
Richest	*Ref*								*Ref*			
Housing ownership												*Ref*
Renters	*0.51*	*0.42-.62*					0.80	0.64-1.00	*0.78*	*0.63-0.98*	*0.78*	*0.62-0.98*
Other type	*0.58*	*0.40-0.84*					0.84	0.54-1.29	0.80	0.52-1.24	0.84	0.55-1.30
Owners	*Ref*						*Ref*		*Ref*		*Ref*	

‡ Adjusted for age
¥ Adjusted for physical activity, alcohol consumption and BMI.
 Note: results were rounded to three digits.

Figure. 2.1. Conceptual model of the first study
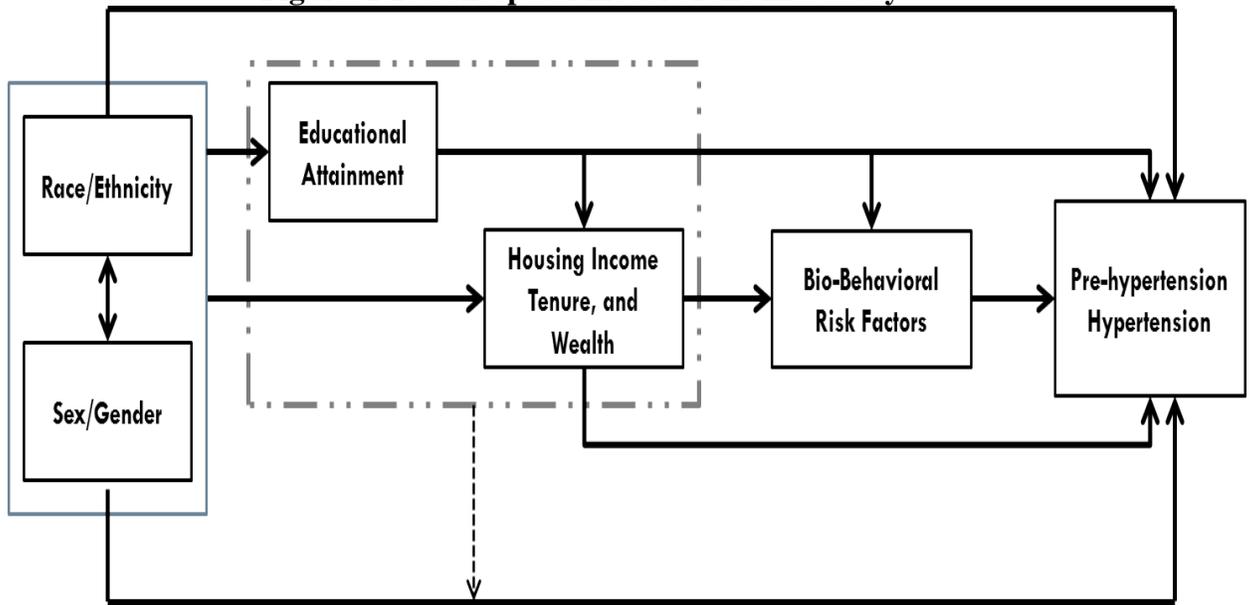
Figure 2.2a. Age-adjusted prevalence of prehypertension and hypertension by ethnicity/race and SEP among Colombia men
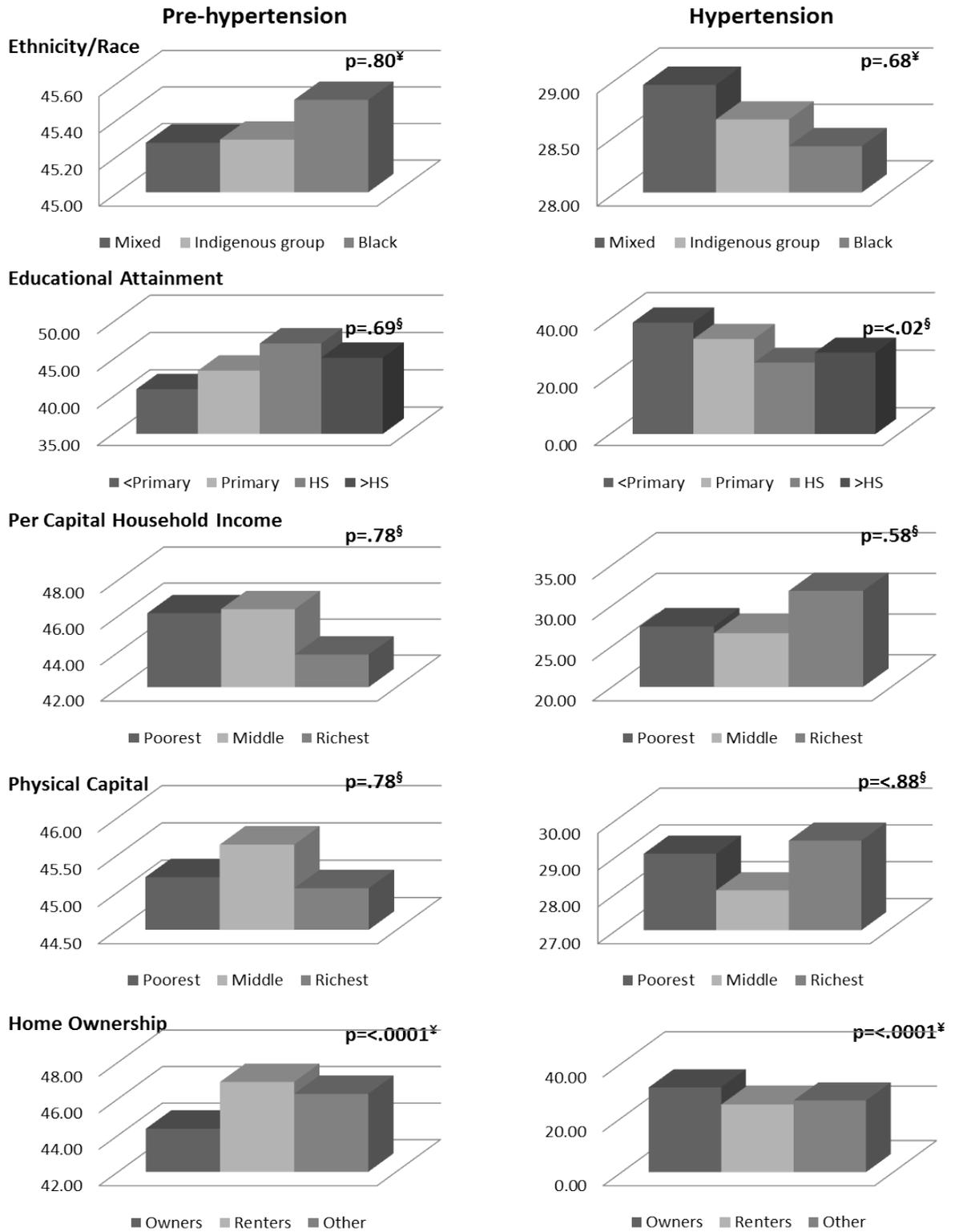
§ p-value for independence

¥ p-value for trend

Figure 2.2b. Age-adjusted prevalence of prehypertension and hypertension by ethnicity/race and SEP among Colombia women

Pre-hypertension / Hypertension charts
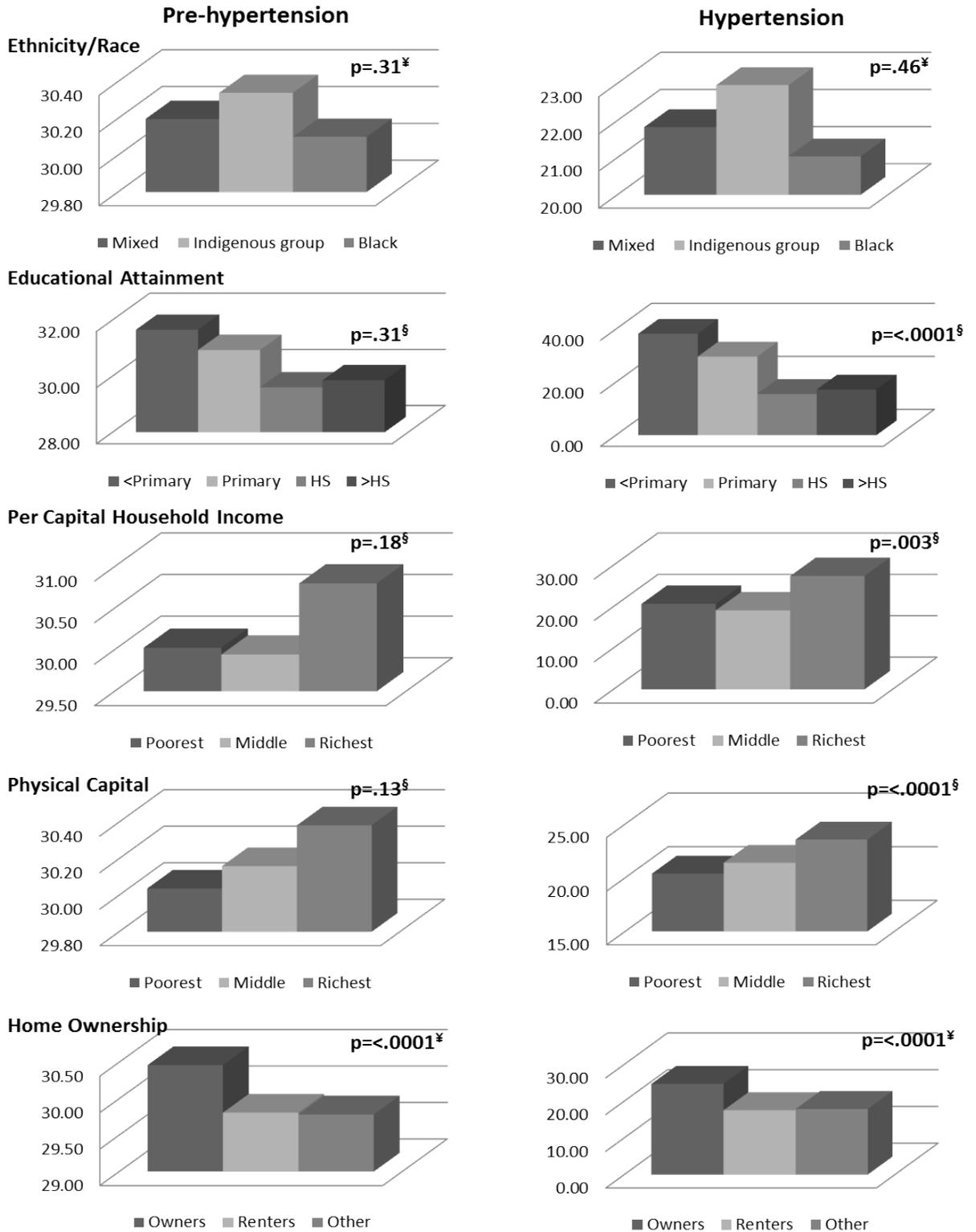
§ p-value for independence
¥ p-value for trend

Figure 2.3. Relational pathways between markers of social position and prehypertension and hypertension by sex/gender
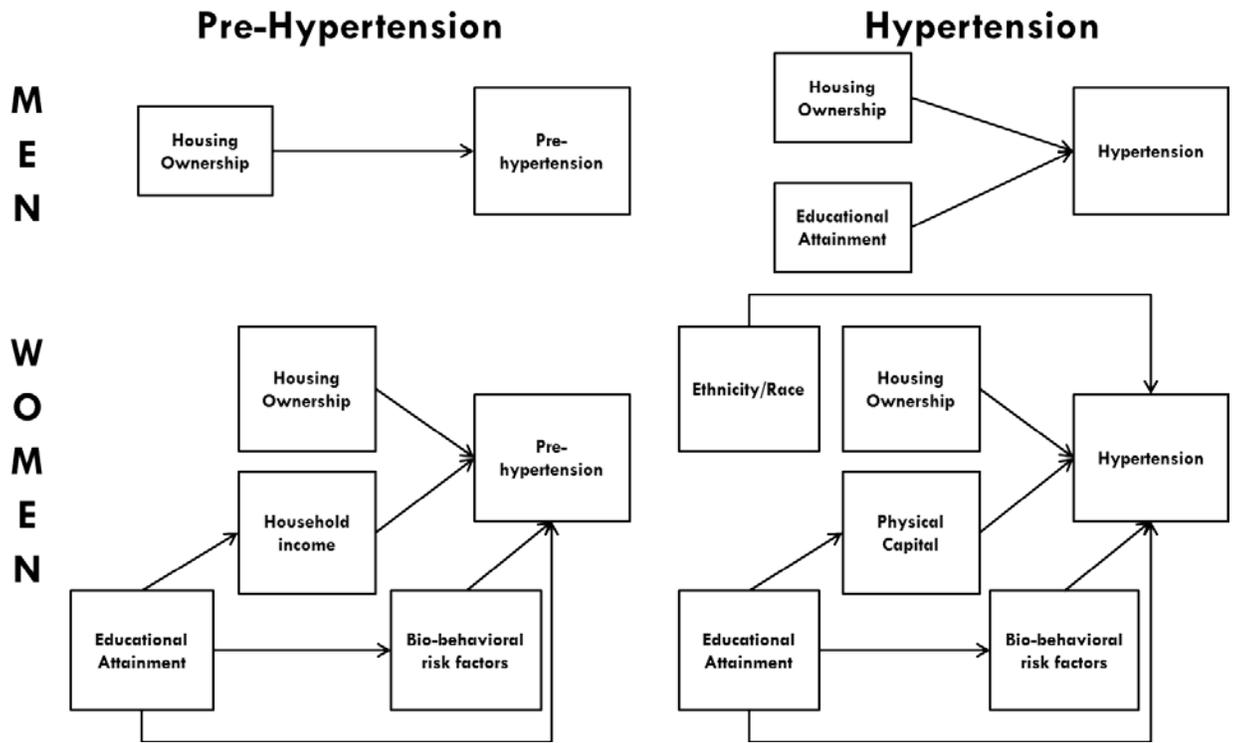
Figure 2.4. Predicted probability of prehypertension and hypertension by sex/gender ethnicity/race, and education in Colombian adults
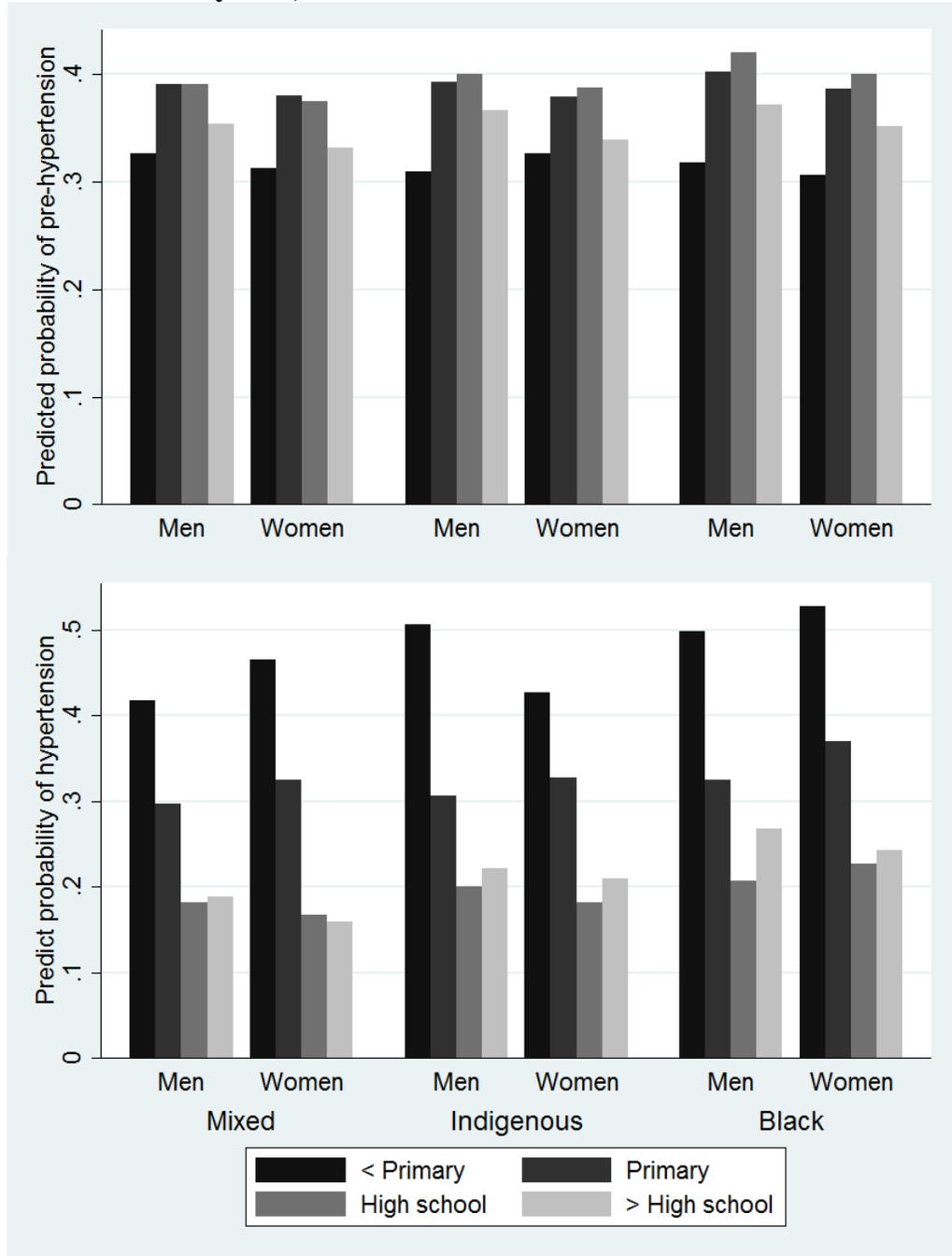
Chapter 3:

Macroeconomic Determinants and Hypertension in Colombia: A Multilevel Analysis

Introduction

Hypertension (HT) is an important and growing public health problem in low- and middle-income countries (LMICs) (1). In these countries, including some in Latin America, HT has already reached an epidemic proportion (1-3). The increase in HT is a crucial factor in explaining the rise in cardiovascular disease, the leading cause of death in LMICs (4). Between 1990 and 2020, mortality from ischemic heart disease, a subset of cardiovascular disease, is expected to increase by 120% for women and 137% for men in LMICs, compared to increases of between 29% and 48% in developed countries, respectively. Predictions for the next 2 decades include a near tripling of ischemic heart disease and stroke mortality in Latin America, as well as in other regions at the same or lower level of economic development (5). In this context, the identification and intervention of the drivers of the increasing prevalence of HT in LMICs must be a research and public policy priority.

A growing body of literature in high income countries (HICs) demonstrates that the contextual characteristics of the place where people live, including social, economic and political factors, play a key role in shaping the risk of being hypertensive (6). Conversely, the role of contextual level factors on HT has been understudied in LMICs. Although the contribution of social, environmental, and macroeconomic factors has been highlighted in the literature to explain the growing burden of HT in LMICs (7), the contribution of these factors remains poorly explained and measured. This may be a consequence of a public health approach to research and

Intervention, which has been, in recent decades, focused on individual-level risk factors. A clear implication of the lack of empirical evidence on the role of contextual factors on HT is that interventions for addressing it, particularly interventions at the policy level, may be either neglected or based on intuition. To synthetize and extend knowledge of the contribution of contextual factors to HT, below I describe current theory and the evidence linking economic development, economic inequality, and poverty to HT and provide empirical evidence of the association of these macroeconomic factors with HT in Colombia, a middle income country in Latin America.

Economic development has been widely proposed as a key condition to explain the burden of HT in LMICs (5, 7). In the health literature, economic development is usually understood as the production of goods and services (8). This approach has been operationalized in research that examines the burden and trends in HT by using the World Bank Classification which is based on countries' gross national income, as well as through economic indicators such as the gross domestic product (GDP) (9, 10). Social and individual level factors may contribute to explanations of the role of economic development in HT. At the social level, economic development is expected to reduce poverty and economic deprivation through increasing incomes (8) and to influence a higher spending on health-promoting social programs, such as public sanitation, potable water, and health awareness initiatives and infrastructure (11, 12). Thus, greater economic development may reduce the detrimental physical and psychosocial effects associated with living in disadvantaged areas that usually have few resources to support those most in need. At the individual level, economic development is supposed to improve material circumstances, create job opportunities, and increase income. As a result, individuals

would have more economic resources to spend, for example, on healthy foods and medical care (11).

The effects of economic development differ across countries' stages of economic growth and socioeconomic groups, however. The literature suggests that in the initial stages of economic growth upper socioeconomic groups have a greater burden of HT as a consequence of the adoption of behaviors that increase risk for this condition (e.g. consumption of high density food). However, as economic growth progresses, these upper groups modify their behaviors and HT becomes more prevalent among middle and low socioeconomic groups, who will in turn have the highest prevalence of HT (13). The contribution of this economic transition to the social patterning of HT in the context of Colombia is partially supported by some of the findings in this dissertation. Results presented in chapter 2 showed that while education has an inverse association with HT in men and women, physical capital, a marker of material resources, is positively associated with this condition. Moreover, the shift in the risks factors for and burden of HT is consistent with the Theory of Fundamental Cause that suggests that upper social socioeconomic groups use their resources flexibly to gain a health advantage (14, 15).

The current literature on the contribution of economic development to public health in general and HT in particular is not without limitations. Specifically, two aspects stressed in the health literature should be kept in mind. First, it has been proposed that wealthier countries become healthier; thus the policy prescription for poorer countries has been to increase their GDP per capita to achieve better population health (12). However, the distribution of the benefits of economic development is still unequal in low economically developed societies (8). Moreover, differences between countries in the distribution of monetary resources may reduce the expected positive benefits of economic development on health. For instance, using data from

Latin America countries, Biggs and colleagues (2010) reported that when inequality and poverty, measured at the national level, were high, the expected positive effect of GDP on three public health indicators was reduced or absent (11). Second, there is evidence that once GDP reaches the level of middle-income countries, the impact of economic development on health is reduced, and income inequality becomes more informative (16). Before examining the potential role of income inequality on HT, I will focus on poverty concentration, the other macroeconomic factor of interest in this chapter.

Poverty is a macroeconomic variable strongly associated with several health outcomes in HICs and LMICs. This association has been found consistently, despite the myriad indicators used in poverty research (8). While there is little research in LMICs examining associations between poverty and HT specifically, there is a growing literature in North America demonstrating these associations at the neighborhood level. For instance, a study in the United States (US) found that higher levels of neighborhood affluence were related to lower odds of being hypertensive (17). In turn, in Canada material neighborhood deprivation exerted a stronger influence on the odds of being hypertensive among women, who on average were 10% more likely to report HT than men living in the same impoverished neighborhood (18). The association between neighborhood deprivation and HT may be due to characteristics of the social and physical environment of deprived neighborhoods that decrease access to healthy resources (19) or more directly to the activation of psychosocial and neuroendocrine mechanisms that lead to high blood pressure in response to the chronic stress of living in deprivation (20). Moreover, in HICs, neighborhood poverty may shape contextual factors that have been associated with HT. For example, in the US, HT has been associated with characteristics that may be more prevalent in disadvantaged neighborhoods, such as low walkability, lack of healthy foods, and low

perception of safety and levels of social cohesion (21). One exception to the dearth of research in

LMICs on the association between contextual poverty and HT are studies conducted in Brazil

and China. In one study carried out in a southern Brazilian city, researchers found that, after

adjusting for individual-level income, people living in the two upper tertiles of contextual

income had lower systolic blood pressure (SBP) and lower odds of having HT than those living

in the bottom tertile (22). Similarly, high income villages were associated with reduced SBP in

rural China (23).

Similar to economic development and poverty, income inequality has been arguably

considered an independent macroeconomic determinant of population health (8). Income

inequality focuses on the distribution of income in a society and is considered a manifestation of

historical and political factors that determine both income distribution and the context for social

and economic policies that shape the living conditions of individuals and communities (24).

Income inequality is measured through multiple indicators that yield similar results (25). Among

these indicators, the Gini coefficient has been the most widely used. According to the Gini

coefficient inequality ranges from 0 to 1. A Gini coefficient equal to 0 reflects absence of

inequality, while 1 indicates maximum inequality. Using the Gini coefficient and similar

indicators, income inequality has been found to be directly associated with multiple health

outcomes. These outcomes include, but are not limited to, self-reported health (26, 27), homicide

(28), risk factors for CVD (29), and overall mortality (30).

Three main and not necessarily mutually exclusive models have been proposed for

explaining the role of income inequality on different health outcomes including HT:

psychosocial, social capital, and neo-material (31). The psychosocial model posits that income

inequality influences health through the perceptions of place in the social hierarchy (28, 32). For

example, the extent that people fail to meet social expectations, there are adverse health effects through feelings of frustration and perception of self as devalued and inferior (28, 33). Psychosocial factors may affect health through a direct effect on chronic stress or indirectly through their influence on health behaviors (28). The social capital mechanism suggests that inequality is socially corrosive and leads to latent social conflict and increasing levels of mistrust (28, 32). This erosion of social ties affects many social domains, including health via inegalitarian patterns of political participation and policies that are particularly detrimental for the health of the most disadvantaged population (33). Moreover, at the neighborhood level, high fairness, a strong indicator of social capital (34), may reduce blood pressure through decreasing chronic stress or increasing the modulation of stressful events (35). Finally, according to the neo-material model, which guides this chapter, health inequalities are a product of the under-investment in human capital (30) and the differential accumulation of exposures and experiences that have their sources in the material world (31, 36). The neo-material model posits that an unequal income distribution is a result of historical, cultural, political, and economic processes. These processes shape the unequal distribution of resources and the differential investment in infrastructure, public services, and poverty concentration among geographic areas within the same country. In addition, an unequal income distribution creates differences in the access to cognitive (e.g. education), economic (e.g. income), and material (e.g. housing conditions) resources held by individuals (31).

The accumulated evidence suggests that under some circumstances, and using appropriate analytical approaches, income inequality has an influence on population health independent of individual-level factors (27, 28, 37). There are a number of key areas of debate within this literature. Income inequality has been considered a statistical artifact or a result of

the limitation of initial ecological studies to disentangle the effect of individual income on health

(compositional effect) from the unequal distribution of income at the geographic unit of analysis

per se (contextual effect) (29). Further studies using multilevel analyses have been able to

identify the particular contribution of income inequality after adjusting for income measured at

the individual level (37). One aspect that has been widely debated is the lag time during which

income inequality should work to produce an effect on health. Studies that use contemporaneous

measures for income inequality and the health outcome of interest have been criticized because

they assume that the mechanisms included in the three models described above occur

instantaneously (38). Further studies have been able to address this limitation and find that it may

take up to 15 years for income inequality to have a significant influence on chronic health

conditions similar to HT (26, 37, 39). However, a shorter time lag may be required for other

health outcomes such as health insurance coverage or use of preventive services (40).

Three additional critiques that still remain under scrutiny are important in this literature.

First, most of the studies that have shown a relationship between income inequality and health

have been conducted in the US (37, 41). It is surprising that more research examining the

relationship between income inequality and health has not been conducted in regions like Latin

America, which persists as the most unequal region in the world (42). Despite the few published

studies examining this relationship in Latin America, the evidence suggests that income

inequality has an independent and detrimental contribution to the population health in this region

(26, 43, 44) or operates by diminishing the positive effects of economic development (11). The

fact that the association between income inequality and health has been more frequently found in

unequal countries has suggested the existence of a threshold beyond which the unequal

distribution of income matters for health (27). A meta-analysis of both prospective cohort and

cross-sectional multilevel studies on the association of income inequality with mortality and self-rated health found that a threshold of Gini ≥ 0.30 had a more consistent association with damaging health effects (41). This finding emphasizes the relevance of conducting research on income inequality in Latin America, where countries' Gini coefficients exceed 0.30 (42). Second, the adjustment for individual-level variables has been controversial (28, 37). While some authors argue that the lack of adjustment for individual-level variables is prone to confounding by individual income, other authors suggest that statistical models adjusting for socioeconomic position indicators underestimate the total inequality effect (29, 37). In general, the results of extensive reviews have found an association between income inequality and health outcomes after adjusting for individual-level variables (28, 37, 41). However, it is important to differentiate, conceptually, which are relevant confounders and which are mediating variables (28). Finally, the mechanisms through which income inequality may affect health also have implications for the level of analysis (33). As concluded from reviews of the evidence by Subramanian and Kawachi (2004) and Wilkinson and Pickett (2006), studies of income inequality with the Gini coefficient measured at the state level were better able to find an association with the measured health outcome than when the unit of analysis was at a lower level (e.g. neighborhoods). Thus, at the state level, a neo-material mechanism may be more appealing to explain these results, while pathways involving social capital or psychosocial effects may be more appropriately examined at smaller units of analysis such as cities or neighborhoods (33). For instance, at the neighborhood level, studies may examine whether differences in social capital, reflecting the involvement of people in addressing problematic issues, have a direct or indirect effect on health.

High blood pressure is in part a physiological response to the exposure to social, physical and psychosocial stressors, as well as the availability or absence of the resources to avoid these exposures or risk factors. Thus, all three models that have been proposed to explain the relationship between income inequality and health may be involved in the development of HT as they relate to the distribution of resources, distribution of these resources according to the levels of social capital, the initiation of a psychosocial and physiological cascade through the stress response, or the adoption of damaging behaviors (Figure 3.1). Despite empirical evidence that suggests that these mechanisms may be relevant for HT research and intervention (21, 35), studies examining the association between income inequality and HT are scarce. The paucity of research examining this association is demonstrated by the few multilevel studies published in this area. Two previous studies, one in an HIC and other in a LMIC, have addressed this issue (29, 45). The study conducted in the US found a positive association between income inequality and HT only in women (29), while the other found an association in rural but not in urban areas of China (45).

The scarce evidence on income inequality and HT highlights the necessity of extending knowledge in this area and addressing the limitations that have been noted in the literature. Thus, building on theory and previous research, this study offers a unique opportunity to test a conceptual model that suggests an association between income inequality, economic development, poverty, and HT (Figure 3.2). By using a multilevel analysis, this study distinguishes between the contextual contribution of income inequality, economic development, and poverty concentration after accounting for indicators of social position measured at the individual level. This study is relevant in Colombia because coronary heart disease and stroke, two conditions largely attributed to HT (46), are the leading cause of mortality in this upper-

middle income country (47), which has one of the most unequal income distributions in the

world (Gini Coefficient of 0.59; 0.41 for the US) (48) and a marked spatial distribution of

poverty (49).

In this study I test six hypotheses derived from the multilevel conceptual model depicted

in Figure 3.2. I hypothesize that the association between income inequality measured at the

departmental level and HT measured at the individual level would be positive and stronger for a

longer time lag than for shorter time lags (*hypothesis 1*). I also examine whether the association

between the longer time lag of income inequality and HT remains statistically significant after

adjusting for age (*hypothesis 2*). In addition to extending our knowledge of the time lag needed

to observe an association between income inequality and HT, by testing this hypotheses I will be

able to estimate the total magnitude of this association through any mechanism. Furthermore, I

hypothesize that the positive association between the longest income inequality time lag and HT

will remain statistically significant after accounting for per-capita GDP at the departmental level

(*hypothesis 3*) and poverty concentration at the municipal level (*hypothesis 4*). Additionally, the

size of the association between income inequality and HT is expected to decline, but remain

statistically significant after including indicators of social position into the models (*hypothesis

5*). Some authors have argued that the inclusion of poverty or indicators of social position (e.g.

ethnicity/race, education) leads to statistical over-adjustment (28, 29). Indeed, theory suggests,

for example, that inequities in public spending on services such as education is a key mechanism

to link income inequality to poor health (8). However, the hypothesized attenuation of the

association between income inequality and HT after accounting for poverty concentration and

SEP would suggest the existence of a partial mediation in this association (29). Finally, I test

whether people with low SEP living in departments with a high level of income inequality are

more likely to have HT relative to people with high SEP living in the same department and those with low SEP, but living in less unequal departments (*hypothesis 6*).

Methods

Study and Data Sources

I conducted a multilevel logistic regression analysis for a binary outcome (50). Data for conducting this secondary data analysis came from several sources. Individual-level data came from the Colombian National Survey of Health (CNSH) 2007. CNSH was a cross-sectional study aimed at studying the health status of the civilian, non-institutionalized Colombian population aged 0-69 years (51). For the analyses in this chapter, I restricted the data to a subsample of 13,301 men and women aged 18-69 who participated in both the interview and clinical component of the CNSH. Data for both departments and municipalities were obtained from the last two national censuses in 1993 and 2005, and official reports (52-54). After review by, and obtaining exemption from, the University of Michigan Institutional Review Board, I merged individual, municipal, and departmental data to create the multilevel data set for both creating the variables and running the statistical analyses described below.

Measures

Dependent Variable: Blood pressure measures were taken from CNSH. As part of the clinical component of the CNSH, SBP and diastolic blood pressure (DBP) were measured in one single occasion by trained staff with participants seated quietly and using a digital sphygmomanometer Omron HEM 714® with cuff-size adjustment made on the basis of arm circumference. HT was the dependent binary variable, which was defined as 1 (yes) if SBP $\geq$140 mmHg or DBP $\geq$90 mmHg or self-reported use of antihypertensive medication (55); otherwise it was 0 (no).

Independent variables: Following the neo-material model (24, 31), income inequality was measured at the departmental level. The Gini coefficients for each department calculated for 1994, 1997, 2002 and 2007 were used in the analysis to correspond to latency periods for income inequality of 13, 10, 5, and 2 year lag, respectively. The information on the Gini coefficient for the 8 Colombian departments created by the new Constitution in 1991 was not disaggregated for the years 1994 and 1997. Thus, I assigned to each new department the global Gini coefficient estimated for them. The information of the Gini coefficient for 2002 and 2007 was neither disaggregated for the new departments nor available as a global indicator. Consequently, the analysis for these years was restricted to 24 departments and the Capital District. Similar to previous studies, the Gini coefficient was rescaled to range between 0 and 20 (37, 39).

Per capita GDP and poverty concentration, the other two contextual variables used in this study, were measured at the departmental and municipal level, respectively. GDP per capita for 1994, 1997, 2002 and 2007 was available in Colombian pesos for all departments and the Capital District. I divided GDPs per capita by 100,000 for the analyses. Poverty concentration was the only municipal-level variable in this study. For poverty concentration I used the index of unsatisfied/unmet basic needs (IUBN) which includes indicators such as inadequate housing, housing with critical overcrowding, housing with inadequate services, households with high levels of economic dependence, and households with school-age children not enrolled in school (56). The IUBN serves as a proxy for income and indicates non-monetary aspects of income and basic service availability (57). The groups that do not reach the minimum threshold are classified as poor (56), and this information is formally used by the government in order to allocate resources for social programs including health insurance for the poorest population. The data of

the proportion of people in each municipality considered poor according to the IUBN came from national census 1993 and 2005.

For the three contextual variables, analyses were conducted using continuous and ordinal indicators (quartiles and quintiles). For Gini coefficient and poverty concentration I found evidence of a non-linear relationship. Thus, I modeled these variables as quartile and quintile categories, withthe use of quintiles as more appropriate to identify non-linear associations, while being readily interpretable. For both variables, the first quintile was the reference category (the lowest income inequality and poverty concentration, respectively). In turn, per capita GDP was modeled as a continuous variable.

Covariates: Several individual-level indicators of social position were used in this study. Ethnicity/race, based on self-report, included indigenous population and blacks, who were compared with those who did not report belonging to any ethnic/racial group and who were grouped as mixed. To account for the multidimensionality of socioeconomic position (SEP), I included in the analysis educational attainment, per capita household income, and physical capital. Educational attainment was divided into less than primary, primary, high school, and higher than high school (reference category). In the previous analysis of this dissertation (chapter 2), education showed a strong, graded, and consistent inverse association with HT, particularly among women. While in chapter 2 of this dissertation household income was not associated with HT in women or men, this variable was included in the analysis due to controversy in the literature about whether the association between income inequality and health is a result of residual confounding due to unmeasured individual income (37). Per capita household income was grouped into quintiles, with the highest quintiles as the reference. Physical capital has been used in a prior study in Colombia (Gonzalez et al., 2010), and a similar variable has also been

used in studies in Mexico (58, 59). Physical capital was a summary measure of 15 household assets (e.g. refrigerator, car), 19 characteristics of housing quality (e.g. floor materials), and overcrowding. The composite measured was the first component of a principal component analysis (Vyas & Kumaranayake, 2006), which was then divided into tertiles. The third and highest tertile of physical capital was the reference category.

A set of covariates were included at the individual level. Health-related behaviors included physical activity (no regular [reference] and regular activity), and alcohol consumption (never [reference], none in the last month, 1-2 days in the last month, 3-5 days in the last month, and six or more days in the last month), and smoking (never, [reference] former, and current). Finally, the body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m2) and divided into three categories according to the World Health Classification (60): <25 (underweight/normal, reference), 25-<30 (overweight), and ≥30 (obese). Additional covariates adjusted for in the models were age in years, place of residence (urban [reference], rural), and covered by health insurance (yes [reference], no).

Statistical Analysis

Analyses were stratified by sex because of evidence of sex differences in HT found in this dissertation (see chapter 2) and prior studies (18, 29). After cleaning the data for implausible values, I calculated univariate descriptive statistics for obtaining means and percentages for continuous and categorical variables, respectively. I used the Spearman correlation in order to examine the level of correlation between continuous and ordinal variables at the three levels of analysis.

I fitted three-level logistic models in which 7529 women and 5278 men were nested within municipalities (n=235 for women; 232 for men), nested within 32 departments and the

Capital District. Multilevel models allow for an appropriate variance estimation and variance partitioning between compositional and contextual effects, as well as the estimation of the independent effects of group-level variables and individual-level variables (61, 62). I fitted the multilevel models by using: a) an approximation to maximum likelihood (63), and b) logit as the link function (50). Because sampling weights for municipalities were not reported and the intent of this study is estimate associations, rather than estimate HT prevalence, sampling weights were not used in the analyses, following the approach of previous multilevel studies (29, 43).

In order to identify the time lag with the strongest association between income inequality and HT, I regressed the outcome on income inequality (Gini coefficient), economic development (GDP per capita), and poverty concentration (IUBN) as a continuous and ordinal variable for each year lag in bivariate analyses in men and women *(hypothesis 1)* . Then, I fitted six subsequent regression models using random intercepts to allow HT to vary randomly across departments. Initially, I fitted an empty or unconditional logistic regression model (50), without predictors at any level, in order to estimate the intraclass correlation coefficient (ICC) attributed to the department-level. Unlike multilevel models with a continuous dependent variable, in multilevel logistic regression analyses the estimation of ICC is not straightforward (61, 64). For variance estimation, I used the linear threshold model method or latent variable method (61, 65). In this method the individual level variance is equal to $\pi^2/3$ (that is, 3.29) (65). Thus, I estimated the ICC for the departmental level by using the following the formula:

$$ICC = VD/ (VD+VM+3.29)$$

where VD is the variance at the departmental level and VM is the variance for the municipal level.

Thereafter, I fitted five subsequent models adjusted for age. In model 1, I estimated the association of the lag time of income inequality with the strongest association with HT in the bivariate analysis in order to obtain the total effect of income inequality *(hypothesis 2)*. In model 2, I included the per capita GDP variable for the same year as the income inequality variable *(hypothesis 3)*. Following the same approach as in previous models, in model 3 I included poverty concentration measured at the closest year of the selected year lag of income inequality *(hypothesis 4)*. Model 4 included the indicators of social position: ethnicity/race, educational attainment, household income, and physical capital *(hypothesis 5)*. The results from the final two models provide information about potential mediation of poverty concentration and indicators of social position in the relationship between income inequality and HT. In model 5 I introduced health-related behaviors, BMI, health insurance coverage and location of residence. Finally, I tested the interactions between income inequality and indicators of socioeconomic position *(hypothesis 6)*. Fixed effects coefficients, random variances for each level, and intraclass correlation are presented for each model. Odds ratios and confidence intervals (95% CI) were calculated. Analyses were conducted in *Stata Release 12* (College Station, TX: StataCorp).

Results

Descriptive statistics are shown in Table 3.1. Results in this table are presented as unweighted sample frequencies, means, and proportions. The mean age was similar for both sexes (37 years), as well as the distribution for ethnic/racial and educational categories. Mixed population was the largest ethnic/race group for both sexes and almost 60% of the participants had completed at least high school. Women had lower incomes, consumption of alcohol, and participation in regular physical activity, and were more likely to be obese. The overall poverty concentration in the Colombian municipalities included in the study declined for men and

women between 1993 and 2005, but in both censuses there were municipalities with 100% of the population below poverty. The range of income inequality in Colombian departments narrowed between 1994 and 2005, but the range of the GDP per capita widened during the same period.

With two exceptions, low correlations were found between the selected variables in females and males (Tables 3.2 and 3.3, respectively). The strongest inverse correlation was found for IUBN in 1993 and GDP per capita in 1994 and 1997 in females and males, respectively. In both sexes physical capital had a moderate correlation with educational attainment and household income.

Bivariate analyses in men showed a marginally significant odds ratio for those living in departments that were at fifth quintile of income inequality in 1997 in comparison with those living in the first quintile (Table 3.4). No statistically significant associations were found for GDP using continuous or ordinal variables. For poverty concentration, similar to women, I found a marginally significant association for municipalities that were in the fourth quintile of the IUBN in 1993 in comparison with men who lived in municipalities that were in the first quintile.

In the bivariate analyses, women living in departments that were in the two highest quintiles of income inequality in 1994 were more likely to have HT than those living in departments that were at the lowest quintile the same year (Table 3.5). This association was statistically significant for the fourth quintile and marginally significant for the fifth quintile. The association between income inequality measured in 2005 and HT was statistically significant for women living in departments that were at the third quintile in comparison with the first and marginally significant for those living in departments that were at the second and fourth quintile. Contrary to findings for income inequality in 1994, the significant and marginal associations found for Gini in 2005 were no longer statistically significant after adjusting for age (results not

shown). GDP per capita had a marginally significant association only for the continuous variable for 1994. For poverty, a statistically significant association was found for women living in municipalities that were in the fourth quintile of IUBN in 1993 in comparison with those living in municipalities that were in the first.

The results for women were consistent with the first hypothesis of this study that a longer lag time for income inequality (13 years) showed a stronger positive association with hypertension compared to the shorter lags. Thus, in the subsequent analyses I used the ordinal variable of the Gini coefficient in 1994, the continuous variable of GDP per capita for the same year, and the ordinal variable of IUBN for 1993. For men, the results were less conclusive, but a 10 year lag time for income inequality seemed most appropriate to use for the subsequent analyses. Thus, multivariate models for men included the ordinal variable of the Gini coefficient and the continuous variable of GDP per capita in 1997, as well as the ordinal variable of IUBN in 1993.

The empty models decomposed the variance in HT in departments and municipalities. Based on these models the estimated ICC for departments was 2.1% for women and 2.4% for men (Tables 6 and 7, respectively). These results suggest that 2% of the variance in HT in Colombian adults at the population level may be attributed to departmental-level contextual factors. A similar variance can be attributed to municipal-level factors, accounting for 2% of the variance in HT for women and 3% for men (data not shown).

The first age-adjusted model showed the total effect of income inequality. The multivariate models for men are shown in table 7, beginning with the model adjusted for age only. This first model showed that men living in departments that were at the fifth quintile of income inequality in 1997 were more likely to have hypertension than those living in

departments at the first quintile in the same year (OR: 1.60). The size of this association was similar and marginally significant across models, except in model 2, in which IUBN was included. Unlike other models, in model 2 the p-value for the fifth quintile of income inequality in 1997 was above marginal significance. Neither marginal nor statistically significant associations were found for GDP per capita 1997 and IUBN in 1993 in any model.

Women living in departments that were at the fourth and fifth quintile of income inequality in 1994 were more likely to have hypertension than those living in departments at the first quintile in the same year (OR: 1.56 and 1.48, respectively) (Table 6). This association was statistically significant and remains without substantial changes in subsequent models after adjusting for GDP per capita in 1994, IUBN in 1993, and the indicators of social position. This association became marginally significant for the fourth quintile after accounting for indicators of social position (model 4). No statistically significant associations were found for the Gini coefficient in the final model, which was additionally adjusted for health-related behaviors, BMI, place of residence and health insurance. In model 2 a statistically significant association between GDP per capita in 1997 and HT was observed. This association was no longer significant after including IUBM for 1993 at the municipal level.

I did not find interactions that were statistically significant between indicators of socioeconomic position and income inequality for either sex (results not shown).

Discussion

To the best of my knowledge, no previous studies in Latin American have examined the association between income inequality and HT, the main risk factor for cardiovascular disease (66). This study yields several important findings. Income inequality was statistically significantly associated with HT, over and above other macroeconomic factors, indicators of

social position and age. This association was particularly clear in women. After using similar time lags for both sexes, this association was found with a time lag of 13 years in women and 10 years in men. Economic development was not a relevant predictor of HT alone or in the presence of other contextual and individual-level variable. A similar finding was found for poverty. Below I discuss these findings, point out the study's strengths and limitations, and describe implications for policy, practice and future research.

Despite the small ICC and size of the associations found in this study, the public health and policy implications of these measures should not be underestimated. Similar to this study, previous studies in CVD have found an ICC around 2% (Matheson et al., 2010). Even with this small ICC, it is important to note that the ICC does not account for all the impact of the context on the individuals living within them. The sizes of the estimated associations in this study are also similar to the general literature of income inequality (41). Although this effect is modest, income inequality is a contextual variable that applies to the overall Colombian population and if income inequality is truly influencing HT risk, the estimated "modest" association may amount to a considerable population burden of HT and cardiovascular morbidity and mortality (16). Moreover, following a population health approach, the modification of contextual factors that influence the entire population may generate more important health benefits than interventions focused at the individuals (67).

The results of this study add previous evidence from two studies on the contextual effect on income inequality on HT (45, 62). For example, Diez-Roux and colleagues (2000) found that income inequality at the state level in the US was associated with higher odds of having a history of high blood pressure among persons with individual-level income below $25,000. Similar to what I found in this study, they also reported that these associations were only statistically

significant for women in the fully adjusted model. Similar gender differences in the relationship between income inequality and health outcomes have been previously reported. For example, Chen and colleagues (2012) reported gender differences in the association between income inequality and health insurance and vaccination. They explained these results as linked to the unequal distribution by gender of benefits of social welfare policies and differences in the awareness and access to preventive programs. All these results are consistent with the evidence from the general health literature that shows a stronger association between individual- and contextual-level socioeconomic factors and health among women (see chapter 2 of this dissertation).

Despite the similarities described above, there are some important differences between the current and previous studies of income inequality and HT. Contrary to my findings, the study by Diez-Roux and colleagues (2000) found evidence to support the hypothesis that effects of income inequality on HT are greater at lower rather than at higher individual income levels. An important methodological difference is that in their study Diez-Roux and colleagues (2000) used as dependent variable the history of high blood pressure based on whether participants had ever been told by a health professional that they had high blood pressure. This approach may have been associated with measurement error or influenced by the unequal access to health care services among participants (68). Another important difference with the studies by Diez-Roux and colleagues (2000) and Chen & Meltzer (2008) is that they used contemporaneous measures of income inequality and HT which fail to show evidence of the required sufficient time to observe this type of relationship (38). In sum, in addition to supporting findings from previous research, this study extends knowledge on the time-lag effect of income inequality on HT using

an objective measure of blood pressure from a nationally representative sample from a middle income country in Latin America.

As suggested by the ICC, differences between departments should be considered to explain disparities in HT in Colombia. Based on the neo-material model these differences may be related to unequal characteristics and availability of infrastructure of health-supportive infrastructure such as transportation, food availability and recreational facilities and opportunities. The fact that for women the association is no longer significant after adjusting for behavioral factors, BMI and place of residence (urban/rural) suggests that income inequality may influence local infrastructure and material assets that play a key role in the adoption and maintenance of behaviors associated to HT (69). However, according to the neo-material explanation income inequality also influences the private resources held by individuals such as money (16). This alternative pathway is less plausible as the association between income inequality and HT remains without changes after including education and relevant markers of material resources, such as income and physical capital, into the models.

Though the findings shed light on the role of structural factors on HT disparities, the psychosocial pathway of income inequality should not be discarded. Psychosocial factors have a direct and indirect effect on blood pressure through physiological mechanisms and health-damaging behaviors, respectively. Psychosocial factors, for instance, can be shaped by the access to material conditions and all material conditions in daily life have a psychosocial meaning (70). Thus, living in contexts without a health-supportive infrastructure may produce negative feelings like shame and distress as well as chronic stress, a key psychosocial predictor of HT (71, 72). Moreover, health-related behaviors are also influenced by stress (71). In fact, abundant evidence

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demonstrates the relationship between exposure to chronic stress and physical inactivity, alcohol consumption, and obesity, which are well-demonstrated risk factors for HT (73).

After accounting for poverty and individual-level variables, economic development, measured in this study through GDP per capita, did not have a significant association with HT. Despite these results, the role of GDP on HT in Colombia should not be totally discarded. In fact, the model in which economic development was associated with HT in women accounted for income inequality, but this association was no longer significant after poverty was included in the model. It suggests that this association may have been attenuated by poverty. Although not explored in this study, the effect of economic development may be moderated by income inequality or poverty. A previous study by Biggs and colleagues (2010), using data from Latin American countries, demonstrated that GDP, rather than poverty or income inequality had the strongest influence on three indicators of population health: life expectancy, TB mortality rates, or infant mortality rates. In this study, GDP had a positive and statistically significant association with some population health indicators but not with others. However, in periods with decreasing inequality and poverty, this positive association became stronger and statistically significant with all indicators. This suggests that in the presence of high levels of inequality and poverty the effect on GDP on health may be diminished. Despite the relevance of this study to understand the complex relationship between macroeconomic factors and population health in Latin America, Biggs and colleagues (2010) did not include indicators of non-communicable conditions. Thus, the implications of these findings for chronic conditions such as HT, whose increase in LMICs has been claimed as a result of the economic growth (5, 7), are unknown.

Though the association between poverty at the municipal level was in the expected direction, its association with HT in this study was not statistically significant. Moreover, I did

not find evidence of the role of poverty concentration as a mediator of the association between income inequality and health. The lack of association between poverty and HT is contrary to the growing evidence of the role of poverty as contextual variable in HT prevalence in high income countries (17, 18). On the other hand, the absence of evidence suggesting a role of poverty as mediator of the relationship between income inequality and HT is not consistent with the literature which suggests that one potential explanation for the role of income inequality on health is the high concentration of poor people (16). Two potential reasons may be considered for explaining these results. First, the measure of poverty used, although including multiple dimensions of material deprivation, may not include conditions not strongly associated with factors that lead to HT. Second, the unit of analysis used for this study may have had a limited ability to capture the heterogeneity of poverty in Colombia. Indeed, the analysis included municipalities with different population sizes and geographic extensions within which there is a mosaic of levels of deprivation. Thus, an alternative in future studies would be to identify datasets that measure poverty at the lower units used in this study. Given the deleterious physical and psychosocial effects of poverty on health, as well as the level of poverty in Colombia, its contribution to HT should be further examined.

Strengths

This study has some important strengths. It was based on a multilevel conceptual model that incorporates three macroeconomic indicators and individual-level variables. These macroeconomic variables accounted for plausible latency periods overcoming potential critiques on the temporal relationship between the predictor and the outcome. The assessment of this conceptual model was possible through the use of a multilevel statistical approach that accounted for contextual and compositional factors by using a national representative dataset. This dataset

allowed for using objective measures to create the dependent binary variable of the study. Although in the CNSH HT was measured on a single occasion, the potential measurement errors associated with only one measure were able to carry implications for HT prevalence, but were unable to have a strong influence on the estimation of the associations that were the goal of this study.

The use of a multilevel analytical approach is other strength of this study. In addition to statistical considerations, the use of a multilevel approach has implications for policy and interventions because it accounts for the fact that individuals' health is not only determined by personal characteristics, but also by the social context which exerts a direct or indirect effect on health or the circumstances that influence it. Additionally, an individual's health may be a result of the interaction between individual and contextual factors (74).

Limitations

The study was limited in the ability to draw causal inferences for several reasons. Even though I used different time lags for contextual variables, this study is cross-sectional in nature. The limitations for making causal claims were also influenced by the potential misclassification bias caused by the lack of information in the dataset about how long people have been living in the departments where their blood pressure was measured (26, 39) or the absence of similar information on migration between departments. However, since the intra-migration processes is expected to be from areas with high levels of poverty and low public investment to areas with better living conditions, the migration of those with the longest exposure to this environment may have underestimated the effect of income inequality. However, as the pattern of migration between Colombian departments is complex and not totally clear (75), in this study the direction of effect of migration between departments remains indeterminate. The results may also have

been influenced for the units selected for the analyses based on the CNSH, which was not designed for multilevel research. For example, different units of analysis may have been more relevant for examining the role of poverty concentration, particularly in the largest municipalities where different residential areas can have a great variation in the concentration of poverty or the characteristics it accounts for. Thus, in the interpretation of the data, it is necessary to be aware that the levels of interest do not necessarily correspond to those that were sampled in the CNSH and included in the analyses of this study. Alternatively, a different conceptualization or measures of poverty concentration should also be considered in future research.

Implications for Policy, Practice, and Research

This study provides a starting point for studying the role of income inequality and HT in Colombia. Specifically, this research examined the role of income inequality in explaining disparities in HT across Colombian departments. Regardless of the theoretical mechanisms that are tested, income inequalities are the result of policies, and thus policy interventions play a crucial role in reducing the pervasive effect of inequality on health. More specifically, the findings of this study suggest that social and economic policies aimed at eliminating income inequalities are needed to reduce HT in Colombia. Thus, it is necessary to modify in LMICs the preponderance of anti-poverty and economic growth policies (8), and include income inequality goals in order to have an impact on HT and other health outcomes. Moreover, policies should seek equitable ways to achieve increases in living standards, addressing the underlying challenges of poverty and inequality. From a practice perspective, health policies should support health care infrastructure and human resources to enhance the screening, treatment and control of HT in departments that have experienced high levels of income inequality in the past decade.

Analyses on the contribution of income inequality to health outcomes are scarce in LMICs and the necessity of more research in these countries has been previously noted (37, 41). In this context, this study extends the existing body of literature in two ways. First, it adds to previous investigations that have found a detrimental effect of income inequality on population health in Latin America. More specifically, this study provides evidence on this relationship by using data from a population-based study conducted in a country outside of the US. Colombia, the country selected for this study, is a middle-upper income nation with one of the highest levels of income inequality in the world, and cardiovascular disease is the leading cause of death (47). This type of research is important in a region such as Latin America which is the most unequal region in the world (42, 76) and where, in most Latin American countries, cardiovascular disease is the leading cause of death (77). Using multilevel approaches, studies in Latin American have found that income inequality, measured by the Gini coefficient, has a detrimental effect on different health outcomes (26, 43, 44). Second, the study addresses some of the most important limitations that have been highlighted in the research on income inequality and health and adds to the evidence that the association of income inequality with health is plausible under some conditions (27, 37, 41). In addition to the above general contributions, this study yields key findings that should be considered in policies, practice, and research regarding the prevention of HT in Colombia. The results suggest that contextual factors matter in the likelihood of HT. In particular, the study found that a contextual long exposure to income inequality measured at the departmental level plays a role in the likelihood of the Colombian adult population having HT even after accounting for relevant contextual and individual level variables.

More research is needed in order to consolidate the evidence about the detrimental effect of income inequality on HT and other health outcomes in Colombia. For example, future studies

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should examine whether the association reported here remains using SBP and DBP as continuous variables. These analyses will provide complementary evidence that is relevant for research and public purposes. As BMI is a strong predictor of HT, the study of its relationship with income inequalities also should be considered. No previous studies in Latin American have examined this association, though the mechanisms suggested for income inequality influencing health may contribute to the dramatic increase in the prevalence of overweight and obesity in Latin American countries. An analysis using an outcome as self-reported health may be appropriate, taking into account that this indicator is an independent predictor of mortality, and that cardiovascular disease is currently the leading cause of death in Colombia.

Several gaps remain in understanding the association between income inequality and health. Some examples illustrate areas of further inquiry. Theoretical explanations for the gender differences observed in this study are needed. The mechanisms through which income inequality exerts its influence on health is an area that deserves more attention. For example, future studies may take advantage of software capabilities for fitting structural equation models for multilevel data to identify in the same analysis the role of variables at different levels and the proposed pathways. Furthermore, studies may build upon these findings to examine both the specific and combined contribution of the three mechanisms that have been proposed for explaining the association between income inequalities on health. Based on the results shown above and the abundant evidence on the role of psychosocial factors in the development of HT, it would be relevant to examine how income inequality is associated with social, environmental and psychosocial stressors that activate psychosocial and biological mechanisms that lead to HT. Similarly, it has been evidenced that the Colombian population has low levels of social capital

(78), but the direct evidence of the contribution of the high levels of income inequality to this low social capital is unclear, as well as its contribution to HT.

In sum, the findings of this study show that income inequality is associated with HT, over and above other macroeconomic factors, indicators of social position and age. Although both the intraclass correlation coefficient and size of the association between income inequality and HT were modest, this association may lead to a considerable population burden of HT and cardiovascular morbidity and mortality, as income inequality is a contextual factor that applies to the overall Colombian population. According to these findings it is necessary to modify the almost exclusive emphasis of anti-poverty and economic growth policies (8), and include explicit income equality goals to have an impact on HT.

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Table 3.1. Descriptive statistics by men and women in Colombia, 2007.

Variable	Women		Men	
	n	Mean (SD) or %	n	Mean (SD) or %
Level 1: Individuals				
Age (years)	7571	37.82	5307	37.67
Ethnicity/Race				
Indigenous group	559	7.39	449	8.48
Black	859	11.36	706	11.36
Mixed	6,144	81.25	4,140	78.19
Educational attainment				
Less than elementary	500	6.60	364	6.86
Primary (5 years)	2,598	34.32	1,902	35.84
High school (11 years)	3,558	47.00	2,500	47.11
Certificate/Bachelor/Graduate (≥ 12 years)	915	12.09	541	10.19
Household income				
First	1,671	22.07	982	18.5
Second	1,806	23.85	1,074	20.24
Third	1,711	22.60	846	15.94
Fourth	1,311	17.32	1,200	22.61
Fifth	1,072	14.16	1,205	22.71
Physical capital				
First	3,043	40.19	2,322	43.75
Second	2,500	33.02	1,674	31.54
Third	2,028	26.79	1,311	24.7
Covered health insurance				
Yes	5,768	76.19	3,820	71.98
Alcohol consumption				
Never	1,178	15.56	275	5.18
No in the last 30 days	4,158	54.92	1,905	35.9
1-2 days in the last 30 days	1,672	22.08	1,897	35.75
3-5 days in the last 30 days	290	3.83	739	13.93
6 or more days in the last 30 days	273	3.61	491	9.25
Physical Activity				
Regular	924	12.20	960	18.09
BMI				
Underweight and normal	3,819	50.44	3,012	56.76
Overweight	2,441	32.24	1,699	32.01
Obesity	1,311	17.32	596	11.23
Place of residence				
Urban	6,043	79.82	4,099	77.24

Variable	Women		Men	
	n	Mean (SD) or %	n	Mean (SD) or %
Level 2: Municipalities[£]				
Poverty concentration				
IUBN 1993 (range: 9.15-100)	7529	44.15 (22.53)	5278	45.38 (22.96)
IUBN 2005 (range: 5.43-100)	7571	34.92 (21.53)	5307	35.89 (21.83)
Level 3: Departments				
Income inequlity				
Gini 1994[T¥] (range: 7.10-12.30)	7571	9.9 (1.17)	5307	9.89 (1.17)
Gini 1997[T¥] (range: 8.66-13.34)	7571	10.97 (0. 98)	5307	10.96 (0.97)
Gini 2002[T€] (range: 9.41-11.91)	6505	10.58 (0.66)	4575	10.59 (0.65)
Gini 2005[T€] (range: 9.11-11.57)	6505	10.26 (0.65)	4575	10.25 (0.65)
Economic development				
GDP per capita 1994[Z] (range: 6.82- 38.63)	7571	16.17 (7.00)	5307	15.99 (6.96)
GDP per capita 1997[Z] (range: 10.89-84.96)	7571	27.38 (12.84)	5307	27.08 (12.82)
GDP per capita 2002[Z] (range: 18.39-161.05)	7571	41.49 (20.08)	5307	41.21 (20.12)
GDP per capita 2005[Z] (range: 20.11-214.74)	7571	54.93 (27.30)	5307	54.62 (27.25)

[£] n = 235 women; n=232 men

[T] Rescaled: 0.00-20.00 ; original: 0.00-1.00;

[¥] N=33

[€] n=25

[Z] In Colombian pesos divide by 100,000

IUBN: Index of Unsatisfied/Unmet Basic Needs

Table 3.2. Spearman correlation coefficients matrix for contextual variables and individual-level indicators of socioeconomic position in Colombian men, 2007.

	Gini 1994	GDP per capita 1994	IUBN 1993	Educational attainment	Household income	Physical capital
Gini 1994	**1.00**					
GDP per capita 1994	-0.32	**1.00**				
	0.00					
IUBN 1993	0.23	-0.46	**1.00**			
	0.00	0.00				
Educational attainment	0.00	0.07	-0.19	**1.00**		
	0.76	0.00	0.00			
Household income	-0.06	0.13	-0.13	0.22	**1.00**	
	0.00	0.00	0.00	0.00		
Physical capital	-0.07	0.22	-0.41	0.37	0.34	**1.00**
	0.00	0.00	0.00	0.00	0.00	

Table 3.3. Spearman correlation coefficients matrix for contextual variables and individual-level indicators of socioeconomic position in Colombian women, 2007.

	Gini 1994	GDP per capita 1994	IUBN 1993	Educational attainment	Household income	Physical capital
Gini 1994	**1.00**					
GDP per capita 1994	0.04	**1.00**				
	0.00					
IUBN 1993	0.03	-0.45	**1.00**			
	0.00	0.00				
Educational attainment	-0.06	0.02	-0.15	**1.00**		
	0.76	0.00	0.00			
Household income	0.00	0.11	-0.13	0.24	**1.00**	
	0.86	0.00	0.00	0.00		
Physical capital	0.00	0.17	-0.39	0.34	0.37	**1.00**
	0.77	0.00	0.00	0.00	0.00	

Table 3.4. Bivariate association between contextual variables and hypertension in Colombian men, 2007.

Variable	Continous		First		Second		Middle		Fourth		Fifth	
	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)
Depertamental Level												
Income Inequality												
Gini 1994	0.98	(0.87-1.10)		*Ref*	0.95	(0.62-1.48)	0.88	0.61-1.26	1.03	(0.62-1.71)	1.08	(0.69-1.70)
Gini 1997	1.03	(0 .90-1.17)		*Ref*	1.19	(0.79-1.78)	0.98	(0.65-1.47)	0.95	(0.67-1.37)	**1.57**	**(0.97-2.54)***
Gini 2002	1.01	(0.82-1.26)		*Ref*	0.91	(0.61-1.36)	0.78	(0.50-1.23)	1.03	(0.68-1.55)	0.88	(0.53-1.44)
Gini 2005	1.03	(0.82-1.29)		*Ref*	1.28	(0.89-1.84)	**1.63**	**(1.11-2.38)****	0.99	(0.68-1.45)	1.28	(0.81-2.03)
Economic Development												
GDP per capita 1994	0.99	(0.97-1.01)	1.36	(0.90-2.06)	0.93	(0.60-1.43)*	1.23	(0.82-1.84)	1.26	(0.81-1.94)		*Ref*
GDP per capita 1997	0.99	(0.98-1.00)	1.32	(0.87-1.99)	0.93	(0.59-1.45)	1.23	(0 .81-1.85)	1.26	(0.81-1.96)		*Ref*
GDP per capita 2002	1.00	(0.99-1.00)	1.17	(0.76- 1.79)	1.08	(0.70-1.67)	0.98	(0.63-1.52)	1.23	(0.79-1.91)		*Ref*
GDP per capita2005	1.00	(0.99-1.00)	1.46	(1.01-2.10)	0.87	(0.61-1.26)	0.97	(0.66-1.47)	1.24	(0.86-1.79)		*Ref*
Municipal Level												
Poverty Concentration												
UBN 1993	1.00	(1.00-1.01)		*Ref*	1.29	(0.93-1.77)	1.15	(0.84-1.57)	**1.33**	**(0 .97-1.81)***	1.17	(0.85-1.63)
UBN 2005	1.00	(1.00-1.01)		*Ref*	1.13	(0 .83-1.55)	1.11	(0.81-1.53)	1.07	(0.77-1.45)	1.18	(0.84-1.64)

*Significant at 10%; **Significant at 5%

Variable	Continous		First		Second		Middle		Fourth		Fifth	
					Quintiles OR (CI 95%)							
	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)	OR	(CI 95%)
Depertamental Level												
Income Inequality												
Gini 1994	1.06	(0.96-1.18)		*Ref*	1.02	(0.72-1.43)	0.95	(0.71-1.27)	**1.54**	**(1.05-2.27)****	**1.37**	**(0.97-1.92)***
Gini 1997	1.02	(0.91-1.16)		*Ref*	0.91	(0.62-1.33)	1.03	(0.70-1.51)	0.91	(0.65-1.28)	1.35	(0.86-2.10)
Gini 2002	1.02	(0.86-1.21)		*Ref*	1.25	(0.93-1.69)	1.00	(0.71-1.41)	1.18	(0.86-1.62)	0.93	(0.64-1.35)
Gini 2005	1.14	(0.96-1.35)		*Ref*	**1.30**	**(0.96-1.76)***	**1.47**	**(1.07-2.02)****	**1.30**	**(0.95-1.78)***	1.24	(0.84-1.83)
Economic Development												
GDP per capita 1994	**0.98**	**(0.97-1.00)***	1.36	(0.93-1.99)	1.01	(0.68-1.51)	1.27	(0.88-1.84)	1.14	(0.77-1.70)		*Ref*
GDP per capita 1997	0.99	(0.98-1.00)	1.32	(0.91-1.93)	1.02	(0.68-1.55)	1.27	(0 .88-1.85)	1.14	(0.76-1.72)		*Ref*
GDP per capita 2002	1.00	(0.99-1.00)	1.13	(0.76-1.67)	1.10	(0.74-1.63)	0.90	(0.60-1.35)	0.93	(0.62-1.40)		*Ref*
GDP per capita2005	1.00	(0.99-1.00)	1.14	(0.78-1.67)	0.93	(0.63-1.377)	1.06	(0.70-1.60)	0.93	(0.62-1.39)		*Ref*
Municipal Level												
Poverty Concentration												
UBN 1993	1.00	(1.00-1.01)		*Ref*	1.03	(0.79-1.34)	1.18	(0.91-1.52)	**1.32**	**(1.00-1.72)***	1.15	(0.86-1.54)
UBN 2005	1.00	(1.00-1.01)		*Ref*	1.08	(0.83-1.41)	1.03	(0.78-1.36)	1.17	(0.87-1.58)	1.21	(0.90-1.64)

*Significant at 10%; **Significant at 5%

Table 3.6. Odds ratios of hypertension according to multilevel models among men in Colombia, 2007.

Variables	Null model	Model 1[a] OR (CI 95%)		Model 2[a] OR (CI 95%)		Model 3[a] OR (CI 95%)		Model 4[b] OR (CI 95%)		Model 5[c] OR (CI 95%)	
Fixed part											
Level 3: Departments											
Income inequality (Gini 1994)											
First		Ref		Ref		Ref		Ref		Ref	
Second		1.26	0.81-1.96	1.23	0.79-1.90	1.22	0.78-1.91	1.24	0.80-1.93	1.22	0.78-1.90
Middle		0.92	0.59-1.43	0.92	0.60-1.42	0.93	0.60-1.44	0.93	0.60-1.43	0.86	0.56-1.33
Fourth		1.00	0.67-1.48	0.98	0.67-1.45	0.98	0.65-1.46	0.99	0.66-1.47	0.92	0.62-1.38
Fifth		1.60*	0.95-2.70	1.54	0.91-2.60	1.57	0.93-2.65*	1.60	0.95-2.68*	1.57	0.93-2.66*
Economic development											
GDP per capita 1994				1.00	0.99-1.01	1.00	0.99-1.01	1.00	0.99-1.01	1.00	0.99-1.01
Level 2: Municipalities *Poverty Concentration (UBN 1993)*											
First						Ref		Ref		Ref	
Second						1.26	0.88-1.81	1.24	0.87-1.78	1.15	0.80-1.65
Middle						1.15	0.81-1.64	1.12	0.78-1.59	1.04	0.72-1.49
Fourth						1.28	0.91-1.82	1.23	0.86-1.76	1.14	0.79-1.65
Fifth						1.21	0.84-1.76	1.15	0.79-1.69	1.01	0.68-1.49
Random parameters											
Departments	0.08	0.07		0.07		0.07		0.06		0.06	
Municipalities	0.10	0.14		0.14		0.14		0.13		0.13	
ICC	2.35%	1.97%		1.86%		1.89%		1.77%		1.80%	

Percentage of proportional change
*Significant at 10%; **Significant at 5%
a: Adjusted for age
b: Adjusted for age, ethnicity/race, education, household income, and physical capital
c: Adjusted for age, ethnicity/race, education, household income, and physical capital, BMI, smoking, physical activity, alcohol consumption, place of residence, and health insurance
Note: results were rounded to the closer digit

Table 3.7. Odds ratios of hypertension according to multilevel models among women in Colombia, 2007.

Variables	Null model	Model 1[a]		Model 2[a]		Model 3[a]		Model 4[b]		Model 5[c]	
		OR (CI 95%)		OR (CI 95%)		OR (CI 95%)		OR (CI 95%)		OR (CI 95%)	
Fixed part											
Level 3: Departments											
Income inequality (Gini 1994)											
First		*Ref*		*Ref*		*Ref*		*Ref*		*Ref*	
Second		1.08	0.75-1.54	1.03	0.74-1.44	1.02	0.72-1.45	1.02	0.71-1.47	1.00	0.69-1.45
Middle		0.93	0.69-1.27	0.95	0.72-1.26	0.91	0 .67-1.24	0.93	0.68-1.28	0.90	0.65-1.25
Fourth		**1.56****	**1.04-2.34**	**1.51****	**1.05-2.19**	**1.56****	**1.05-2.32**	**1.45***	**0.96-2.19**	1.36	0.89-2.07
Fifth		**1.48****	**1.04-2.09**	**1.53****	**1.11-2.10**	**1.53****	**1.08-2.18**	**1.45****	**1.01-2.09**	1.30	0.90-1.89
Economic development											
GDP per capita 1994				**0.99****	**0.97-1.00**	0.98*	0.97-1.00	0.99	0.971.00	0.99	0.97-1.00
Level 2: Municipalities *Poverty Concentration (UBN 1993)*											
First						*Ref*		*Ref*		*Ref*	
Second						1.10	0.79-1.53	1.04	0.75-1.44	0.94	0.66-1.32
Middle						1.26	0.91-1.73	1.15	0.84-1.58	1.02	0.73-1.42
Fourth						1.32*	0.95-1.85	1.20	0.86-1.67	1.04	0.741.48
Fifth						1.18	0.84-1.66	1.02	0.72-1.44	0.88	0.61-1.27
Random parameters											
Departments	0.07	0.02		0.01		0.02		0.02		0.02	
Municipalities	0.07	0.15		0.15		0.12		0.15		0.15	
ICC	2.07%	0.65%		0.26%		0.71%		1%		1%	

Percentage of proportional change
*Significant at 10%; **Significant at 5%
a: Adjusted for age
b: Adjusted for age, ethnicity/race, education, household income, and physical capital
c: Adjusted for age, ethnicity/race, education, household income, and physical capital, BMI, smoking, physical activity, alcohol consumption, place of residence, and health insurance
Note: results were rounded to the closer digit

**Figure 3.1. Proposed mechanisms through which income inequality leads to hypertension.**
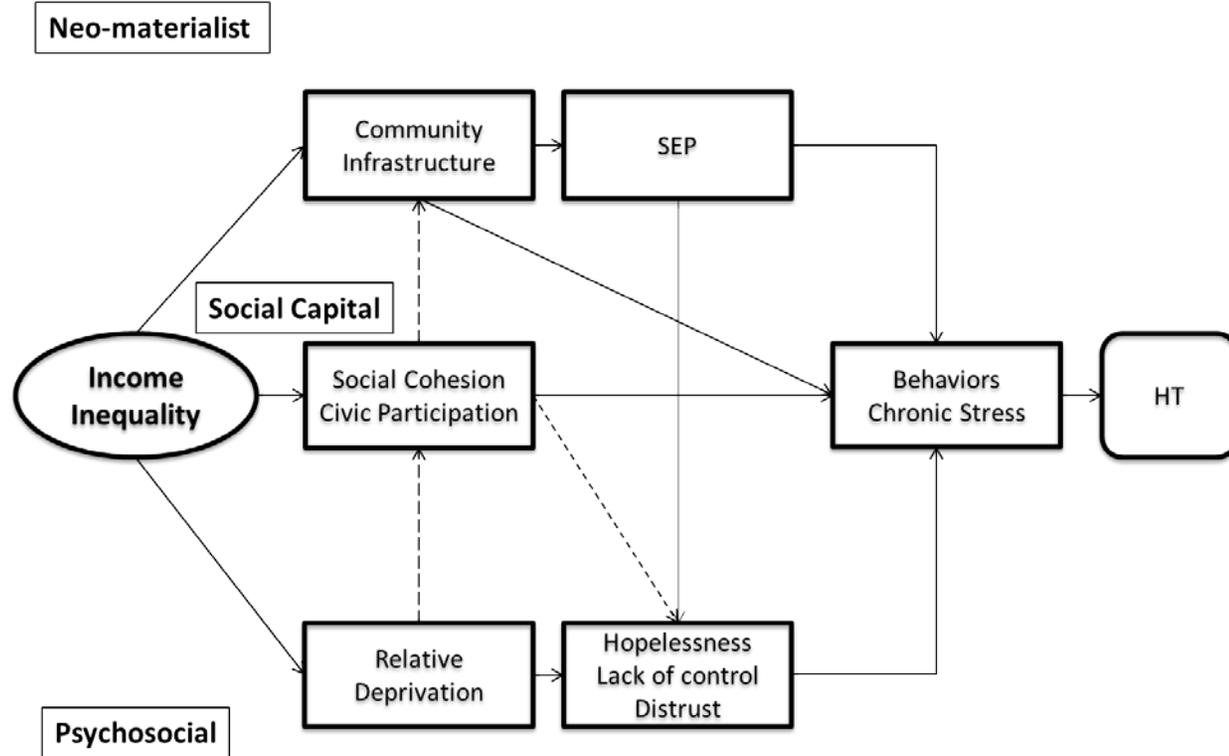
Figure 3.2. Conceptual model of the study 2.
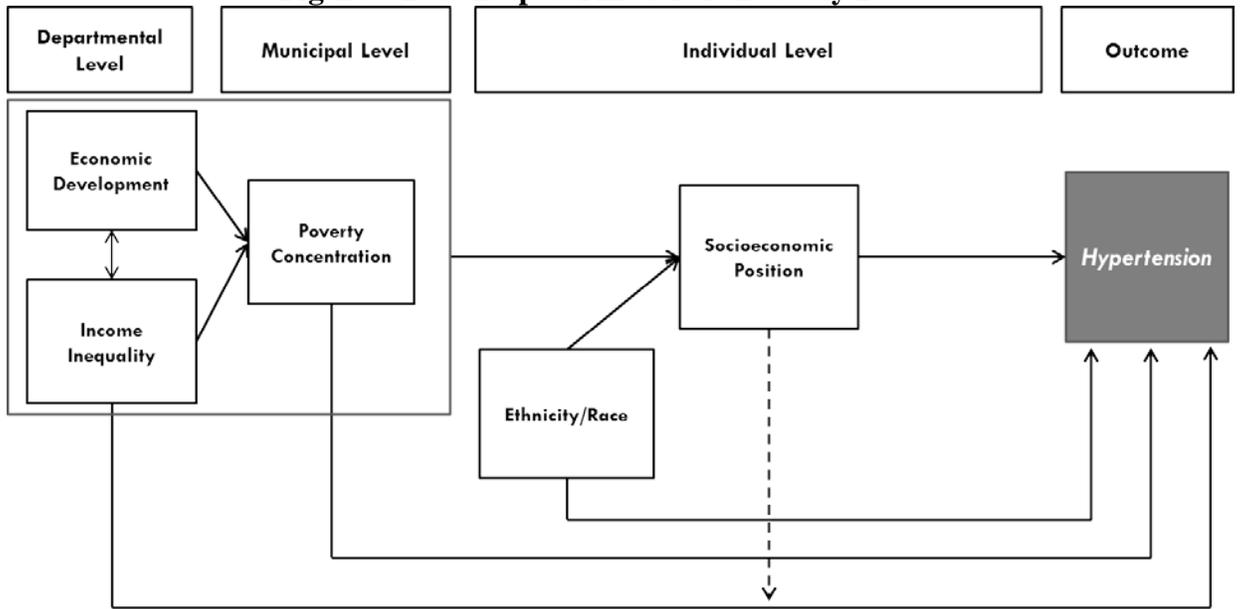
Chapter 4:

Framing Hypertension Risk and Disparities: A Case Study on Social and Political Actors'

Perceptions of the Role of Living Conditions in a Colombian Municipality

Introduction

Hypertension (HT) is the principle cause of cardiovascular disease (CVD), the leading

cause of death in Colombia (133 per 100,000) (1, 2) and other Latin American countries (3). In

Latin America, however, there is a paucity of research on understanding how social and political

actors view the contribution of living conditions on the development and unequal distribution of

HT in their jurisdiction. Living conditions have been defined as those municipal features that

shape the day-to-day life of local residents and have a direct effect on population health (4).

These features include population characteristics (e.g. poverty level and population turnover),

services (e.g. transportation and recreation), and physical and social environmental factors (e.g.

green spaces and social capital, respectively) (4).

In Colombia, the municipal level plays a key role in addressing multiple obligations.

After the local election of mayors started in 1988 and a new Constitution and political reforms

were enacted in the 1990s, municipalities became more engaged in addressing obligations in

areas such as public and social services, building and maintaining infrastructure, and health care

and public health services (5). At the local level, social and political actors such as mayors, city

council members, public officials, community leaders, and service providers are involved in the

selection of policy alternatives, the allocation of public resources, and the implementation of

interventions to modify living conditions at the municipal level (4).

Ultimately, these conditions have an impact on health-protective resources, harmful exposures, and people's vulnerability to conditions that undermine their health (4, 6, 7). Moreover, the municipal or local level area is where people experience the effects of choices and conditions that influence their health risks, as well as the opportunities and resources that protect them against adverse health outcomes (8). These choices and conditions are shaped by decisions made by social and political actors about, for example, how resources for prevention are allocated and how needs such as education, transportation, employment, and recreation are addressed.

At the municipal level, social and political actors play a key role in influencing the economic and social patterning of health and disease in their jurisdictions (4, 9). They take part in the process of implementing national policies by defining how these policies play out in practice, and they are also decisive participants in creating local policies and programs to modify living conditions, enhance access to protective resources, and mitigate risk exposures (4, 10). These policies and programs usually respond to problems that are socially constructed, based on the identification and interpretation of issues of the social world as problematic (11). Therefore, understanding how social and political actors frame their understanding of, and decisions about, the causes of HT and HT disparities is a critical next step in identifying opportunities to address these processes. Qualitative research involving social and political actors at the local level may make a critical contribution to exploring which frames are used for these actors for explaining HT as a social and public health problem. Specifically, such research can help develop an understanding of how these frames guide the decisions that social actors make about the problem or its related conditions in a given jurisdiction, and to consider social and political actors' assessments of what actors should be involved in addressing the problem at hand (12).

While local municipal authorities can play an important role in making decisions and implementing policy for addressing health problems (4), they also face several challenges that may limit their capacity and resources to carry out policies for influencing population characteristics, environmental factors, and social services for which they are responsible (13, 14). For instance, in low- and middle-income countries (LMICs), such as those in Latin America, the adoption or implementation of policies for enhancing living conditions at the municipal level is influenced by multiple and interrelated challenges. These challenges include a low financial capacity due in part to a reduced tax base and high poverty concentration (15-17), the impact of accelerated urbanization on the delivery of services (14, 18), and the presence of competing health problems that undermine the capacity of local governments and communities to provide services and infrastructure to local dwellers and address old and new public health problems (19).

Although municipal actors may have real or perceived challenges in addressing social determinants of health and health disparities (9, 20), the evidence described above suggests that those actors who are responsible for making decisions about the living conditions at the municipal level may play an intentional or unintentional critical role in influencing HT risks and disparities. Indeed, the way these actors frame HT and its associated factors may contribute to establishing the social pattern of this condition in a given population, shape the scope of alternatives for preventing it, and determine how these alternatives are implemented. Thus, understanding the frameworks that municipal social and political actors bring to their decision making processes is an essential step in order to implement a more comprehensive approach for reducing HT risk and disparities. However, little is known about how municipal social and political actors at the local level in Colombia frame HT, the decisions they consider for

addressing this condition, and the actors that they believe should be involved in these decisions and interventions.

Theoretical Frameworks

The health of populations is determined by factors at different levels. In their frameworks, Galea and colleagues (4) and Schulz and Northridge (8), suggest niches and policy implications which the municipal actors can directly focus to improve the health of local dwellers. While in the Galea and colleagues' framework, the characteristics of the social context and physical environment that influence health at the municipal level are grouped under the denomination of urban living conditions; in Schulz and Northridge he intermediate level (meso or community level) identifies detailed characteristics that influence the health of local residents. Efforts to understand whether these characteristics are considered in the understanding of a particular public health problem will help to increase recognition of the role of local level characteristics on shaping the health problem and identify potential interventions to modify the social context and physical environment. In fact, the way a particular problem is defined or framed is critical for assigning responsibilities, creating a rationale for intervention, and choosing one course of action while discarding others (21).

The concept of framing which acquired relevance after the seminal work of Goffman (21) has been widely applied in the social sciences, including the study of social movements (22) and public policy-making (11). Frames are symbolic-interpretive constructs that include beliefs and images or symbols shared by people in a given society, used in making social reality meaningful and to guide action (11, 22). More concretely, by using the frame approach, it is possible to examine what factors are incorporated in the understanding of HT by local social and political actors. Moreover, social and political actors' frames suggest suitable courses of action for either

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addressing current problems or addressing future ones. For instance, if HT is framed solely as a consequence of individual health-related behaviors, decisions for interventions would focus on modifying lifestyles and the responsibility for behavior change would be exclusively left to the individual (23, 24). In contrast, framing HT as a consequence of living conditions considers broader interventions to modify, for instance social and physical contexts. In light of this distinction, through the decisions and actions based on their frames, social and political actors have the ability to increase, reduce, or legitimatize social disparities in health (24). Therefore, the use of a frame approach allows for the exploration of how such understanding shapes the understanding of, and alternatives for, influencing HT risk and disparities in a given context.

Drawing from literature on the use of frame analysis to understand social movements (22) and the policy making process (11), I used three core framing tasks to conceptualize this study and guide the research questions: diagnostic, prognostic, and motivational (22). The diagnostic task refers to how the problem is defined and attempts to identify who or what is to blame or who is responsible. The diagnostic task is important because it focuses attention on one particular explanation and not others. The prognostic task focuses on the selection of solutions to the problem and the tactics or means for achieving a proposed goal. Finally, in public policy the motivational framing task relates to the identification of those actors who should do something about the problem (25).

The use of Framing Theory has several relevant implications in policy formulation, implementation, and evaluation. First, policy initiatives are more likely to succeed if they match with current frames and policymakers' priorities (9). Therefore, it is important to understand the frames that social and political actors' bring to the policy-making process or in the implementation of an intended initiative. Second, as these interpretative frames play a key role in

making visible the options that might be considered for addressing a problem, the initial component of some policy endeavors should focus on creating conditions for influencing the prevailing frames or considering alternative ones. Third, as the options chosen by social and political actors are crucial for modifying the risk and selecting alternatives for prevention of a health problem, the understanding of frames can help to explain the distribution and trends of the problem and the rationale for the alternatives in place for addressing it.

Research Questions

In response to both the research gaps and theoretical consideration described above, this study addresses three main research questions. First, how do social and political actors understand the role played by living conditions in influencing HT risk and disparities in their municipality? Second, to what extent are living conditions included in the decisions that social and political actors consider for influencing HT risk and disparities in their municipality? And finally, who are the actors that participants consider should be involved in addressing the living conditions they relate to HT?

To answer these questions, a qualitative single case study was done in Quibdó, a Colombian municipality characterized by a high poverty level and a multiethnic and growing urban population, as well as a double burden of communicable and non-communicable diseases, including CVD. In addition to expanding knowledge in the field, this study may inform policy interventions aimed at reducing HT risk in Quibdó and in similar contexts in Colombia and Latin America.

Methods

Setting

Using a critical case sampling strategy (26), I selected Quibdó, the capital and largest municipality of the department of Chocó to conduct a qualitative single-case study (27). In 2012 the population of Quibdó was 115,052, 92% of whom are Afro-Colombians. Quibdó concentrates 25% of the population of Chocó and based on the Unmet Basic Needs Index its percentage of poverty is 89.5% (28). Quibdó is the only capital city located in, and the third largest municipality of, the Colombian Pacific Coast, the sub-region with the highest prevalence of HT in the country (38.3%; Colombia 25.5%) (29). Coronary heart disease (CHD) and stroke, the two most important types of CVD, are the leading causes of mortality in population aged 45 years and over (211.6 and 311.9 per 100,000, respectively) in Quibdó (28). Extensive epidemiological research has demonstrated that HT is the main risk factor for CVD. Globally, 54% of stroke and 47% of CHD are attributed to high blood pressure (30). Although the prevalence of HT in Quibdó is unknown, the high rate of mortality for CVD in Quibdó and high prevalence of HT in the sub-region where this municipality is located suggest that HT is an important contributor to morbidity, disability, and mortality among the population of Quibdó.

This study was reviewed by and granted exemption from The University of Michigan IRB for Protection of Human Subjects in 2011.

Participant Recruitment

Based on stratified purposive sampling (26), I selected participants from four strata, each of which have different roles in the policy-making process at the local level. These strata were: 1) community leaders (e.g. leaders of civic associations or members of the neighborhood associations), 2) appointed municipal officials (e.g. public health, planning), 3) policymakers

(e.g. mayors and members of the local council), and 4) health practitioners. This sampling strategy sought to account for the inclusion of participants with rich information on political, social, and economic characteristics, resources, and interventions at the municipal level. Additionally, as the sampling strategy was based on the selection of key municipal stakeholders, it sought to increase the usefulness, utilization, and credibility of findings among those who were more likely to use the results and were in a better position to translate evidence into interventions (26, 31).

In order to select municipal officials and policymakers, I considered those who were appointed or elected during the periods 2004-2007, 2008-2011, and 2012-2015. These are the most recent municipal terms and are the closest periods to the 2007 Colombian National Survey of Health (CNSH) (32), which is the survey that I used for the quantitative analyses of this dissertation. According to the type of participants and periods examined, I anticipated conducting a total of 18 semi-structured interviews in three rounds of data collection as described below (Table 4.1). I contacted and had several conference calls with both a local health researcher who had previously been working on chronic disease projects and a local nurse who worked as fieldwork assistant on this study. With support from the local health researcher and fieldwork assistant I created a list with actors who fulfilled the requirements for participation. After I selected those participants who could provide rich information on the issues to be explored, either the local health researcher or the fieldwork assistant contacted each selected participant in person to give them a letter of invitation and explain the details of the study. Upon acceptance of participation, appointments were made according to each person's date and time availability. For each round, the selection and list of participants was reviewed and adjusted in accordance with the initial and emerging areas of interest.

Data Collection

By using a topic guide I conducted individual interviews with key informants to answer questions regarding the tasks of the framing theory: diagnostic, prognostic, and actors. Samples of the questions that were asked are shown in Table 4.2. Before starting the interview the purpose of the study was again explained and the written informed consent was discussed with each participant, who received a copy that she or he and I signed. Thirteen interviews were conducted in three rounds of four days each in September, October and November 2012. Five of out 18 planned interviews were not conducted because potential participants expressed time constraints or were out of the city during the different time periods the interviews were scheduled.

Gathering information in different rounds enabled a preliminary immersion in the data and analysis to inform subsequent rounds regarding issues that needed to be addressed. I conducted the interviews in Spanish, which is my native language as well as the native language of residents of Quibdó. Interviews lasted 60-80 minutes and were audio taped, transcribed verbatim by a person with experience in this work, and checked by me for errors. In addition to contacting participants, and making the schedule and logistical arrangements for the interviews in each round, the fieldwork assistant was responsible for taking notes during the interviews and monitoring the tape recorders. After each interview I discussed with the fieldwork assistant the notes that were taken during the interview which were particularly useful for addressing new or recurrent topics.

Data Analysis

Data were analyzed according to the methods of the Framework approach (33). Framework analysis is a systematic approach and well-defined procedure to sifting, charting and

sorting the collected material according to key issues and themes. Framework was selected for the analysis of this study because it is particularly oriented towards generating policy and practice-oriented findings (31, 34). Although Framework is more structured than some other qualitative analytic processes, it also relies on the creativity and conceptual ability of the analyst and is strongly informed by both original research aims and the themes that emerge from the data (33, 34).

Framework analysis has five steps: familiarization, identification of a thematic framework, indexing, charting, and mapping and interpretation (33). Familiarization involved immersion in the data by listening to tapes and reading field notes and transcripts of each interview in order to list key ideas and themes. I developed a thematic framework by identifying themes based on the three framing tasks and the issues derived from the data. This thematic framework evolved as the indexing and charting were conducted. In the final thematic framework the themes in the diagnostic task were grouped into 3 major themes that included 16 sub-themes; the prognostic task contained 2 themes and 6 sub-themes; and the motivational task had 3 themes (Figure 4.1). As in other analytic approaches, this step involved both logical and intuitive thinking; however, it also involved making sure that the questions guiding the study were fully incorporated in the thematic framework (33). According to this consideration and the research questions, the thematic framework included issues from the diagnostic, prognostic, and actors' frames. In the third step, indexing, I applied the thematic framework to all the data that were gathered. Thus, indexing references were directly applied to the transcript passages according to the meaning and significance of the data.

Different from other qualitative analytical approaches, in the Framework approach, charting involved the abstraction and synthesis of data before they were rearranged according to

the thematic framework to create charts. However, the original text was referenced in order to trace the source. Unlike the three previous steps, the information for charting was translated into English. I translated information into English at this step in order to reduce potential distortions of meanings that may have arisen in previous steps. Charts were organized by themes according to the specified areas of each frame and emergent issues (31, 33). Since I conducted a thematic analysis, charts included areas with entries for the 13 participants. Table 4.3 provides an extract of 1 out of 6 charts that I created to cover all the emerging themes and sub-themes described above. This extract includes data from 2 interviewees regarding the 6 sub-themes grouped into the structural themes of the diagnostic frame. Finally, I used the charts to map the nature of the phenomenon under study and find relationships between themes to provide sufficient description and explanations for the findings as well as to guide policy recommendations (33). *Nvivo10* (Doncaster, Australia: QSR International Pty Ltd) was used for managing the data including the indexing and charting.

Respondent Validation

In order to conduct a process for external validation a group discussion was held to take research evidence back to the participants. For this meeting all participants were invited personally by the fieldwork assistant who gave them a letter that explained the goal and relevance of this discussion. Findings were discussed with 5 out of 13 participants. Three participants excused themselves from attending the meeting due to travel or work constraints. The reasons why the remaining 5 participants did not attend the meeting were unknown. The meeting included a summary of the results and open discussions on completeness, relevance, and clarity of the findings. Participants felt that the findings described their responses and mainly emphasized aspects that were noted in the interviews. For example, participants emphasized the

role of the social stressors in the risk of HT and the low availability of some protective

environmental factors (e.g. facilities for physical activity). Based on these discussions findings

were reviewed and no relevant adjustments were needed. As small token of gratitude, all 13

participants in the study received a mug marked with the University of Michigan.

Results

Table 4.4 shows the type, characteristic and number of interviewees. Community leaders

and appointed municipal officials, with four participants each, were the sampling strata with

more participants, followed by policymakers with three, and health practitioners with two. The

final sample yielded a similar number of females and males (six and seven, respectively). All but

three participants had a certificate, bachelor or graduate degree, and most were 40-50 years old.

As shown in Figure 4.2, most of the information was indexed on the diagnostic task.

Within diagnostic, the structural factors category and more specifically the subcategory of job

opportunities and income generation contained more references. In turn, less information was

indexed into the three themes grouped under the actor (motivational) task. The results of the

analysis are presented according to the three framing tasks: diagnostic, prognostic, and actors. I

provide exemplary quotes drawn from all participants. These quotes were identified by a code

that included a number and letters according to the order of the interview and type of participant

based on the stratified purposive sampling and the participant's sex. Identifying details were

omitted in order to ensure confidentiality.

Diagnostic: The Role of Living Conditions on HT Risk and Disparities in Quibdó

Based on analysis of participants' responses, 3 major themes and 16 sub-themes were

identified as aspects of the diagnostic task. These included the following: 1) structural factors (7

sub-themes), 2) urban characteristics (5 sub-themes), and 3) bio-behavioral factors (4 sub-

themes). The analysis of participants' responses regarding the diagnostic task suggests that they perceived three interrelated municipal determinants as influencing living conditions that they associated with HT risk and disparities in Quibdó: unemployment, forced displacement, and unplanned urban space (Fig 3). These determinants are expressed in how the city is geographically and socially built and imagined, the nature of the economic circumstances in which people live, and the proximal factors associated with HT. Below, I describe these results in four sections, which are developed using elements of the major themes and sub-themes of the diagnostic task.

Living together and apart in a place we own with others: The changes in the city's population size and composition were described by participants in these interviews as a result of the immigration and emigration dynamics. The former includes forced displacement, non-forced migration from rural areas or smaller cities in Chocó, and the immigration of people, especially mestizos (called *"paisas"* by people of Quibdó) from neighboring departments (e.g. Antioquia and Risaralda). On the other hand, the emigration of residents of Quibdó toward the main urban areas of Colombia was linked by those interviewed for this study to social and economic mobility. Interestingly, while people of Quibdó emigrate seeking a better socioeconomic condition, participants described *"paisas"* who often come to the city looking for economic opportunities through, for example, owning businesses in the city. As described below, population dynamics have produced profound social and economic impacts on the city's life. These impacts include, but are not limited to, spatial enlargement, population growth, unemployment rate, and the capacity of the local government to provide public services.

Forced displacement emerged from these interviews as a contemporary driver that influences almost every aspect of the city. Displaced people arrived to escape the armed conflict

that has affected more rural and isolated areas in Chocó. Some interviewees noted that the trauma experienced by the displaced population was linked to the loss of their loved ones, lands, social connectedness, and culture. After arriving, displaced people were living in poor conditions in crowded public spaces and basic needs were partially supplied by public assistance or donations. In addition to the traumas associated with the displacement and relocation in Quibdó, displaced people had to face the rejection and stigmatization of the residents of the city. A policymaker summed up the treatment displaced people received by saying:

"The traditional people of Quibdó, like Colombians in general, have considered that these persons (displaced population) are like a plague." (03-PMM)

The negative perception toward the displaced population is also illustrated by the predominant idea that they are unskilled, delinquents or street sellers. Moreover, displaced persons are portrayed as people of rural customs who have difficulties adapting to life in the city. Also, they are considered suspects and generators of violence. Although there was no clear distinction between the type of participant regarding the perception of the role of displacement in shaping living conditions in the city, some interviewees tended to consider displaced people as a problem rather than as victims of violence and displacement. Conversely, another group of participants noted that displacement has been the expression of more complex problems whose solution is beyond of the capacity of the local level. However, most participants' responses suggest that the conjugation of negative perceptions toward the displaced people and the circumstances they experienced created a tense social relationship between traditional residents and newcomers. In addition, displacement led to a culture shock among the new urban dwellers. This culture shock has forced acculturation dynamics that are observed particularly among the younger displaced population, who try, but do not always succeed, in assimilating to the social

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and cultural models that predominate in the city. As noted by some participants, the necessity of assimilation and recognition in the absence of economic opportunities has contributed to increased delinquency and participation in the informal job market.

Migration dynamics have also influenced the social stratification of the city. Although some participants highlighted that, over time, different social stratifiers have been in place in the city, the contemporary social scale seems to be extensively influenced by the forced displacement. The social scale has mutated from the white and black dichotomy in the earliest years of the city, to a more complex social hierarchy that is based on ethnic background, place of origin, and possession of material resources. Four social groups emerged from analysis of the interviews for this study. These included:

- Immigrant mestizos *("paisas")*: They own the majority of the local businesses. They are considered a group with strong internal cohesion, but with or limited social interactions with other groups in the city.

- Traditional residents: They make up the black population who has traditionally lived in the city. Most of them are low or middle social class and consider education a means for social and economic mobility. Some participants that can be located within this social group expressed negative feelings toward immigrant mestizos, arguing that despite their lower educational level they own almost all local businesses and impose unequal opportunities for job promotion that disadvantage blacks.

- Displaced blacks: They are considered as a low education and unskilled group. As reported by displaced participants, they have gained social and political spaces through social organization. Also for this group, education has become considered a means for social mobility.

- Indigenous people: They are a subgroup among the immigrant population. Indigenous people arrive to the city as a result of either the armed conflict or looking for better living conditions. They are considered socially and politically marginalized and in the social imaginary are perceived as "inferiors". Indigenous people are discriminated against and stereotyped. They are experiencing a process of rapid acculturation and women particularly face language barriers. The bottom position occupied by indigenous people in the social hierarchy is illustrated by the quote of a public health official:

"It is not a secret to anyone that there is a lot marginalization toward the indigenous population. Traditionally, we have seen them as ignorant, as different people. Many times we even feel superior." (05-PHOW)

Summary: Findings from this section show that for participants forced displacement plays a key role in shaping HT and HT risk in the context of Quibdó. Forced displacement, determined by factors not explored in this study, is not only directly involved in defining the population composition of the city, but also in sorting people into the social hierarchy and marginalizing them across social, economic, and political domains. According to this study, the processes of social stratification and marginalization shaped by migration are mainly based on two dimensions of social position: ethnicity and geographic origin. As described below, the differences in resources, exposures, and vulnerabilities conferred by the location in the social scale were perceived by those interviewed for this study as influencing the unequal distribution of proximal factors that lead to HT such as the experience of chronic stress and the adoption of risky behaviors.

A central and peripheral city in the periphery of a centralized country: Some

participants perceived Quibdó as a socially and geographically marginalized Colombian city that

receives little attention from the national government:

"The government [nationa] is not interested in this region."(09-HPM)

According to participants, the lack of attention from the national government is due to the

consideration of Quibdó as peripheral city, the centralized model of government, and the lack of

officials born in the city working at national institutions.

"…the government's (national) policies have always been for the Andean region…because those who work for the government (national) are from that region and know only the dynamics of that region of the country." (03-PMM)

Additionally, some participants noted that historically the national government has only

paid attention to the demands of the city's residents after massive strikes. However, after these

social movements end, most of the demands remain unattended to:

"…the little we have achieved here in Quibdó and in the Chocó has been through a people's struggle. We got electrical power because there was a strike, we got telephone services because there was a strike...we got a university because of a strike, this is all evidence that we have been in complete oblivion...." (10-CLM)

Similar to the country as a whole, within the city, processes of centralization and

marginalization are also reproduced. Some participants reported that since the initial settlement,

the river has remained as an urban reference for the social and geographical location in the city.

The city has historically grown from the river to the periphery and this geographical orientation

has been recognized as a marker of social stratification. As the Atrato River was the main means

used to connect the city with the rest of the country, the white population and immigrant business

men located by the river, which is also where the main local institutions were established. In turn, the black population occupied more peripheral areas. More recently, as forced displacement has influenced the expansion of the city, a new mental map has been created in which geographical borders are not precisely defined, but invisible borders emerge. Indeed, although participants described several geographic and socioeconomic similarities across Quibdó, they imagined in their mental map two areas: the center and the periphery. To some extent this map suggests that a new social and geographic urban pattern is emerging as all participants were able to make distinctions about how these two areas are made up (compositional features) and to identify some urban living features that are particular for each area (contextual features) (Table 4.5).

Some participants perceived the urban growth as an unplanned and persistent process due to both the lack of urban planning policies and the dynamics linked to the forced displacement. In fact, according to participants the current periphery has been a product of the invasion of vacant lots by displaced populations who have built poor housing and substandard neighborhoods. In light of the two distinct social and geographical spaces participants described, they related the periphery to otherness, displacement, inhospitality, and social problems, as illustrated by the following quotes:

"Currently and for many years there have been new neighborhoods (in the periphery). There are people living downtown who do not know those neighborhoods. And there are people that would not go there even if they were paid in euros." (09-HPM)

"…because they [traditional residents) say that only displaced people live there, there are many problems with violence, they are thieves, there are gamins[*]…So it became like a little Quibdó." (03PMM)

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[*]"An often homeless boy who roams about the streets; an urchin". "http://www.thefreedictionary.com/gamins"

Summary: Based on analysis of interviews conducted with participants in this study, a picture emerged of Quibdó as a subordinated city in the country and the periphery of Quibdó as a subordinate area within that city. In the context of the city, the conjunction of migration dynamics, particularly forced displacement and lack of urban planning policies reinforce processes of stratification and marginalization. These processes are evidenced in the reproduction of hierarchical and exclusionary location of social groups in the city. As suggested by participants, this segmentation is mental and physical and may have psychosocial, social, and material impacts on the living conditions of inhabitants of Quibdó, especially for those with more disadvantages. Segmentation creates barriers for social integration, is also linked to the unequal distribution of material circumstances, and contributes to the differences in the vulnerabilities and exposures observed across social groups and geographic areas of the city. The conjunction of all these factors may explain disparities in HT in the city.

Without opportunities for living with dignity: Unemployment was a recurrent and key condition reported by all participants to explain the relationship between living conditions and HT. Unemployment was considered high and perceived as a condition that affects all social groups in the city; however, it was considered to be higher for those with low SEP and for the displaced population. The high level of unemployment was explained as a consequence of the lack of public services that restricts the possibilities to establish business or to attract companies that generate employment in the city. Some participants mentioned that unemployment is caused by the lack of national and local policies to promote the creation of jobs. As noted by the participants, a consequence of the lack of job opportunities was the creation of informal, temporal and alternative jobs, which are mainly occupied by displaced people. The jobs mentioned by the participants can be classified into 3 groups according to gender:

- Predominantly male occupations: informal motorcycles taxi drivers ("*rapimoteros*"), construction workers and mineworkers.

- Predominantly female occupations: domestic workers

- Both genders: street sellers

As noted by some respondents, there are jobs that particularly benefit the displaced population, who find in these job a viable alternative for income generation:

"…for these people (displaced people) the phenomenon of rapimotismo (informal motorcycles taxis) was like a panacea. Many of them owned a canoe tied in a river and now are in the city with a motorcycle (to transport people)." (12-MOM)

Although some groups of the population benefit from informal activities, informal jobs were linked to negative impacts on public transportation and safety. For example, participants considered the disproportionate growth of informal motorcycle taxi drivers to be responsible for the traffic congestion, high levels of noise, and reduction of walking as a main means of transport.

There was a unanimous perception among participants regarding formal jobs being scarce in the city. Some participants highlighted that these jobs are concentrated almost exclusively in the public sector and in fewer numbers in non-governmental organizations (NGO) that have established themselves in the city. Participants reported that jobs in the public sector are under the control of politicians and are offered in exchange for political support. Thus, people in public jobs are under permanent pressure to provide support to the politicians that help them to get jobs and are subject to lose these jobs after the end of each election term if other political groups are in power. As result of these political practices, the job opportunities are not always linked to educational credentials or experience. In terms of access to formal jobs, few job opportunities

and the fact that those available are under control of politicians were proposed as key reasons to

explain why professionals from Quibdó immigrate to other places in the country. Moreover,

participants described that formal job opportunities are even more limited for those with lower

education or lack of training in a particular field. Thus, informal jobs are almost the exclusive

opportunity available for this population. Women in general face more limitations for finding

jobs, even in the informal sector. As mentioned by a female respondent, on some occasions

women experience sexual harassment for getting or keeping their jobs:

"I came in to present my resume and the first thing they take note of is your physique from head to toe, and excuse me for my language, they take note of your tits and your ass to see if you are good. They call you to offer you an opportunity if things happen as they'd like, and not all women are going to accept those conditions. This is also part of what happens here in Chocó, as they say very rudely you give it up to me (sex) and I'll give you the job then, and it stays like that, if you gave it up already, you need to keep giving it to keep the job." (07-CLW)

For participants, the lack of employment or low income are the most crucial conditions

mentioned for explaining the poor quality of life of the population and their risk of having HT, as

well as the daily struggles of the population of Quibdó to make ends meet:

"Here, we survive (everyday) off miracles." (02-PMM)

"…one of the main causes of hypertension among people of Choco, particularly among people of Quibdó, is the lack of opportunities." (01-PMW)

"…another thing that has exacerbated the problem of hypertension is that we are number one in Colombia in the problem of unemployment, also in violence and insecurity." (05-PHOW)

Summary: In this section I examined themes emerging from the interviews that described

unemployment as a municipal determinant of the living conditions and the risk of HT among the

population of Quibdó. As described in this section, processes of social marginalization and stratification magnify the negative consequences of this municipal determinant of health. The synergistic relationship between this determinant and these social processes creates additional conditions of disadvantage that are expressed in informal jobs and poor incomes, which shape the distribution of almost every known proximal risk factor for HT. Although the influence of unemployment on proximal risk factor for HT emerged from the interviews as a major pathway through which unemployment and the lack of job opportunities can lead to HT, unemployment can also exert its effect through enabling predominant informal means of transport that decreases walking and increases chronic stress. Importantly, participants' responses evidence that in addition to the status of being displaced there are relevant gender differences in job opportunities and in the circumstances women experience for finding and maintaining their jobs. Given the close relationship between employment, income and the material and psychosocial effects income is associated with, it is possible to expect gender difference in the risk of HT.

Living conditions: shaping behaviors and getting under the skin: The municipal determinants that emerged from the interview (unemployment, forced displacement, unplanned urban space), have a synergistic relationship; create differences in resources, exposures, and vulnerabilities among residents of the city; and subordinate the most proximal conditions associated with HT. What follows is a description of the intervening mechanism through which participants considered the influence of these determinants on well-established risk factors for HT: food insecurity and poor diet patterns, physical inactivity, obesity, stress, and alcohol consumption. In addition, I describe biological factors and family antecedents for HT that were suggested by participants.

Food insecurity and poor diet patterns: Social and political actors noted that food security and diet patterns are strongly influenced by food availability and access. They are also shaped by social practices and preferences that are determined by structural conditions. Historically, the food availability in the city has been based on the products that come from other regions of the country. Due to the poor conditions of the roads that connect Quibdó with the rest of the country and long distances from the places where food products are harvested or produced, these products arrive in low quality and are sold with high prices. This situation is exacerbated by the lack of a supply center or large supermarkets that according to participants are not established in the city because of the difficulties in ensuring a regular supply of products. These difficulties particularly affect the availability of fresh vegetables, which are a protective factor for HT. In addition to the easy deterioration of the vegetables after a long trip, it was said that the soil and weather conditions in the region are not good for growing vegetables on a large scale. Thus, the low availability of vegetables in the city resembles a vegetable desert. Moreover, some participants said that the incipient local agriculture has been affected by the displacement of people from rural areas. As consequence of the forced displacement, people shifted from producers of organic food for their own consumption to shoppers of manufactured products for which they struggle to pay because of the food prices and people's limited economic situation.

Participants mentioned that people in Quibdó eat *"a lot, bad, salty, and fatty."* According to their responses, the structural conditions that characterize the city influence the availability and accessibility of staple foods. Although salted cheese is not produced in the region, it became a staple, widely available and accessible food as its high concentration of salt preserves it on the long trip to Quibdó from the north part of the country, where this type of cheese is produced. The high consumption of salt participants described among the population of Quibdó was explained

for another structural condition: the historical deficit of electricity. This deficit of electricity

remains in some rural areas of the municipality and led the population to adopt traditional means

of food preservation. Through generations, fish, an available and essential food in the region, has

been cured. Despite the fact that electricity is now available in almost the whole city, the

preparation and consumption of cured fish and meat has become part of the dietary habits of the

population:

> *"The fish is salted and then it is put to be dried by sun, and also the meat, and then they are put it in the refrigerator." (08-CLW)*

In sum, the wide consumption of salt was perceived by participants as an example of how

food access and preferences are shaped by multiple driving forces and how local determinants

create conditions to increase the risk of HT in the population of Quibdó.

Although participants noted that the food pattern of people in Quibdo is clearly associated

with HT, they considered that the ability to modify this pattern is closely determined by the

economic conditions and social practices of the population. Because of the high prices of

"healthy" food, people choose quantity rather than quality. Thus, in terms of food access and

consumption of healthy food among the population of the city,according to participants it is

possible to differentiate three groups: those who know the benefits of healthy food and can buy

it; those who know, but cannot; and those who do not know. Participants considered that the

majority of the population belongs to the second group, as described in the following quote:

> *"Here, most people don't eat what they want, they eat what they can." (02-PMM)*

Physical activity: As derived from participants' comments, physical activity is

determined by the availability and conditions of physical infrastructure, characteristics of the

transportation system, and residents' socioeconomic background. In terms of availability and conditions of recreational and physical activity infrastructure, participants considered that there are few spaces for social interaction and physical activity. The low availability of physical spaces includes the lack of covered facilities for recreation, despite the frequency and intensity of rains in this region during most months of the year. Moreover, the main open space in the city is not enough for the population size and its location mainly benefits people living in traditional areas of the city, who are low and middle social class, but not those living in the periphery. In addition, not every neighborhood has a playground area, and the existing areas are more available in traditional neighborhoods. Some participants said that the options for addressing the lack of recreational and physical activity infrastructure are constrained by the fact that in most of the new neighborhoods, particularly in the periphery, residents did not preserve areas for building recreational and sport facilities and the town hall faces economic restrictions for acquiring houses or lots with the purpose of building these facilities. Some participants responsible for making or enforcing urban planning policies fear that the acquisition of housing for building public spaces in neighborhoods occupied predominantly by the displaced people may raise legal problems for the local government or they could be personally accused of violating human rights.

The diversity and maintenance of the existing sport and recreational facilities is also limited. Most facilities are poorly maintained or they can be used basically to play basketball and/or mini-soccer; thus not everybody can use these facilities. Although all age groups are mentioned as affected by the low availability and poor conditions of the recreational and physical activity infrastructure, participants noted that children and young people are more negatively impacted by the lack of spaces to spend leisure time. Thus, the most common alternative for

them is to play in the street, even in some areas where they are in close contact to wastewater. The low opportunities for physical activity at earlier ages are also linked to the little amount of time devoted to physical education classes in schools. In this context, participants noted that the levels of physical activity are low in Quibdó and there are few opportunities for exercising.

Walking, exercise at the gym, and public aerobic classes are the main types of physical activity participants mentioned as available in the city. Walking is constrained by the large number of motorcycles in the city, the lack of traffic lights and signs on the streets, the usual infraction of the transit rules by motorcycle and car drivers, and the poor conditions of sidewalks, as well as by the safety concerns of pedestrians because of these other factors. Additional barriers for walking are generated by the occupation of the sidewalks by informal sellers. In addition, the public and private use of motorcycle taxis has had a negative impact on physical activity not only because of its impact on traffic congestion and safety, but also because the extended use of motorcycles has substituted walking as a major means of transport even for distances that were walkable for people in the past:

> *"…motorcycles also have contributed to people not walking because people are afraid. I am not blind, but I am afraid to walk on the street." (04-HPW)*

> *"…you get a motorcycle to go the governorship building, get a motorcycle to go from the market to the church, but from the market to the church there are just four blocks. So, you have to pay one thousand pesos (almost half dollar) for four blocks." (11-MOP)*

Although some gyms have been opened in the city, lack of economic resources is a relevant barrier for paying gym fees. As a result this alternative for physical activity is restricted for most parts of the population:

"Gyms? There are gyms, but who goes there is who has the money to pay; who has the exercise habit and the money to pay…" (01-PMW)

Recently, the local government has promoted aerobic classes to create new opportunities for physical activity in some neighborhoods of the city. However, the coverage of this program is reduced because funding limitations restrict its spread across all neighborhoods. It was noted that due to time constraints, informal workers have few opportunities for any type of physical activity. Finally, although some participants considered obesity as a serious problem in the city, they do not see alternatives to prevent it because of the mentioned determinants and patterns of diet and physical activity.

"I believe in Quibdó and Chocó more than 70% of the population is above of the normal weight, of which a low proportion is obese. This also contributes to hypertension." (03-PMM)

"Here in Quibdó people eat too much fatty food and carbohydrates. If people are not educated about the consumption of these foods, they will become obese shortly. Also because there are not places for physical activity." (06-CLM)

Stress: From participants' perspective, stress affects everyone, is everywhere, and is caused by stressors that come from many sources. As quoted by a respondent, stress is directly associated with HT:

"So yeah, I think my stress led to me having hypertension." (07-CLPW)

Based on participants' responses, across social groups there are commonalities and differences in the sources of stress and stressful experiences. For the population as whole, the most important stressor is the lack of job opportunities. However, as was described above, the lack of employment opportunities is a circumstance that disproportionately affects the displaced population and those with low socioeconomic status. Other stressors participants cited are the

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traffic congestion, the few opportunities for having a good quality of life, which was defined by a participant as the possibility that:

> *"...each person has a decent house, education, and basic public services." (01-PMW)*

Food insecurity was also cited by participants as a permanent source of stress for poor families. Additional stressors mentioned by the participants were the high levels of noise and safety concerns people experience in some neighborhoods. Moreover, living in a neighborhood with poor public services was described as a traumatic daily experience.

> *"People of Quibdó, can be stressed for many reasons: the lack of a decent job, (thinking) about how to get the daily bread for his/her family. That is stressful." (02-PMM)*

> *"...it is a little traumatic to know that our neighborhoods are subnormal." (01-PMW)*

The traumatic experience associated with the lack of public services, such as having clean water for drinking and cooking is exacerbated when the alternatives people have adopted to supply these services are not available:

> *"...after three days without rains, it is a terrible problem for the general population. It is stressful; people get desperate because there is no rainwater" (06-CLM)*

Differences in the exposure to chronic stressors are noted according to the status of displaced, ethnicity, socioeconomic differences and gender. For displaced people, stress is associated with the traumatic experience of the displacement and the memories of their lost land, the disruption of family and community ties, the reception and treatment they received after arriving to Quibdó, the stigmatization and marginalization, and the difficulties for adapting to the city. In addition to these factors as part of the displaced population, indigenous communities also

have to face language barriers. Despite these multiple circumstances, indigenous people are perceived as immune to the disadvantaged living conditions in which they live, as it was noted by a respondent:

"…indigenous people do not have many concerns." (05-PHOW)

Non-indigenous people may perceive low stress among indigenous people due to coping mechanisms used by indigenous people (e.g. praying), cultural differences in the expression of stress, or languages barriers that constrain the expression of stress. In contrast to perceptions of the non-indigenous participants in this study (described above), a displaced indigenous woman described her experience of chronic stress due to her double condition of being displaced and indigenous.

Regardless of their socioeconomic condition black women face additional stressors than the rest of the population. For instance, black women participants said stressful conditions experienced particularly by black women are linked to the multiple roles they play as mothers, housewives, and workers (formal or informal). According to these participants, single mothers, mentioned as a common condition for women in the city, and unemployed women have a higher exposure to chronic stressors. Although gender differences in the exposure to stressors were recognized in the traditional black population of Quibdó, participants noted in general that these differences tend to disappear in black displaced people, who regardless of their gender experience high levels of stress.

Alcohol consumption: Alcohol consumption was considered by some participants as a common behavior among the population of the city. Participants noted that the consumption of alcohol is seen as a public health problem for the young population, but a "*normal*" behavior for adults. Socioeconomic differences are not recognized for alcohol consumption, and it was seen

by the participants in these interviews as an alternative for the lack of recreational or cultural

opportunities and a coping mechanism particularly for informal workers:

"People go to work and after work the only fun is dancing and drinking. In Chocó there is no more fun." (13-PHOW)

Biology and family antecedents: Some participants considered HT as a genetic and

inevitable disease for blacks. However, many of them were able to challenge their own

understanding of HT as a condition with an exclusive genetic determination. In that regard, they

linked the environmental conditions in which they live to the risk of having HT.

"… to know if is true that there is a biological factor that predisposes to hypertension or if the disease is associated with external factors such as salty food, the food preparation, or the lack of sports. Also, I'd like to compare (people from Quibdó) with people of African descent that live in a larger city, eat healthy food, and do sports to see if the problem of hypertension remains." (12-MOM)

"We have some predisposition to be hypertensive, but the characteristics of the city contribute to increase this predisposition and the risk to be hypertensive." (11-MOM)

Summary: This section has described participants' perspectives regarding the multiple

pathways through which the local determinants or driving forces operate to lead to HT or their

unequal distribution across social groups in Quibdó. Although several adverse conditions are

widely distributed in the population of the city, social processes of marginalization and

stratification create additional circumstances for disadvantaging those at the bottom of the social

hierarchy. The findings in this section show the importance, alone or in combination, of three

markers of social position for the stratification and marginalization processes in the city:

ethnicity, being displaced, and gender.

Municipal determinants and their interaction with these social processes lead to differences in living conditions through altering three contextual factors: availability, accessibility, and acceptability. In this context, availability is based on the presence or absence of conditions that are important in the adoption of promoting or damaging health behavior related to HT. For example, participants highlighted the role of a low availability of physical infrastructure in shaping the physical activity pattern of the population or how the poor road infrastructure creates conditions that enhance the availability of some foods and constrains the access to others contributing to the adoption of diet patterns associated with HT. These unhealthy patterns were considered by participants as more prevalent among those with fewer resources or alternatives for adopting a healthier diet (e.g. displaced population). This unequal distribution of resources in the population of Quibdó refers more directly to the concept of accessibility. Lack or limited economic resources was considered a generalized condition among inhabitants of the city, but as was mentioned by participants, it is more common for the displaced population. Finally, the adaptation to adverse circumstances has generated social acceptance of several practices, which remain even if their determinants have been modified. This is exemplified in the consumption of cured fish despite the access to alternatives for food preservation. Figure 4.3 summarizes participants' understanding of the determinants, factors, and mechanisms that play a role in shaping the risk and disparities in HT in Quibdó.

Prognostic: Importance of Living Conditions in the Decisions for Influencing HT Risk and Disparities in Quibdó

Public policies and other types of public health interventions, as well as several barriers were considered relevant by the study's participants for addressing HT in Quibdó. The goals of the proposed policies and other types of public health interventions can be divided into two

groups based on whether they are distal or proximal to HT. The first group includes those

interventions aimed at modifying structural factors, while the second group includes proposed

policies that seek to address health-related behaviors (Table 4.6). Participants also reported

critical factors and barriers for achieving the policy goals mentioned above. Among the critical

factors, participants highlighted the importance of having local evidence about the situation of

HT in the city. This evidence would contribute to recognizing HT as a health problem and to

identifying differences in the prevalence of HT among the different social groups that reside in

the city.

"Statistics have to be available to say that a problem exists." (03-PMM)

Interestingly, although some participants said that HT should be considered a relevant

local problem, some of them noted that there are no actions for addressing it or that HT is seen as

a not significant health problem. In this regard, there are other pressing social or health problems

that monopolize the attention of society and the local government.

"I'm looking and going over all the committees that have taken place before, and I don't
see any on hypertension because here in el Choco we don't pay attention to that...." (04-HPW)

Some actions were identified as important forHT to gain more attention as local problem.

These actions include placing HT on the policy agenda, showing that HT is a problem that

deserves intersectoral action, and demonstrating to different audiences that the actions for

preventing HT will address other health-related problems.

Participants mentioned that prevention should start early in life and that the availability of

healthy food is also limited in school settings. Specific preventive interventions for HT also need

to consider other important issues. For example, participants suggested a community health

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model should be adopted to increase inclusiveness and social participation. Some participants also noted that more proximal interventions for prevention of HT will have a limited impact or will not be a priority for the population if people do not have an adequate income to cover their basic needs. In addition, a low education status was identified as a strong constraint for behavior modification. These two barriers for successful interventions are exemplified in the following quotes:

"…when we promote the campaign it is a little successful because people are always concerned about going to get food…." (05-PHOW)

"…I go inside their houses… I go to teach and talk and talk about healthy habits so that people can stay healthy, and one out of many changes, one out of many behaves. For people with less education change is harder." (04-HPW)

The necessity of cultural-based interventions, particularly for indigenous people was noted; however, as was noted in an interview, stereotypes about indigenous communities cautioned about the potential low success of behavioral interventions targeting this population.

Key barriers were also underscored by participants. Although an approach integrating multiple sectors approach was considered an important alternative for addressing HT in the city, the adoption of this approach may be limited by several factors cited by the participants. These factors included the tradition of the institutions working independently, the lack of mechanisms or strategies to help the institutions to deal with the management of the resources that in many cases have a specific sectorial destination, and the low levels of trust among different constituents. Another barrier is the funding limitations historically experienced by the local government. Participants mentioned that the lack of economic resources is exacerbated by the displacement and the city's low tax base. All these conditions restrict the local capacity of the

local government to respond to the demands of the city dwellers. As a result of budget restrictions, only the health problems considered priorities are funded.

As a consequence of the social situation of the city, non-governmental organizations (NGO) have invested important economic resources. However, some participants noted that these interventions are not always articulated to the local plan of development or do not contribute to create local capacity. To modify this situation, it was said that the current mayor is adopting alternatives to improve the coordination with the NGOs working in the city.

> *"…some NGOs come here, and it is cool that they come and invest money in Quibdó, but we don't work in coordination. It means that when they leave we cannot have the capacity to continue the projects and continue the actions."(05-PHOW)*

Another barrier that was reported was the fact that after a mayor's term ends interventions in place are usually replaced regardless of their impact. Thus, the sustainability of effective interventions is not ensured. An alternative suggested to overcome this barrier was to work with the technical staff that may remain in their positions after a new election term. However, the fact that job positions in the public sector are under the control of politicians also limits the possibility of having a lasting impact working with the technical staff.

Summary: These findings include an ample range of interventions and challenges to address HT in Quibdó. Potential interventions address distal or proximal factors and some of them are closely related to issues that the participants mentioned as part of the diagnostic component of this analysis. The relationship between the issues noted in the diagnostic and the interventions proposed in the prognostic, corroborates framework theory in the sense that the causes used for explaining the problem are strong predictors of the range and type of solutions that are proposed (22). The barriers stressed by the participants highlight the level of complexity

that may be associated with intervention for addressing HT in Quibdó. In sum, a comprehensive approach for preventing HT and reducing, and eventually eliminating its disparities will require that HT is considered a priority public health problem linked to a complex interaction of factors at different levels, an intersectoral approach, and a long-term perspective.

Actors to Be Involved in Addressing Living Conditions

Participants identified several actors who should be involved in addressing HT directly or through related factors. At the local level, actors can be grouped into four categories: 1) governor and mayor, 2) department assembly and local council, 3) local departments, and 4) local community leaders. At the national level, the national government was identified as the unique actor. The governor and mayor were considered key actors in terms of leading actions for addressing structural factors related to HT. The department assembly and the local council were considered important to pass regulations in order to address risk factors for HT. Local council was also recognized as key to incorporate strategic actions into the local development plan. It was said that local councilors may be particularly motivated to work on this issue as some of them personally have HT or hear about it from their neighbors and relatives:

> *"…the other council members are not unaware of this problem because you hear about a friend, a family member or even themselves are afflicted with this problem, hence I believe that the council members would be willing to collaborate in whatever way they can...." (02-PMM)*

Two particular local departments were mentioned as key players for addressing HT in the city: the health department and the sport and recreational department. However, the role played by these two actors is influenced by factors such as the lack of political will or knowledge about health promotion and disease prevention, low capacity, and high levels of corruption. According to participants, community leaders should work on providing information about the problem to

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local residents, having information about HT in their communities, involving their neighbors in actions for preventing HT, and identifying strategies for job generation in their neighborhoods, as was noted by a community leader:

"…so yeah, that is I'm trying to do, to see how I can create at least a few jobs." (07-CLP)

Some participants noted that the national government must play a key role in addressing the structural factors faced by the city. However, they felt that the support that the city received from the national level is limited to addressing all the challenges that the city is experiencing:

"The resources that are sent to Quibdó are not enough to cover the whole population here and all the existing problems." (12-MOM)

So, it is necessary to have serious, responsible, structural, and pertinent policies from the central government that can be applied to each region." (03-PMM)

Summary: Actors at different levels were identified by the participants. The findings suggest that a strong leadership in the local government is required; however, the complexity of the problem, the resources required, and the limits on the power of the local government were considered strong reasons for involving the national government. As described in the diagnostic task, the process of marginalization that occurs in the city mirrors the exclusion and social and political subordination of the city in the country, and more equitable treatment is demanded from the national level. Interestingly, although in the prognostic section an intersectoral approach was identified as a key strategy for addressing HT in the city, only two local departments were identified as relevant for this endeavor. In addition, the range of actions of community members was limited. It is possible that the burden conferred by structural factors have restricted the identification of potential actions of the local departments and community.

Discussion

This qualitative case study was intended to examine whether and how municipal social and political actors of Quibdó incorporate living conditions in their framing of HT risk and disparities. Specifically, the results of the study contribute to understanding which urban conditions are part of the social actors' frames of HT; how these actors explain the links between municipal level determinants, living conditions, and well-established risk factors for HT; what interventions, based on their frames, they consider relevant to address risk and disparities in HT; and who they think should be involved in the proposed interventions. These findings are a novel contribution to understanding how, from the perspective of local actors, contextual factors influence the risk and disparities in HT in a disadvantaged and marginalized area in Colombia, where, similar to other Latin American countries, the existing research on HT has particularly focused on individual-level explanations using quantitative approaches.

The results were grouped into the three tasks proposed in framing theory: diagnostic, prognostic, and actors (22). In the diagnostic task, participants suggested three municipal determinants: unemployment, forced displacement, and unplanned urban space. In combination with social processes of stratification and marginalization, these shaped both living conditions in the city and well-established risk factors for HT. The most important living conditions recognized by local actors as important for HT were related to income and job informality, social capital and security, physical infrastructure, urban transportation, and the local food environment (Figure 4.2).

Following the assumption of the framing theory, the prognostic identified public policies and other types of public health interventions that address some of the structural and more proximal factors used to explain the problem in the diagnostic task. Finally, participants

indicated that actors at different levels should be involved in addressing the factors related to HT in Quibdó. However, except for the role of government and mayor, the contribution of other local actors was considered limited. On the contrary, a high responsibility was assigned to the national government. Below, I discuss in detail the main findings and their implications for policy and practice, as well as future research directions.

In the public health discourse, HT and related health problems are considered chronic conditions due to their long latency period and prolonged course of illness. Paradoxically, the chronicity of the social circumstances that may lead to high risk of HT at the population level has been little explored. As derived from participants' explanations, multiple and interconnected factors that have occurred for a long period of time are involved in the risk and disparities in HT in Quibdó. The presence, expression, and consequences of these factors should be understood in the context of either the inability for addressing social determinants of health in this jurisdiction or the intentional or unintentional decision of not tackling these determinants. This inability creates a formula with devastating and lasting social consequences. Indeed, the chronicity, complexity and pervasiveness of these factors fit with the concept of slow-motion social disaster used in previous literature (35). As suggested by Draus (35), the use of the term "slow motion disaster" has been employed not as a strict definition, but rather as a means of framing an argument about the particular implications of polices (or the lack of them) and societal response. At the population level, the use of this frame allows for understanding HT in this and future generations not as the conglomeration of individuals who are ill or the result of isolated social factors, but as an effect of a chronic and ongoing catastrophe that has shaped living conditions in Quibdó for decades. This conceptualization opens new venues for research and interventions

which privilege structural processes, social and economic policies, and population vulnerabilities.

Evidence of the contribution of detrimental structural factors and living conditions in damaging population health is abundant (36). In the case of HT, these factors and conditions may act through different pathways. Displacement, for example, has multiple negative social, economic, and health consequences. Generally speaking, people flee toward areas where they expect better conditions when their integrity is threatened. However, for many of them the displacement is the continuation or even the accentuation of a poor and vulnerable condition (37). This fact was clearly pointed out by participants as they suggested that most of the displaced population in Quibdó experienced limitations for meeting basic survival necessities, stigmatization, and a variety of difficulties for accommodating to their new life in the city. Although literature has focused more on acute consequences of displacement, it has the potential to activate mechanisms that increase blood pressure. Indeed, displacement results in socio-cultural, psychosocial, and physiological stressors (38) that have been linked to HT (39-42).

Although the health consequences of displacement may present even years after its occurrence (e.g. mental health problems) (37), it is not clear to which extent this stressful experience may alone produce a permanent increase in blood pressure. However, as evidenced in the current study, rather than being a single and isolated condition, displacement is part of a cascade of stressful events occurring as part of a slow motion social disaster. In this regard, displacement may lead to HT through several mechanisms. According to the weathering hypothesis, stressful events persisting over time can lead to permanent damages in the physiologic systems including those associated with a lasting increase of blood pressure (43, 44). In the long term, displacement also may lead to HT through the adoption of damaging coping

behaviors (e.g. excessive alcohol consumption), and the lack of economic resources for eating

healthy as was evidenced in this study. Moreover, in the absence of opportunities for a regular

income, the displaced population in Quibdó had to face the change in their role from producers

for their own consumption to shoppers of manufactured food, which can lead to obesity, a strong

predictor of HT.

Based on the findings that emerged from this study, three additional explanations should

be considered in understanding the potential implications of displacement on HT in Quibdó.

First, displacement may contribute to the erosion of social ties. On one hand, as a consequence of

displacement, people tend to lose their social network and the social support it provides, which in

the stress-buffering model is associated with the modulation of stressful events (45, 46). On the

other hand, as was reported by participants, the integration of the displaced into the new context

was a difficult process as members of the host society were hostile to and wary of the displaced

population. It has been reported that feelings of hostility are common in host societies that often

are not consulted to accommodate new groups and fear for the competition of already scarce

resources (38). These mistrustful social relationships are an important source of stress for all

groups in society and have been associated with a higher level of systolic blood pressure (47).

On the contrary, good community integration and active involvement in a social network have

been found to be a protective factor for HT in urban populations (48). Second, participants

reported that the displaced population, particularly the young age group, tried but did not always

succeed in assimilating to the social and cultural models that predominated in the city. This

phenomenon relates to the concept of cultural consonance, which is defined as the degree to

which individuals are able to behave according to the prototypes for behavior encoded in shared

cultural models (40). Dressler and associates (2005) found that lower cultural consonance was

associated with higher blood pressure among Brazilian adults. A low cultural consonance may also be found among other low socioeconomic groups in Quibdó, who lack the means to have the culturally-valued lifestyle elements. Finally, unfair treatment and stigmatization, two conditions experienced by the displaced population and other groups in Quibdó, have also been associated with a higher level of blood pressure (49, 50).

The explanations provided by the participants about the social context of Quibdó attributed a key role to displacement as a driver of the urbanization process of Quibdó. Urbanization, regardless of its drivers, has been widely cited as an important contextual factor associated with HT in low- and middle income countries (LMICs) (48, 51). However, living in an urban context is not negative per se. Urban areas, in comparison with rural, may be more beneficial for health as cities are generally better equipped with health care and public health infrastructure, as well as other features that have a lasting benefit on health (52). This suggests that what matters for the risk of HT among urban dwellers are the features of the urban context rather than the degree of urbanization alone. Thus, what is important in the context of this study is to recognize those underlying conditions of urbanization that may increase the risk of HT in growing urban settlements and how they apply to the features of Quibdó described by the participants.

The descriptions participants made of some of the urban areas of Quibdó meet the five criteria that the United Nations Expert Group established to operationally define a slum (53). According to these criteria, a slum is defined as a human settlement with the following characteristics: 1) inadequate access to safe water; 2) inadequate access to sanitation and other infrastructure; 3) poor structural quality of housing; 4) overcrowding; and 5) insecure residential status. Two additional attributes that characterize slums are poverty and social exclusion, which

are considered causes and consequences of slum conditions (53). In this regard, the conditions of disadvantaged areas of Quibdó coincide with the most disadvantaged areas or slums in LMICs, as well as those that exist in cities in high-income countries. Despite 1 billion of the world's population living under slum conditions, research on the relevance of and contributors to HT (54) in slums or similar disadvantaged urban areas in LMICs is still limited (55-57).

Studies, particularly from African cities, some of which may share urban and sociodemographic characteristics with Quibdó, have found an increase in blood pressure in urban compared with rural populations, which has been associated with current urban residence and/or lifetime exposure to urban environments (48, 58, 59). Most of these studies state that changes in well-established risk factors for HT are involved in this increase. This research, however, has usually failed to explore which particular urban characteristics lead to HT, particularly among poor urban residents. In general, disadvantaged urban areas in LMICs have been associated with the risk of infectious diseases and undernutrition. The emphasis on these conditions has hidden the role of urban disadvantaged areas in LMICs in the development of HT (55). Yet from a life course perspective, it is possible to recognize multiple predisposing exposures that would increase the risk of HT in these areas. These exposures include, but are not limited to, undernutrition early in life, low socioeconomic status across the lifespan, crowded spaces that restrict building recreational and social spaces for physical activity and gathering, poor food environments, and multiple social, physical, and psychosocial stressors (55). As research in high-income countries has advanced in demonstrating the relationship between disadvantaged urban environments and HT, studies in LMICs should move in the same direction in order to provide context-based evidence that guides more appropriate and effective interventions.

Policies and urban conditions (e.g. lack of public services) that hinder job creation and foster unemployment and informal income-earning opportunities are also part of the expressions of the inability or lack of political will to address social determinants of health, which leads to structural assaults that configure a slow-motion social disaster in Quibdó. In turn, this disaster shapes the risk of and disparities in HT among the city's residents. These policies and urban conditions may lead to HT through interconnected mechanisms. First, models of socioeconomic position posit that occupation is a predecessor of income (60, 61), which in turn is associated with material resources such as food and shelter, access to services, self-esteem and social standing (61). In this study, participants noted that the predominance of informal jobs in the population of Quibdó influence irregular and low income, as well as the access to basic goods and services. Second, unemployment and job insecurity are important sources of chronic stress (62), a predictor of HT (41, 42). Thus, it is not surprising that participants reported unemployment as the leading cause of stress among the population of Quibdó. As these sources of stress were said to be more relevant for women, and sexes differ in the stress response, sex/gender disparities in HT is an issue that deserves further attention. In addition, stress associated with unemployment may be an important factor that leads to HT among displaced people who do not have the skills to participate in the limited labor market.

Regarding the first mechanism, it is worth noting that the causal order proposed in the literature indicate that education determines occupation and income (60). However, this order seems to be partly distorted in the public and private sector in Quibdó. In the public sector, this distortion is due to the control of public jobs for politicians, who according to participants have created a system that is based on political support rather than academic merit and experience. Thus, this system limits the opportunities for finding and retaining job positions in the public

sector. According to participants, employees in the public sector are also exposed to stress because the psychological strain associated with the anticipation of future unemployment. In turn, in some private businesses, the distortion is due to discriminatory practices lead to unequal opportunities for job promotion.

Furthermore, as reported by participants, the lack of job opportunities in Quibdó has contributed to the proliferation of informal jobs and economic activities, some of which influence well-established risk factors for HT. For instance, reduction in walking was in part explained by the excessive number of both informal motorcycles taxi drivers and sellers on the street. In sum, through direct or indirect pathways the lack of job opportunities and unemployment add complexity to the explanations of HT in Quibdó.

Findings of the current study provide a starting point to examine how urban characteristics of disadvantaged urban areas in Colombia contribute to the risk of HT. In fact, this study builds on the unique contribution of qualitative research to mapping contexts and answering "what is" and "how" questions that are needed to start understanding the social phenomenon in a particular context (12). As shown in Figure 4.3, a complex set of interactions between factors are part of the social and political actors' frame of HT in the context of Quibdó. These findings are unique as they represent the particular social world or perspective of participants by penetrating their frames. Knowing these frames is not only important for research purposes, but also to recognize which factors are involved in the policy-making process or in the implementation of intended initiatives, to identify the options that might be considered for addressing HT in Quibdó, and to understand how some features of the city may be important to explain the distribution and trends of HT.

Strengths

This single case study has two main strengths. First, it was possible to involve four different types of social and political actors and cover an ample range of topics that are central to this exploration. This enabled me to capture diverse and multifaceted experiences and understandings of the participants. However, the small number of participants in each sampling stratum may have limited the ability to capture differences in how each type of participant frame HT in the context of the city. Second, I was able to articulate a theoretical and analytical approach. This contributes to the process of organizing the information, analyzing it and generating a research report. Also, an advantage of Framework analysis is that by following a well-defined procedure, the information remains accessible to further scrutiny of the analytical constructions that have occurred (33).

Limitations

Some limitations of the study need to be stated. Because the information was obtained in Spanish and the reports were made in English, it is possible that the description of the findings may not capture totally participants' meanings, feelings and understandings. In order to reduce these limitations I translated information into the English only in the last step of the analysis. In addition, despite the efforts to involve additional key local actors, particularly from the government, it was not possible due to their time constraints. These actors may have provided an additional or different perspective regarding the task examined in this study. In particular, although it was hard to find a clear distinction between the perspectives of social and political actors, I found some differences between participants in the understanding of the role of displacement in shaping urban living conditions in Quibdó. It is not clear if the perspective of those who did not participate in the study would have helped to make distinction clearer.

However, the recurrence of major topics along the interviews that were conducted suggests that the report is comprehensive enough and not biased. Finally, it is worth noting that, while a single-case study imposes limits on whether the results can be generalized (27), some findings may guide action in similar political, social, and economic contexts.

Implications for Policy, Practice, and Research

The understanding of HT for research participants suggests that municipal level determinants and processes of marginalization and stratification shape the living conditions of residents of Quibdó and the availability, accessibility, and acceptability of resources, goods, and services that may influence the risks and disparities in HT in this locality. Importantly, the presence of and interactions between the conditions that were highlighted by the participants are a consequence of historical and structural factors. As emerged from participants' responses, the combination of all these factors and circumstances in the same context determine, for example, the social and spatial configuration of Quibdó, the job opportunities, and the type of food that is available in the city. These findings show the importance of adopting the social determinants of health approach for addressing HT in the context of Quibdó.

As evidenced in the case of Quibdó, the inability or lack of decision to address social determinants of health creates the formula for the emergence of conditions that lead to disease, disadvantage people, and reduce their opportunities to live with dignity. In fact, what this case study shows is the confluence of factors that create the formula of a social disaster. Consequently with the non-random distribution of social determinants of health, social disasters are not an accident. These disasters and their devastating manifestations and consequences are products of the combination of counterproductive political and social decisions and processes, as well as the accumulation of vulnerabilities in the population (35). Understanding social and public health

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problems as manifestations and results of these social disasters, such as was noted by participants, opens opportunities for more complex approaches and structural interventions. In particular, this approach implies a need for public policies that have a meaningful local impact on the social determinants of health, as was emphasized by participants in this study.

In most of the traditional literature on social determinants of health the role of municipalities in addressing these determinants and their unequal distribution has been little considered (20, 63). However, some literature recognizes the local level as the setting where people have access to most of the services and infrastructure that shape their living conditions and stresses the importance of the interventions to address the living conditions of local dwellers (4, 8, 64). In this regard, a socio-ecological approach may be relevant to tackle the myriad of factors that influence health and disparities in local communities. This approach is characterized by including interventions at different levels which range from public policies enacted by different government bodies to more individual-based interventions (65). In this study, participants suggested a set of public policies that should be adopted to address some of the structural factors they mentioned. Not surprisingly they prioritized policies to increase economic opportunities and job creation, regulate urban planning, improve access to public services and physical infrastructure, and allow the population access to decent housing. Although current evidence prevents firm conclusions about the effect of slum upgrading strategies on health in general and chronic conditions in particular (66), these interviews suggest that social and political actors believe that modification of the social, economic, and physical environment may potentially reduce the development and disparities in HT among the urban poor.

Undoubtedly, the modification of the factors that foster forced displacement will have a great impact on the social conditions of the population of Quibdó. Even if the local government

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increases its current capacity for planning and providing services, the presence of forced displacement would remain as an important factor in shaping the health and well-being of urban residents and social inequalities would persist. Indeed, under these conditions a successful group of urban residents may improve their living standards, while those left behind will be joined by the newly displaced. These dynamics were understood and articulated by local decision makers. As this study provides some evidence of the differences between actors in understanding the role of displacement in shaping living conditions, it would be important to consider this complexity in the discussion and identification of alternatives for addressing displacement as a determinant of HT in Quibdó.

In addition to public policies, participants stressed the importance of more behavioral interventions, which may be easier to implement and generate a shorter effect than interventions focused on influencing municipal determinants of HT. However, as evidenced in the health education literature such interventions are strongly determined by social, economic, physical environments in which people live. In this regard, participants responsible for implementing health education programs mentioned that people in Quibdó with lower education and low income tend to have a lower engagement with health education programs or behavioral change.

In terms of actors (the last task of the framing theory) beyond the governor and mayor, the role of other local actors was considered limited. For instance, the role of community and social organizations was considered weak and only the health and the sport and recreation departments were suggested as key actors in addressing factors related to HT. Here, there is a clear lack of relationship between the identification of responsible actors at the local level and the type of factors and policies recognized in this study in the diagnostic and prognostic tasks, respectively. This might be explained by the emphasis given to the role of the national

government in modifying structural factors or difficulties in recognizing how other local institutions may contribute to address determinants of health. Without negating the important role of the national government, interventions should contribute to educate local actors about the important role of institutions at different levels for influencing the conditions that shape health and well-being of people of Quibdó. To extend local recognition of the problem and alternatives for solution, it may be crucial to carry out interventions aimed at identifying key local leaders that help to put the issue on public and policy agendas and open the discussion on the role of different local actors in addressing the problem. These interventions may also be important to framing both the issue in relation to common values and the solutions in terms of policies that enjoy broad support (9).

Because municipalities are embedded in other levels, future studies may benefit from the participation from national and departmental government actors, who may provide additional or wholly different insights into the phenomena reported here and the potential alternatives for addressing them. As participants said, the problems and solutions to the "*disaster*" of Quibdó, perceived as a peripheral city in the country, are seen from the center with a perspective that does not necessarily coincide with the reality observed by and the aspirations of their inhabitants. Previous analyses suggest that from the central and more "*developed*" areas of the country peripheral regions of Colombia are seen as disarticulated, conflicting, and populated by people unable to exercise citizenship, as well being seen as barriers for national integration and progress (67). As the dominant discourse, these conceptualizations shape to a great extent the type of solutions that are offered and help to explain the historical exclusion of these regions. Quantitative and qualitative research provides different, but complementary evidence to understand social problems (68). Thus, the use of quantitative approaches in future research may

be important to gain an understanding of the association between some of the factors reported in this study and the risk and disparities in HT.

In conclusion, in this study social and political actors identify that unemployment, unplanned urban space, and forced and voluntary migration, in combination with processes of stratification and marginalization, act through different mechanisms to both shape living conditions of residents of Quibdó and influence the development of and disparities in HT in the population of Quibdó. As noted by participants, to address these complex conditions, public policies and other types of public health interventions are needed, as well as an intersectoral approach that involves actors at different levels.

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Table 4.1. Type and characteristics of participants in the proposed sample

Type of participant		Characteristics	Round			Total
			1	2	3	
Community Leaders (CL)		Members of neighborhood associations or local non-governmental organizations	1	2	1	4
Appointed Municipal Officials	Public Health Official (PHO)	Director or staff of the department of public health	1	0	1	2
	Municipal Official (MO)	Director or staff of the department of planning, social development, and recreation	1	2	1	4
Policymakers (PM)		Members of the social commission of the local council and former or current mayors	2	1	1	4
Health Practitioners (HP)		Local doctors and nurses	1	1	2	4
Total						**18**

Table 4.2. Sample of questions according to framing tasks and issues explored

Framing Task	Issues Explored	Sample Question
Diagnostic (Aim 1)	Problem definition or nature	Could you tell me any characteristic of Quibdó that increases the risk of HT?
	Attribution of causality	Could you explain me how (characteristic) work for increasing people's risk of HT in Quibdó? How important is (characteristic) in influencing people's risk of HT in Quibdó?
Prognostic (Aim 1)	Alternatives for solution	How are policies important for reducing the differences in the population risk of HT?
Actors (Motivational) (Aim 3)	Responsible for action	What should be the government's role in preventing HT?

Table 4.3. Extract from the diagnostic task of the study

	A: 1.1. Forced and non-forced displacement	B: 1.2. Job opportunities-income generation	C: 1.3 Urban planning
1 : 06CLM-NM Age group = Unassigned Type of participant = Community member Education level = Secondary Location of the residency = Periphery	From growers of their own products to shoppers Displaced came to live with relatives Armed conflict was a key driver of the forced displacement	People get desperate if they don't find job The city has high levels of unemployment. People in Quibdó get money from informal or temporal jobs (e.g. mining). Finding job is difficult. Women find job easier (housework). Men find job in mining and construction Limitations for finding job are related to older age and lack of training (particularly for displaced people) Job/income is important because they allow education, health, and food. If people can pay for their health they have better quality of life. Thus employment is one of the most important aspects. People working in informal jobs do not receive a fair salary	Displaced people invade vacant lots. After the arrival of the first wave of families, arrive more. They create neighborhood associations. The local government legalizes these neighborhoods later and people can access to housing subsidies The area of the city with the fastest growing is that where live the displaced population. Now there are few lots for housing programs
2 : 02PMM-RC Age group = Unassigned Type of participant = Policymaker Education level = Secondary Location of the residency = Periphery	Quibdó is a recipient of displaced people from all over the department Displaced population accommodate as they can for example with relatives. They use to locate in the periphery usually in vacant lots. Displaced people come with many problems, including economic constraints	We live in a city with high levels of unemployment. Here we don't have companies. Most people live from informal jobs and day laborer. The town hall can generate few jobs. In the city there are little investment and conditions for attracting companies. Professionals emigrate looking for better opportunities If you don't find job you feel stressed We have few opportunities to live with dignity, to have a good job People eat based on their employment status. Those in informal jobs have more time constraints for exercising Employed and unemployed people have differences in the possibility of having HT Women have fewer job opportunities Men get frustrated if they don't find a job, especially when their couples work. Society stigmatize them	The downtown is better place and the lots are expensive They use to locate in the periphery usually in vacant lots. The aqueduct is very old that was built for downtown Displaced locate without any plan. They use to locate in the periphery

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4.4. Characteristics of the participants in the study

Cases	Age group	Gender	Type of participant	Education level
01-PMW	40-50	Female	Policymaker	Certificate/Bachelor/Degree
02-PMM	Unassigned	Male	Policymaker	High school
03-PMM	30-40	Male	Policymaker	Certificate/Bachelor/Degree
04-HPW	40-50	Female	Health practitioner	Certificate/Bachelor/Degree
05-PHOW	30-40	Female	Public Health Official	Certificate/Bachelor/Degree
06-CLM	Unassigned	Male	Community member	High school
07-CLW	40-50	Female	Community member	Certificate/Bachelor/Degree
08-CLW	40-50	Female	Community member	Primary
09-HPM	30-40	Male	Health practitioner	Certificate/Bachelor/Degree
10-CLM	30-40	Male	Community member	Certificate/Bachelor/Degree
11-MOM	40-50	Male	Public official	Certificate/Bachelor/Degree
12-MOM	40-50	Male	Public official	Certificate/Bachelor/Degree
13-PHOW	40-50	Female	Public Health Official	Certificate/Bachelor/Degree

Table 4.5. Social characteristics of the center, periphery and shared city

Center:	Periphery:
• Proximal to the river	• Distal to the river
• More urban	• More rural
• Mainly inhabited by mixed immigrants and traditional blacks, low/middle income and more educated residents, and good people	• Mainly inhabited by displaced blacks and indigenous people, low income residents or those living in misery, and good/bad people
• Traditional and known	• New/unknown
• Victims of the city's transformation	• Responsible of the city's transformation
• Excessive motor vehicles for transportation (particularly motorcycles)	• Poor urban transportation particularly at night

Shared city (some characteristic are perceived as more serious in the periphery):
- Poor housing conditions and lack of public services: infrastructure is old and was built for a small city. Displacement exacerbates the critical conditions of the public services. Those areas with better public services have been traditionally inhabited by people higher socioeconomic position (formal jobs)
- Chaotic and disorganized: drivers do not follow transit rules, the presences of street sellers, the lack of transportation policy, lack of traffic signs and lights, competition among the different type of public transportation options
- Unsafe: there are red/hot neighborhoods, but there are more safety concerns in the periphery

Table 4.6. Goals of interventions for addressing hypertension in Quibdó

Goals Structural policies	Goals proximal policies
Increase economic opportunities. In addition to increase jobs opportunities and income we emphasized their direct effect of these policies on stress reduction and well-being improvement Adopt urban planning regulations Improve access to public services, physical infrastructure, and housing of good quality Reduce violence and mobility problems	Adopt food security interventions Implement and physical activity plan Implement school based-programs Increase awareness of hypertension as a local problem

Figure 4.1. Framing tasks, themes and sub-themes of the analysis

A. Diagnostic
- A1. Structural factors
  - A1-1. Forced and non-forced displacement
  - A1-2. Job opportunities and income generation
  - A1-3. Urban planning
  - A1-4. Historical access to public services
  - A1-5. Culture
  - A1-6. Quality of life, poverty and SEP
- A2. Urban characteristics
  - A2-1. Food availability and access
  - A2-2. Physical activity infrastructure
  - A2-3. Safety
  - A2-4. Social integration and capital
  - A2-5. Urban transportation
- A3. Bi-behavioral factors
  - A3-1. Behaviors
    - A3-1-1. Alcohol consumption
    - A3-1-2. Diet
    - A3-1-3. Physical activity
  - A3-2. Obesity
  - A3-3. Stress
  - A3-4. Antecedent familiar

B. Prognostic
- B1. Interventions
  - B1-1. General
  - B1-2. Employment
  - B1-3. Public spaces and recreational opportunities
- B2. Enabling factors and barriers
  - B2-1. Intersectoral action
  - B2-2. Competing issues
  - B2-3. Political representativeness and participation

C. Actors
- C1. Local policymakers and government
- C2. Community leaders
- C3. National government

Figure 4.2. Distribution of references for framing tasks, themes, and sub-themes

Nodes compared by number of coding references

Figure 4.3. Relationships described in the diagnostic task
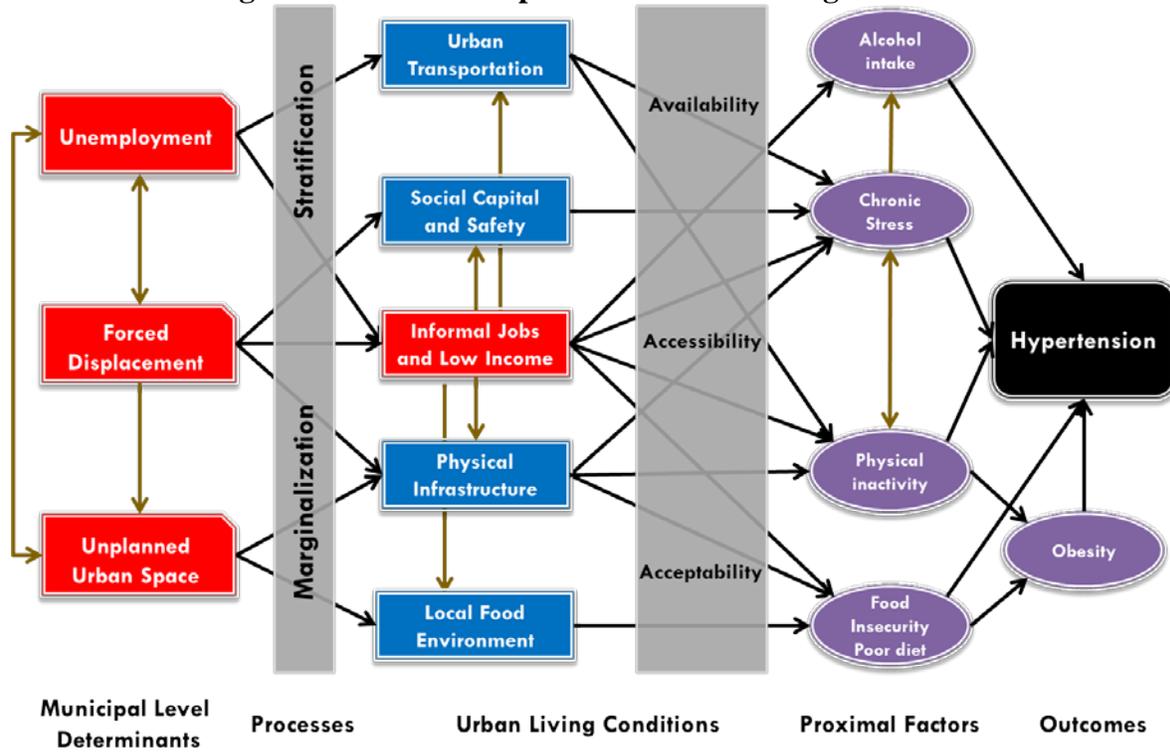
Chapter 5:

Recommendations for Policy, Practice, and Research

Introduction

Hypertension (HT) is an important public health problem (1). HT is a major risk factor for cardiovascular disease (CVD), the leading cause of death worldwide. Every year almost 7.6 million people die of causes attributed to HT (2), particularly coronary heart disease (CHD) and stroke, the two main manifestations of CVD (3). Despite the extraordinary burden of morbidity, disability, and mortality associated with HT, it is a highly preventable condition (4).

Evidence suggests that a small reduction in the population mean of blood pressure will lead to an important decrease in the mortality for stroke and CHD (5). However, HT remains a neglected condition (4). Although the term "neglected disease" has been used to refer to a group of infectious diseases found principally in poor or marginalized communities in the tropics, subtropics, and in parts of North America (6), inexplicably and unfortunately HT receives the same lack of attention as these conditions. Like other neglected diseases, HT is characterized by little public investment in prevention, treatment, and surveillance (4). Another commonality with neglected infectious diseases is that these conditions are both a cause and a consequence of poverty, and their prevention and control require a comprehensive and intersectoral approach (6). Yet the limited efforts to prevent HT have primarily focused on individual decisions, underestimating strong evidence of the effectiveness of a population-based approach for both the prevention of HT and the reduction of its unequal social distribution (4).

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Similar to other world regions, in Latin America HT remains a neglected condition. This neglect is in part evidenced by the growing prevalence of HT in this region and the lack of research on its social distribution and the role of contextual factors. Moreover, in this region, there is limited information on the magnitude of the problem and strategies to monitor its trends and disparities (7, 8). To the extent that the problem is being addressed, recommendations in low- and middle-income countries (LMICs) emphasize blood pressure-lowering therapy or lifestyle modification (9, 10). Although important to reduce health consequences of HT (4), these approaches is unlikely to contribute to reducing the growing epidemic and distribution of HT in LMICs. This individual-level approach is unable, for example, to modify the unequal access to protective resources, the differential exposures to poor social and physical environments and to multiple chronic stressors, and the lack of effective regulations that protect against the marketing, advertising, and availability of alcohol, processed food rich in salt, and energy-dense foods, all of which are closely linked to risks factors for HT (4).

In the face of the daunting reality of HT, this dissertation has sought to extend current evidence of HT in Latin America by conducting a mixed-methods study in Colombia, a middle-income country in this region. The goals of this dissertation were to: 1) examine the social patterning of PHT and HT prevalence among Colombian adults; 2) test whether macroeconomic factors at the departmental and municipal levels are associated with HT in Colombia after accounting for variables measured at the individual level; and 3) understand whether and how municipal social and political actors incorporate living conditions in how they frame HT risk and disparities. Below, I synthetize key findings and contributions from the analyses presented in previous chapters, and then offer a series of recommendations, grounded in these results, in order to more effectively prevent HT and reduce its social disparities in Colombia.

Synthesis of Findings

In this study, I used a mixed-methods approach in order to answer different research questions to provide a more complex understanding of the phenomena under study and extend the existing body of literature on research on HT in Colombia in several ways. Chapters 2 and 3 measured the extents to which social and economic factors contribute to disparities in HT in the Colombian adult population. Findings of these chapters suggest some potential mechanisms through which these factors lead to HT disparities, summarized briefly below. Chapter 4, in turn, was useful to understand how, from the perspective of local actors, social and economic forces and processes operate to shape living conditions of urban dwellers and influence their risk for HT. The main contributions of this dissertation are to: 1) test and extend a multilevel conceptual model that was proposed for guiding the quantitative analyses; 2) provide evidence of social factors associated with, and explanations for, the unequal distribution of HT in Colombia; 3) inform structural interventions at different levels; and 4) propose new topics for research in this field, which should be addressed in further studies.

Chapter 2 estimated the overall prevalence of PHT and HT in Colombian adults, yielding several important findings. First, 62% of the Colombian adult population aged 18-69 years had PHT or HT. For both outcomes the prevalence was higher in men. These findings have important implications. By estimating the prevalence of PHT and HT and examining the social patterning of both outcomes using a nationally representative sample of Colombian adults, the study highlights the seriousness of PHT and HT as public health problems in Colombia. These results can be used for prevention, estimation of societal impact, and strategic resource allocation (11). Indeed, the fact that in this study more than a third of the Colombian adult population has been classified as having PHT and a quarter as having HT deserves immediate attention in terms of

adopting population-based interventions, especially focused on high-risk groups and people with HT. In this regard, it is important to note that after Mexico had the same prevalence of HT as estimated for Colombia in this study, the country experienced an extraordinary increase in this prevalence in a short period of time -- from 23.8% in 1993 to 30.7% in 2000 to 43.2% in 2006 (12). This dramatic increase illustrates that in the face of poor or no interventions, and economic policies (e.g. free trade agreements) and environments that promote unhealthy behaviors, chronic health problems become epidemic, particularly in the poorest communities (13) .

By using a multinomial multivariate analysis, in the same chapter I examined the social distribution of both conditions. In these analyses, ethnicity/race was not a significant predictor of either PHT or HT for men. Black women were more likely to have HT than their mixed race counterparts (OR: 1.88. CI: 1.33-2.67). This association was not mediated by indicators of socioeconomic position (SEP). As hypothesized, education had a strong and inverse association with PHT and HT; with a clearer and more graded pattern for HT in women. The association between education and HT in women, but not in men, was mediated by markers of material resources and bio-behavioral risk factors. Contrary to my hypothesis that material resources had a positive association with PHT and HT, given that Colombia is a middle-income country, I found that physical capital had an inverse relationship with both conditions; that is, those with lower physical capital were more likely to be hypertensive. However, this relationship was only significant for women. In contrast, home ownership behaved in the hypothesized direction, as renters were less likely to have PHT and HT than those who owned their homes.

Findings in Chapter 2 show the unequal social distribution of HT in Colombia and the mosaic of associations between indicators of SEP and HT. However, the strong protective effect of education, as well as physical capital, resembles the pattern observed in high income

countries. Equally important, these results show the intersection between gender, SEP, and ethnicity/race in shaping HT risk and disparities in Colombia adults. Consistent with the theory of fundamental causes (14), these results suggest that those at the bottom of the social hierarchy have more limited access to resources to avoid risks, multiple social vulnerabilities, and exposure to material conditions that lead to HT. These results can inform social policies focused on addressing the social patterning of HT evidenced in this study. In addition, this research is a starting point for monitoring trends in social disparities of PHT and HT in Colombia.

Chapter 3 examined the association between macroeconomic factors and HT, using a multilevel logistic regression analysis in which individuals were nested within municipalities nested within Colombian departments and the Capital District. Few prior studies have examined the relationship between HT and income inequality. These studies have limitations because due to use of self-reported measures of HT (15) and contemporaneous measures of both income inequality and HT (15, 16). In this regard, this dissertation makes a unique contribution to the Latin American literature on HT, by using multilevel analysis to examine the association between income inequality and subsequent HT in Colombia, one of the most economically unequal countries in the world (17). Unlike prior studies, this dissertation used an objective measure of blood pressure from a population-based survey conducted outside of the United States (US), where most studies have shown a significant association between income inequality and health (18). In addition, a time lag effect was used to examine the relationship between macroeconomic indicators, including income inequality, and HT.

Income inequality, measured at the departmental level, was associated with HT. However, this association was statistically significant only for women. More specifically, women living in departments that were at the fourth and fifth quintile of income inequality (that is, those

with the highest levels of inequality) in 1994 were more likely to have HT in 2007 than those living in departments at the first quintile in the same year (OR: 1.56 and 1.48, respectively). After using different latent periods, neither economic development, measured at the departmental level, nor concentration of poverty, measured at the municipal level, were statistically significantly associated with HT.

Although both the intraclass correlation coefficient and the size of the association between income inequality and HT were modest, income inequality is a contextual factor that applies to the overall Colombian population. Thus, this relatively modest association contributes to a considerable population burden of HT and cardiovascular morbidity and mortality. Therefore, beyond economic growth and urbanization, suggested as main drivers of the rise of HT in LMICs (10, 19), the results of this chapter suggest that income inequality deserves important political attention in Colombia and probably in other countries in Latin America, which despite recent economic growth remains the most unequal region in the world (20, 21).

Chapter 4 reported a single-case qualitative study aimed at understanding whether and how social and political actors involved in the making or implementing of public policies include living conditions in how they frame HT risk and disparities. This study was conducted through individual semi-structured interviews to social and political actors in Quibdó, a disadvantaged Colombian municipality located in a region with the highest prevalence of HT in the country.

Findings were grouped into the three tasks proposed in framing theory: diagnostic, prognostic, and actors (22). Findings in the diagnostic task suggest that those interviewed perceive three municipal determinants: unemployment, unplanned urban space, and forced and voluntary migration, in combination with processes of stratification and marginalization, as shaping living conditions in the city. Participants made clear connections between these

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conditions and well-established risk factors for HT. Participants of this study highlighted that urban living conditions such as low income and job informality, social capital and security, physical infrastructure, urban transportation, and the local food environment play key roles in explaining exposures and risk for HT in Quibdó. Public policies and other types of public health interventions were proposed by participants as means for addressing some structural and proximal factors highlighted in the diagnostic task. Finally, participants identified local (e.g. mayor and government, city council, and local departments) and national actors as responsible for addressing the factors related to HT in Quibdó. However, their perception of the contribution of other local actors was fairly limited, except for the governor and mayor, who were considered in better positions to tackle some of the reported problems. Likewise, a high responsibility was assigned to the national government to provide funds and enact polices for addressing problems in the city, such as the poor infrastructure, low opportunities for job, and substandard housing.

Findings of this qualitative study are relevant in terms of explaining the complex set of factors and relationships that in a marginalized local context create conditions for HT by shaping people's exposures, risks, and vulnerabilities. Moreover, this study extends quantitative chapters in significant ways. First, it helps to recognize how some of the constructs proposed in the conceptual model operate at the local level. Indeed, although the meso level in the broad conceptual model of the dissertation includes policy, social, and economic constructs, the case-study in Quibdó illustrates from the perspective of key actors how some of these constructs operate. A particular case is how forced displacement contributes to explain the proposed constructs on the meso level, as this prevalent condition in the city influences the population makeup, the urban features and services, the social functioning, and the poverty concentration, all constructs proposed in the conceptual model. Second, although the quantitative analyses were

not able to test the contribution of the stress pathway, participants' responses in the qualitative study suggest a myriad of stressful circumstances that may play key roles in shaping the risk of HT in the population of Quibdó. Similarly, the results highlight how the presence of adverse conditions such as forced displacement influence the collective social functioning, limiting its effect as buffer of stressful circumstances. Third, although the second chapter shows that black women have higher odds of HT than their mixed counterparts, the quantitative results presented do not provide an explanation for this unequal outcome. However, the qualitative study provides some explanations that should be considered in understanding how social circumstances experienced by black women put them at increased risk for HT.

Beyond the contribution of the qualitative chapter to extend the broad conceptual model and the results of quantitative analyses, this chapter is relevant in its own right. The findings of the qualitative case-study have significant public health implications as they highlight the importance of using policies and an intersectoral approach for addressing social determinants of HT at the local level. Furthermore, the use of a qualitative approach in this chapter for examining social and political actors' understanding of HT at the local level will help fill the gap of qualitative studies aimed at mapping meanings, processes, and contexts related to HT in Latin America.

In sum, by using a mixed-methods approach in this dissertation I was able to answer a set of questions regarding social and economic processes and circumstances that influence disparities in HT in Colombia that differ from those previously addressed in the literature. The integration of the quantitative and qualitative analyses demonstrates that people in the bottom of a social hierarchy, living in social and economic marginalization, have exposures, risks, and vulnerabilities that make them more likely to have HT. The findings show that HT should be

understood as a problem that is in part a consequence of the social stratification and inequalities of the Colombian society. As a social problem, according to the results of this dissertation, HT tends to affect people with a low level of education and physical capital, black women, and inhabitants of departments with high levels of income inequality. Likewise, based on the explanations of social and policy actors of Quibdó, residents of this city are exposed to and endure adverse living conditions that create conditions for the development of HT. In addition, the overall findings suggest that HT is influenced by, and requires interventions at, different levels as is depicted in the broad conceptual model proposed in this dissertation and illustrated in the three analytical papers. Finally, a population-based response to HT should go beyond traditional approaches of individual behavior and medical treatment. In this regard, a comprehensive approach that incorporates structural interventions at different levels is needed.

What follows is a description of the main recommendations for policy and practice based on the integration of the three analytical chapters in this dissertation. Then, I state recommendations that should be considered in future research on social disparities in HT in Colombia.

Recommendations for Policy and Practice

Three overarching implications for policy and practice at different levels derive from this study: 1) structural interventions are needed for effective prevention of prehypertension (PHT) and HT and reducing their unequal distribution; 2) a population-based screening program for PHT and HT Colombian adults should be adopted based on the current prevalences and social distribution of both outcomes; and 3) a monitoring system should be implemented for tracking trends in prevalence and social distribution of PHT and HT. I discuss these implications below.

Adoption of structural interventions for preventing HT: Findings of this dissertation call for addressing HT using structural interventions (23). Structural interventions locate health problems at the society level, view individual agency as constrained by social structures, and focus on three contextual factors that determine health: availability, accessibility, and acceptability of social, political, and economic resources (24). More specifically, structural interventions include those with health-related and health-directed approaches (25). Health-related approaches enhance access to resources and reduce exposures and social vulnerabilities (25). In other words, they seek to modify fundamental causes of disease (14). In turn, health-directed structural interventions aim to modify policies and environmental factors that directly influence health outcomes. In the case of HT, this intervention should be focused on structural changes that support healthy weights, decreasing sodium and alcohol intake, and increasing the consumption of a healthy diet and the levels of physical activity (4). This section includes health-related interventions focused on social and economic policies, as well as health-directed interventions aimed at modifying contextual factors at the local level, as this is where people most directly experience the conditions that shape their health and well-being (26-28).

Social and economic policies, considered interventions at the top of the socio ecological models (29, 30), have been recognized as fundamental tools for addressing social determinants of health and a myriad of health outcomes (31). Based on the findings of this dissertation, three specific groups of policies may play a key role in influencing the resources, exposures and risk related to HT in Colombia. The first group of policies center on addressing income inequalities at the departmental level. The second group focuses on education. The final group includes policies for other key social factors. The last two types of polices, although passed at different

levels of government, are expected to have a direct effect on individual resources and opportunities, which may reduce people's exposure, risks, and vulnerabilities for HT.

Income inequality can exert its influence on health through different mechanisms and at different levels (18, 32). According to the neomaterial model that guides analyses in Chapter 3, income inequality leads to a differential accumulation of exposures and experiences that are related to material resources (33). Thus, income inequality influences the access individuals have to human capital, economic, and material resources. In turn, these resources shape more proximal factors such as health-related behaviors, coping mechanisms, and stress. At the population level, income inequality reflects the unequal distribution of resources among departments (33), resulting in differential public investment. Public investment is important to create healthy environments and maintain infrastructure that supports social life and mitigates stressful living conditions (34, 35). Differences in such public investments across departments contribute to differences in access to health-sustaining resources, and ultimately to health inequities.

In light of the neomaterial explanation and the findings of this study that support the population effect of income inequality, universal policies should be considered to increase resource allocation to populations with increasing needs. Universal policies are a type of policy that maximize population health benefits, while contributing to health inequalities reduction (36). In particular, these policies should ensure public financing for community infrastructure services that may have significant distributional effects such as education, public transportation, and health (33), which in turn may modify the distribution of resources, exposures, and vulnerabilities related to HT. Findings of the qualitative case-study in Chapter 4 provide important clues to the potential benefits from community investment in reducing the risk of HT.

For instance, as noted by participants of the qualitative chapter, the poor community infrastructure of Quibdó contributes to the physical inactivity and chronic stress experienced by the inhabitants of the city.

Although some universal policies are supposed to be applied in Colombia, the fact that the country remains one of the most economically unequal countries in the world suggests failures in the implantation or enforcement of these policies. As suggested in the literature, these failures can be explained for multiple reasons, including the characteristics of the social context and historical circumstances (33, 36). In sum, as suggested by findings in Chapter 3, in countries like Colombia, it may be necessary to modify the almost exclusive emphasis of anti-poverty and economic growth policies, and include explicit income equality goals to have an impact on HT and potentially on other health outcomes (37).

The second group of public policies that are supported by the findings of this dissertation are education policies. The results showed a strong and consistent relationship between education and PHT and HT, so interventions aimed at expanding educational opportunities in the most disadvantaged groups may be relevant to the distribution of both outcomes. Although more benefits from education may be obtained when schooling starts at earlier ages (38), some benefits may be obtained when people complete basic levels of education later in life. In this regard, a life course approach for education may have an important impact in the development and distribution of HT. As education influences multiple dimensions that enhance the adoption of health preventive practices (39), these quantitative findings may be related to the noted by some participants in Chapter 4, who said that residents of Quibdó with low levels of education are less able to benefit from preventive interventions. These results suggest that lifelong learning opportunities such as vocational training for adults may yield important social, economic, and

health benefits, including a reduction in the risk of HT, especially among those with lower levels of education. However, to maximize the effects of education, additional social policies are needed.

The third groups of social policies are supported by findings described in chapters 2 and 4. First, social policies should focus on the circumstances that disadvantage black women and increase their risk of HT. Based on these findings, a comprehensive approach should include policies to promote effective actions against stereotyping and social subordination that particularly affect black women, displaced populations, and indigenous communities. In addition, policies that alleviate the multiple responsibilities women have to fulfill as, for example, economic providers and dependent caretakers in their families, their close social networks, and their communities. For instance, resources may be allocated to programs and campaigns that support and recognize the important contribution that black women make to society through their work in different areas. In addition, it is important to consider the extension of childcare services, banking opportunities, and seed funds that can help women to cope with their job demands and create economic opportunities.

The need to enhance physical capital is supported by findings in Chapter 2. This marker of SEP includes characteristics associated with housing conditions and overcrowding, so policies should focus on improving access to good quality housing, as was also noted by participants in the qualitative study. Finally, in addition to the quantitative evidence from this dissertation that support policies for education, participants of the qualitative study in Quibdó prioritized policies aimed at increasing economic opportunities and job creation.

The qualitative study in Chapter 4 highlights the relevance of addressing other social determinants of living conditions in Quibdó. For example, modification of conditions that lead to

forced displacement are necessary to protect the health of those vulnerable to displacement from rural communities. In addition, the local government faces growing demands for services and infrastructure, even though its capacity to address these issues is restricted by a low tax base and limited resources allocated from the national government. All these conditions suggest that any local intervention for preventing HT may be influenced by factors that are located at higher levels of decision making. Thus, clear connections are needed between local efforts for addressing HT and the external contribution required from other levels.

Regarding health-directed structural interventions at the local level, it is important to note that according to the explanations of the participants in the qualitative study, traditional risk factors for HT in Quibdó are shaped by living conditions such as informal jobs and low income, as well as poor urban transportation, social capital, safety, physical infrastructure, and local food environment. Policies for improving economic opportunities were suggested above, so additional interventions should address other factors that create conditions that support healthy lives and make individual autonomy not constrained by the context. Policy recommendations suggested by these findings and supported by the literature include reduced availability and consumption of alcohol; increased access to healthy food (e.g. fruits and vegetables); and enhanced conditions and increased opportunities for physical activity, particularly improved physical infrastructure and supporting social norms that promote walking as means of transport, as well as creating more spaces for different types of physical activity (4). In addition, policies should seek to strengthen social bonds among residents of the city, as evidence suggests that low social cohesion is associated with increased blood pressure (40, 41). Some interventions may meet several of these policy goals. For example, interventions to enhance the built environment by building sport and recreation facilities in neighborhoods in the periphery of the city not only may

enable people to engage in physical activity, but also may provide a positive impact on the social

environment as they provide public spaces for social gathering and interaction, which may

increase social ties and trust between neighbors. Finally, health-related structural interventions

should also focus on upgrading the urban environments in which a large and growing segment of

the population of Quibdó lives. Although current evidence prevents firm conclusions about the

effect of slum-upgrading strategies on chronic conditions (42), the modification of the social and

physical environment may potentially reduce the development of HT among the urban poor.

In general, these policies are out of the competency of the health sector. Addressing

chronic conditions such as HT in urban areas of LMICs requires an intersectoral approach,

bringing together multiple social and governmental organizations (43). However, participants in

the qualitative study noted real-life barriers for the adoption of this approach in Quibdó. These

barriers include the organizational culture of working independently, lack of mechanisms to

overcome the sectorial investment of limited resources, low levels of trust among different

constituents, and lack of information and strategies to gain public and political attention and

mobilize concerted action. These challenges for intersectoral action have also been noted in other

studies (44, 45). Some of the strategies that have been proposed to overcome these barriers

include influencing stakeholders through advocacy, engaging in collective actions to demand

infrastructural development for health improvement, and mobilizing funds to support the

implementation of non-health projects (45, 46).

Population-based screening program: Large screening campaigns have been suggested

to improve the rate of diagnosis of HT in LMICs (47). Although this dissertation does not assess

the prevalence of HT awareness, treatment, and control, three considerations support the

recommendation of adopting a population-based screening for PHT and HT in Colombia. First,

my findings show a high prevalence of PHT (37.1%), an independent predictor of CVD which is also associated with higher probability of progression to HT. Second, it has been proposed that in middle-income countries such as Colombia lack of diagnosis and inappropriate treatment are major bottlenecks for effective HT control (47). Finally, according to the findings reported in previous chapters, some subgroups are more likely to have HT; thus, they should be prioritized for screening. These subgroups include people with low education, those living in departments that experienced high levels of income inequality in the previous 10-13 years, and populations of marginalized municipalities. In sum, although screening will not change social determinants of HT, screening programs may contribute to reduce inequalities in health outcomes (48). However, in the case of HT, additional actions are needed to achieve control and reduction of complications. These actions not only ensure long-term access to care and appropriate treatment, but also enhance social conditions that may influence control (4).

Establishing a screening program for PHT and HT should consider existing evidence. For instance, evidence from a study of screening for cancer suggests that a national program is a better alternative than either a regional or opportunistic program (49). In this study, women in European countries with these latter two types of programs were less likely to have undergone screening for cervical and breast cancer. However, nationwide population-based programs were associated with fewer socio-economic inequalities in screening for breast cancer (49). The finding that opportunistic screening increases inequalities is consistent with the theory of fundamental cause, as those people with higher resources are more likely to adopt practices that benefit their health (14). Regional screening programs, on the other hand, should be avoided in countries with high levels of income inequality like Colombia, where differences in public

investment between regions may constrain the availability of human resources and infrastructure for an effective screening, particularly in poor areas where screening for HT is more needed.

Monitoring prevalence and disparities in HT: The reliable and ongoing monitoring of HT is an essential task for its prevention and control (4, 50). However, this is not the case for HT in Latin America and the Caribbean, which exemplify the neglect of HT as a relevant public health problem. Indeed, in a review of the peer-reviewed literature on the prevalence of HT in Latin America and the Caribbean published from 1962 to 2010, two studies concluded that despite a moderate increase in the published literature on the prevalence of HT, its quality was inadequate with limited usefulness for public health surveillance (8, 50). Moreover, the social distribution of HT remains understudied (50). As countries ignore the magnitude and social distribution of a public health problem or assume that its burden and distribution are similar to other regions, they risk selecting inappropriate and ineffective interventions (51).

This situation contrasts with the fact that HT is relatively easy to monitor and that monitoring offers opportunities to evaluate advances in prevention, control, and equity in associated chronic diseases, particularly CVD (4) (Figure 5.1). These opportunities are linked to the characteristics of HT, as well as the available approaches for its measurement. Because HT is influenced by social determinants, community and individual risk factors, and biological characteristics, the overall prevalence of HT, as well as its social distribution, may be linked to multiple public health and health care interventions. In addition, the ongoing monitoring of the prevalence of HT and its social distribution provides an opportunity to assess the performance and effectiveness of interventions at different levels and social groups (4). For example, the overall prevalence of HT can be an indicator of population-based programs for increasing

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physical activity, while disaggregated prevalences can provide information on the effect of the programs across different socioeconomic groups.

Furthermore, unlike other chronic conditions, measurement of HT has important qualities for use in monitoring and surveillance systems. Measurement of HT is objective, relatively inexpensive, reliable, reproducible, and comparable across social groups and time. In addition, the ongoing measurement of HT in the population can capture short-term changes in the prevalence, awareness, treatment, and control (4). To take advantage of these qualities, we should implement repeated cross-sectional surveys of blood pressure in the overall Colombian population, which will allow for inferences at least at the departmental level and may be a strategy to monitor progress in HT, CVD, and the reduction of social disparities of health. Despite the methodological limitations of the Colombian National Survey of Health 2007, this survey was useful for the quantitative analyses of this dissertation, which provide a starting point for future efforts in this area.

Finally, the findings of this dissertation highlight the importance of initiating a national dialogue on the relevance of a comprehensive approach in order to advance in reducing morbidity and mortality from HT in Colombia. Moreover, HT should become a public and political priority, and a public policy approach for addressing HT risk and disparities needs to be adopted in the near future. In this regard, the recommendations described above are a first step in this direction. However, the enactment and implementation of these recommendations require political will and public support at different levels.

Recommendations for Research

I have identified multiple research gaps that need to be included in a research agenda focused on addressing prevention and disparities in HT in Colombia. Although the gaps I have

pointed out are not exhaustive, they cover some of the issues that should be prioritized to give

HT the prominence it deserves as public health problem. Research focused on closing these gaps

may be divided into different areas; however, these efforts may be coordinated in order to reduce

costs and produce more compelling evidence.

A first area of research is related to the estimation of prevalence and social distribution of

PHT and HT. The Colombian National Survey of Health 2007 was the first nationally

representative survey in Colombian that incorporated objective measures of blood pressure, as

well as a complete set of indicators of social position. However, in new versions of the survey, it

is important to apply international standards in the measurement of blood pressure (three

readings apart for several minutes), as well as consider the feasibility of including nutritional

information, in particular salt, fruits, and vegetables intake; measures about environmental and

psychosocial stressors; and questions about perceptions of the physical and social environment,

for example questions about the availability of recreational spaces or the characteristics of the

food environment. This information will help to conduct more comprehensive analyses and

disentangle some of the mechanisms that may explain the risk and distribution of HT in

Colombia. Finally, additional studies should focus on estimating the prevalence and social

patterning of awareness, treatment and control. Data available in the CNSH 2007 are a good

starting point for doing such work.

The second area of research should focus on testing mechanisms that need to be proposed

for explaining the risk and distribution of PHT and HT in the Colombian population. In Chapter

2, socioeconomic and behavioral factors did not fully explain the associations between education

and PHT and HT in women, and mediating mechanisms were not identified in men. Thus,

research is needed to better understand the mechanisms that lead to the consistent association

between education with both PHT and HT for women, and to better understand the factors that shape HT risk among men.

In fact, formulation of social and economic policies should benefit from strong empirical evidence of causal mechanisms (31, 52). The selection of more specific policy alternatives based on the findings reported in this dissertation has some limitations, however. For example, additional data and more formal examination of mediating mechanisms should contribute to examine the pathways through which income inequality leads to HT. For education, in this dissertation it was only possible to examine evidence of two potential pathways through which education may be associated to PHT and HT. Alternative mechanisms proposed for the association between education and health, such as childhood and adolescent socio-economic circumstances and health deserve further attention (39). Moreover, the cross-sectional nature of the analyses limits the ability to establish causality. Nevertheless, these findings add to the accumulated body of evidence showing associations between income inequality and education with health and other social outcomes. So rather than wait for more studies, current knowledge should foster initiatives to implement these kinds of policies (31, 53).

In addition, I have highlighted the importance of further analyses that formally examine the intersection between ethnicity/race, SEP, and sex/gender. More theoretical and empirical evidence is needed for disentangling the sex/gender differences that were found in the social patterning of PHT and HT and in the lag time required to see associations between income inequality and HT. The qualitative study provided some insights into the gender differences that may explain in part the quantitative findings, but broader studies are needed to test these explanations. Moreover, future research should examine the role of neighborhood environments, workforce conditions, and experiences of discrimination. Although this study does not provide

direct evidence of the role of stress in the social disparities of HT in Colombia, the results and the accumulated literature in this area suggest that social, environmental and psychosocial stressors can activate biological mechanisms that lead to HT (54). Thus, exposure to these stressors may play a key role in the excess prevalence of HT, particularly among blacks and socioeconomically disadvantaged groups (55).

The mechanism through which income inequality exerts its influence on HT is an area that also deserves further attention. Studies may build upon the findings reported here to examine both the specific and combined contribution of the neomaterial, social capital, and psychosocial mechanisms to HT. For example, future studies to assess the neomaterial mechanism should incorporate objective measures of community infrastructure and public investment to examine income inequality at the departmental level. Moreover, available indicators of participation, such as percentage of participation in elections, have been used to examine contextual social capital (56, 57); thus, the use of these indicators may contribute to extend knowledge in HT research on the social capital mechanism at the local level. Finally, research is needed that incorporates measures of objective and perceived chronic stressors and stress exposure to help elucidate the role of the psychosocial mechanism of income inequality in HT in Colombia. In addition, more research is needed to consolidate the evidence about the detrimental effect of income inequality on HT and other health outcomes in Colombia. For example, future studies may examine whether the association reported in the third chapter remains when using SBP and DBP as continuous variables, as well as BMI, a strong predictor of HT. An analysis using income inequality as the exposure and self-reported health as the outcome may also be appropriate, taking into account that this outcome is an independent global predictor of mortality, including CVD (58), the leading cause of death in Colombia (59, 60).

It is also important to extend the findings of the qualitative study. For example, future studies may benefit from the participation of national and departmental social and political actors, who may provide additional or wholly different insights on the role of living conditions in HT at the local level and alternatives for addressing them. Moreover, research should provide opportunities for dialogue amongst these actors in order to create opportunities for developing shared solutions. On the other hand, the use of quantitative approaches in future research will be important to test the association between some of the factors reported in the case study and HT. For example, studies should examine the association between the characteristics of the food environment in Quibdó and HT and its risks factors, as well as the role of the built environment.

Conclusion

In sum, the goal of this dissertation was to provide evidence of the social disparities in HT in Colombia in order to identify recommendations for policy, practice, and research. The dissertation showed that education, markers of material resources, ethnicity/race and sex/gender are important in terms of shaping the social patterning of PHT and HT in the Colombian adult population. In particular, black women and those with lower level education were more likely to have HT, regardless of any other marker of social position. In addition, those adults who live in departments that for more than a decade have had high levels of income inequality are more likely to have HT than those living in less economically unequal departments. Finally, from the perspective of local actors, HT is a problem explained by the complex and pervasive confluence of structural conditions and processes that determine living conditions and well-established traditional risk factors for this condition. In general, these findings suggest the significance of using a comprehensive approach for addressing risks and disparities in HT. This approach should include structural interventions, a population-based screening, and strategies for monitoring

prevalence and disparities in HT. Although a research agenda is needed to close the existing gaps

in this field, there is enough evidence to give HT the prominence it deserves as public health

problem in Colombia.

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Figure 5.1. Model for monitoring hypertension in Colombia