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# Subjective social status and its associations with social vulnerabilities and health

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UNIVERSITY OF CALGARY

Subjective social status and its associations with social vulnerabilities and health

by

Karen Tang

A THESIS

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## Abstract

**Background:** Subjective social status (SSS) is the perception of where one stands in a social hierarchy, distinct from one's actual, objective position in this hierarchy. SSS may influence health through behavioral and psychosocial mechanisms.

**Methods:** We conducted three sub-studies to examine whether SSS affects risk of and outcomes in chronic disease, and to explore the role of health care access and experience of social vulnerabilities in the SSS-health pathway.

**Results:** We found that low SSS is associated with increased risk of 1) cardiovascular disease; 2) hospital readmissions and barriers to health care access; and 3) social vulnerabilities that affect health care access. Having high perceived status in the community appears to mitigate the experience of social vulnerabilities through the ability to mobilize social supports.

**Conclusion:** Subjective social status has important associations with health and clinical outcomes. These findings have implications to the development of interventions that aim to reduce disparities.

## Preface

This is a manuscript-based thesis. The following manuscripts have been published, are under review, or in the final stages of preparation for submission to a journal. For all papers, KT led the conception of the study, led the data analysis, interpreted study results, and drafted the paper, with guidance and support from the co-authors. All authors contributed to the interpretation of findings and provided critical review of the papers.

- 1) **Tang KL**, Rashid R, Godley J, Ghali WA. Association between subjective social status and cardiovascular disease and cardiovascular risk factors: A systematic review and meta-analysis. *BMJ Open* 2016;6:e010137.
- 2) **Tang KL**, Pilote L, Behloul H, Godley J, Ghali WA. An exploration of the subjective social status construct in patients with acute coronary syndrome. (Under review)
- 3) **Tang KL**, Rabi DM, Manns BJ, Santana MJ, Ghali WA. Subjective social status and its association with social vulnerabilities: A cross-sectional study of medical inpatients. (Final stages of preparation for submission)

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## List of Symbols, Abbreviations, and Nomenclature

ACS	Acute coronary syndrome
CAD	Coronary artery disease
CARDIA cohort	Coronary Artery Risk Development in Young Adults cohort
CI	Confidence interval
CK-MB	Creatine kinase – MB isoenzyme
CPK	Creatine phosphokinase
cSSS	Community subjective social status
ECG	Electrocardiogram
ELSA cohort	English Longitudinal Study of Ageing cohort
ESSI	ENRICHD Social Support Instrument
GENESIS-PRAXY	Gender and Sex Determinants of Cardiovascular Disease: From Bench to Beyond Premature Acute Coronary Syndrome
HR	Hazard ratio
IQR	Interquartile range
MUQ	Medication understanding questionnaire
OR	Odds ratio
SD	Standard deviation
SES	Socioeconomic status
SSS	Subjective social status
sSSS	Societal subjective social status
SILS	Single item literacy screener

## **CHAPTER 1: Introduction and overview of thesis**

Socioeconomic status (SES), as measured by income, education, and occupation, has been extensively studied, and repeatedly demonstrated to be associated with health outcomes. One potential mechanism by which these objective measures affect health may be due to their psychological, and in turn behavioural and physiologic, effects of relative inferiority in a social hierarchy. This thesis explores the role of perceived social status, also known as subjective social status (SSS), on various health-related outcomes. This introductory chapter provides a review of the literature that underpins the rationale for this thesis, then presents a conceptual model that explores the associations between SSS and health upon which the sub-studies for the thesis are based, and ends with an overview of the thesis content.

### **1.1 Objective measures of socioeconomic status and health**

Health disparities exist based on objective SES measures (income, education, and occupation), where those with higher SES have better health compared to their lower SES counterparts.

Individuals with low SES have increased risk of adverse lifestyle behaviours that may affect health, such as increased smoking, lack of exercise, and poor diet.<sup>1,2</sup> Though important, differences in health-related behaviours do not fully account for the health disparities seen between those with high versus low SES, with only one-quarter of disparities being attributable to such lifestyle differences.<sup>2</sup>

Health disparities exist not only for disease risk, incidence, and prevalence, but also for prognosis, morbidity and mortality.<sup>3</sup> Low SES is associated with increased prevalence of stroke

and other central nervous system diseases, cardiovascular disease and risk factors including diabetes mellitus, hypertension, and dyslipidemia, and respiratory pathology such as chronic obstructive pulmonary disease.<sup>4-8</sup> Furthermore, certain diseases such as cancers and coronary artery disease are diagnosed at a more advanced stage for those with low SES compared with high SES.<sup>9,10</sup> Not only are low SES persons more likely to experience chronic disease, they are also more likely to experience increased morbidity, disability, and functional limitation, and also have an increased risk of death.<sup>1,8,11-14</sup> It is clear, therefore, that socioeconomic status has powerful influences on health and health outcomes, and is a public health issue of utmost importance. An understanding of the mechanisms by which SES affects health is imperative in the development of policies and interventions that aim to reduce health disparities.

## **1.2 Mechanisms by which SES affects health**

Though the literature on hypothesized mechanisms by which SES affects health is diverse, most mechanisms fall under two categories: 1) resource and environmental constraints, and 2) psychosocial pathways.<sup>15</sup>

The first category includes the physical environment. Specifically, those with low SES may be more susceptible to direct health hazards from their physical environment, due to their places of residence and employment. This includes increased exposure to pathogens, heavy metals, and carcinogens, as well as a hostile social environment where there is increased violence and aggression.<sup>15-17</sup> For example, low SES persons tend to experience greater crowding in their living environments and environmental noise, which has been associated with hypertension, cognitive and learning deficits, and higher levels of biologic markers of stress such as catecholamines.<sup>17</sup>

Resource constraints also affect health, by the inability of those in absolute poverty to meet basic needs such as access to clean water and stable housing, access to health insurance and health care, and by the lack of available nutritious dietary and healthy lifestyle options.<sup>3</sup>

However, absolute resource deprivation does not adequately nor fully explain the associations between SES and health, particularly in resource-rich, developed nations.<sup>18</sup> When examining the association between low SES and adverse lifestyle behaviours, there is a discrepancy between cost of resources and such behaviours. For example, smoking requires a financial expenditure, yet low SES persons with low income tend to smoke more than high SES persons.<sup>2</sup> Similarly, exercises such as walking or running does not always require resource use, yet low SES is still associated with lower levels of physical activity.<sup>2</sup> Resource deprivation also does not explain cross-country differences in health, where there is only weak correlation between a country's gross national product and the life expectancy of that country's population.<sup>3</sup> The two seminal Whitehall studies, led by Sir Michael Marmot, further illustrated that associations between SES and health lie beyond absolute resource and environmental constraints. The Whitehall I study followed nearly 18 000 male British civil servants, and found that those within the lowest occupational grade had a 3 to 6 fold increased risk of cardiovascular mortality compared to those within the highest occupational grade.<sup>19</sup> Similarly, the Whitehall II study followed over 10 000 male and female civil servants and found a similar class difference for health behaviours, prevalence of angina and cardiac ischemia, and self-perceived health.<sup>20</sup> These health disparities were present though all individuals in both studies had stable employment, and none experienced absolute poverty or material deprivation. This evidence supports the importance of relative deprivation in the association between SES and health.<sup>3,21</sup>

Relative deprivation results from a gradient in income and other SES or social status measures. The *perception* of having low status, that is, having low subjective social status (SSS), may have effects on health due to its influence on psychosocial pathways, by affecting empowerment, or how much control an individual has over his or her own life, and opportunities for social participation and engagement.<sup>22,23</sup> Income is important, therefore, less as an end, but rather in the opportunities that it affords socially, physically, and psychologically.<sup>22,24</sup> The psychosocial implications of low status are thought to result in chronic stress reactions and changes to physiology, resulting in impaired cellular immune function and increased release of stress hormones.<sup>25</sup> Low social status may also result in the lack of social supports and social relationships, which affects the ability of individuals to cope with environmental and psychosocial stressors.<sup>25</sup> This combination of neuro-hormonal changes from chronic daily stresses of classism and other phenomena unique to having low status, and an impaired ability to respond and cope with these challenges has been hypothesized as an important mechanism by which social status affects health.<sup>1</sup>

### **1.3 Indirect evidence supporting associations between SSS and health**

The two main bodies of evidence that support the association between subjective social status and health are 1) non-human primate studies, and 2) income inequality literature.

Animal studies are an important contribution to social status literature, due to similarities in social structures between human and non-human primates, and the ability to control for confounding and mediating factors, such as access to material resources.<sup>26</sup> In addition, social

status in human studies is mostly measured through proxies such as income or education, and status is compared across individuals who do not interact with each other. In contrast, social status is directly observed in non-human primate studies, where dominance and subordination can be seen through interactions among the animals.<sup>27</sup> These animal studies tend to measure the associations between social status and rank on cellular function and hormonal responses. They consistently show that cell-mediated immunity is lower in animals with low status compared to those with animals of high status.<sup>27</sup> Social status alone can influence immune function, by changing gene expression, signaling pathways, and leukocyte composition.<sup>28</sup> Findings from studies that measure stress (glucocorticoid) hormone secretion are more variable. There is increased production of stress hormones in high versus low status animals, when the social hierarchy is unstable and where dominant animals continually need to physically defend and uphold their rank. On the other hand, low versus high status animals have increased production of stress hormones in stable social hierarchies, where status is less based on physical aggression and intimidation.<sup>27,29</sup> In sum, this body of animal literature supports the role and importance of social rank and status on health-related laboratory measures, independent of absolute resource acquisition.

Income inequality literature comprises the second large body of evidence supporting the association between subjective social status and health. These are ecological studies that compare population level health measures across different communities, regions, states, or countries. High levels of income inequality are believed to heighten social class differences, and therefore accentuate the effect that subjective social status has on health through psychosocial mechanisms.<sup>30</sup> Decreased social trust and community engagement, which constitute decreased

social capital, are believed to mediate this pathway.<sup>30,31</sup> In a review of 155 papers on income inequality and health, nearly three-quarters of such papers found an association between greater income inequality and worse health outcomes.<sup>21</sup> This was true of a variety of outcomes, including heart disease, diabetes, obesity, mental illness, prostate and breast cancer, respiratory disease, and mortality.<sup>21,30</sup> Larger areas of comparison, using at minimum metropolitan areas, tended to report more significant findings. This supports the fact that social class and status are determined not within neighborhoods, but across society as a whole.

#### **1.4 MacArthur Scales of Subjective Social Status**

Because the evidence for the association between social class and health is indirect in that it stems from animal and ecological studies, and because the objective SES measures are only proxies for social status, there is a need for a more direct, individualized measure of subjective social status for use in health research. Dr. Nancy Adler and her colleagues at the MacArthur Network on Socioeconomic Status and Health developed the MacArthur Scales of Subjective Social Status, to capture an individual's perception of his or her own social rank.<sup>32-35</sup> Two different scales were developed, each a self-anchoring ten-rung ladder, with one (that we have termed the "societal ladder", Figure 1.1) using the country as the reference group, and the other (that we have termed the "community ladder", Figure 1.2) using the community, however defined by the individual completing the scale, as the reference group.

**Think of this ladder as representing where people stand in the United States.**

At the **top** of the ladder are the people who are the best off – those who have the most money, the most education and the most respected jobs. At the **bottom** are the people who are the worst off – who have the least money, least education, and the least respected jobs or no job. The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom.

**Where would you place yourself on this ladder?**

Please place a large “X” on the rung where you think you stand at this time in your life, relative to other people in the United States.



**Figure 1.1: MacArthur Scale of Subjective Social Status: Societal Ladder**

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**Think of this ladder as representing where people stand in their communities.**

People define community in different ways; please define it in whatever way is most meaningful to you. At the **top** of the ladder are the people who have the highest standing in their community. At the **bottom** are the people who have the lowest standing in their community.

**Where would you place yourself on this ladder?**

Please place a large "X" on the rung where you think you stand at this time in your life, relative to other people in your community.



**Figure 1.2: MacArthur Scale of Subjective Social Status: Community Ladder**

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Of note, the societal ladder refers to traditional SES measures when describing the social hierarchy, whereas the community ladder makes no references and provides no definitions for social status at all.

How individuals determine their own subjective social status, or the factors that contribute to this self-reported social rank are unclear. Income and wealth appear to be the biggest contributors to societal subjective social status, though objective SES measures are not the sole determinants of SSS.<sup>36,37</sup> Psychosocial factors including perceived control, mastery, trust in one's self-worth, social trust, life satisfaction, and self-rated economy also influence societal SSS.<sup>38,39</sup> Therefore, though the societal MacArthur Scale of Subjective Social Status refers to the traditional objective SES measures when describing status in the social hierarchy, this scale also captures non-SES related measures of social status and worth.

There are far fewer studies that examine the determinants of community SSS; how community and societal SSS differ is currently unclear. There is a correlation between the two ladders, with one study citing a correlation coefficient of 0.71;<sup>40</sup> that is, the societal and community ladders share 50% variance.<sup>40</sup> Unsurprisingly, the objective SES measures such as income, education, and occupation play a much smaller role in determining community SSS as compared with societal SSS. Instead, the major determinant to community SSS appears to be participation in the community by contributing and giving to others.<sup>36</sup> Local and cultural contexts affect perceived social status,<sup>41</sup> and the community ladder attempts to take these different social environments into consideration. Though the evidence is sparse, there is a suggestion that for ethnic minorities, the community ladder may be more salient as a measure of SSS, given the greater geographic and cultural similarities of this reference group as compared with the national population.<sup>37</sup>

## **1.5 State of the current direct evidence: MacArthur Scales of SSS and health**

The body of literature investigating the effects of societal SSS on health rests primarily within the realms of self-rated health, mental health, and health-related behaviours. This evidence shows that low societal SSS, directly measured using the MacArthur Scale of Social Status, is consistently associated with worse self-rated health or poorer general health status,<sup>34,42-46</sup> worse mental health including increased depressive symptoms and negative affect,<sup>42,44-47</sup> increased disability and functional limitation,<sup>42,43</sup> and adverse lifestyle behaviours such as less healthy dietary and physical activity habits, and increased smoking and alcohol intake.<sup>40,48-50</sup> These findings hold even when analyses control for objective SES measures, suggesting that though SSS may act as a mediator in the association between SES and health, SSS has independent effects on health over and above the role of income, education, and occupation.<sup>42,43</sup> That is, SSS captures dimensions of social status and psychosocial variables that are not solely informed by the traditional SES indicators; SSS is not merely another equivalent, interchangeable, measure of SES. The evidence for the association between SSS and risk of chronic diseases is much more sparse, though it does suggest that low societal SSS may be associated with increased prevalence of diabetes, dyslipidemia, and obesity.<sup>42</sup> Unlike the SES and health literature, there exists minimal research on the effect of subjective social status on prognosis, morbidity, and mortality in cohorts with established disease.

In contrast to the evidence noted above supporting the role of societal SSS in health, there is a dearth of literature examining similar associations for community SSS. Study findings are also less consistent and at times contradictory to the findings for societal SSS. For example, community SSS does not seem to be significantly associated with certain lifestyle behaviours

such as physical activity and healthy dietary habits in healthy populations,<sup>48,50</sup> though high community SSS does seem to predict abstinence from smoking.<sup>51</sup> There is a similar scarcity of studies examining community SSS and the risk of chronic disease, as well as prognosis and outcomes in those with established disease.

## **1.6 Overview of thesis content**

There are several gaps in knowledge in the SSS literature and its association with health outcomes. The first is the association between SSS and the risk of chronic disease. The second is the association between SSS and clinical outcomes in those with established disease.

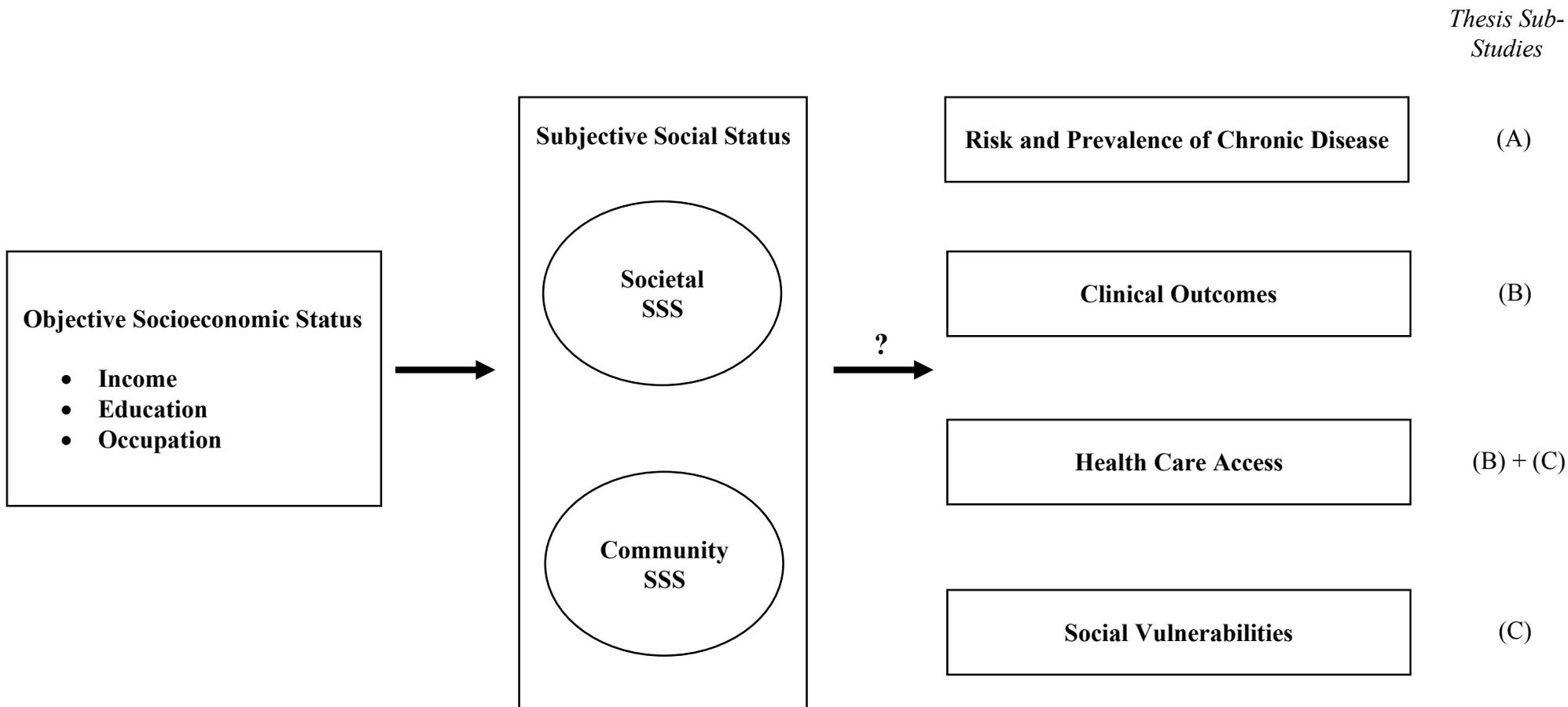
Though SSS is believed to be reflective of psychosocial factors of having low versus high social status, it remains unclear as to how these psychosocial factors affect health. Some, such as Pampeii et al., have hypothesized that low social status affects certain health outcomes and behaviours directly due to 1) financial constraints such as the inability to pay for healthy food or fitness programs; 2) smaller and less robust social networks to help support the individual through health-related needs; 3) poorer understanding of health consequences of certain behaviours due to lower levels of education; and 4) lower priority of health due to heavy discounting of the future, as the life trajectories of low SSS individuals portend less social and economic benefit compare to high SSS individuals.<sup>2</sup> Indeed, these factors have been corroborated in studies of patients with low socioeconomic status, who state that the four aforementioned barriers (direct financial barriers, lack of social support, low health literacy, and low priority of health), in addition to transportation barriers, impede their ability to convalesce and maintain optimal health post-hospital discharge.<sup>52,53</sup> These difficulties, which some have termed “social

vulnerabilities”, fall disproportionately on those with low social status, and likely mediate the association between low SSS and poor health.

Not only are low SSS individuals likely to experience social vulnerabilities that affect health care access and health maintenance, they are also less able to respond effectively to overcome such stressors and barriers.<sup>2,25</sup> This is due to lack of economic and social resources, as well as lower human capital, less self-effectiveness and ability to problem-solve, and lower sense of control.<sup>2,54</sup> The difficulty overcoming social vulnerabilities and other daily stressors can result in physiologic neuroendocrine changes, as well as adverse lifestyle behaviours as a coping mechanism;<sup>25</sup> both have the potential to negatively affect health.

The third gap in knowledge is therefore the association between SSS and social vulnerabilities. Social vulnerabilities are unique in that they are amenable to downstream interventions and policies. Therefore, if SSS affects health through the experience of and ability to respond to social vulnerabilities, then interventions can be designed to address these specific barriers.

This thesis will address these gaps in knowledge, through three sub-studies. Fig 1.3 presents a conceptual model that frames these three studies.



**Figure 1.3: Conceptual model of thesis**

In sub-study A (Chapter 2), we undertake a systematic review to determine the association between subjective social status and the risk of coronary artery disease and related chronic cardiovascular risk factors such as hypertension, diabetes mellitus, obesity, and dyslipidemia. Sub-study B (Chapter 3) is a prospective cohort study to determine whether SSS is associated with clinical outcomes in patients with established cardiovascular disease. Such outcomes include hospital readmissions. These two sub-studies address the first two knowledge gaps regarding the association between SSS and risk and prognosis of chronic diseases.

We hypothesize that SSS affects both risk and prognosis of disease due to various mediating factors, such as the experience of social vulnerabilities, as well as the ability to effectively respond to social vulnerabilities in order to access timely health care and maintain optimal health. Sub-study B (Chapter 3) will examine the associations between SSS and health care access, while sub-study C (Chapter 4) will explore the associations between SSS and social vulnerabilities. These two sub-studies are crucial in that they attempt to disentangle the complex associations between social status and health outcomes.

Few studies to date have assessed the effects of both societal and community SSS on health, though they theoretically represent different aspects of social status. Given the very small number of studies in the literature examining community SSS and risk of chronic cardiovascular disease, a systematic review on this topic is not possible. Therefore, sub-study A includes only societal SSS and its association with chronic disease. Community SSS is associated with greater social trust and capital, which may mitigate some of the health-related barriers experienced by

those with low societal SSS. We therefore attempt to explore the role of community SSS and its potential moderating effect on the societal SSS – health pathway in sub-studies B and C.

### **1.7 Summary of thesis objectives**

In three sub-studies, this thesis explores the association between subjective social status and health outcomes, and the role that potential mediating factors such as social vulnerabilities and health care access play in this pathway. The overarching thesis objectives are:

1. To determine if there is an association between societal subjective social status and risk of coronary artery disease and chronic cardiovascular risk factors including hypertension, diabetes mellitus, obesity, and dyslipidemia
2. To determine if there is an association between societal subjective social status and risk of hospital readmissions patients with established cardiovascular disease (acute coronary syndrome)
3. To determine if there is an association between societal subjective social status and barriers to accessing health care
4. To determine whether community subjective social status mitigates the risk of experiencing health care access barriers
5. To determine if there is an association between societal subjective social status and five social vulnerabilities: financial constraints, transportation barriers, low health literacy, poor social support, and low priority of health maintenance
6. To determine whether community subjective social status mitigates the risk of experiencing each of the five social vulnerabilities

**CHAPTER 2: Association between subjective social status and cardiovascular disease and cardiovascular risk factors: A systematic review and meta-analysis (Thesis sub-study A)**

## 2.1 Abstract

**Background:** Subjective social status (SSS), or the individual's perception of his or her position in the social hierarchy has been associated with mental health and self-rated health outcomes, though the associations with chronic clinical disease are more variable and less clear. We conducted a systematic review and meta-analysis to whether low SSS is associated with higher odds of coronary artery disease (CAD), hypertension, diabetes, obesity, and dyslipidemia.

**Methods:** We searched PubMed, MEDLINE, EMBASE, CINAHL, PsycINFO, SocINDEX, Web of Science, and reference lists of all included studies up to October 2014, with a verification search in July 2015. Inclusion criteria were original studies in adults that reported odds, risk, or hazard ratios of at least one outcome of interest (CAD, hypertension, diabetes, obesity, or dyslipidemia), comparing "lower" versus "higher" SSS groups, where SSS is measured on a self-anchoring ladder. Odds ratios (ORs) were pooled using a random-effects model.

**Results:** Ten studies were included into the systematic review; nine of these were included in the meta-analysis. In analyses unadjusted for objective socioeconomic (SES) measures such as income, education, or occupation, the pooled OR comparing the bottom versus the top of the SSS ladder was 1.82 (95% confidence interval [CI] 1.10, 2.99) for CAD, 1.88 (95% CI 1.27, 2.79) for hypertension, 1.90 (95% CI 1.25, 2.87) for diabetes, 3.68 (95% CI 2.03, 6.64) for dyslipidemia, and 1.57 (95% CI 0.95, 2.59) for obesity. These associations were attenuated when adjusting for objective SES measures, with the only statistically significant association remaining for dyslipidemia (OR 2.10, 95% CI 1.09, 4.06), though all odds ratios remained greater than one.

**Conclusion:** Lower SSS is associated with significantly increased odds of CAD, hypertension, diabetes, and dyslipidemia, with a trend toward increased odds of obesity. These trends are

consistently present, though the effects attenuated, when adjusting for SES, suggesting that perception of one's own status on a social hierarchy has health effects above and beyond one's actual income, occupation, and education.

## 2.2 Background

Objective measures of socioeconomic status (SES) have long been linked with health outcomes, with those having lower income, lower education, or working in lower status occupations experiencing increased mortality and prevalence of coronary artery disease.<sup>8</sup> Class differences in health appear not just at the extremes when comparing the “rich” versus the “poor”, but even among those with relatively high status. For example, British civil servants at the highest administrator level had lower risk of angina and cardiac ischemia compared with those at the professional/executive level in the Whitehall II cohort study.<sup>20</sup> The effect of SES on health therefore appears to stem beyond disparities in resources and opportunities to include psychosocial contributions arising from relative and perceived differences in social position.

Subjective social status (SSS) is an individual’s perception of his or her own position in the social and socioeconomic hierarchy.<sup>55</sup> Though SSS can be measured in different ways, such as individuals self-identifying as low, middle, or upper class,<sup>56,57</sup> or through a single question about how their income compares to others with a Likert scale of responses,<sup>58-60</sup> the most common and standardized method of measurement of SSS is through the MacArthur Scale of Subjective Social Status.<sup>36</sup> This tool asks individuals to rank themselves on a ladder representing the social hierarchy, using either the society/country or their community as the reference group. Increasing evidence suggests that low SSS may have adverse effects on health due to internalization of perceptions of inferiority resulting in activation of stress-related neuroendocrine mechanisms<sup>61-</sup><sup>63</sup> and increased tendency to participate in behaviors that may negatively influence health.<sup>45,64</sup> Whether this translates clinically to increased risk of coronary artery disease (CAD) remains less clear, with variable results across studies. There is therefore a need for the synthesis of evidence

of the effect of SSS on cardiovascular chronic diseases, given uncertain clinical relevance despite consistent demonstration of biologic plausibility.

We conducted a systematic review with the objective of determining the association between SSS and the odds of CAD, hypertension, diabetes mellitus, obesity, and dyslipidemia in adults. We hypothesized that lower SSS would be associated with increased odds of each of the five outcomes.

## **2.3 Methods**

### ***2.3.1 Data sources and searches***

A systematic review and meta-analysis was performed and reported in compliance with the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines and followed a protocol created by study investigators.<sup>65</sup> We searched the following databases up to October 2014: PubMed (1966-present), MEDLINE (1950-present), EMBASE (1980-present), CINAHL (1982-present), SocINDEX (1895-present), PsycINFO (1803-present), and additionally, Web of Science (1990-present) to include relevant conference proceedings and dissertations. Reference lists of included studies were manually searched. No limits on language were placed. Though there was a plan to contact authors if data were missing or insufficient, this was not needed as data were found to be comprehensive.

Two investigators (KT and RR) undertook the search strategy with the help of a research librarian. The search strategy comprised of two search themes (Appendix A). The first theme, “perception”, combined exploded subject headings “*Social perception*” or “*Self-Concept*” with

the key words “subjective\* or perceiv\* or perception\* or belief\*”. The second theme, “social status” combined the exploded subject heading “*Social Class*” and key words including “social status\* or social position\* or social standing\* or social class\* or social rank\*”. Finally, the two search themes were combined using the Boolean operator “and”. We limited the search to the adult population (aged 18 years and over).

### **2.3.2 Study selection**

Two investigators (KT and RR) independently reviewed all titles and abstracts identified by the search strategy for eligibility. All abstracts reporting on the relationship between SSS and CAD, hypertension, diabetes mellitus, obesity, or dyslipidemia in adults were selected for full text review. Non-English studies (n=4) were translated with the assistance of interpreters and web-based translation programs.

Full text review was performed independently by the same investigators to select articles for inclusion into the systematic review based on the following criteria; studies must: 1) be in adults aged 18 years and over; 2) compare the odds, risk, or hazard of at least one of the outcomes of interest in a lower SSS group compared with a higher SSS group; and 3) measure SSS using a “self-anchoring” ladder scale, where the top and bottom of the ladder are defined by the study subject.<sup>66</sup> We limited studies only to those with observational designs (cohort, case-control, and cross-sectional), and excluded reviews, case studies or series, ecological studies, and qualitative studies. Studies were included into the systematic review if they met the above inclusion criteria, regardless of whether the reference group for the SSS ladder was the community or the country/society. However, because these two ladders represent distinct concepts with the societal

SSS ladder being the more robust and more widely studied measure, meta-analysis was performed only for those studies where an effect estimate for the societal SSS ladder was reported. The interrater agreement for inclusion of studies after full text review was excellent ( $\kappa=1.0$ ).

### ***2.3.3 Data extraction and study quality assessment***

The primary exposure variable was “lower” SSS compared with “higher” SSS. The outcomes of interest were odds ratios of CAD, hypertension, diabetes, dyslipidemia, and obesity. The outcome of CAD included ischemic heart disease, angina, myocardial infarction, and cardiac ischemia. Studies that reported only quantitative differences in blood pressure, body mass index, or lipid levels without a diagnosis of hypertension, obesity, or dyslipidemia respectively were not considered.

One investigator (KT) extracted data from all included studies, with data extraction performed in duplicate for a random 20% of studies by a second investigator (RR). Data extracted included exposure and outcome variables, study design, setting, methods (including exclusion rates and sample size), and participant demographics. Both investigators independently assessed study quality for all studies using the following dimensions: well-defined and representative sample, objective outcome measures, blinding of outcome assessors, adequate follow-up, adequate consideration of potential confounding variables, and appropriate statistical analysis.

Disagreements were resolved by consensus.

### 2.3.4 Data analysis

All included studies reported odds ratios (OR) with the exception of one reporting hazard ratios (HR).<sup>67</sup> Conversion from HR to OR was performed using the formula:<sup>68</sup>  $OR = (RR[1-P_0]) / (1-RR*P_0)$ , where HR was approximated to be the relative risk (RR), and  $P_0$  was the prevalence of the outcome in the reference group. Outcome categories (CAD, hypertension, diabetes, obesity, and dyslipidemia) were not pooled in the systematic review, as they were not pooled in the individual studies.

Because a majority of studies presented stratified ORs without an overall summary measure,<sup>67,69-74</sup> and because studies used different comparison groups (with some reporting ORs between the bottom versus the top of the SSS ladder,<sup>69,72</sup> others reporting ORs per one,<sup>70,75,76</sup> 1.6,<sup>77</sup> or two<sup>73,74</sup> rung increase in SSS, and still others, per quartile change in SSS<sup>67,71</sup>) we calculated a single weighted effect estimate comparing the bottom (lowest rung) versus the top (highest rung) of the SSS ladder to facilitate comparisons across studies. This was achieved through the following steps: 1) if both community and societal ladders were used to measure SSS, only ORs for societal ladders were considered; 2) if multiple effect estimates for a single outcome were reported in a single study, the OR using the broadest level of comparison was used; 3) reciprocals of all ORs that used lower SSS as the reference group were taken, so that higher SSS became the reference group; 4) all ORs were converted to log(OR)s; 5) each stratified log(OR) was multiplied by the proportion of the sample in that stratum, then summed across strata, resulting in one weighted log(OR) per outcome per study; 6) weighted log(OR)s were calculated comparing the bottom rung to the top rung of the SSS ladder, then converted back to ORs. Linearity in the relationship between log(OR)s of outcomes and SSS was assumed.

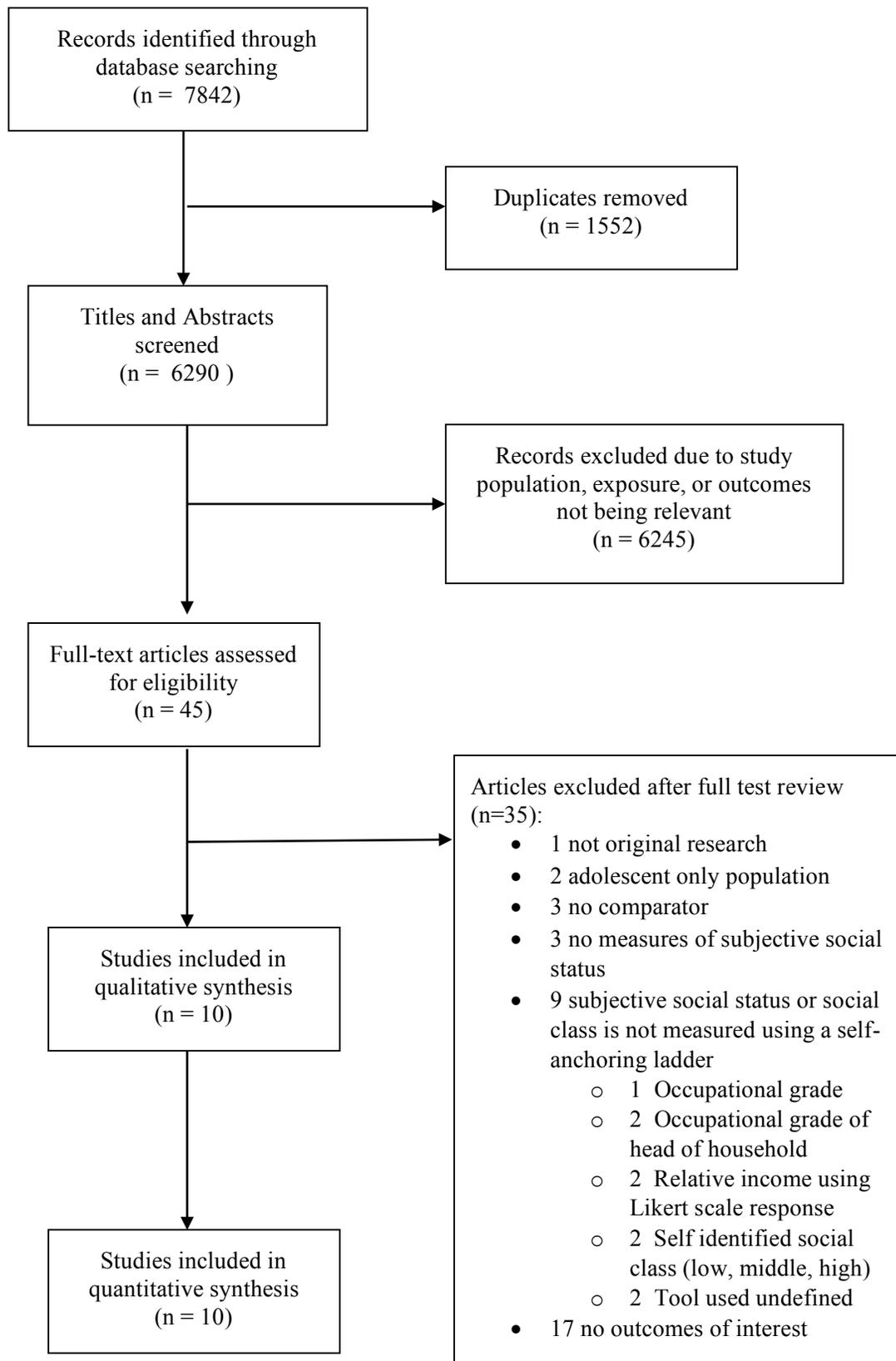
Meta-analysis was performed separately for each of the outcomes using Stata version 13 (StataCorp, Texas). Separate meta-analyses were performed for effect measures that were unadjusted and adjusted for objective SES measures (income, education, and occupation). Both SES-unadjusted and adjusted ORs still adjusted for non-SES measures such as age, marital status, and physical activity. Of note, one study reporting only SES-adjusted effect measures was included in both SES-unadjusted and adjusted meta-analyses.<sup>76</sup> DerSimonian and Laird random effects models were used to pool ORs across studies, and forest plots were generated. Heterogeneity of effect estimates was assessed using Cochran's Q test and the  $I^2$  statistic. We performed stratified analyses and meta-regression on the pre-selected variables of ethnicity, sex, and dimensions of study quality including outcome measure objectivity, adjustment for confounding, and selection bias. This was performed for the SES-unadjusted outcome measures of hypertension, diabetes, and obesity only, due to insufficient numbers of studies reporting CAD and dyslipidemia outcomes.

Publication bias was assessed using Begg's test, and by visually examining funnel plots for each outcome. For any outcomes where funnel plot asymmetry suggested publication bias, sensitivity analysis was performed through the trim and fill procedure.<sup>78</sup>

## **2.4 Results**

### ***2.4.1 Identification of studies***

The initial search strategy identified 7842 citations, of which 45 were included in full-text review (Figure 2.1).



**Figure 2.1: Study selection process**

Of these, 35 were excluded (17 did not include an outcome of interest, 9 measured social status but not using a self-anchoring ladder, 3 had no measure of SSS, 3 had no comparator, 2 consisted of an adolescent only population, and 1 was not an original study). In total, ten studies were included in the systematic review.<sup>67,69-77</sup> Of these, nine studies were included in the meta-analysis, excluding the single dissertation<sup>75</sup> that evaluated SSS on a community ladder only. A manual review of reference lists identified no additional studies. A verification search performed July 2015 using the related articles function in PubMed for all included studies did not reveal any additional studies for inclusion into the systematic review.

#### ***2.4.2 Study characteristics***

Of the ten studies, one study reported on two separate cohorts (Whitehall II and “Coronary Artery Risk Development in Young Adults” [CARDIA]),<sup>69</sup> two studies reported outcomes on the same Whitehall II cohort,<sup>69,72</sup> and another two studies reported outcomes on the same “English Longitudinal Study of Ageing” (ELSA) cohort of participants (Table 2.1).<sup>67,70</sup>

**Table 2.1: Study characteristics**

Study	Country	Cohort Designation	Study Design	Sample Size at Analysis	Age (years) Mean (SD)	Female (%)	SSS Reference Group (Community, Societal, Both)	SSS Mean (SD)	Outcomes Measured				
									CAD	HTN	DM	Obesity	Lipids
Adler 2008 <sup>69</sup>	England	Whitehall II	Cross-sectional	6981	NR (Range 47-67)	34.0	Societal	NR	Y	N	N	N	N
	US	CARDIA	Cross-sectional	3632	NR (Range 33-48)	55.8	Societal	NR	Y	N	N	N	N
Cross 2011 <sup>75</sup>	US	HANDLS	Cross-sectional	1824	48.2 (9.1)	44.0	Community	6.8 (2.0)	N	Y	N	N	N
Demakakos 2008 <sup>70</sup>	England	ELSA	Cross-sectional	7433	Median 65 to 66 <sup>a</sup>	53.4	Societal	5.9 (2.2)	N	Y	Y	Y	Y
Demakakos 2012 <sup>67</sup>	England	ELSA	Cohort	7432	62.8 to 66.1 <sup>b</sup>	55.2	Societal	NR	N	N	Y	N	N
Frerichs 2014 <sup>71</sup>	China, Japan, S.Korea, Taiwan	N/A	Cross-sectional	8152	39.5 to 44.9 (11.5 to 13.9) <sup>c</sup>	52.3	Societal	3.9 – 5.3 <sup>c</sup> (1.5 – 1.7)	N	N	N	Y	N
Manuck 2010 <sup>77</sup>	US	N/A	Cross-sectional	981	45.2 (6.6)	52.0	Societal	6.2 (1.6)	N	Y	Y	Y	Y
Reitzel 2013 <sup>76</sup>	US	N/A	Cross-sectional	1467	45.2 (12.9)	74.6	Both	6.6 (1.7) <sup>d</sup>	N	N	N	Y	N
Singh-Manoux 2013 <sup>72</sup>	England	Whitehall II	Cross-sectional	6981	NR (Range 47-67)	34.0	Societal	NR	Y	N	Y	N	N
Subramanyam 2013 <sup>73</sup>	US	Jackson Heart Study	Cross-sectional	3939	53.8 to 54.8 (12.5 to 12.7) <sup>c</sup>	63.2	Both	6.2 – 6.3 <sup>a, d</sup> (2.1–2.2)	N	N	Y	N	N
Woo 2008 <sup>74</sup>	China	N/A	Cross-sectional	4000	NR (Proportions: Age 65-69: 33.9%; 70-74: 34.9% 75+: 31.2%)	47.8	Both	4.0 – 5.7 <sup>d, e</sup> (1.5–2.0)	Y	Y	Y	Y	Y

<sup>a</sup>Stratified by sex<sup>b</sup>Stratified by sex and wealth tertile<sup>c</sup>Stratified by sex and country<sup>d</sup>Reported for societal ladder only<sup>e</sup>Stratified by sex, age, education, and income

**Abbreviations:** SSS, Subjective social status; SD, standard deviation; CAD, coronary artery disease; HTN, hypertension; DM, diabetes mellitus; “Lipids”, dyslipidemia; CARDIA, Coronary Artery Risk Development in Young Adults Study; HANDLS, Healthy Aging in Neighborhoods of Diversity across the Life Span; ELSA, English Longitudinal Study of Ageing; S. Korea, South Korea; N/A, not applicable; NR, not reported; Y, yes (outcome measured); N, no (outcome not measured)

Though nine were cross-sectional studies with only one being a cohort study,<sup>67</sup> four of these drew data from longitudinal cohorts but used only one phase of data collection for analysis.<sup>69,70,72,75</sup> Five cohorts were from the United States, four from the United Kingdom, and two from Asia. The sample size for the individual study cohorts ranged from 981 to 8152. Nine of ten studies used a ten-rung ladder to measure SSS, with one study using a nine-rung ladder.<sup>69</sup> Six studies used the societal ladder only to measure SSS,<sup>67,69-72,77</sup> one study used the community ladder only,<sup>75</sup> and three used both.<sup>73,74,76</sup>

The method of measurement of each of the five outcomes varied across studies (Table 2.2).

**Table 2.2: Methods of measurement of outcomes**

Study	Coronary Artery Disease	Hypertension	Diabetes	Obesity	Dyslipidemia
Adler 2008 <sup>69</sup>		Staff-measured BP readings >135/85 <i>or</i> Self-reported current use of anti-hypertensive medications			
Cross 2011 <sup>75</sup>		Self-reported doctor diagnosis of hypertension			
Demakakos 2008 <sup>70</sup>			Self-reported doctor diagnosis of diabetes		
Demakakos 2012 <sup>67</sup>		Self-reported doctor diagnosis of hypertension <i>or</i> Staff-measured mean BP $\geq 140/90$	Self-reported doctor diagnosis of diabetes <i>or</i> HbA1c lab test $\geq 6\%$	Staff-measured waist circumference >94 cm for men and >80cm for women	Lab tests, with two outcomes reported: <ul style="list-style-type: none"> <li>• HDL &lt;1mmol/L (men); &lt;1.3 mmol/L women);</li> <li>• Triglycerides <math>\geq 1.7</math>mmol/L</li> </ul>
Frerichs 2014 <sup>71</sup>				Self-reported weight and height to calculate BMI. Outcome is overweight or obese, BMI $\geq 25$ kg/m <sup>2</sup>	
Manuck 2010 <sup>77</sup>		Staff-measured BP readings $\geq 130/85$ (mean of 2 consecutive readings) <i>or</i> Self-reported use of antihypertensive medications	Self-reported use of oral hypoglycemic medications <i>or</i> Fasting serum glucose lab test $\geq 100$ mg/dl	Staff-measured waist circumference $\geq 102$ cm for men and $\geq 88$ cm for women	Two outcomes reported: <ul style="list-style-type: none"> <li>• HDL: Fasting HDL lab test &lt;40mg/dl men or &lt;50mg/dl women <i>or</i> Self-reported use of medication for low HDL</li> <li>• Triglycerides: Fasting TG lab test <math>\geq 150</math>mg/dl <i>or</i> Self-reported use of medication for high TG</li> </ul>
Reitzel 2013 <sup>76</sup>				Staff-measured height and weight to calculate BMI. Outcome is obesity, BMI $\geq 30$ kg/m <sup>2</sup>	
Singh-Manoux 2013 <sup>72</sup>	Self-reported Rose angina questionnaire		Self-reported doctor diagnosis of diabetes		

Study	Coronary Artery Disease	Hypertension	Diabetes	Obesity	Dyslipidemia
Subramanyam 2013 <sup>73</sup>			Self-reported history of diabetes, <i>or</i> Fasting serum glucose lab test ≥126mg/dl <i>and</i> self-reported use of anti-diabetic medications within 2 weeks prior to clinic visit.		
Woo 2008 <sup>74</sup>	Self-reported doctor diagnosis of myocardial infarction or angina	Staff-measured BP measurements ≥140/90	Self-reported doctor diagnosis of diabetes	Staff-measured height and weight to calculate BMI. Outcome is overweight or obesity, BMI ≥25kg/m <sup>2</sup>	

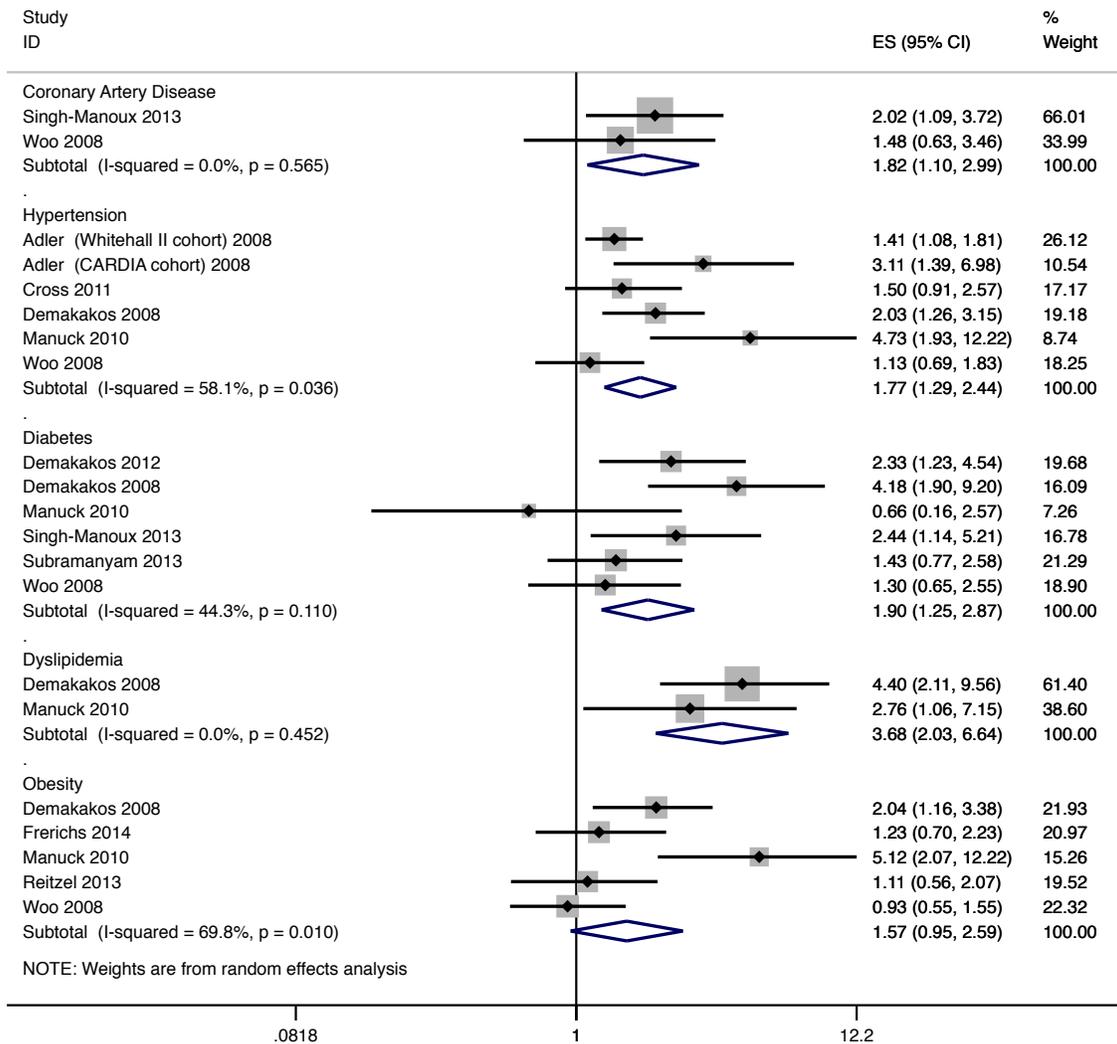
Blank cells= studies did not evaluate or report this outcome

Abbreviations: BP, blood pressure; HbA1c, hemoglobin A1c; HDL, high density lipoprotein; TG, triglycerides; BMI, body mass index

The two studies reporting CAD outcomes used self-reported measures.<sup>72,74</sup> Studies reporting on dyslipidemia and obesity tended to use more objective measurements (such as measurement of weight, height, waist circumference, and use of lab tests); studies reporting on hypertension and diabetes used a combination of self-report and objective measures.

### ***2.4.3 Synthesis of results***

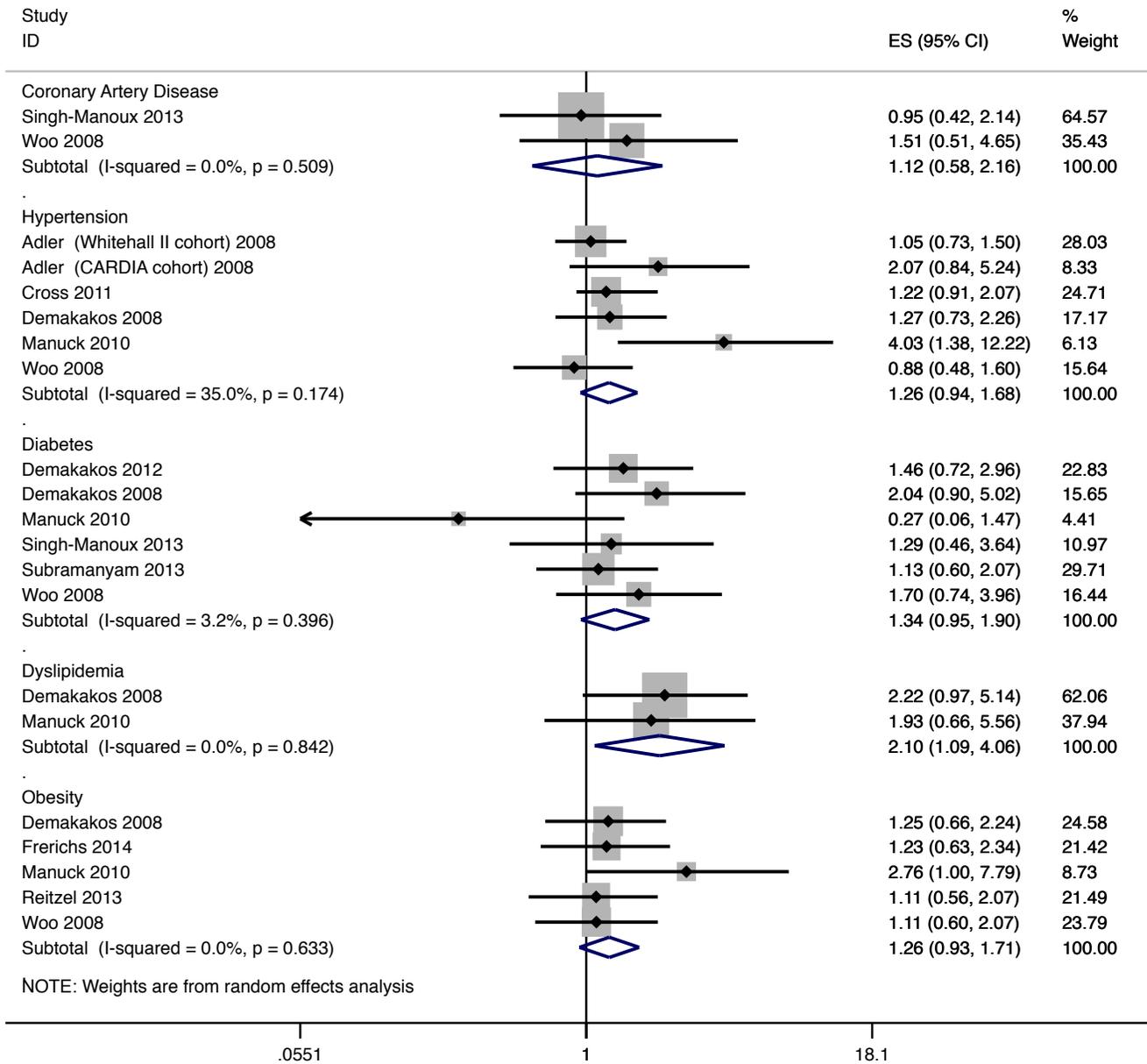
SES-unadjusted analysis showed an inverse association between SSS and all outcomes of interest, though not all were statistically significant. Pooled ORs comparing the bottom versus the top of the SSS ladder (Figure 2.2) were significantly greater than one for CAD (1.82, 95% CI 1.10, 2.99), hypertension (1.88, 95% CI 1.27, 2.79), diabetes (1.90, 95% CI 1.25, 2.87), and dyslipidemia (3.68, 95% CI 2.03, 6.64), but did not reach statistical significance for obesity (1.57, 95% CI 0.95, 2.59).



**Figure 2.2: Forest plot of odds ratios of coronary artery disease, hypertension, diabetes, dyslipidemia, and obesity comparing the bottom versus the top of the subjective social status ladder, unadjusted for socioeconomic status**

The corresponding ORs per rung decrease in SSS for CAD, hypertension, diabetes, dyslipidemia, and obesity were 1.06 (95% CI 1.01, 1.12), 1.07 (95% CI 1.02, 1.11), 1.07 (95% CI 1.02, 1.11), 1.14 (95% CI 1.07, 1.21), and 1.05 (95% CI 0.99, 1.10) respectively.

When analyses were adjusted for objective SES measures, there was attenuation of the association between SSS and outcomes. Pooled SES-adjusted ORs comparing the bottom versus top of the SSS ladder (Figure 2.3) were statistically significant only for dyslipidemia (2.10, 95% CI 1.09, 4.06), with a non-statistically significant trend seen for the other outcomes (1.12 [95% CI 0.58, 2.16] for CAD, 1.32 [95% CI 0.89, 1.96] for hypertension, 1.34 [95% CI 0.95, 1.90] for diabetes, and 1.26 [95% CI 0.93, 1.71] for obesity).



**Figure 2.3: Forest plot of odds ratios of coronary artery disease, hypertension, diabetes, dyslipidemia, and obesity comparing the bottom versus the top of the subjective social status ladder, adjusted for socioeconomic status**

The corresponding SES-adjusted ORs per rung decrease in SSS were 1.08 (95% CI 1.01, 1.15) for dyslipidemia, 1.01 (95% CI 0.95, 1.08) for CAD, 1.03 (95% CI 0.99, 1.07) for hypertension, 1.03 (95% CI 0.99, 1.07) for diabetes, and 1.02 (95% CI 0.99, 1.06) for obesity.

Inspection of SES-unadjusted forest plots revealed little visual heterogeneity, with all point estimates being greater than one for all outcomes, with the exception of one study in diabetes<sup>77</sup> and one study in obesity.<sup>74</sup> The  $I^2$  statistics varied from 0.0% for CAD and dyslipidemia to 69.8% for obesity. The outcomes of hypertension and obesity demonstrated statistically significant heterogeneity (Cochran Q test  $p=0.018$  and  $0.010$  respectively), likely driven by the large number of study participants, and thus statistical power for the test of heterogeneity, in these studies.

#### ***2.4.4 Stratified analysis and meta-regression***

To explore study heterogeneity, stratified analysis and meta-regression were performed on five variables: ethnicity, sex, and three quality measures (Table 2.3).

**Table 2.3: Stratified analyses of pooled odds ratios (95% confidence interval) of hypertension, diabetes, and obesity comparing the bottom versus the top of the subjective social status ladder (number of pooled studies in parenthesis after effect estimate)**

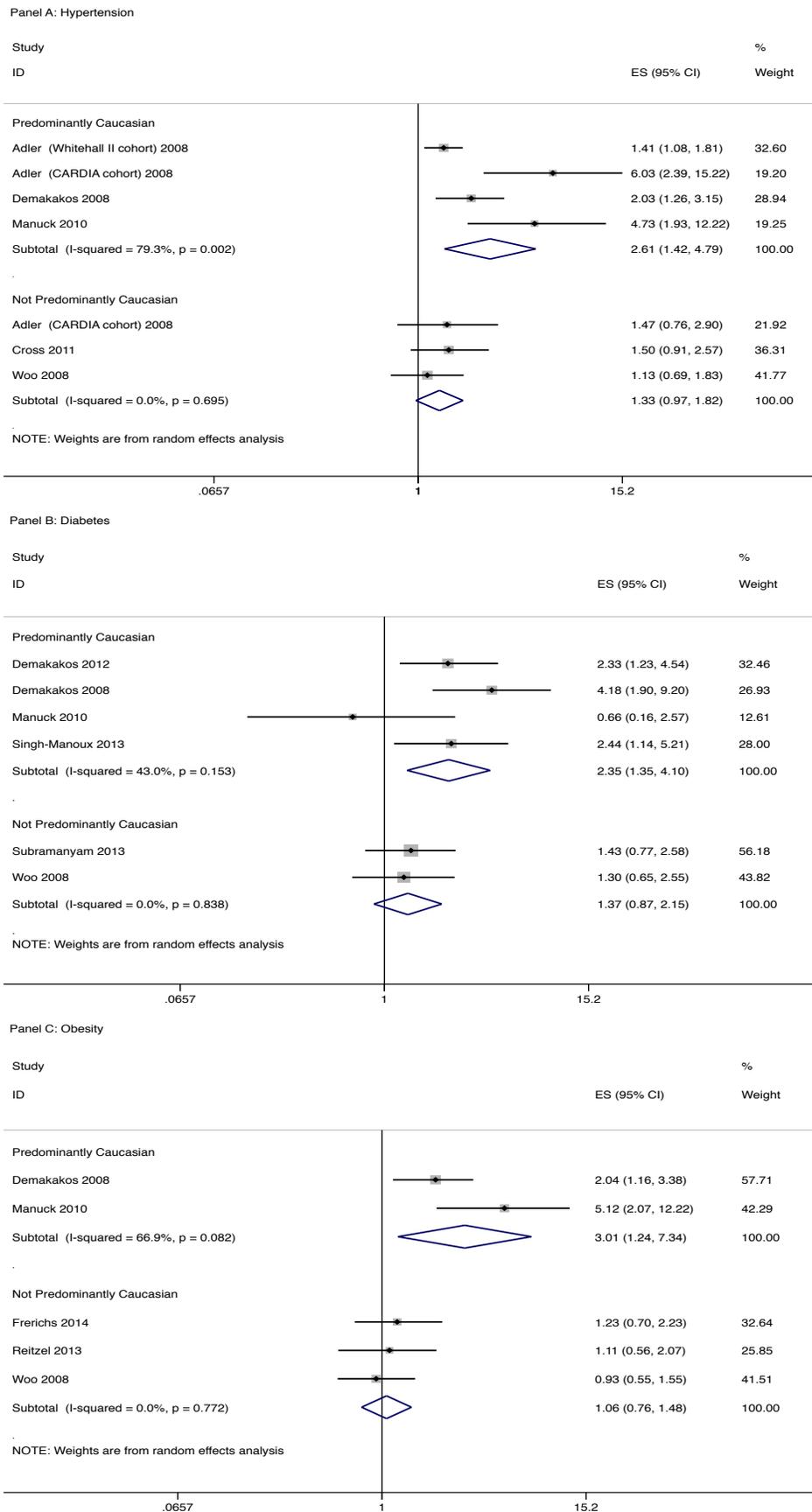
	Hypertension			Diabetes			Obesity		
	OR (95% CI)	Heterogeneity p-value	Meta-Regression p-value	OR (95% CI)	Heterogeneity p-value	Meta-Regression p-value	OR (95% CI)	Heterogeneity p-value	Meta-Regression p-value
<b>Ethnicity</b>									
Predominantly ( $\geq 75\%$ of sample) Caucasian	2.61 (1.42, 4.79) (4)	<0.01		2.35 (1.35, 4.10) (4)	0.15		3.01 (1.24, 7.34) (2)	0.08	
Not Predominantly (<75% of sample) Caucasian	1.24 (0.84, 1.83) (2)	0.54	0.24	1.37 (0.87, 2.15) (2)	0.84	0.18	1.06 (0.76, 1.48) (3)	0.77	0.07
<b>Sex</b>									
Male	1.57 (1.03, 2.38) (4)	0.01		1.99 (1.40, 2.84) (5)	0.25		1.02 (0.76, 1.37) (3)	0.41	
Female	1.77 (1.27, 2.49) (4)	0.13	0.64	2.14 (1.34, 3.42) (5)	0.07	0.82	1.66 (0.88, 3.13) (3)	0.03	0.25
<b>Outcome measure<sup>a</sup></b>									
Objective				1.75 (0.69, 4.47) (3)	0.37				
Subjective				1.93 (1.29, 2.88) (3)	0.03	0.91			
<b>Adjustment of non-SES confounders</b>									
Adequate (adjustment for more than age alone)	2.81 (1.25, 6.28) (2)	0.11		2.35 (1.35, 4.10) (4)	0.15		3.01 (1.24, 7.34) (2)	0.08	
Inadequate (no adjustment or for age alone)	1.51 (1.00, 2.28) (3)	0.11	0.32	1.37 (0.87, 2.15) (2)	0.84	0.18	1.06 (0.76, 1.48) (3)	0.77	0.07
<b>Selection bias<sup>b</sup></b>									
Lower selection bias (not convenience sample and <20% exclusion rate)				2.21 (0.93, 5.29) (3)	0.07		2.18 (1.08, 4.41) (3)	0.03	
Higher selection bias (convenience sample or $\geq 20\%$ exclusion rate)				1.62 (1.12, 2.35) (3)	0.41	0.40	0.99 (0.66, 1.49) (2)	0.68	0.22

<sup>a</sup> Stratified analysis not performed for hypertension (5 of 6 studies had objective outcomes), or obesity (4 of 5 studies had objective outcomes)

<sup>b</sup> Stratified analysis not performed for hypertension (5 of 6 studies had lower selection bias)

Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval; SES, socioeconomic status

Analysis stratified by ethnicity revealed increased effect sizes for hypertension (Figure 2.4, Panel A), diabetes (Figure 2.4, Panel B), and obesity (Figure 2.4, Panel C) for studies with a predominantly Caucasian sample, compared to studies with a predominantly non-Caucasian sample (ORs comparing bottom versus top of SSS ladder: 2.61 [95% CI 1.42, 4.79], 2.35 [95%CI 1.35, 4.10], and 3.01 [95% CI 1.24, 7.34] for hypertension, diabetes and obesity respectively, for studies with a predominantly Caucasian sample versus 1.24 [95% CI 0.84, 1.83], 1.37 [95% CI 0.87, 2.15], and 1.06 [95% CI 0.76, 1.48] respectively for studies with a predominantly non-Caucasian sample).



**Figure 2.4: Forest plots of odds ratio of hypertension (Panel A), diabetes (Panel B), and obesity (Panel C) comparing the bottom versus the top of the subjective social status ladder, stratified by ethnicity**

For two of the three quality measures (adequacy of adjustment of non-SES confounders and level of selection bias), better quality studies reported greater effect sizes compared with lower quality studies, for all three outcomes. No differences in effect sizes were seen between studies using objective versus subjective outcome measures. Ethnicity and study quality seemed, at least in part, to explain between-study heterogeneity. Meta-regression performed for each of the above five variables did not result in any statistically significant p-values, likely due to being underpowered from limited numbers of studies. P-values approached significance for ethnicity and adequacy of adjustment of confounders (p=0.07 for both variables, for the outcome of obesity).

#### ***2.4.5 Publication bias***

Begg's test for funnel plot asymmetry was not statistically significant for any of the five outcomes. Visual inspection of funnel plots did reveal visual asymmetry for hypertension only, so a sensitivity analysis using the trim and fill method was performed. The OR of hypertension comparing the bottom versus top of the SSS ladder after imputation of hypothetical "missing" studies decreased slightly to 1.47 (95% CI 0.96, 2.24) compared with an OR of 1.88 (95% CI 1.27, 2.79) without imputation. Therefore, publication bias may have resulted in slightly overestimated effect sizes for hypertension alone though the same trends remain.

#### ***2.4.6 Study quality***

Assessment of study quality can be found in Table 2.4.

**Table 2.4: Study quality criteria**

<b>Study</b>	<b>Defined sample population</b>	<b>Sample is representative of population of interest</b>	<b>Objective outcome measure</b>	<b>Outcome assessor blinded</b>	<b>Follow-up sufficiently long</b>	<b>Follow-up same for all subjects</b>	<b>Sufficient adjustment and consideration of confounding variables</b>	<b>Subjects from both exposure groups recruited from same population</b>	<b>Subjects from both exposure groups recruited from same time period</b>	<b>Statistical analysis appropriate</b>
Adler 2008 <sup>69</sup>	Y	U	Y	U	N	Y	N	Y	Y	Y
Cross 2011 <sup>75</sup>	Y	N	N	N	N	Y	N	Y	Y	N
Demakakos 2008 <sup>70</sup>	Y	N	Y	U	N	Y	N	Y	Y	Y
Demakakos 2012 <sup>67</sup>	Y	N	N	N	Y	Y	Y	Y	Y	Y
Frerichs 2014 <sup>71</sup>	Y	N	N	N	N	Y	N	Y	Y	Y
Manuck 2010 <sup>77</sup>	Y	Y	Y	U	N	Y	Y	Y	Y	Y
Reitzel 2013 <sup>76</sup>	N	N	Y	U	N	Y	Y	Y	Y	N
Singh-Manoux 2013 <sup>72</sup>	Y	U	N	N	N	Y	N	Y	Y	Y
Subramanyam 2013 <sup>73</sup>	Y	N	Y	U	N	Y	N	Y	Y	Y
Woo 2008 <sup>74</sup>	Y	N	N	N	N	Y	N	Y	Y	Y

Y= Study criterion met; N= Study criterion not met; U= Unclear if study criterion is met

One area of deficiency was in study samples being insufficiently representative of the target population due to the use of convenience samples,<sup>74,76</sup> lack of description of recruitment strategies,<sup>71,75</sup> lack of reporting of response rates,<sup>67,75-77</sup> high or unreported exclusion rates,<sup>73-76</sup> and lack of reporting of participant demographics.<sup>69,72</sup> In addition, nearly three-quarters of included studies only performed limited adjustment of non-SES confounders, such as for age alone or age and marital status without consideration of comorbidities or cardiovascular risk behaviors.<sup>69-75</sup> Despite these limitations, there were clear areas of strengths in study quality. All ten studies drew the exposure and comparator groups from the same population, nine of ten studies had a well-defined sample population, and eight studies performed appropriate statistical analyses. Half of the included studies used objective outcome measures.

## **2.5 Discussion**

In this meta-analysis of nine studies, there appeared to be a consistent and statistically significant increase in odds, of approximately 1.8 to 3.7 fold, of CAD, hypertension, diabetes, and dyslipidemia when comparing the bottom versus the top of the SSS ladder; there was a non-significant trend for obesity. To our knowledge, this is the first systematic review and meta-analysis to comprehensively summarize the body of literature examining the association between SSS and cardiovascular disease and cardiovascular risk factors.

A previous qualitative study demonstrated that individuals cite income, education, and occupation as the top three dimensions used to determine their own SSS ranking.<sup>36</sup> SES measures cannot therefore be considered confounders, due to their place on the causal pathway of SES, SSS, and health outcomes. That is, if SES affects health due to status differentiation and its

psychosocial consequences rather than absolute resource deprivation, then it is likely inappropriate to adjust for these factors that contribute to, and are closely associated, with social status.<sup>79</sup> Despite probable over-adjustment for socioeconomic factors, our meta-analysis shows that a consistent trend remains between lower SSS and higher odds cardiovascular risk and cardiovascular disease after adjustments for socioeconomic status, with all odds ratios for all outcomes remaining greater than one. This adds robust evidence that not only is SSS likely a mediator in the SES - cardiovascular outcomes pathway, but that SSS is still independently associated with cardiovascular risk independent of income, education, or occupation. That is, the *perception* of where one stands on a social hierarchy is associated with health affects independent of a person's *actual* objective income, education, or occupation.

Various bodies of evidence point to the role of psychosocial effects of social status on health, including studies in baboons and macaques, which show that these non-human primates are organized in linear social hierarchies; those who are subordinate tend to have higher lipid levels, cortisol levels, more coronary plaques, and higher rates of obesity.<sup>80-83</sup> In a study that manipulated social status by switching female macaque monkeys from one social group to another, those who previously held dominant positions but were then subordinate in their new group had a five-fold risk of developing coronary plaques compared to those that did not change social position.<sup>82</sup> This would argue that it is the psychosocial implications of social status rather than physical fitness or ability to attain resources that contribute to cardiovascular risk. In the income inequality literature, residents of countries with high income inequality have more status anxiety<sup>84</sup> and increased cardiovascular morbidity, mortality, and risk factors<sup>85</sup> compared with countries with less income inequality. However, none of the primate or income inequality studies

actually measures individual perception of social status and its association on health, but rather infers that this perception must be present and acts as a causal factor in determining health outcomes because absolute resource and income levels cannot adequately explain the social gradient in health. In this sea of indirect evidence, our review advances knowledge by demonstrating that explicitly-measured perceived social status is associated with risk of cardiovascular disease.

Though previous literature has clearly demonstrated the associations between psychosocial factors and health outcomes, the literature does not link these psychosocial factors to social status. For example, control, anxiety, social supports, social participation, and social cohesion and trust have all been shown to contribute to health outcomes, though these were not specifically studied in the context of psychosocial responses to social status.<sup>86,87</sup> Similarly, health disparities based on occupation have been attributed to imbalances between high demands/low control, and high personal efforts/ low rewards; these imbalances increase the risk of cardiovascular disease.<sup>86,88</sup> Perhaps these findings at the workplace are a microcosm of a similar mechanism between the same imbalances in life as a whole leading to the development of cardiovascular disease, for those with low perceived social class. The simple self-ranking on the MacArthur Scale of Subjective Social Status may capture this spectrum of psychosocial factors and imbalances between effort and reward, making it a robust summary measure of the psychosocial effects of social status.

Previous studies have suggested that the inverse relationship between SSS and health is less strong in African Americans compared with Caucasians.<sup>34,69</sup> Our stratified analysis, though

underpowered, demonstrates similar results, with pooled ORs for hypertension, diabetes, and obesity comparing those at the bottom versus the top of the SSS ladder being statistically significantly greater than one for studies with a predominantly Caucasian population, but not for studies with a predominantly non-Caucasian population. This may be because different ethnicities derive social status from different sources. For example, African-Americans may derive social status from racial identity, Afrocentric values, self-esteem, and personal efficacy;<sup>89,90</sup> they have been shown to have higher self-perceived status compared with Caucasians even at a lower income levels.<sup>90</sup> The MacArthur Scale of Subjective Social Status societal ladder explicitly defines the top of the ladder as those with “the most money, the most education, and the most respected jobs”.<sup>36</sup> Therefore, low SSS as measured by this ladder may not have the same associations with poor health outcomes for non-Caucasians who may have higher self-worth and satisfaction than is indicated by this ladder. Future research in SSS may need to take this account by examining associations between SSS and health specifically within specific ethnic groups rather than in a heterogeneous and ethnically diverse population. In addition, perhaps the MacArthur Scale of Subjective Social Status community ladder, where perceived social status is measured without reference to objective socioeconomic measures, may more accurately reflect social status in non-Caucasian ethnicities that derive status primarily from non-SES measures; however, a comparison of the validity of the societal versus the community ladder is needed before the community ladder is widely adopted over the more commonly used and studied societal ladder.

### **2.5.1 Limitations**

There are limitations to our review. First, as with any systematic review, our study is limited by the quality of underlying studies. While there were clear strengths in the included studies, our quality assessment revealed deficiencies particularly in the areas of the representative study samples, adjustment of confounders, and in length of follow-up. These issues highlight the difficulty in performing studies at the intersection between social determinants and health. Our stratified analysis suggested that higher quality studies reported higher effect sizes compared with lower quality studies. Given this, our review likely underestimated the association between SSS and CAD and CAD risk factors. Second, we were unable to assess the role of negative affect in the association between SSS and cardiovascular health, given that only one study included psychosocial variables in their regression models. However, previous literature suggests that negative affect may act as a mediator rather than a confounder in the association between SSS and health outcomes,<sup>46</sup> and adjustment for these factors may therefore not always be appropriate. Third, because only one of ten studies was a cohort study, the association between SSS and CAD and CAD factors cannot be deemed to be causal, despite consistency of effect and biologic plausibility. We note though that five of the nine cross-sectional studies used longitudinal patient cohorts; there is therefore great potential for future cohort studies, given that data for these cohorts are available. Lastly, we included only studies that measured SSS using a ladder scale, excluding a total of nine studies that measured SSS using a different tool. However, studies using other SSS measures show consistent results, with low perceived social class being associated with increased risk of cardiovascular disease and cardiovascular risk factors, reduced mobility, and worse self-rated health.<sup>56,57,59,60</sup> Restriction of studies to those using SSS ladders was necessary to allow a standard comparison across studies given the heterogeneity and uncertain

validity of other instruments; this restriction is unlikely to have biased our findings and conclusions.

### ***2.5.2 Implications***

Though social hierarchies are inevitable, the presence of the hierarchy itself does not automatically translate to perceptions of status inferiority or superiority, but rather depends on how this hierarchy is linked to resource distribution.<sup>87</sup> Unequal societies result in a greater differential in social status. Interventions to address the association between subjective social status and cardiovascular risk can therefore work to reduce the social hierarchy, or alternatively, to address the psychosocial consequences of low standing in this hierarchy. The former includes interventions aimed at improved early childhood education and income distribution, such as changing taxation rules and increasing minimum income thresholds to allow for healthy living.<sup>91</sup> The latter includes interventions to improve social cohesion, social trust, and social participation; examples include increased variety of work, use of skills, and level of control in the workplace, and increased accessibility and affordability of public transportation. Our findings serve to highlight not only the need for these interventions for the health of a population, but may also provide guidance on more specific public health and social policies. For example, commitment to work and parental roles have been shown to be associated with higher self-image in the middle-aged population. Policies that invest in human capital, such as through job training and creation, may therefore have greater impacts on SSS and subsequently on health compared to policies that provide income assistance and subsidies. The United Kingdom (UK) has led in recognizing the role that social disparities play in health, with specific recommendations for interventions in the Acheson Report<sup>92</sup> and Marmot Review.<sup>93</sup> These recommendations though

have been slow to gain traction due to the need for multiple stakeholder involvement, spanning local and national governments, in health and non-health sectors. Given the clear associations between social status and health, health professionals and public health agencies are not only well placed, but also have both a social and professional responsibility to lead and advocate for these policy changes, acting as a link between politics, health, and research.

**CHAPTER 3: An exploration of the subjective social status construct in patients with acute coronary syndrome (Thesis sub-study B)**

### 3.1 Abstract

**Background:** Perception of low subjective social status (SSS) relative to others in society or in the community has been associated with increased risk of cardiovascular disease. Our objectives were to determine whether low SSS in society was associated with barriers to access to care or readmissions in patients with established cardiovascular disease, and whether perceptions of discordantly high SSS in the community modified this association.

**Methods:** We conducted a prospective cohort study from 2009 to 2013 in Canada, United States, and Switzerland in patients admitted to hospital with acute coronary syndrome (ACS). Data on access to care and SSS variables were obtained at baseline. Readmission data were obtained 12 months post-discharge. We conducted multivariable logistic regression to model the odds of access to care and readmission outcomes in those with low versus high societal SSS.

**Results:** 1090 patients admitted with ACS provided both societal and community SSS rankings. The low societal SSS cohort had greater odds of reporting that their health was affected by lack of health care access (OR 1.48, 95% CI 1.11, 1.97) and of experiencing cardiac readmissions (1.88, 95% CI 1.15, 3.06). Within the low societal SSS cohort, there was a trend toward fewer access to care barriers for those with discordantly high community SSS though findings varied based on the outcome variable. There were no statistically significant differences in readmissions based on community SSS rankings.

**Conclusion:** Low societal SSS is associated with increased barriers to access to care and cardiac readmissions. Variable results were seen with community SSS, with high community SSS potentially modifying the association between low societal SSS and access to care but not readmissions. SSS in society versus in the community seem to represent distinct concepts.

Insight into the differences between these two SSS constructs is imperative in the development of public health policies.

### 3.2 Background

Individuals with lower income, lower educational attainment, or working in lower status occupations consistently experience increased mortality, increased prevalence of coronary artery disease, and worse prognosis after an acute coronary syndrome (ACS) event relative to those with higher objective socioeconomic status.<sup>8,94-98</sup> These disparities exist even within universal health care systems and amongst those who do not experience absolute poverty, suggesting that perceived differences in social standing (or subjective social status) may contribute to health in important ways for those with established chronic disease.

In health research, SSS is generally measured on a vertical ten-rung ladder representing either the society or the specific country in which the tool is being used (the “societal ladder”), or the community as defined by the participant (the “community ladder”).<sup>36</sup> Though the two ladders are correlated, sharing 50% of variance,<sup>99</sup> preliminary evidence suggests that they may be distinct, with individuals choosing their rankings on the societal ladder primarily based on wealth, occupation and education, whereas less objective characteristics such as altruism seem to take priority in choosing one’s position on the community ladder.<sup>36</sup> Most studies on SSS and cardiovascular health consider the societal ladder only.<sup>71,72,77,100-102</sup> Only one cross-sectional study considers the combined effect of both ladder rankings on the prevalence of cardiovascular risk factors.<sup>74</sup>

Though there are large numbers of studies on the association between SSS and mental health, self-rated health, risk-taking behaviours, and cardiovascular risk factors,<sup>103</sup> there are few studies on the association of SSS and outcomes and prognosis in those with established cardiovascular

disease.<sup>104,105</sup> We undertook a study in patients hospitalized with ACS to address whether low societal SSS is associated with increased barriers to access to health care and increased readmissions within 1 year after discharge from hospital. In addition, we sought to examine whether community SSS modified the association between societal SSS and access to care and readmissions in this cohort of patients. Because high community SSS may reflect increased social support, social capital, and altruism, each of which tends to confer cardio-protective benefit,<sup>106-108</sup> we hypothesized that having high community SSS might mitigate the risk of barriers to access to care and readmissions especially in those with low societal SSS. Our findings shed light on the construct of SSS and the differences between societal versus community SSS, and they also raise interesting mechanistic questions regarding the relationships between social determinants of health and outcomes.

### **3.3 Methods**

#### ***3.3.1 Study population***

Study participants were from the GENESIS PRAXY (Gender and Sex Determinants of Cardiovascular Disease: From Bench to Beyond Premature Acute Coronary Syndrome) prospective cohort study of patients hospitalized with ACS. Patients were enrolled into the study from January 2009 to April 2013, from 24 participating hospitals across Canada, 1 hospital in the United States, and 1 in Switzerland. Inclusion criteria were: 1) adults aged 18 to 55 years; 2) fluency in English or French; 3) ability to provide informed consent; and 4) diagnosis of ACS by the treating physician, meeting at least one of the following two criteria: (a) ECG changes in two or more contiguous leads (transient ST segment elevations of  $\geq 1$  mm, ST segment depressions of  $\geq 1$  mm, new T wave inversions of  $\geq 1$  mm, pseudo-normalization of previously inverted T

waves, new Q-waves [1/3 the height of the R wave or  $\geq 0.04$  seconds], new R > S wave in lead V1, or new left bundle branch block); (b) Increase in cardiac enzymes (CK-MB or CPK (if CK-MB not available) > 2x the upper limit of the hospital's normal, positive troponin I, or positive troponin T).<sup>109</sup> Each study participant provided written informed consent.

### ***3.3.2 Data collection***

Data were collected using questionnaires and full chart review at baseline and at 12 months. The questionnaire was self-administered at baseline and administered by a research nurse over the telephone at 12 months. Details regarding study methods have been previously published.<sup>110</sup>

Patients were asked to complete both the community and societal MacArthur Scales of Subjective Social Status on the baseline questionnaire.<sup>36</sup> Sociodemographic information including age, sex, employment, household income, and social supports were also obtained from this baseline questionnaire. Clinical factors including type of ACS experienced, clinical comorbidities, and in-hospital complications were obtained from baseline chart review.

Outcome measures included access to care and readmissions to hospital. Access to care variables, such as whether patients have a regular family doctor and whether (and what types of) difficulties were experienced in accessing care, were obtained from the baseline questionnaire. Readmission information were obtained via telephone follow-up and chart review 12 months after the index hospitalization.

### ***3.3.3 Statistical analysis***

Because the societal SSS ladder has better reliability<sup>111</sup> and is also much more widely studied in the literature compared to the community ladder, the main division of our cohort was based on

societal SSS rankings. Three sets of comparisons were made for each analysis: 1) low societal SSS (ranking lower than median) versus high societal SSS (ranking at least as high as the median); 2) within the low societal SSS cohort, concordantly low community SSS versus discordantly high community SSS; and 3) within the high societal SSS cohort, concordantly high community SSS versus discordantly low community SSS.

We compared baseline demographics, clinical characteristics and comorbidities, proportions reporting barriers to access to care, and proportions being readmitted to hospital between the two groups for each of the three sets of comparisons, using Fisher's exact and Chi-square tests (for proportions) and t-tests (for continuous variables). Both unadjusted and adjusted logistic regression were undertaken, modeling the odds of readmission and four access to care outcomes (no family doctor, difficulty accessing a cardiologist, difficulty accessing routine care, and health affected by lack of access). Adjustment for confounding was undertaken for age, sex, comorbidity count, type of ACS, household income, and employment status. All statistical analyses were performed using SAS Version 9.4 (SAS Institute, Cary, North Carolina).

## **3.4 Results**

### ***3.4.1 Concordance versus discordance of societal versus community SSS***

Of 1213 enrolled patients with ACS, 1090 patients provided both societal and community SSS rankings. The median and mean rankings were 6 (interquartile range, IQR, 4, 7) and 5.5 (standard deviation, SD, 2.1) respectively for the societal ladder and 6 (IQR 5, 7) and 6.0 (SD 2.0) respectively for the community ladder.

We considered two different approaches to create cohorts based on concordance and discordance in societal and community SSS rankings. The “quadrant approach” (Figure 3.1, Panel A) divides the cross-tabulation of societal and community SSS rankings into four quadrants, based on whether rankings were below versus at least as high as the median.

Panel A: Quadrant Approach

		Community Ladder									
		1	2	3	4	5	6	7	8	9	10
Societal Ladder	1	17	10	7	8	4	0	1	0	0	0
	2	5	11	7	14	13	7	5	1	1	0
	3	5	5	21	12	17	13	9	7	3	0
	4	2	1	9	28	32	22	13	7	2	2
	5	2	0	16	16	80	35	31	12	3	2
	6	2	3	3	5	25	96	36	29	7	3
	7	2	0	0	1	10	31	79	31	18	4
	8	0	3	0	2	3	17	33	52	12	5
	9	1	0	0	1	1	4	5	13	12	4
	10	0	1	0	1	1	1	1	2	4	8

Panel B: Agreement Band Approach

		Community Ladder									
		1	2	3	4	5	6	7	8	9	10
Societal Ladder	1	17	10	7	8	4	0	1	0	0	0
	2	5	11	7	14	13	7	5	1	1	0
	3	5	5	21	12	17	13	9	7	3	0
	4	2	1	9	28	32	22	13	7	2	2
	5	2	0	16	16	80	35	31	12	3	2
	6	2	3	3	5	25	96	36	29	7	3
	7	2	0	0	1	10	31	79	31	18	4
	8	0	3	0	2	3	17	33	52	12	5
	9	1	0	0	1	1	4	5	13	12	4
	10	0	1	0	1	1	1	1	2	4	8

Where Red = Low societal subjective social status (SSS) with concordantly low community SSS; Orange = High societal SSS with concordantly high community SSS; Green= Low societal SSS with discordantly high community SSS; Blue= High societal SSS with discordantly low community SSS

**Figure 3.1: Cross-tabulation of MacArthur Scale of Subjective Social Status societal and community ladders, using the quadrant (Panel A) and agreement band (Panel B) approaches to divide the sample into four groups.**

A concern with this division is that rankings on a community ladder may need to be interpreted relative to rankings on the societal ladder. For example, an individual with a self-rank of “5” on the societal ladder and “1” on the community ladder would be considered to have concordantly low rankings, when there is considerable difference between these two rankings, while another individual with a self-rank of “5” and “6” respectively would be considered to have discordant rankings despite the difference of only one.

Therefore, we devised and used the “agreement band approach” (Figure 3.1, Panel B). Within the low societal group, patients ranking themselves higher on the community ladder by two rungs or more were considered to have discordantly high community rankings; all others in the low societal group were considered to have concordantly low rankings. Similarly, within the high societal group, patients ranking themselves lower on the community ladder by 2 rungs or more were considered to have discordantly low community rankings; all others in the high societal group were considered to have concordantly high rankings. This approach allows consideration of relative rankings on the two ladders. Within the low societal SSS cohort (n=518), 314 patients had concordantly low and 204 had discordantly high community rankings; within the high societal SSS cohort (n=572), 502 had concordantly high and 72 had discordantly low community rankings.

### ***3.4.2 Low societal SSS versus high societal SSS***

Baseline demographics for the low versus high societal SSS cohorts are outlined in Table 3.1.

**Table 3.1: Baseline demographics**

					Low Societal SSS			High Societal SSS		
		Low Societal SSS N= 518, n(%)	High Societal SSS N= 572, n(%)	P value	Low Community N= 314, n(%)	High Community N= 204, n(%)	P value	High Community N= 502, n(%)	Low Community N= 70, n(%)	P value
<b>Age (years)</b>	Mean (SD)	48.1 (5.9)	48.3 (5.8)	0.57	47.9 (6.1)	48.3 (5.6)	0.45	48.3 (5.8)	48.1 (5.6)	0.79
<b>Female</b>		192 (37.1)	154 (26.9)	<0.01	119 (37.9)	73 (35.8)	0.64	135 (26.9)	19 (27.1)	1.00
<b>Ethnicity</b>	Caucasian	436 (85.8)	496 (88.9)	0.23	263 (85.1)	173 (86.9)	0.12	431 (88.1)	65 (94.2)	0.09
	Aboriginal	18 (3.5)	13 (2.3)		9 (2.9)	9 (4.5)		10 (2.0)	3 (4.4)	
	Chinese	48 (9.5)	39 (7.0)		35 (11.3)	13 (6.5)		38 (7.8)	1(1.5)	
	Other	6 (1.2)	10 (1.8)		2 (0.7)	4 (2.0)		10 (2.0)	0 (0.0)	
<b>First Language</b>	English	288 (58.0)	335 (60.8)	<b>0.04</b>	164 (55.0)	124 (62.3)	0.26	282 (58.5)	53 (76.8)	<b>0.01</b>
	French	125 (25.2)	153 (27.8)		79 (26.5)	46 (23.1)		141 (29.3)	12 (17.4)	
	Other	84 (16.9)	63 (11.4)		55 (18.5)	29 (14.6)		59 (12.2)	4 (5.8)	
<b>Current Smoker</b>		251 (48.5)	187 (32.7)	<0.01	150 (47.8)	101 (49.5)	0.72	166 (33.1)	21 (30.0)	0.68
<b>Low Household Income</b>	<\$50 000	221 (50.8)	99 (20.3)	<0.01	133 (50.4)	88 (51.5)	0.85	90 (20.9)	9 (15.5)	0.39
<b>Education</b>	No degree, certificate, diploma	79 (15.5)	51 (9.0)	<0.01	51 (16.5)	28 (14.0)	0.86	43 (8.6)	8 (11.6)	0.16
	High School Diploma	143 (28.1)	128 (22.6)		86 (27.8)	57 (28.5)		114 (22.9)	14 (20.3)	
	Some Post-Secondary	105 (20.6)	102 (18.0)		64 (20.7)	41 (20.5)		94 (18.9)	8 (11.6)	
	Completed Post-Secondary	117 (23.0)	217 (38.3)		72 (23.3)	45 (22.5)		183 (36.8)	34 (49.3)	
	Trades Certificate	65 (12.8)	69 (12.2)		36 (11.7)	29 (14.5)		64 (12.9)	5 (7.3)	
<b>Employment Status</b>	Currently working	371 (71.6)	500 (87.4)	<0.01	218 (69.4)	153 (75.0)	0.20	440 (87.7)	60 (85.7)	0.70
	Student	9 (1.7)	8 (1.4)	0.81	5 (1.6)	4 (2.0)	0.74	8 (1.6)	0 (0.0)	0.61
	Homemaker	31 (6.0)	18 (3.2)	<b>0.03</b>	19 (6.1)	12 (5.9)	1.00	16 (3.2)	2 (2.9)	1.00
	Unemployed	46 (8.9)	17 (3.0)	<0.01	32 (10.2)	14 (6.9)	0.21	13 (2.6)	4 (5.7)	0.14
	Leave of Absence	66 (12.7)	32 (5.6)	<0.01	45 (14.3)	21 (10.3)	0.23	31 (6.2)	1 (1.4)	0.16
	Disabled	7 (1.4)	3 (0.5)	0.21	5 (1.6)	2 (1.0)	0.71	2 (0.4)	1 (1.4)	0.33
	Retired	8 (1.5)	11 (1.9)	0.65	5 (1.6)	3 (1.5)	1.00	9 (1.8)	2 (2.9)	0.63
<b>Live alone</b>		106 (20.5)	66 (11.5)	<0.01	69 (22.0)	37 (18.1)	0.32	61 (12.2)	5 (7.1)	0.32
<b>Social Support ESSI Sum Score</b>	Mean (SD)	27.0 (7.3)	29.8 (5.9)	<0.01	27.1 (7.4)	26.8 (7.2)	0.58	29.8 (5.9)	29.3 (6.0)	0.49

Abbreviations: SSS- subjective social status ; SD- standard deviation; ESSI- ENRICHD Social Support Inventory

The median ages (IQR) in the low and high societal SSS cohorts were 49 (45, 53) years and 50 (45, 53) years respectively. Compared with the high societal SSS cohort, a greater proportion of the low societal SSS cohort were females (37.1% vs. 26.9%,  $p<0.01$ ), smokers (48.5% vs. 32.7%,  $p<0.01$ ), had first languages that were neither English nor French (16.9% vs. 11.4%,  $p=0.04$ ), lived alone (20.5% vs. 11.5%,  $p<0.01$ ), had a household income of  $< \$50\,000$  (50.8% vs. 20.3%,  $p<0.01$ ), and had a lower proportion who completed post-secondary education (23.0% vs. 38.3%,  $p<0.01$ ). The mean social support score on the ENRICH Social Support Instrument (ESSI) was also lower in those with low societal SSS compared with high societal SSS. The baseline clinical characteristics for the low and the high societal SSS cohorts were similar (Table 3.2), though a greater proportion of low societal SSS patients had non-ST segment elevation myocardial infarctions, and the comorbidities of diabetes (19.1% vs. 12.4%,  $p<0.01$ ) and depression (12.8% vs. 8.1%,  $p=0.01$ ).

**Table 3.2: Baseline clinical characteristics**

					Low Societal SSS			High Societal SSS		
		Low Societal SSS N= 518, n(%)	High Societal SSS N= 572, n(%)	P value	Low Community N= 314, n(%)	High Community N= 204, n(%)	P value	High Community N= 502, n(%)	Low Community N= 70, n(%)	P value
<b>BMI (kg/m<sup>2</sup>)</b>	Mean (SD)	29.9 (7.2)	29.2 (5.7)	0.08	29.7 (7.2)	30.2 (7.1)	0.41	29.1 (5.3)	30.1 (7.7)	0.18
<b>Type of MI on admission</b>	STEMI	291 (56.2)	344 (60.1)	0.20	167 (53.2)	124 (60.8)	0.10	299 (59.6)	45 (64.3)	0.52
	NSTEMI	189 (36.5)	173 (30.2)	<b>0.03</b>	123 (39.2)	66 (32.4)	0.14	158 (31.5)	15 (21.4)	0.10
	Unstable Angina	28 (5.4)	50 (8.7)	<b>0.04</b>	18 (5.7)	10 (4.9)	0.84	41 (8.2)	9 (12.9)	0.18
<b>Reperfusion</b>		395 (77.6)	444 (78.6)	0.71	238 (77.0)	157 (78.5)	0.75	390 (78.5)	54 (79.4)	1.00
<b>Method of Reperfusion</b>	Primary PCI	182 (44.5)	225 (48.3)	0.28	102 (42.3)	80 (47.6)	0.31	193 (47.3)	32 (55.2)	0.27
	Non Primary PCI	205 (50.3)	216 (46.4)	0.28	129 (53.5)	76 (45.5)	0.13	192 (47.1)	24 (41.4)	0.48
	Thrombolytics	69 (16.9)	71 (15.2)	0.52	41 (17.0)	28 (16.8)	1.00	64 (15.7)	7 (12.1)	0.56
<b>Peak Troponin T, Mean (SD)</b>		8.6 (28.2)	6.1 (18.3)	0.32	6.5 (20.7)	11.2 (35.6)	0.28	6.5 (19.7)	3.9 (4.1)	0.51
<b>Comorbidities</b>	Angina	174 (33.6)	176 (30.8)	0.33	98 (31.2)	76 (37.3)	0.18	147 (29.3)	29 (41.4)	0.05
	Cancer	5 (1.0)	17 (3.0)	<b>0.03</b>	3 (1.0)	2 (1.0)	1.00	16 (3.2)	1 (1.4)	0.71
	Diabetes	99 (19.1)	71 (12.4)	<b>&lt;0.01</b>	56 (17.8)	43 (21.1)	0.36	65 (13.0)	6 (8.6)	0.44
	Congestive heart failure	10 (1.9)	10 (1.8)	0.83	7 (2.2)	3 (1.5)	0.78	10 (2.0)	0 (0.0)	0.62
	Hypertension	207 (40.0)	208 (36.4)	0.24	120 (38.2)	87 (42.7)	0.36	186 (37.1)	22 (31.4)	0.43
	Hyperthyroid	7 (1.4)	10 (1.8)	0.56	3 (1.0)	4 (2.0)	0.44	9 (1.8)	1 (1.4)	<b>0.03</b>
	Dyslipidemia	224 (43.2)	228 (39.9)	0.27	129 (41.1)	95 (46.6)	0.24	202 (40.2)	26 (37.1)	0.70
	Peripheral Artery Disease	13 (2.5)	5 (0.9)	0.05	9 (2.9)	4 (2.0)	0.58	4 (0.8)	1 (1.4)	0.48
	Depression	62 (12.8)	44 (8.1)	<b>0.01</b>	36 (12.1)	26 (13.8)	0.58	41 (8.6)	3 (4.6)	0.34
	Renal Disease	7 (1.4)	10 (1.8)	0.64	5 (1.6)	2 (1.0)	0.71	7 (1.4)	3 (4.3)	0.11
	Previous MI	75 (14.5)	60 (10.5)	0.05	47 (15.0)	28 (13.7)	0.80	54 (10.8)	6 (8.6)	0.68
	<b>LV Function (%)</b>	Mean (SD)	51.1 (11.5)	51.1 (9.8)	0.99	51.0 (11.0)	51.2 (12.3)	0.87	51.4 (9.9)	48.3 (9.1)
<b>Complications in hospital</b>	Atrial fibrillation	12 (2.3)	8 (1.4)	0.27	9 (2.9)	3 (1.5)	0.38	8 (1.6)	0 (0.0)	0.61
	Angina	25 (4.8)	27 (4.7)	1.00	16 (5.1)	9 (4.4)	0.84	23 (4.6)	4 (5.7)	0.56
	Bradycardia	12 (2.3)	10 (1.8)	0.53	7 (2.2)	5 (2.5)	1.00	9 (1.8)	1 (1.4)	1.00
	Cardiogenic Shock	3 (0.6)	5 (0.9)	0.73	1 (0.3)	2 (1.0)	0.57	5 (1.0)	0 (0.0)	1.00
	Hypotension	14 (2.7)	17 (3.0)	0.86	6 (1.9)	8 (3.9)	0.18	15 (3.0)	2 (2.9)	1.00
	Ventricular tachycardia	25 (4.8)	17 (3.0)	0.12	14 (4.5)	11 (5.4)	0.68	16 (3.2)	1 (1.4)	0.71
	Ventricular fibrillation	15 (2.9)	20 (3.5)	0.61	11 (3.5)	4 (2.0)	0.42	18 (3.6)	2 (2.9)	1.00
	Congestive heart failure	6 (1.2)	12 (2.1)	0.25	5 (1.6)	1 (0.5)	0.41	9 (1.8)	3 (4.3)	0.17
	Pericarditis	4 (0.8)	4 (0.7)	1.00	1 (0.3)	3 (1.5)	0.31	3 (0.6)	1 (1.4)	0.41
	Re-infarction	4 (0.8)	2 (0.4)	0.43	2 (0.6)	2 (1.0)	0.65	1 (0.2)	1 (1.4)	0.23

Abbreviations: SSS- subjective social status; SD- standard deviation; BMI- body mass index; PCI- percutaneous coronary intervention; MI-myocardial infarction; STEMI- ST segment elevation myocardial infarction; NSTEMI- Non-ST segment elevation myocardial infarction; LV- left ventricular dysfunction

Access to care and readmission outcomes are presented in Table 3.3 and Figure 3.2.

**Table 3.3: Access to care and readmission outcomes**

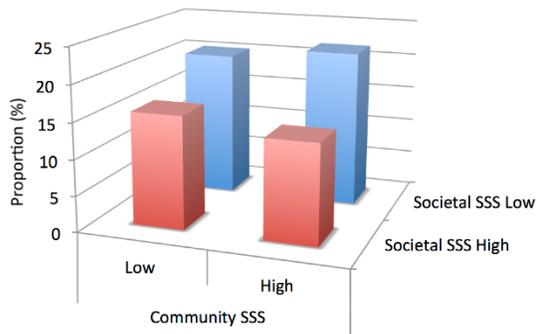
		Low Societal SSS N= 518, n(%)	High Societal SSS N=572, n(%)	P value	Low Societal SSS			High Societal SSS		
					Low Community N= 314, n(%)	High Community N= 204, n(%)	P value	High Community N= 502, n(%)	Low Community N= 70, n(%)	P value
<b>No family doctor</b>		107 (20.9)	80 (14.1)	<b>&lt;0.01</b>	63 (20.3)	44 (21.8)	0.74	69 (13.8)	11 (15.7)	0.71
<b>Difficulty accessing cardiologist</b>		61 (15.8)	68 (15.4)	0.92	48 (20.6)	13 (8.4)	<b>&lt;0.01</b>	63 (16.3)	5 (9.3)	0.23
<b>Difficulty getting routine care</b>		101 (20.6)	104 (19.7)	0.76	57 (18.9)	44 (23.4)	0.25	90 (19.4)	14 (22.6)	0.61
<b>Barriers in getting routine care<sup>a</sup></b>	Difficulty contacting physician	33 (27.1)	33 (29.5)	0.77	20 (29.4)	13 (24.1)	0.55	29 (29.9)	4 (26.7)	1.00
	Difficulty getting appt	67 (54.5)	69 (61.6)	0.29	38 (55.9)	29 (52.7)	0.86	60 (61.9)	9 (60.0)	1.00
	No GP	30 (25.0)	23 (20.5)	0.44	13 (19.7)	17 (31.5)	0.15	19 (19.6)	4 (26.7)	0.51
	Waited too long to get appt	41 (33.9)	40 (35.4)	0.89	20 (29.9)	21 (38.9)	0.34	32 (32.7)	8 (53.3)	0.15
	Long in office wait	37 (30.8)	31 (27.4)	0.67	20 (30.3)	17 (31.5)	1.00	25 (25.5)	6 (40.0)	0.35
	Transportation	10 (8.3)	1 (0.9)	<b>0.01</b>	8 (11.9)	2 (3.7)	0.18	1 (1.0)	0 (0.0)	1.00
	Cost	4 (3.3)	0 (0.0)	0.12	3 (4.6)	1 (1.9)	0.63	0 (0.0)	0 (0.0)	1.00
	Information	7 (5.8)	6 (5.4)	1.00	6 (9.1)	1 (1.9)	0.13	5 (5.2)	1 (6.7)	0.59
	Unable to leave house	11 (9.2)	1 (0.9)	<b>0.01</b>	9 (13.6)	2 (3.7)	0.11	1 (1.0)	0 (0.0)	1.00
Other	8 (8.3)	3 (3.1)	0.213	4 (7.7)	4 (8.9)	1.00	3 (3.6)	0 (0.0)	1.00	
<b>Health affected by lack of access</b>		153 (38.4)	129 (29.7)	<b>0.01</b>	92 (37.6)	61 (39.9)	0.67	111 (29.3)	18 (32.7)	0.64
<b>Readmission within one year<sup>b</sup></b>	All Cause	64 (13.0)	53 (9.6)	0.10	35 (11.8)	29 (14.7)	0.41	47 (9.7)	6 (9.0)	1.00
	Cardiac	45 (9.1)	28 (5.1)	<b>0.02</b>	25 (8.4)	20 (10.1)	0.53	25 (5.1)	3 (4.6)	1.00

<sup>a</sup> Sample sizes are those indicating difficulty in getting routine care

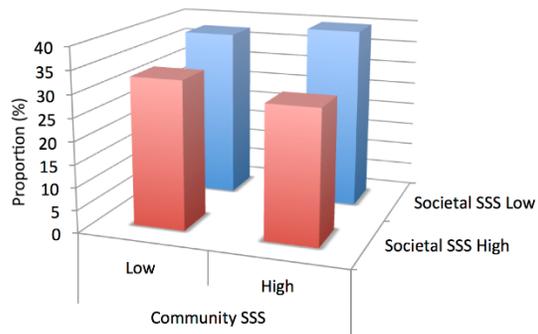
<sup>b</sup> Sample sizes at one year: Low societal/Low community= 296; Low societal/High community= 198; High societal/High community = 487; High societal/Lower Community = 67

Abbreviations: SSS- subjective social status; appt- appointment; GP- general practitioner

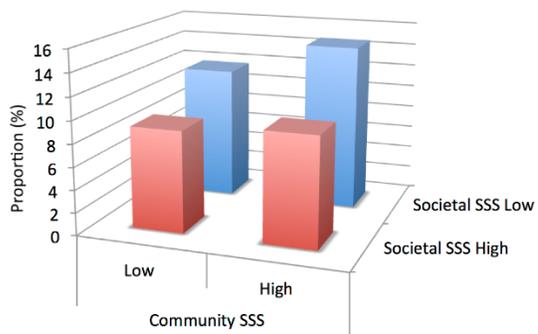
Panel A- No family doctor



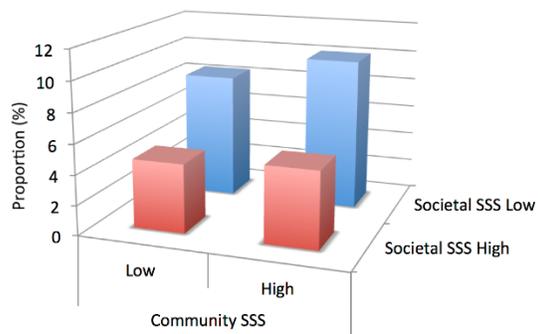
Panel B- Health affected by lack of access to care



Panel C- All-cause readmissions



Panel D- Cardiac readmissions



**Figure 3.2: Proportions having no family doctor (Panel A), reporting that health is affected by lack of access to health care (Panel B), and experiencing all-cause (Panel C) and cardiac-specific (Panel D) readmissions to hospital within one year post-discharge, by societal and community subjective social status**

The low societal SSS cohort reported greater barriers to access to care compared with the high societal SSS cohort, with a higher proportion having no family physician (20.9% vs. 14.1%,  $p<0.01$ ), reporting transportation and the inability to leave the house as barriers to receiving routine care, and reporting that health was affected due to lack of access to care (38.4% vs. 29.7%,  $p<0.01$ ). The proportion of patients who were readmitted for a cardiac diagnosis within one year of hospital discharge was significantly higher in the low compared to the high societal SSS cohort (9.1% vs. 5.1%,  $p=0.02$ ) with a trend toward higher all-cause readmissions as well (13.1% vs. 9.6%,  $p=0.10$ ). Similarly, the odds ratios of not having a family doctor, reporting that health was affected by lack of health care access, and cardiac readmissions were greater than 1 for those in the low societal cohort compared with the high societal cohort (OR 1.81 [95% CI 1.31, 2.53], 1.38 [95% CI 1.02, 1.86], and 1.76 [95% CI 1.07, 2.90] respectively), adjusting for age, sex, comorbidity, and type of ACS (Table 3.4).

**Table 3.4: Logistic regression, modeling the odds of readmissions and access to care outcomes**

	No family doctor	Difficulty accessing cardiologist	Difficulty accessing routine care	Health affected by lack of access	All-cause readmissions	Cardiac readmissions
<b>UNADJUSTED</b>						
High societal	Reference	Reference	Reference	Reference	Reference	Reference
Low societal	<b>1.61 (1.17, 2.21)</b>	1.03 (0.71, 1.50)	1.06 (0.78, 1.44)	<b>1.48 (1.11, 1.97)</b>	1.41 (0.96, 2.07)	<b>1.88 (1.15, 3.06)</b>
High societal/ High community	Reference	Reference	Reference	Reference	Reference	Reference
High societal/ Low community	1.16 (0.58, 2.32)	0.53 (0.20, 1.37)	1.22 (0.64, 2.30)	1.18 (0.64, 2.15)	0.92 (0.38, 2.24)	0.88 (0.26, 3.00)
Low societal/ High community	<b>1.74 (1.14, 2.64)</b>	<b>0.47 (0.25, 0.89)</b>	1.27 (0.85, 1.92)	<b>1.60 (1.08, 2.37)</b>	1.61 (0.98, 2.64)	<b>2.08 (1.13, 3.83)</b>
Low societal/ Low community	<b>1.58 (1.09, 2.30)</b>	1.33 (0.88, 2.02)	0.97 (0.67, 1.40)	<b>1.45 (1.03, 2.04)</b>	1.26 (0.79, 2.00)	1.70 (0.96, 3.02)
<b>ADJUSTED FOR CLINICAL AND DEMOGRAPHIC FACTORS<sup>a</sup></b>						
High societal	Reference	Reference	Reference	Reference	Reference	Reference
Low societal	<b>1.81 (1.31, 2.53)</b>	0.96 (0.64, 1.44)	0.99 (0.72, 1.35)	<b>1.38 (1.02, 1.86)</b>	1.30 (0.88, 1.93)	<b>1.76 (1.07, 2.90)</b>
High societal/ High community	Reference	Reference	Reference	Reference	Reference	Reference
High societal/ Low community	1.20 (0.60, 2.43)	0.53 (0.19, 1.45)	1.26 (0.66, 2.41)	1.11 (0.60, 2.06)	0.85 (0.34, 2.14)	0.76 (0.21, 2.75)
Low societal/ High community	<b>2.02 (1.31, 3.12)</b>	<b>0.46 (0.24, 0.88)</b>	1.20 (0.79, 1.82)	1.47 (0.98, 2.21)	1.41 (0.84, 2.34)	1.82 (0.97, 3.41)
Low societal/ Low community	<b>1.76 (1.20, 2.60)</b>	1.26 (0.81, 1.98)	0.91 (0.63, 1.33)	1.35 (0.95, 1.92)	1.19 (0.74, 1.91)	1.63 (0.91, 2.92)
<b>ADJUSTED FOR CLINICAL, DEMOGRAPHIC, AND SOCIOECONOMIC FACTORS<sup>b</sup></b>						
High societal	Reference	Reference	Reference	Reference	Reference	Reference
Low societal	<b>1.54 (1.05, 2.25)</b>	0.79 (0.50, 1.26)	1.07 (0.75, 1.53)	1.32 (0.93, 1.87)	1.28 (0.81, 2.02)	1.76 (0.99, 3.12)
High societal/ High community	Reference	Reference	Reference	Reference	Reference	Reference
High societal/ Low community	1.00 (0.45, 2.24)	0.62 (0.22, 1.71)	1.46 (0.72, 2.96)	1.00 (0.50, 1.98)	0.84 (0.30, 2.33)	0.53 (0.11, 2.61)
Low societal/ High community	1.63 (1.00, 2.66)	<b>0.38 (0.18, 0.80)</b>	1.33 (0.84, 2.11)	1.36 (0.86, 2.16)	1.32 (0.74, 2.36)	1.57 (0.76, 3.25)
Low societal/ Low community	1.48 (0.95, 2.30)	1.04 (0.62, 1.74)	0.99 (0.65, 1.51)	1.29 (0.87, 1.93)	1.21 (0.71, 2.07)	1.72 (0.90, 3.29)

<sup>a</sup> Adjusted for age, sex, comorbidity count, and type of acute coronary syndrome

<sup>b</sup> Adjusted for age, sex, comorbidity count, type of acute coronary syndrome, household income, employment status

Though the effects were slightly attenuated when adjusting additionally for objective SES, the trends remained, with low societal SSS being associated with increased barriers to access to care and readmissions (OR 1.54 [95% CI 1.05, 2.25], 1.32 [95% CI 0.93, 1.87], and 1.76 [95% CI 0.99, 3.12] respectively for the outcomes above).

### ***3.4.3 Concordant versus discordant community rankings within the low societal SSS cohort***

Within the low societal SSS cohort, those with concordantly low community SSS rankings had similar baseline demographics and clinical characteristics compared to those with discordantly high community rankings (Tables 3.1 and 3.2). However, there were significant differences in access to care outcomes (Table 3.3 and Figure 3.2), with a higher proportion of those with concordantly low community rankings reporting difficulty accessing a cardiologist compared to those with discordantly high community rankings (20.6% vs. 8.4%,  $p < 0.01$ ). Of those reporting difficulty accessing routine care, a higher proportion of those with concordantly low community rankings reported that this difficulty was due to transportation, cost, and information barriers, as well as inability to leave the house due to the medical condition. These differences were not statistically significant, likely due to the low numbers reporting difficulty accessing routine care. There were no statistically significant differences in the readmission rates between those with low versus high community rankings.

The odds of experiencing any of the barriers to health care access and readmission outcomes were not significantly different when comparing patients with concordantly low community rankings to those with discordantly high rankings within the low societal SSS cohort (Table 3.4). If having high community SSS were to mitigate the access to care barriers and readmissions, one

would expect the odds ratios for these outcomes to be greater for the low societal with concordantly low community rankings group compared to the low societal with discordantly high community rankings group (Table 3.4). This was not found to be the case, with the 95% confidence intervals for the odds ratios for these groups overlapping, and with no clear pattern demonstrating that one group had higher odds of worse outcomes.

#### ***3.4.4 Concordant versus discordant community rankings within the high societal SSS cohort***

Within the high societal SSS cohort, patients with concordantly high community SSS rankings were similar to those patients with discordantly low community SSS rankings in terms of baseline demographics and clinical characteristics (Tables 3.1 and 3.2). There were no statistically significant differences in access to care and readmission rates (Table 3.3 and Figure 3.2) or in the odds ratios of these outcomes between the concordant versus discordant community ranking groups (Table 3.4).

### **3.5 Discussion**

In a cohort of hospitalized patients with acute coronary syndrome, low societal subjective social status is associated with increased barriers to access to care, increased cardiac readmissions, and a trend toward increased all-cause readmissions. Subjective social status then, appears to be an important measure that not only has implications for the risk of developing cardiovascular disease, but also has prognostic implications in those with established disease. This leads to fundamental questions about what SSS actually measures and how it links to cardiovascular health.

There are three main hypotheses in the literature regarding the general SSS construct and its relationship to health. The first is that SSS is a general self-rank of social status based on the average of one's socioeconomic contributions.<sup>36,112</sup> An example used in the SSS literature is that a high school graduate from an inner-city school may not have the same life chances as a student with extensive family resources graduating from an elite prep school, yet objective SES measures would consider them to have the same social status.<sup>36</sup> SSS may therefore be a more comprehensive measure of overall SES taking into account past and future resource trajectories. A second related hypothesis is that SSS captures not only objective socioeconomic measures but also non-objective measures of self-worth and social position. In a qualitative study, a majority of participants indicated that non-objective measures such as values and altruism contributed to their perceived worth and social position in the community.<sup>36</sup>

A third hypothesis is that SSS captures the psychosocial processes that mediate the association between SES and health outcomes, rather than being just another measure of SES. It posits that SES affects health not just in the resources that can be accessed, but that SES serves as “reference points for social comparison.”<sup>113</sup> Perceptions of inferiority in a social hierarchy may have psychosocial consequences by acting as a source of chronic stress, and by affecting optimism/pessimism, sense of mastery, social supports, and ability to cope with life stressors.<sup>32,114</sup> Low societal and community SSS have both been shown to be associated with reduced endothelial function and impaired vasodilation, increased cortisol production, and reduced beta adrenergic receptor responsiveness;<sup>61-63</sup> these changes are consistent with activation of neuroendocrine stress pathways. Our study findings lend support to this third hypothesis, by showing that non-socioeconomic attributes such as social support differ between the high and

low SSS cohorts; additionally, when objective SES measures are added to regression models, there is attenuation of the associations between SSS and access to health and readmission outcomes, which would be expected if SES and SSS are on the same causal pathway. Despite this attenuation, a consistent trend remains, which suggests that SSS has independent associations on health and health care access over and above what is captured by traditional SES measures. This would also support the first two aforementioned hypotheses. Our study findings therefore lend support to all three hypotheses of the mechanisms that link SSS to cardiovascular health.

The relationship between rankings on the societal versus community SSS ladders, and the association of this relationship with health outcomes has not been previously established. We have developed a novel method of examining societal and community SSS rankings simultaneously in a way that captures their relative positions; in doing so, we have found that the two ladders appear to be distinct constructs. First, objective SES measures do not seem to weigh heavily into community ladder rankings, though they do for societal ladder rankings. When the study sample was divided into low versus high societal SSS, there was no further difference in income, education, or employment for those with low versus high community rankings. Second, our findings suggest that the societal scale may take into account more than objective SES measures to reflect psychosocial contributions as well, with those in the high societal SSS cohort reporting greater social support compared to the low societal SSS cohort. Also, differences in rankings of the community scale cannot be ascribed purely to differences in social support as captured by the ESSi, as there were no further differences in ESSi scores between high and low community SSS patients within either the low or the high societal SSS cohorts.

The two SSS ladders also seem to have unique associations with health outcomes in patients with ACS. Though results were variable based on the outcome studied, high community rankings showed a trend in possibly modifying some of the access to care barriers in those with low societal SSS, though there did not seem to be any modifying effects for those with high societal SSS. Community SSS also did not modify the association between societal SSS and readmissions, contrary to our hypothesis. There may be numerous reasons for this. Higher social trust, reciprocity, social capital, and social connectedness are associated with improved health outcomes,<sup>115</sup> but these concepts may not be accurately represented by the MacArthur community ladder; residents of neighbourhoods with high social cohesion may consider themselves more or less as equals with their neighbours and therefore not rank themselves highly. Secondly, there is no consensus as to what community SSS rankings actually capture. Based on preliminary data, it seems that social capital is one characteristic that may determine community SSS rankings,<sup>36</sup> but social capital in itself is a vague and difficult-to-measure concept. A systematic review on the association between social capital and health care access has shown inconsistent effects, with numerous definitions and methods of operationalizing social capital;<sup>116</sup> no single indicator of social capital is consistently associated with improved health care access across studies. To add to this confusion, community SSS likely encompasses not only social capital, but also social relationships, self-esteem, self-worth, and psychosocial factors such as optimism, stress, and anxiety.<sup>40,107,117</sup> The lack of association between community SSS and readmissions is not surprising then, given the heterogeneous concepts captured in this ladder. The ladder is known to have lower test-retest stability compared to the societal ladder,<sup>111</sup> and rankings are also less predictable on this ladder compared to the societal ladder.<sup>118</sup> Though the community SSS ladder

captures some psychosocial aspect of social status, these aspects are likely heterogeneous and the use of a summary measure likely results in variable and weakened associations with health outcomes.

The fundamental limitation to our study is inherent to the topic of interest, with SSS being an indistinct and mysterious concept. Though the theoretical basis of SSS is well-defined, how individuals choose to rank themselves on a social hierarchy, how this differs between the two SSS ladders, and what psychosocial characteristics these rankings represent remain uncertain. This ambiguity limits our analysis and interpretation of our findings, but also serves to highlight the difficulty in undertaking research around the complex construct of subjective social status. Other specific limitations include being underpowered to detect the type of barriers to access of care despite appropriate power to detect clinical outcomes of readmissions, the measurement of access to care variables at baseline as these may change over time, and our inclusion criterion of individuals needing to be fluent in English or French. This inclusion criterion may have excluded those with least access to care and lowest SSS, resulting in an underestimation of the association between low SSS and health outcomes in patients with ACS in our study.

Subjective social status appears to be a social determinant of health, with previous studies showing associations between low SSS and mental health, self-rated health, and cardiovascular disease. We show that that low SSS is associated with barriers to access to care and poor health outcomes in patients with established coronary artery disease. Furthermore, our findings suggest that subjective social status is not a homogenous construct, with societal and community SSS representing distinct concepts. This distinction has significant implications for the development

of interventions. For example, programs that address the former include investment in human capital such as job training and job creation; interventions that address the latter include increasing social capital through improving community supports and community engagement. Future research will need to focus on clarifying the similarities and differences between the societal and community SSS constructs and their associations with health, as this is imperative in informing the prioritization and development for public health interventions.

**CHAPTER 4: Subjective social status and its association with social vulnerabilities: A cross-sectional study of medical inpatients (Thesis sub-study C)**

## 4.1 Abstract

**Background:** Social vulnerabilities – including low health literacy, poor social support, financial constraints, transportation barriers, and low priority of health maintenance – act as barriers to health maintenance for patients who are discharged from hospital. Given that these social vulnerabilities may mediate the relationship between subjective social status (SSS) and health, we sought to determine the associations between subjective social status (SSS) and the risk of these five social vulnerabilities.

**Methods:** We conducted a cross-sectional study of medical inpatients admitted to a tertiary care center in Calgary, Alberta. Health literacy and social support data were collected using validated instruments, while the other three social vulnerabilities were measured using a 51-item questionnaire. Two separate SSS rankings were obtained for each patient, one using society and the other using community as the frame of reference. Multivariable logistic regression was used to model the odds of each of the five social vulnerabilities in those with low versus high SSS.

**Results:** 418 patients met inclusion criteria. Low societal SSS was associated with increased odds of transportation (OR 2.86, 95% CI 1.50, 5.43), social support (OR 2.23, 95% CI 1.14, 4.36), and health literacy barriers (OR 2.07, 95% CI 1.04, 4.10), adjusting for income and community SSS. Low community SSS was associated with increased odds of social support (OR 2.05, 95% CI 1.03, 3.81) and financial barriers (OR 2.59, 95% CI 1.27, 5.27), adjusting for income and societal SSS. Community SSS was found to be an effect modifier of the association between societal SSS and social support, where high community SSS appeared to mitigate the risk of social support barriers in those with low societal SSS.

**Conclusion:** Low SSS is associated with increased social vulnerabilities that have effects on health maintenance and access to care. Societal and community SSS are unique constructs, with different associations with the social vulnerabilities. Furthermore, community SSS mitigates the risk of certain social vulnerabilities for patients with low societal SSS. The development of interventions that increase community SSS, by increasing social cohesion, engagement, and connectedness, may be an important avenue to explore in improving health of the population.

## 4.2 Introduction

There is a growing understanding that health disparities among those belonging to different social classes stem beyond absolute income and access to resources, and exist along a gradient rather than being a phenomenon of the “rich” versus the “poor”. Sir Michael Marmot argues that above a certain basic threshold of material attainment, it is the social hierarchy that is crucial for well-being and health. That is, those with higher relative income have higher social status, which translates to greater autonomy and control over life circumstances, and more opportunities for social participation and engagement.<sup>87</sup> Indeed, sub-study A (chapter 2) of this thesis demonstrates the importance of subjective social status on health above and beyond absolute income levels, where those with high SSS have lower risk of cardiovascular risk factors and disease. We have similarly shown in sub-study B (chapter 3) that for hospitalized patients with established cardiovascular disease, those with low SSS have increased risk for readmissions, though the reasons for this are unclear. Further complicating the picture is the difficulty in measuring perceived social status, and how SSS as measured by the societal ladder differs from SSS as measured by the community ladder. Sub-study B also suggested that high community SSS may mitigate some of the barriers to health care access experienced by those with low societal SSS, though these trends were inconsistent and not statistically significant.

Two recent qualitative studies examined barriers to optimal health maintenance in patients being discharged from hospital.<sup>52,53</sup> Both studies found that individual-level social vulnerabilities such as the presence of transportation barriers, financial barriers (such as inability to afford medications), low health literacy, poor social support, and low priority of health maintenance due to other life stressors contribute to poor coping, function, and health and may thereby lead to

increased re-admissions.<sup>52,53</sup> There have not been any studies that have looked at the effect of subjective social status on the experience of these social vulnerabilities. This is particularly important, as the associations between SSS and health, disease, and health care utilization are less likely a result of basic material deprivation and more likely due to the experience and ability to overcome these social vulnerabilities.

We therefore undertook a study in a cohort of Canadian medical patients being discharged from hospital, examining the associations between societal SSS, community SSS, on the five aforementioned social vulnerabilities.

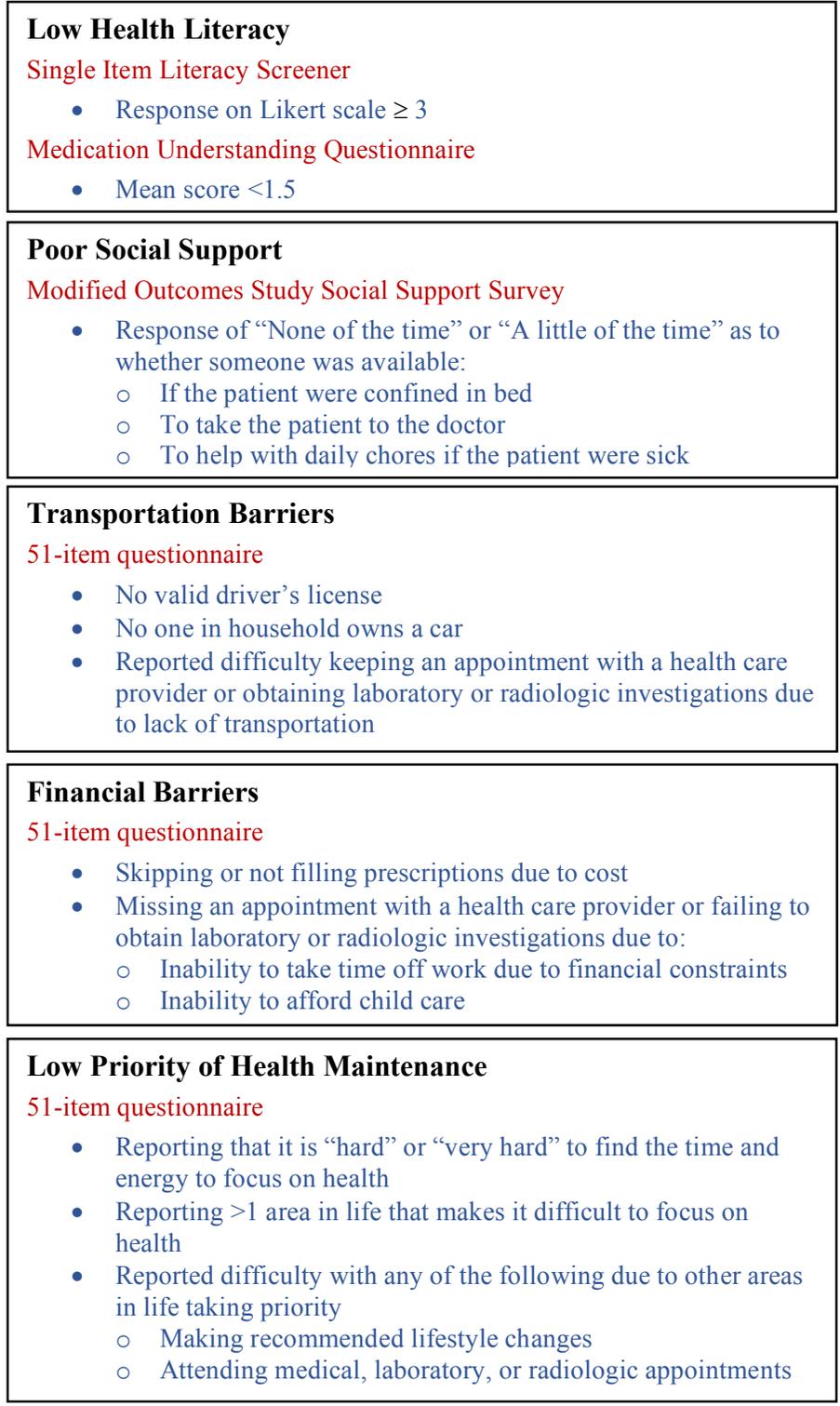
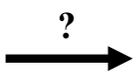
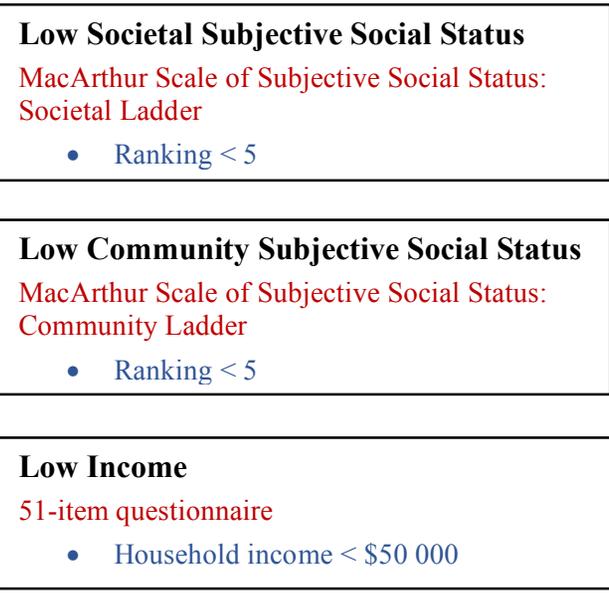
## **4.3 Methods**

### ***4.3.1 Study population***

Study participants were patients admitted to the internal medicine service at the Foothills Medical Centre in Calgary, Alberta. Patients were recruited from December 2014 to October 2015. The only inclusion criteria were that patients must be Canadian citizens or permanent residents (and therefore qualify for universal health care access), and that the discharge destination for patients must be home or an independent living facility. All patients discharged to a long-term care center, an assisted living facility, group home, or transferred to another service, hospital or a rehabilitation facility were excluded. For non-English speaking patients, translation was performed via family members, health care staff, or a professional translation telephone service as available.

### ***4.3.2 Data collection***

Data were collected using a combination of validated tools and a questionnaire that was developed for the purposes of this study (Figure 4.1).



**LEGEND**

Measurement tool

Operational definition

**Figure 4.1: Measurement tools and operational definitions for explanatory and response variables**

The social vulnerabilities comprised of the response variables. For each of the five social vulnerability domains, there were several operational definitions; each was considered as a separate variable and reported separately (Figure 4.1). Health literacy was assessed using the validated Single Item Literacy Screener (SILS)<sup>119,120</sup> and Medication Understanding Questionnaire (MUQ).<sup>121</sup> Prior to administering the MUQ, the study team randomly selected five pre-admission medications for each patient from the medication reconciliation document present in every chart. The MUQ tests the patient's understanding of the purposes and dosing of these medications. Social support was assessed using the validated 8-item Modified Outcomes Study Social Support Survey.<sup>122</sup> The other social vulnerabilities (transportation barriers, financial barriers, and low priority of health maintenance) and the patients' socio-demographics were assessed using a 51-item questionnaire. Societal and community subjective social status, which constituted the explanatory variables, were assessed using the societal and community MacArthur Scales of Subjective Social Status respectively.<sup>36</sup>

### ***4.3.3 Data analysis***

We compared baseline demographics, clinical characteristics and comorbidities for those with low versus high societal SSS, low versus high community SSS, and low versus high household income, using Fisher's exact and Chi-square tests (for proportions) and t-tests (for continuous variables). We compared proportions of patients reporting presence of the five social vulnerabilities, for each of the variables contained within each domain, for these same groups using Fisher's exact and Chi-square tests.

The low and high societal SSS groups were subdivided into patients with low versus high community SSS rankings using the agreement band approach as previously described in sub-study B (chapter 3). Within the low societal SSS group, patients ranking themselves higher on the community ladder by two rungs or more were considered to have discordantly high community rankings; all others in the low societal group were considered to have concordantly low rankings. Similarly, within the high societal group, patients ranking themselves lower on the community ladder by two rungs or more were considered to have discordantly low community rankings; all others in the high societal group were considered to have concordantly high rankings. To assess whether high community SSS reduced the presence of social vulnerabilities, proportions reporting the presence of each social vulnerability for discordantly high community SSS versus concordantly low community SSS within the low societal SSS group were compared using Fisher's exact and Chi-square tests. The same analysis was undertaken for the high societal SSS group and the low income group.

Both unadjusted and adjusted logistic regression were undertaken, modeling the odds of reporting each of the five social vulnerability domains. For each domain, the social vulnerability was deemed to be present if any individual barrier within that domain was present. Adjustment for confounding was undertaken for societal SSS, community SSS, and income individually and also in a hierarchical manner within the logistic regression models. We assessed whether community SSS was an effect modifier of the association between societal SSS, income, and the social vulnerabilities as an interaction term within the logistic regression models. All statistical analyses were performed using Stata Version 14 (StataCorp LP, Texas).

## **4.4 Results**

In total, 471 inpatients were recruited into the study. Of these, 53 were excluded for the following reasons: 16 were not internal medicine patients, 10 were transferred to another service or hospital, 9 were discharged to an assisted living facility, 2 patients died, 14 withdrew consent, 1 was not a Canadian citizen or permanent resident, and 1 was a readmission. A total of 418 patients were included and analyzed in this study.

### ***4.4.1 Sample demographics***

The mean age of the study participants was 55.5 (SD 18.6) years. 55.4% were males, 85.2% reported English being their first language, and 72.4% were born in Canada. 30.5% of the participants were actively working, 38.9% were retired, and 9.1% were unemployed. Of the 418 included patients, 365 provided rankings on both societal and community SSS ladders. The median and mean rankings on the societal ladder were 5 (IQR 5, 7) and 5.7 (SD 2.1) respectively, whereas the median and mean rankings on the community ladder were 5 (IQR 4,7) and 5.4 (SD 2.4) respectively. Spearman's rank correlation coefficient was 0.45 between income and societal SSS, 0.27 between income and community SSS, and 0.48 between societal and community SSS.

Based on the median, the sample was divided into those with low (below the median) versus high (at or above the median) societal SSS and community SSS rankings, and also into low (less than \$50 000) versus high (\$50 000 or more) household income. The proportions of patients in the low societal SSS (sSSS), low community SSS (cSSS), and low income groups who were

married, had any postgraduate education, and were currently employed were lower compared to the high societal SSS, high community SSS, and high income groups respectively (Table 4.1).

**Table 4.1: Demographics of study population, by subjective social status and income**

		Societal SSS			Community SSS			Household income		
		Low (n=91)	High (n=277)	p-value	Low (n=106)	High (n=261)	p-value	Low (n=143)	High (n=144)	p-value
<b>Age</b>	Mean (SD)	49.1	57.3	<0.01	50.8	57.0	<0.01	56.2	52.0	0.04
<b>Male</b>		58 (63.7%)	139 (50.4%)	0.03	63 (60.0%)	135 (51.7%)	0.17	82 (57.3%)	87 (60.4%)	0.63
<b>First language English</b>		76 (83.5%)	241 (87.0%)	0.39	90 (84.9%)	225 (86.2%)	0.74	119 (83.8%)	129 (89.6%)	0.17
<b>Born in Canada</b>		71 (78.0%)	197 (71.4%)	0.28	82 (77.4%)	184 (70.8%)	0.24	108 (75.5%)	103 (72.0%)	0.59
<b>Ethnicity</b>	Caucasian	54 (60.0%)	191 (69.5%)	0.06	64 (60.4%)	179 (69.4%)	0.29	90 (63.4%)	110 (77.5%)	0.01
	Aboriginal	16 (17.8%)	21 (7.6%)		16 (15.1%)	21 (8.1%)		23 (16.2%)	5 (3.5%)	
	Chinese	4 (4.4%)	16 (5.8%)		6 (5.7%)	14 (5.4%)		7 (4.9%)	7 (4.9%)	
	South Asian	6 (6.7%)	12 (4.4%)		5 (4.7%)	14 (5.4%)		6 (4.2%)	5 (3.5%)	
	Other	10 (11.1%)	35 (12.73%)		15 (14.2%)	30 (11.6%)		16 (11.3%)	15 (10.6%)	
<b>Marital Status</b>	Married	26 (28.6%)	139 (50.2%)	<0.01	40 (37.7%)	125 (47.9%)	<0.01	46 (32.2%)	76 (52.8%)	<0.01
	Common-Law	11 (12.1%)	23 (8.3%)		11 (10.4%)	23 (8.8%)		12 (8.4%)	17 (11.8%)	
	Widowed	6 (6.6%)	22 (7.9%)		2 (1.9%)	26 (10.0%)		13 (9.1%)	4 (2.8%)	
	Divorced/Separated	14 (15.4%)	34 (12.3%)		13 (12.3%)	34 (13.0%)		33 (23.1%)	12 (8.3%)	
	Single	34 (37.4%)	59 (21.3%)		40 (37.7%)	53 (20.3%)		39 (27.3%)	35 (24.3%)	
<b>Education</b>	Less Than High School	33 (36.7%)	39 (14.1%)	<0.01	32 (30.5%)	39 (14.9%)	<0.01	41 (28.7%)	15 (10.4%)	<0.01
	High School Graduate	23 (25.6%)	65 (23.5%)		30 (28.6%)	58 (22.2%)		41 (28.7%)	29 (20.1%)	
	Certificate or Diploma	9 (10.0%)	25 (9.0%)		9 (8.6%)	25 (9.6%)		18 (12.6%)	10 (6.9%)	
	Some postgraduate	16 (17.8%)	83 (30.0%)		21 (20.0%)	78 (29.9%)		30 (21.0%)	45 (31.3%)	
	Post-secondary graduate	9 (10.0%)	65 (23.5%)		13 (12.4%)	61 (23.4%)		13 (9.1%)	45 (31.3%)	
<b>Employment</b>	Currently Working	25 (27.5%)	93 (33.6%)	<0.01	31 (29.3%)	87 (33.3%)	0.20	27 (18.9%)	70 (48.6%)	<0.01
	Unemployed	15 (16.5%)	18 (6.5%)		15 (14.2%)	18 (6.9%)		15 (10.5%)	12 (8.3%)	
	Temporary LOA	3 (3.3%)	20 (7.2%)		7 (6.6%)	16 (6.1%)		12 (8.4%)	10 (6.9%)	
	Permanently Unable to Work	10 (11.0%)	15 (5.4%)		10 (9.4%)	15 (5.8%)		16 (11.2%)	5 (3.5%)	
	Retired	27 (29.7%)	114 (41.2%)		35 (33.0%)	105 (40.2%)		60 (42.0%)	38 (26.4%)	
	Other	11 (12.1%)	17 (6.1%)		8 (7.6%)	20 (7.7%)		13 (9.1%)	9 (6.3%)	
<b>Household Income</b>	<\$15 000	16 (17.6%)	26 (9.4%)	<0.01	21 (19.8%)	21 (8.1%)	<0.01			
	\$15 000 - \$24 999	18 (19.8%)	19 (6.9%)		12 (11.3%)	24 (9.2%)				
	\$25 000 - \$49 999	16 (17.6%)	37 (13.4%)		17 (16.0%)	36 (13.8%)				
	\$50 000 - \$74 999	11 (12.1%)	33 (11.9%)		13 (12.3%)	31 (11.9%)				
	\$75 000 - \$99 999	5 (5.5%)	25 (9.0%)		11 (10.4%)	19 (7.3%)				
	\$100 000 - \$124 999	1 (1.1%)	17 (6.1%)		2 (1.9%)	16 (6.1%)				
	\$125 000 - \$149 999	0 (0.0%)	7 (2.5%)		1 (0.9%)	6 (2.3%)				
	\$150 000 - \$174 999	1 (1.1%)	6 (2.2%)		1 (0.9%)	6 (2.3%)				
	\$175 000 - \$199 999	0 (0.0%)	6 (2.2%)		0 (0.0%)	6 (2.3%)				
	≥\$200 000	3 (3.3%)	19 (6.9%)		4 (3.8%)	18 (6.9%)				
	Do not know, Do not wish to answer, or Missing	20 (22.0%)	82 (29.6%)		24 (22.6%)	78 (29.9%)				

		Societal SSS			Community SSS			Household income		
		Low (n=91)	High (n=277)	p-value	Low (n=106)	High (n=261)	p-value	Low (n=143)	High (n=144)	p-value
<b>Number of Dependents on Household Income</b>	1	36 (40.0%)	82 (29.7%)	0.38	37 (35.2%)	80 (30.8%)	0.28	77 (53.9%)	27 (18.9%)	<0.01
	2	29 (32.2%)	110 (39.9%)		35 (33.3%)	104 (40.0%)		44 (30.8%)	57 (39.9%)	
	3	13 (14.4%)	35 (12.7%)		19 (18.1%)	29 (11.2%)		12 (8.4%)	29 (20.3%)	
	4	7 (7.8%)	29 (10.5%)		8 (7.6%)	28 (10.8%)		4 (2.8%)	20 (14.0%)	
	5 or greater	5 (5.6%)	20 (7.3%)		6 (5.7%)	19 (7.3%)		6 (4.2%)	10 (7.0%)	
<b>Currently Homeless</b>		8 (8.3%)	6 (2.2%)	<0.01	8 (7.6%)	6 (2.3%)	0.02	7 (4.9%)	2 (1.4%)	0.09
<b>Societal SSS</b>	Mean (SD)				4.3 (2.0)	6.2 (1.9)	<0.01	4.7 (2.1)	6.4 (1.9)	<0.01
<b>Community SSS</b>	Mean (SD)	3.9 (2.6)	5.9 (2.2)	<0.01				4.8 (2.5)	5.8 (2.3)	<0.01

Abbreviations: LOA- leave of absence; SD- standard deviation; SSS- subjective social status

The mean age for patients with low societal or community SSS rankings was lower than for patients with high rankings on these two scales. In contrast, the mean age for those with low income was higher than those with high income (56.2 years versus 52.0 years).

#### ***4.4.2 Proportions reporting social vulnerabilities by subjective social status and income***

A significantly higher proportion of patients with low sSSS, cSSS, or income reported the presence of transportation social support barriers compared to those with high sSSS, cSSS, or income respectively (Table 4.2).

**Table 4.2: Proportions experiencing individual social vulnerabilities, by subjective social status and household income**

	Societal SSS			Community SSS			Household Income		
	Low N=91	High N=277	P-value	Low N=106	High N=261	P-Value	Low N=143	High N=144	P-value
<b><i>Transportation Barriers</i></b>									
No license	39 (42.9%)	54 (19.5%)	<0.01	36 (34.0%)	59 (22.6%)	0.04	47 (32.9%)	18 (12.5%)	<0.01
No car	24 (26.4%)	24 (8.7%)	<0.01	21 (19.8%)	27 (10.3%)	0.03	37 (25.9%)	5 (3.5%)	<0.01
Skipping appts due to transportation barriers	24 (26.4%)	27 (9.8%)	<0.01	27 (25.5%)	24 (9.2%)	<0.01	29 (20.3%)	6 (4.2%)	<0.01
Any of the above 3 barriers	53 (58.2%)	75 (27.1%)	<0.01	52 (49.1%)	77 (29.5%)	<0.01	66 (46.2%)	24 (16.7%)	<0.01
<b><i>Social Support Barriers</i></b>									
Lack of help if confined in bed	18 (19.8%)	34 (12.3%)	0.08	20 (18.9%)	32 (12.3%)	0.14	30 (30.0%)	14 (9.7%)	<0.01
Lack of help if need to see a doctor	19 (20.9%)	23 (8.3%)	<0.01	22 (20.8%)	20 (7.7%)	<0.01	24 (16.8%)	10 (6.9%)	0.01
Lack of help for chores	22 (24.4%)	32 (11.6%)	<0.01	25 (23.8%)	29 (11.2%)	<0.01	34 (23.8%)	14 (9.7%)	<0.01
Any of the above 3 barriers	31 (34.4%)	48 (17.4%)	<0.01	35 (33.3%)	44 (16.9%)	<0.01	44 (30.8%)	20 (13.9%)	<0.01
<b><i>Financial Barriers</i></b>									
Skip or do not fill Rx because of cost	20 (22.0%)	25 (9.1%)	<0.01	25 (23.6%)	20 (7.7%)	<0.01	25 (17.5%)	12 (8.3%)	0.02
Miss appts because cannot afford to not work	13 (14.3%)	12 (4.4%)	<0.01	15 (14.2%)	10 (3.9%)	<0.01	7 (4.9%)	12 (8.3%)	0.37
Missed appt because cannot afford childcare	2 (13.3%)	3 (6.8%)	0.54	1 (6.3%)	4 (9.3%)	0.62	1 (4.6%)	3 (10.8%)	0.30
Any of the above 3 barriers	27 (29.7%)	34 (12.3%)	<0.01	31 (29.3%)	30 (11.5%)	<0.01	28 (19.6%)	19 (13.3%)	0.20
<b><i>Low Health Literacy</i></b>									
Single Health Literacy Screen: 3 or greater	19 (21.1%)	30 (10.9%)	0.02	18 (17.1%)	32 (12.3%)	0.24	30 (21.1%)	15 (10.5%)	0.02
Medication Understanding Questionnaire mean <1.5	17 (25.4%)	38 (17.5%)	0.16	18 (24.3%)	37 (17.7%)	0.23	25 (22.7%)	8 (7.3%)	0.02
Either of the above 2 indicating low health literacy	31 (34.4%)	59 (21.3%)	0.02	31 (29.5%)	60 (23.0%)	0.23	47 (33.1%)	23 (16.0%)	<0.01
<b><i>Low Priority of Health Maintenance</i></b>									
Did not make lifestyle changes or missed tests / meds because other areas took priority	46 (50.6%)	101 (36.5%)	0.02	55 (51.9%)	92 (35.3%)	0.01	62 (43.7%)	56 (38.9%)	0.47

	Societal SSS			Community SSS			Household Income		
	Low N=91	High N=277	P-value	Low N=106	High N=261	P-Value	Low N=143	High N=144	P-value
It is hard to find the time and energy to focus on health	23 (25.3%)	48 (17.3%)	0.13	29 (27.4%)	41 (15.7%)	<b>0.01</b>	27 (18.9%)	31 (21.5%)	0.66
More than 1 area that makes it difficult to focus on health	43 (47.3%)	82 (29.6%)	<b>&lt;0.01</b>	49 (46.2%)	74 (28.4%)	<b>&lt;0.01</b>	67 (47.2%)	41 (28.5%)	<b>&lt;0.01</b>
Either of the above 3 indicating low priority of health	64 (70.3%)	149 (53.1%)	<b>0.01</b>	73 (68.9%)	139 (52.5%)	<b>0.01</b>	89 (62.7%)	84 (56.9%)	0.34

Abbreviations: appt- appointment; Rx- prescription

A higher proportion of patients with low sSSS and cSSS reported experiencing financial barriers and low priority of health maintenance, compared to those with high sSSS and cSSS.

Interestingly, there was no statistically significant difference in the proportion of low versus high income patients reporting these same barriers. In contrast, though there was no statistically significant difference in proportions of patients with low health literacy for those with low versus high cSSS, a significantly higher proportion of patients in the low sSSS and low income groups had low health literacy compared with their high sSSS and income counterparts.

#### ***4.4.3 Logistic regression***

In univariate analysis, the odds of reporting any barrier to transportation for those with low sSSS were 3.76 times the odds for those with high sSSS (OR 3.76, 95% CI 2.29, 6.15). Similarly, the odds ratios for the other four social vulnerabilities were between 2-3, indicating that the odds of reporting each social vulnerability were 2-3 times higher in the low sSSS group compared to the high sSSS group (Table 4.3).

**Table 4.3: Logistic regression modeling the odds of reporting the presence of social vulnerabilities**

	<b>Any Transportation Barriers</b>	<b>Overall Poor Social Support</b>	<b>Any Financial Barriers</b>	<b>Overall Low Health Literacy</b>	<b>Low Priority of Health Maintenance</b>
<i>Univariate analysis</i>					
Low sSSS	<b>3.76 (95% CI 2.29, 6.15)</b>	<b>2.50 (95% CI 1.46, 4.26)</b>	<b>3.00 (95% CI 1.69, 5.34)</b>	<b>1.94 (95% CI 1.15, 3.27)</b>	<b>2.10 (95% CI 1.26, 3.48)</b>
Low cSSS	<b>2.30 (95% CI 1.45, 3.66)</b>	<b>2.45 (95% CI 1.46, 4.13)</b>	<b>3.17 (95% CI 1.80, 5.58)</b>	1.40 (95% CI 0.84, 2.33)	<b>2.00 (95% CI 1.24, 3.23)</b>
Low Household income	<b>4.29 (95% CI 2.48, 7.41)</b>	<b>2.76 (95% CI 1.53, 4.98)</b>	1.59 (95% CI 0.84, 3.00)	<b>2.60 (95% CI 1.48, 4.59)</b>	1.27 (95% CI 0.79, 2.04)
<i>Bivariate analysis including sSSS and household income in the model</i>					
Low sSSS	<b>3.06 (95% CI 1.68, 5.58)</b>	<b>2.90 (95% CI 1.55, 5.43)</b>	<b>2.54 (95% CI 1.27, 5.06)</b>	<b>2.11 (95% CI 1.12, 3.98)</b>	1.68 (95% CI 0.93, 3.05)
Low Household income	<b>3.51 (95% CI 1.96, 6.30)</b>	<b>2.26 (95% CI 1.20, 4.25)</b>	1.18 (95% CI 0.60, 2.32)	<b>2.24 (95% CI 1.19, 4.20)</b>	1.09 (95% CI 0.65, 1.81)
<i>Bivariate analysis including cSSS and household income in the model</i>					
Low cSSS	<b>1.81 (95% CI 1.02, 3.23)</b>	<b>2.52 (95% CI 1.37, 4.62)</b>	<b>3.06 (95% CI 1.57, 5.95)</b>	1.33 (95% CI 0.72, 2.47)	1.43 (95% CI 0.83, 2.48)
Low Household income	<b>4.06 (95% CI 2.30, 7.19)</b>	<b>2.56 (95% CI 1.38, 4.77)</b>	1.26 (95% CI 0.65, 2.47)	<b>2.65 (95% CI 1.43, 4.91)</b>	1.14 (95% CI 0.69, 1.88)
<i>Bivariate analysis including sSSS and cSSS in the model</i>					
Low sSSS	<b>3.21 (95% CI 1.88, 5.49)</b>	<b>1.88 (95% CI 1.04, 3.37)</b>	<b>2.06 (95% CI 1.09, 3.89)</b>	<b>1.87 (95% CI 1.06, 3.32)</b>	1.70 (95% CI 0.98, 2.94)
Low cSSS	1.49 (95% CI 0.88, 2.50)	<b>1.95 (95% CI 1.10, 3.45)</b>	<b>2.42 (95% CI 1.30, 4.51)</b>	1.05 (95% CI 0.60, 1.86)	<b>1.72 (95% CI 1.02, 2.89)</b>
<i>Multivariate analysis including sSSS, cSSS, and household income in the model</i>					
Low sSSS	<b>2.86 (95% CI 1.50, 5.43)</b>	<b>2.23 (95% CI 1.14, 4.36)</b>	1.76 (95% CI 0.83, 3.72)	<b>2.07 (95% CI 1.04, 4.10)</b>	1.52 (95% CI 0.81, 2.87)
Low cSSS	1.25 (95% CI 0.66, 2.35)	<b>2.05 (95% CI 1.03, 3.81)</b>	<b>2.59 (95% CI 1.27, 5.27)</b>	0.99 (95% CI 0.50, 1.96)	1.30 (95% CI 0.72, 2.34)
Low Household income	<b>3.45 (95% CI 1.92, 6.20)</b>	<b>2.25 (95% CI 1.19, 4.26)</b>	1.14 (95% CI 0.57, 2.28)	<b>2.29 (95% CI 1.22, 4.31)</b>	1.08 (95% CI 0.65, 1.80)

When considering cSSS, odds ratios ranged between 2.00 to 3.17 for transportation barriers, poor social support, financial barriers, and low priority of health maintenance. The odds of having low health literacy in those with low cSSS were 1.40 times the odds for those with high cSSS, though this was not statistically significant.

When sSSS, cSSS, and income were added to the logistic regression models, the effects were attenuated though the trends remained. When all three variables were included in the model, the OR for transportation barriers and low health literacy were significantly greater than 1 for sSSS. That is, low societal SSS was associated with a threefold higher risk of experiencing transportation barriers, and a twofold higher risk of having low health literacy, even when taking into account household income and community SSS. Similarly, low income was associated with a twofold higher risk of experiencing these same barriers, adjusting for both societal and community SSS. On the other hand, neither societal SSS nor income was associated with a significantly higher risk of reporting financial barriers to health care access in multivariate analysis, though community SSS did demonstrate this association.

The odds ratios for poor social support were significantly greater than 1 for all three social status variables in this multivariate analysis (sSSS 2.23, 95% CI 1.14, 4.36; cSSS 2.05, 95% CI 1.03, 3.81; and household income 2.25, 95% CI 1.19, 4.26). In contrast, no odds ratios for the three social status variables were significantly greater than 1 for the social vulnerability of low priority of health maintenance.

#### ***4.4.4 Effect modification by community SSS***

Recognizing that high perceived status within one's community may decrease the impact that low societal SSS and low income have on the risk of social vulnerabilities, we examined whether community SSS was an effect modifier by dividing the sample based on concordance versus discordance between community and societal SSS rankings (Figure 4.2).

		Community Ladder									
		1	2	3	4	5	6	7	8	9	10
Societal Ladder	1	13	0	1	0	1	0	0	0	0	0
	2	1	4	0	0	1	0	1	0	0	0
	3	4	5	6	2	7	0	1	3	2	2
	4	2	6	4	7	5	5	2	6	0	0
	5	6	5	10	8	52	7	10	10	0	2
	6	2	0	1	3	8	8	3	6	1	0
	7	2	2	0	2	9	5	15	12	5	2
	8	2	3	2	1	3	5	12	14	3	1
	9	0	0	0	0	1	3	1	4	5	2
	10	0	1	0	0	6	2	1	0	2	4

Where Red = Low societal subjective social status (SSS) with concordantly low community SSS; Orange = High societal SSS with concordantly high community SSS; Green= Low societal SSS with discordantly high community SSS; Blue= High societal SSS with discordantly low community SSS

**Figure 4.2: Cross-tabulation of MacArthur Scale of Subjective Social Status societal and community ladders, using the agreement band approach to divide the sample into four groups.**

Within the low societal SSS group, we examined whether the proportions of patients experiencing each social vulnerability were different for those reporting concordantly low versus discordantly high community SSS (Table 4.4).

**Table 4.4: Proportions experiencing individual social vulnerabilities, by concordant and discordant community subjective social status**

	Low Societal SSS			High Societal SSS			Low income		
	Low Community SSS (Concordant), N=147	High Community SSS (Discordant), N=54	P-value	Low Community SSS (Discordant), N=52	High Community SSS (Concordant), N=112	P-value	Low Community SSS, N=50	High Community SSS, N=81	P-value
<b><i>Transportation Barriers</i></b>									
No license	45 (30.6%)	21 (38.9%)	0.31	8 (15.4%)	19 (17.0%)	1.00	17 (34.0%)	28 (34.6%)	1.00
No car	24 (16.3%)	11 (20.4%)	0.53	6 (11.6%)	6 (5.4%)	0.20	15 (30.0%)	20 (24.7%)	0.55
Missed appt due to transportation barrier	28 (19.1%)	12 (22.2%)	0.38	7 (13.5%)	3 (2.7%)	<b>0.03</b>	16 (32.0%)	11 (13.6%)	<b>0.04</b>
Any of the above 3 barriers	61 (41.5%)	29 (53.7%)	0.15	15 (28.9%)	22 (19.6%)	0.23	27 (54.0%)	35 (43.2%)	0.28
<b><i>Social Support Barriers</i></b>									
Lack of help if confined in bed	33 (22.5%)	5 (9.3%)	<b>0.04</b>	7 (13.5%)	7 (6.3%)	0.14	13 (26.0%)	15 (18.5%)	0.38
Lack of help if need to see a doctor	29 (19.7%)	2 (3.7%)	<b>&lt;0.01</b>	4 (9.6%)	6 (5.4%)	0.33	16 (32.0%)	6 (7.4%)	<b>&lt;0.01</b>
Lack of help for chores	35 (24.1%)	4 (7.4%)	<b>&lt;0.01</b>	9 (17.3%)	6 (5.4%)	<b>0.02</b>	17 (34.0%)	15 (18.5%)	0.06
Any of the above 3 barriers	49 (33.8%)	5 (9.3%)	<b>&lt;0.01</b>	12 (23.1%)	13 (11.6%)	0.07	23 (46.0%)	19 (23.5%)	<b>0.01</b>
<b><i>Financial Barriers</i></b>									
Skip or do not fill Rx because of cost	28 (19.1%)	7 (14.0%)	0.40	3 (5.8%)	7 (6.3%)	1.00	14 (28.0%)	9 (11.1%)	<b>0.02</b>
Miss appts because cannot afford to not work	16 (10.9%)	4 (7.4%)	0.63	1 (1.9%)	4 (3.6%)	0.85	4 (8.0%)	3 (3.7%)	0.49
Missed appt because cannot afford childcare	2 (8.7%)	2 (25.0%)	0.43	0 (0.0%)	1 (5.0%)	0.23	0 (0.0%)	1 (8.3%)	0.40
Any of the above 3 barriers	35 (23.8%)	12 (22.2%)	0.85	3 (5.8%)	11 (9.9%)	0.55	15 (30.0%)	11 (13.6%)	<b>0.03</b>
<b><i>Low Health Literacy</i></b>									
Single Health Literacy Screen: 3 or greater	23 (15.8%)	7 (13.0%)	0.82	9 (17.3%)	19 (9.0%)	0.19	12 (24.0%)	13 (16.1%)	0.26
Medication Understanding Questionnaire mean <1.5	29 (26.6%)	9 (21.4%)	0.68	6 (16.7%)	11 (11.6%)	0.56	11 (29.7%)	13 (20.3%)	0.34
Either of the above 2 indicating low health literacy	43 (29.5%)	14 (25.9%)	0.73	15 (29.9%)	18 (16.1%)	0.06	20 (40.0%)	21 (25.9%)	0.12

	Low Societal SSS			High Societal SSS			Low income		
	Low Community SSS (Concordant), N=147	High Community SSS (Discordant), N=54	P-value	Low Community SSS (Discordant), N=52	High Community SSS (Concordant), N=112	P-value	Low Community SSS, N=50	High Community SSS, N=81	P-value
<b><i>Low Saliency of Health Maintenance</i></b>									
Did not make lifestyle changes or missed tests/ meds because other areas took priority	66 (44.9%)	24 (44.4%)	1.00	20 (38.5%)	36 (32.1%)	0.48	23 (46.0%)	34 (42.0%)	0.72
It is hard to find the time and energy to focus on health	34 (23.1%)	9 (16.7%)	0.32	9 (17.3%)	18 (16.1%)	0.83	12 (24.0%)	13 (16.1%)	0.26
More than 1 area that makes it difficult to focus on health	67 (45.6%)	17 (31.5%)	0.08	14 (26.9%)	25 (22.3%)	0.56	25 (50.0%)	35 (43.2%)	0.48
Any of the above 3 barriers	94 (64.0%)	31 (57.4%)	0.42	29 (55.8%)	55 (49.1%)	0.50	30 (60.0%)	51 (63.0%)	0.85

Abbreviations: SSS- subjective social status; appt- appointment; Rx- prescription

There were no significant differences in the proportions of patients reporting the presence of transportation barriers, financial barriers, low priority of health maintenance, and having low health literacy within the low societal SSS group, for those with concordantly low versus discordantly high community SSS. In contrast, a lower proportion of low societal SSS patients with high community SSS rankings experienced social support barriers compared to those with low community SSS rankings (9.3% vs 33.8%,  $p < 0.01$ ). Findings were similar, though did not reach statistical significance, when considering the high societal SSS group, with a lower proportion of patients with concordantly high community SSS rankings experiencing social support barriers compared with patients with discordantly low community SSS rankings (11.6% vs 23.1%,  $p = 0.07$ ).

In patients with low income, a lower proportion of patients with high community SSS experienced social support barriers, as well as financial barriers, compared to patients with low community SSS (23.5% vs 46.0%,  $p = 0.01$ ; 13.6% vs 30.0%,  $p = 0.03$  respectively). That is, having discordantly high community SSS appeared to result in lower prevalence of social vulnerabilities, specifically financial and social support barriers, for those with low income or low societal SSS.

These results were corroborated with logistic regression modelling. The odds ratio of the presence of social support barriers for those with low sSSS versus high sSSS was 2.30 (95% CI 0.97, 5.57) for those with discordantly high community SSS, compared to 3.04 (95% CI 1.02, 9.79) for those with concordantly low community SSS. The interaction effect of community SSS

was statistically significant ( $p=0.05$ ). These findings suggest that community SSS does indeed modify the association between societal SSS and social support.

#### **4.5 Discussion**

In study of medical patients being discharged from hospital, we have demonstrated that low societal subjective social status is associated with a two to three-fold increased risk of experiencing transportation barriers, social support barriers, and low health literacy, even when taking income into account. Similarly, low community subjective social status is associated with a two-fold increased risk of experiencing social support barriers, when taking income and societal SSS into account. That is, for those with low status, it is not the lack of material resources that impede the ability to access health care and maintain health, but rather the psychosocial consequences of low social status. Furthermore, community SSS acts as an effect modifier of the societal SSS – social vulnerability association, where high community SSS mitigates the risk of experiencing certain social vulnerabilities.

Though subjective social status has previously been studied in the context of its association with health behaviors, self-rated health, and cardiovascular health, this is the first study, to our knowledge, to examine the associations between SSS and social vulnerabilities that affect health maintenance and health care access. The experience of and the ability to overcome social vulnerabilities likely act as mediators in the pathway between social status and health care outcomes. This exploration is therefore essential in understanding the mechanisms by which SSS affect health.

A surprising and remarkable finding from this study is the high prevalence of patients who report the presence of social vulnerabilities, even amongst those with high status and high income. For example, 16% of those with high income have low health literacy. When considering the overall patient cohort, 10-30% report the presence of financial barriers that affect their ability to adhere to medications or attend medical appointments, and up to 25% of patients note that they have missed medical appointments due to lack of transportation options. Therefore, it is important to consider the presence of social vulnerabilities on health, not only in those with known financial difficulties (such as those who are homeless, or those with low household income), but in the entire patient population, as these social vulnerabilities exist across the resource continuum. Similarly, the development of interventions to mitigate these social vulnerabilities must target the broader population as a whole rather than only those at highest risk.

Societal SSS, community SSS, and income appear to represent overlapping, but distinct measures of social status. The correlation coefficient between income and sSSS in our study was 0.45, indicating that only 20% of variance was shared between these two variables. Similarly, the sociodemographic profiles of those with low income were not found to be the same as those with low SSS. For example, those with low income tended to be older than those with high income, whereas those with low sSSS tended to be younger than those with high sSSS. Societal SSS therefore seems to measure a distinct measure of social status from income.

Similarly, community SSS is distinct from sSSS, having different associations with the different social vulnerabilities. Further, low community SSS is independently associated with increased risk of adverse behavioural responses to social vulnerabilities, such as skipping medications and

appointments in the presence of financial constraints, even when taking into account both income and sSSS. That is, those with low cSSS are more likely to skip medications compared with those with high cSSS, whereas patients with low sSSS do not report the same response when faced with financial limitations. Supporting the hypothesis that community SSS may reflect the ability to respond to vulnerabilities and barriers is the finding that high community SSS is an effect modifier of the societal SSS, income, and health relationship. High subjective social status in the community may be a marker of the ability to access and mobilize community resources, networks, and supports to mitigate social vulnerabilities and improve health care access. These findings have important implications not just in understanding the role of subjective social status in health, but in the development of interventions that may improve well-being and health outcomes.

There are numerous limitations to our study. The patient cohort was recruited from a single center in Calgary, Canada. Those these patients represent a diverse sociodemographic group and have a wide variety of diagnoses and comorbidities, our findings have limited generalizability outside of Canadian internal medicine inpatients. Second, there are no validated tools that measure the presence of all five social vulnerabilities of interest to this study. Health literacy<sup>119,120</sup> and social support<sup>122</sup> were assessed using validated tools. The other three social vulnerabilities were assessed using a survey constructed for the purposes of this study. However, questions were adapted from existing national surveys where possible.<sup>123,124</sup> Furthermore, we established face validity of the survey through interviews of health care professionals, research personnel, and patients.

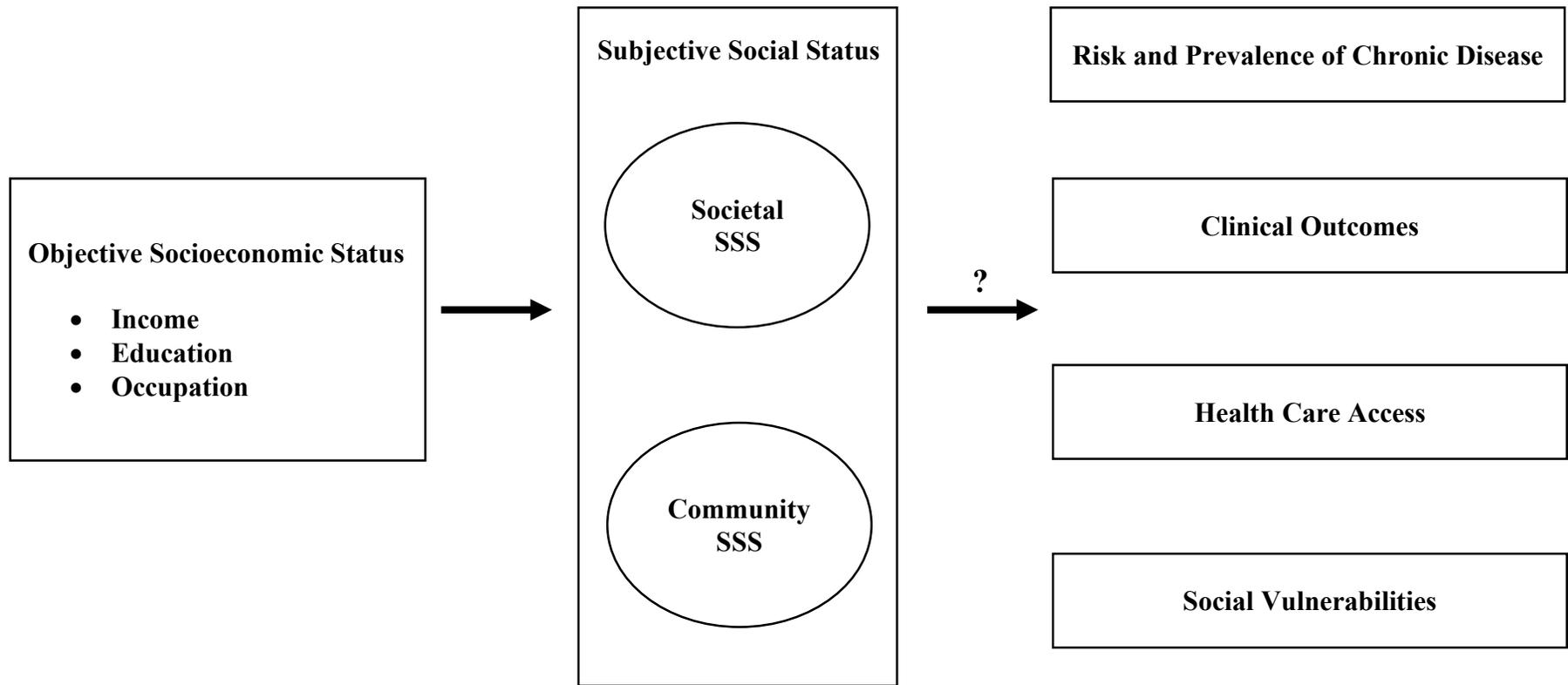
Our findings have important implications on the development of interventions that target social vulnerabilities. First, interventions that focus on raising income levels, such as through income redistribution or raising minimum wages, need to also target improvement of perceived social status of the population. Because health disparities exist not simply due to disparities in absolute resources, but also due to the implications that having relatively more or less resources have on social status, policy makers must recognize the importance of social status independent of absolute income alone. Second, the improvement of community subjective social status may be an important mechanism by which health disparities may be mitigated. Community SSS appears to be most strongly associated with social support. Therefore, the development of strong support communities, whether they be disease communities, local communities, or organizational or religious communities, may help individuals with low income and low societal SSS to overcome many of the social vulnerabilities that affect their ability to maintain health. The relationship between social status and health is complex and multi-faceted. Our exploration of societal subjective social status, community subjective social status, and income reveal different ways by which health disparities among those with high and low status may be addressed.

## **CHAPTER 5: Synthesis and overriding conclusions**

Subjective social status is a relatively new concept, with a standardized measure, the MacArthur Scales of Subjective Social Status, developed only within the last 20 years. Though the relationship between SSS and mental health and self-rated health have been extensively studied, there has been far less literature on the associations between SSS and risk of and prognosis in clinical chronic disease, and on the exploration of the mechanisms by which social status and its psychosocial implications affect health. The program of research presented in this thesis sought to address these knowledge gaps.

### **5.1 Conceptual model and synthesis of findings**

In Chapter 1, we had introduced a conceptual framework underpinning the thesis and its three sub-studies (Figure 5.1).



**Figure 5.1: Initial conceptual model of thesis**

We had hypothesized that SSS would be associated with both risk of chronic disease as well as clinical outcomes in those with established disease. In addition, we also hypothesized that SSS would affect health care access and the experience and response to social vulnerabilities as possible mediators in the SSS – clinical outcomes pathway.

Given the findings of the three sub-studies, we are now able to expand upon this conceptual model (Figure 5.2), and will summarize the thesis findings based on this expanded model.

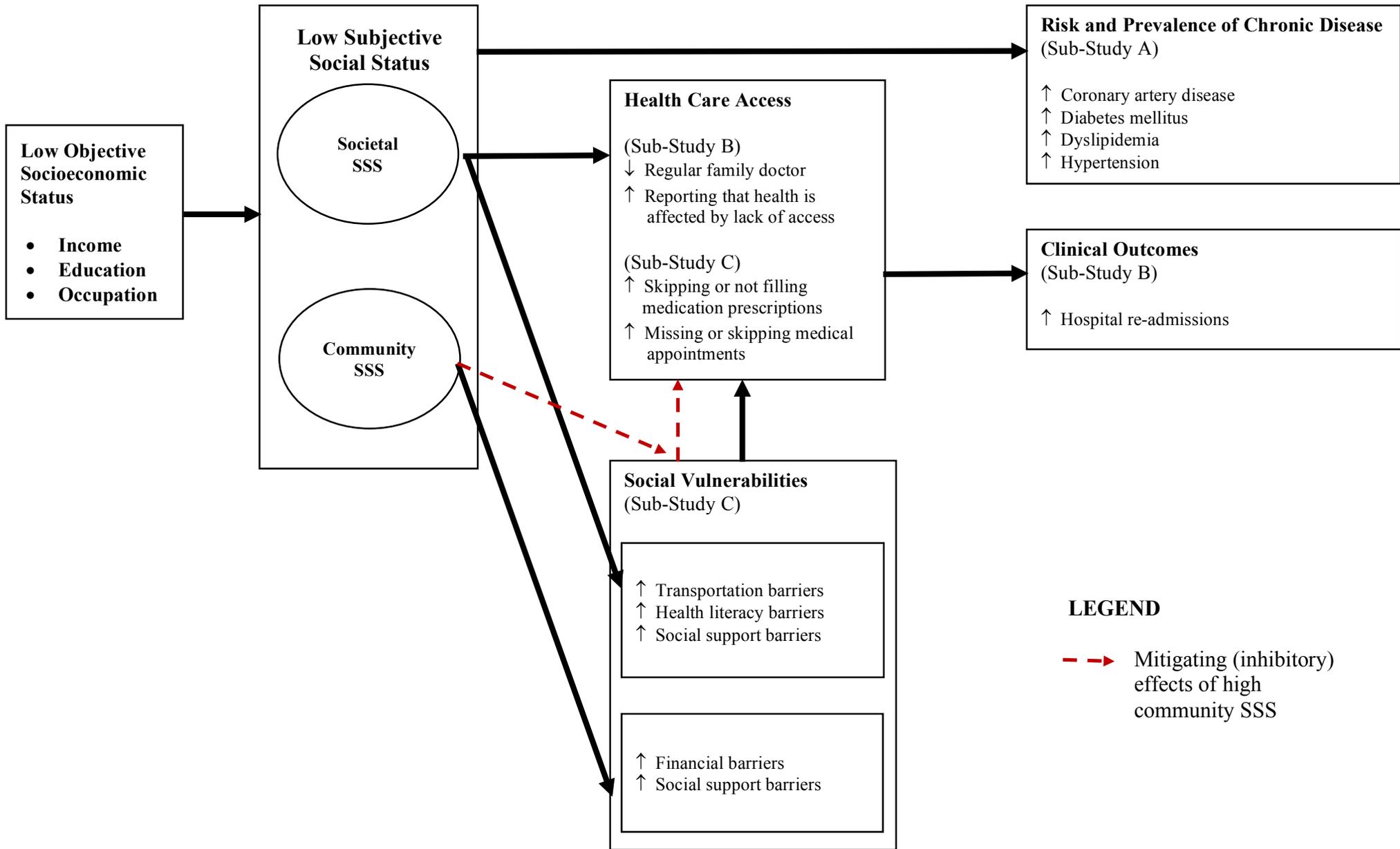


Figure 5.2: Expanded conceptual model based on thesis findings

### ***5.1.1 Associations between SSS, risk of chronic disease, and clinical outcomes***

In sub-study A, we found that low societal SSS was associated with an increased risk of coronary artery disease, and an increased risk of three out of four chronic cardiovascular risk factors – diabetes mellitus, dyslipidemia, and hypertension. These associations remained significant even with adjustment for objective socioeconomic status indicators, suggesting that perceived social status influences risk of chronic disease beyond the absolute effects of income, education, and occupation. There was also a trend toward increased obesity with low societal SSS, though this was not statistically significant. Similarly, in sub-study B, low societal SSS was shown to increase the risk of poor clinical outcomes, that is, cardiac readmissions, one-year post-discharge, for patients with acute coronary syndrome. Therefore, SSS not only affects risk of developing illness, but is also associated with worse outcomes in those who have chronic disease.

### ***5.1.2 Health care access and social vulnerabilities as mediators in the SSS – health relationship***

Recognizing that the SSS – health relationship is complex and multifactorial, including behavioural, neuroendocrine, and psychosocial pathways, we sought to explore the ways in which SSS affects modifiable barriers that thereby affects health. That is, if SSS affects health through the presence of modifiable barriers, then these barriers may be able to be targeted in health and policy interventions. Indeed, in sub-study B, we found that low SSS affects health care access, where those with low SSS more frequently report not having a regular family physician, and that the lack of health care access affects their health. The issue of decreased health care access in those with low SSS was corroborated by findings from sub-study C, which

showed that low perceived social status was associated with increased risk of skipping or not filling prescription medications, and missing medical appointments due to transportation and financial barriers, even when adjusting for the effects of income. This same study revealed that the issue of reduced health care access may be due to the experience of and response to social vulnerabilities. Those with low SSS experienced more financial, social support, health literacy, and transportation barriers compared to those with high SSS. This inability to overcome social barriers leads to reduced access to health care and reduced access to the resources necessary for health maintenance, which may then lead to worse clinical outcomes.

### ***5.1.3 SSS versus SES***

Subjective social status, regardless of the frame of reference, is not simply another measure of SES and cannot be replaced by proxies for social status (e.g. income). Similar to the literature, we have found that objective SES measures are correlated more strongly with societal SSS rankings compared with community SSS, with correlation coefficients of 0.45 and 0.27 respectively. In addition, the socio-demographics of those with low versus high income were not the same as those with low versus high societal SSS or community SSS. For example, those who were older tended to have lower income but higher SSS. This would be consistent with Hu et al.'s hypothesis that SSS is a measure of achievement throughout the life course in the elderly, and therefore reflects cumulative social status.<sup>26</sup> In contrast, income alone would be a less accurate assessment of social status, especially in the elderly, given that it is only relevant to a single time-point rather than an overall trajectory.

#### ***5.1.4 Differences between societal and community SSS***

There has been minimal study of the similarities and differences in societal versus community SSS in the literature. In addition, few studies compare and contrast how these two types of SSS affect health. Though there is overlap, sub-studies B and C in this thesis support that societal and community SSS are distinct measures that are not interchangeable. Further, societal SSS and community SSS seem to have different associations with social vulnerabilities, and may represent very different dimensions of social status. Low societal SSS is associated with health literacy, transportation, and social support barriers, while low community SSS is associated with financial and social support barriers.

We have also found that community SSS appears to be an effect modifier of the relationship between societal SSS and health. Sub-study B suggested that amongst those with low societal SSS, those with discordantly high community SSS experienced fewer access to health care barriers compared to those with low community SSS. This study suggested that the experience of social vulnerabilities (specifically cost, transportation, and language) may have resulted in differences in health care access, though the trends were not statistically significant. These findings were corroborated by sub-study C, which showed that those with low community SSS appeared to respond adversely to social vulnerabilities, by skipping medications or appointments when financial barriers arose. Furthermore, amongst those with low societal SSS, patients with concordantly low community SSS reported significantly more social support barriers compared to those with high community SSS. Having high community SSS may therefore mitigate the social vulnerabilities experienced by those with low societal SSS, by empowering individuals to effectively mobilize their social support networks and community resources to respond to these social vulnerabilities so that health care access and health maintenance are not compromised.

## **5.2 Implications and next steps**

Though a thorough understanding of subjective social status and the ways in which it affects health are important, continued description of health disparities without reflecting upon actionable changes is insufficient. Based on our findings, we have identified next steps for future research, as well as potential interventions that reduce the social gradient to improve population health.

### ***5.2.1 Future research***

Due to the complexity of the SSS – health association, with many possible mediators and moderators, there is much to be done to further disentangle this relationship. Of utmost priority is the need to understand the determinants of community and societal subjective social status. Currently, the only evidence available as to how individuals assign themselves a rank in the social hierarchy is based on preliminary, unpublished data presented by the MacArthur Research Network.<sup>36</sup> A qualitative study of a heterogeneous group of participants would be valuable to delineate to what extent objective SES weighs into community and societal SSS, which psychosocial factors contribute to community and societal SSS, how the two types of SSS differ, and what specific reference group is being used for the community SSS scale. A better understanding of the SSS construct itself is pertinent in the development of upstream interventions. As it currently stands, we can only assume that interventions that have psychosocial benefits also improve perceived social status. Development of more specific and nuanced interventions depends upon a better understanding of the factors that determine subjective social status.

A second area for future research is the need to establish not just an association between SSS and health, but causation. The majority of studies in the literature on SSS are cross-sectional in nature. Similarly, though we assessed clinical outcomes longitudinally in thesis sub-study B, health access variables were studied cross-sectionally, at the time that data on SSS were collected. Sub-study C on the associations between SSS and social vulnerabilities had a similar cross-sectional design. Without longitudinal cohort studies, there is question as to whether reverse causation is possible, where poor health negatively affects subjective social status. This issue has been thoroughly examined in the SES- health association, and reverse causation has been determined to be unlikely due to the effects that childhood SES and educational attainment in youth have on adult health (outside of adult SES influences), the association between the SES of the head of the household on the health of family members, and the effect of income on the health of retired individuals (i.e. where reverse causation would not apply because income does not depend on health for non-working or retired individuals).<sup>15,16</sup> Given that SSS and SES are closely linked with SES being an important determinant of SSS, SSS likely does have similar important effects on health rather than the reverse. However, until similar longitudinal studies are done using SSS, there will be continued doubt as to whether the SSS-health relationship is causal.

### ***5.2.2 Potential interventions and next steps***

In 2010, the Marmot Review was published, in response to a request by the British government for a review of evidence-based recommendations to reduce health disparities.<sup>93</sup> This review

provides recommended strategies that are directly relevant here. Rather than re-iterating all six policy recommendations, we have focused on three pertinent areas for potential intervention.

Given that subjective social status arises from a social hierarchy, one way to improve SSS is to reduce the social gradient. The provision of a basic minimum income for healthy living is one method that can be used to achieve this, where all citizens are provided with sufficient funds needed to pay for nutritious diets, physical activity options, social interactions, transportation, and hygiene.<sup>93</sup> That is, this basic income would provide the resources needed to effectively participate and engage in society. Finland has embarked on a two-year trial of 200 participants. These participants will be randomly selected from citizens receiving unemployment benefits, and each are guaranteed to receive 560 euros per month, regardless of whether individuals eventually find employment.<sup>125</sup> The goal of this intervention, other than providing a basic income required for healthy living, is to encourage societal participation, increase employment by removing disincentives, and increase social capital by allowing individuals to contribute to their communities.<sup>125</sup>

A second area for intervention is in the improvement of employment opportunities and the work environment. Given that subjective social status is determined not just by the income resulting from employment, but also from feeling valued, respected, and from contributing to others and the society, an improvement in the quality of jobs is important to improving overall SSS. There is moderately strong evidence that low levels of control at work and the presence of bullying increase depressive symptoms.<sup>126</sup> Similarly, a low effort to reward ratio, lack of support, and lack of justice at work are also detrimental to mental health.<sup>126,127</sup> Work environments should

therefore be enhanced to provide opportunities for personal and professional growth, and to increase flexibility to allow employees greater control of their work and work-life balance.<sup>93</sup>

The third area of focus for the development of interventions is in improving social cohesion. The literature has shown that increased social inclusion, social capital, diversity, social trust, and increased group membership are all associated with improved health and lower mortality.<sup>31,128</sup> Our findings support the importance of social cohesion and engagement, where high community SSS seems to mitigate the experience of social vulnerabilities, by increasing social support and resources. Interventions that address social isolation and improve community supports and participation are therefore likely to be beneficial for well-being and health. Interventions that have demonstrated effectiveness include social support groups,<sup>129</sup> community-based exercise programs,<sup>129</sup> and formation of clubs of individuals with common interests.<sup>130</sup> Passive interventions, such as home visits, appear to be less effective than interventions that encourage active social participation and contact.<sup>131</sup> Volunteering appears also to improve sense of mastery, life satisfaction, and social support,<sup>131</sup> and therefore likely to increase community subjective social status as well. An example of such an intervention that shows great promise is inter-generational mentorship programs. Not only are there benefits to the adult or senior mentors, but the youth mentees also show improvements in social skills, development of social relationships, self-esteem, and mental health.<sup>132</sup> There is potential with these mentorship programs to improve social support and subjective social status for all involved parties.

### **5.3 Final comments**

This program of research has contributed to the literature in several important ways. We have shown that subjective social status is an important determinant of health, influencing both risk of and outcomes in chronic disease. Furthermore, we have begun to disentangle the pathways by which subjective social status affects health, by affecting the experience and response to social vulnerabilities, thereby affecting access to health care and the resources needed to maintain health. Lastly, we have shown that community and societal subjective social status are distinct constructs, and that having high perceived status in the community may mitigate some of the risks associated with having low societal subjective social status.

Our findings are widely relevant to individuals, administrators, system planners, and government. As citizens, we must reflect on the anchor holds upon which we base our status and worth. Connecting with communities, neighbors, and groups is of utmost importance, given its potential to positively influence our perceived status and thereby our health. Within the health care system, health care providers must recognize that subjective social status is a social determinant of health. Not only is it important to understand a patient's objective background in terms of income, occupation, and education, but their social connections and contributions are also important in their experience of and ability to cope with social vulnerabilities that may ultimately affect their ability to optimize health and well-being. Our findings are relevant even to the upper echelons of leadership and government. Health system planners and the Ministry of Health may consider different paradigms of care provision that consider the importance of social status and connection. This may mean re-directing efforts away from institutionalized care, such as long-term care facilities for the elderly, and focusing rather on funding policies and programs

that provide better social connection and supports, such as personal health care aids and family caregivers. In sum, the study of subjective social status and its health consequences is not merely a nebulous concept of interest. An understanding of subjective social status is crucial in the development of tangible policy changes and interventions that can be applied to improve the well-being of those with low perceived social status and to diminish the social hierarchy in which we live.

## References

1. Lantz PM, House JS, Lepkowski JM, Williams DR, Mero RP, Chen J. Socioeconomic factors, health behaviors, and mortality: results from a nationally representative prospective study of US adults. *JAMA : the journal of the American Medical Association*. 1998;279(21):1703-1708.
2. Pampel FC, Krueger PM, Denney JT. Socioeconomic Disparities in Health Behaviors. *Annu Rev Sociol*. 2010;36:349-370.
3. Marmot M. Social determinants of health inequalities. *Lancet*. 2005;365(9464):1099-1104.
4. Dalstra JA, Kunst AE, Borrell C, et al. Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries. *International journal of epidemiology*. 2005;34(2):316-326.
5. Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *American journal of public health*. 1992;82(6):816-820.
6. Gershon AS, Dolmage TE, Stephenson A, Jackson B. Chronic obstructive pulmonary disease and socioeconomic status: a systematic review. *Copd*. 2012;9(3):216-226.
7. Prescott E, Vestbo J. Socioeconomic status and chronic obstructive pulmonary disease. *Thorax*. 1999;54(8):737-741.
8. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. *Circulation*. 1993;88(4 Pt 1):1973-1998.
9. Clegg LX, Reichman ME, Miller BA, et al. Impact of socioeconomic status on cancer incidence and stage at diagnosis: selected findings from the surveillance, epidemiology, and end results: National Longitudinal Mortality Study. *Cancer causes & control : CCC*. 2009;20(4):417-435.
10. Bashinskaya B, Nahed BV, Walcott BP, Coumans JV, Onuma OK. Socioeconomic status correlates with the prevalence of advanced coronary artery disease in the United States. *PloS one*. 2012;7(9):e46314.
11. Bacon SL, Bouchard A, Loucks EB, Lavoie KL. Individual-level socioeconomic status is associated with worse asthma morbidity in patients with asthma. *Respiratory research*. 2009;10:125.
12. Liao Y, McGee DL, Kaufman JS, Cao G, Cooper RS. Socioeconomic status and morbidity in the last years of life. *American journal of public health*. 1999;89(4):569-572.
13. Mackenbach JP. Socio-economic health differences in The Netherlands: a review of recent empirical findings. *Social science & medicine (1982)*. 1992;34(3):213-226.
14. Cella DF, Orav EJ, Kornblith AB, et al. Socioeconomic status and cancer survival. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology*. 1991;9(8):1500-1509.
15. Adler NE, Ostrove JM. Socioeconomic status and health: what we know and what we don't. *Annals of the New York Academy of Sciences*. 1999;896:3-15.
16. Adler NE, Boyce T, Chesney MA, et al. Socioeconomic status and health. The challenge of the gradient. *The American psychologist*. 1994;49(1):15-24.
17. Adler NE, Newman K. Socioeconomic disparities in health: pathways and policies. *Health affairs*. 2002;21(2):60-76.

18. Wilkinson RG. Socioeconomic determinants of health. Health inequalities: relative or absolute material standards? *BMJ (Clinical research ed)*. 1997;314(7080):591-595.
19. Marmot MG, Rose G, Shipley M, Hamilton PJ. Employment grade and coronary heart disease in British civil servants. *Journal of epidemiology and community health*. 1978;32(4):244-249.
20. Marmot MG, Smith GD, Stansfeld S, et al. Health inequalities among British civil servants: the Whitehall II study. *Lancet*. 1991;337(8754):1387-1393.
21. Wilkinson RG, Pickett KE. Income inequality and population health: a review and explanation of the evidence. *Social science & medicine (1982)*. 2006;62(7):1768-1784.
22. Marmot MG. Status syndrome: a challenge to medicine. *JAMA : the journal of the American Medical Association*. 2006;295(11):1304-1307.
23. Marmot M. The health gap: the challenge of an unequal world. *Lancet*. 2015;386(10011):2442-2444.
24. Sen A. *Development as Freedom*. Toronto: Alfred A. Knopf, Inc.; 1999.
25. Gehlert S, Sohmer D, Sacks T, Mininger C, McClintock M, Olopade O. Targeting health disparities: a model linking upstream determinants to downstream interventions. *Health affairs*. 2008;27(2):339-349.
26. Shively CA, Day SM. Social inequalities in health in nonhuman primates. *Neurobiology of stress*. 2015;1:156-163.
27. Cavigelli SA, Chaudhry HS. Social status, glucocorticoids, immune function, and health: can animal studies help us understand human socioeconomic-status-related health disparities? *Hormones and behavior*. 2012;62(3):295-313.
28. Snyder-Mackler N, Sanz J, Kohn JN, et al. Social status alters immune regulation and response to infection in macaques. *Science (New York, NY)*. 2016;354(6315):1041-1045.
29. Sapolsky RM. The influence of social hierarchy on primate health. *Science (New York, NY)*. 2005;308(5722):648-652.
30. Pickett KE, Wilkinson RG. Income inequality and health: a causal review. *Social science & medicine (1982)*. 2015;128:316-326.
31. Kawachi I, Kennedy BP, Lochner K, Prothrow-Stith D. Social capital, income inequality, and mortality. *American journal of public health*. 1997;87(9):1491-1498.
32. Adler NE, Epel ES, Castellazzo G, Ickovics JR. Relationship of subjective and objective social status with psychological and physiological functioning: preliminary data in healthy white women. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*. 2000;19(6):586-592.
33. Goodman E, Adler NE, Kawachi I, Frazier AL, Huang B, Colditz GA. Adolescents' perceptions of social status: development and evaluation of a new indicator. *Pediatrics*. 2001;108(2):E31.
34. Ostrove JM, Adler NE, Kuppermann M, Washington AE. Objective and subjective assessments of socioeconomic status and their relationship to self-rated health in an ethnically diverse sample of pregnant women. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*. 2000;19(6):613-618.
35. Singh-Manoux A, Adler NE, Marmot MG. Subjective social status: its determinants and its association with measures of ill-health in the Whitehall II study. *Social science & medicine*. 2003;56(6):1321-1333.

36. Adler N, Stewart J. The MacArthur Scale of Subjective Social Status. 2008; <http://www.macses.ucsf.edu/research/psychosocial/subjective.php>. Accessed October 3, 2016.
37. Wolff LS, Subramanian SV, Acevedo-Garcia D, Weber D, Kawachi I. Compared to whom? Subjective social status, self-rated health, and referent group sensitivity in a diverse US sample. *Social science & medicine (1982)*. 2010;70(12):2019-2028.
38. Lundberg J, Kristenson M. Is subjective status influenced by psychosocial factors? *Social Indicators Research*. 2008;89(3):375-390.
39. Shaked D, Williams M, Evans MK, Zonderman AB. Indicators of subjective social status: Differential associations across race and sex. *SSM-Population Health*. 2016;2:700-707.
40. Ghaed SG, Gallo LC. Subjective social status, objective socioeconomic status, and cardiovascular risk in women. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*. 2007;26(6):668-674.
41. Brown RA, Adler NE, Worthman CM, Copeland WE, Costello EJ, Angold A. Cultural and community determinants of subjective social status among Cherokee and White youth. *Ethnicity & health*. 2008;13(4):289-303.
42. Demakakos P, Nazroo J, Breeze E, Marmot M. Socioeconomic status and health: the role of subjective social status. *Social science & medicine (1982)*. 2008;67(2):330-340.
43. Hu P, Adler NE, Goldman N, Weinstein M, Seeman TE. Relationship between subjective social status and measures of health in older Taiwanese persons. *Journal of the American Geriatrics Society*. 2005;53(3):483-488.
44. Franzini L, Fernandez-Esquer ME. The association of subjective social status and health in low-income Mexican-origin individuals in Texas. *Social science & medicine (1982)*. 2006;63(3):788-804.
45. Singh-Manoux A, Marmot MG, Adler NE. Does subjective social status predict health and change in health status better than objective status? *Psychosomatic medicine*. 2005;67(6):855-861.
46. Operario D, Adler NE, Williams DR. Subjective social status: Reliability and predictive utility for global health. *Psychology & Health*. 2004;19(2):237-246.
47. Honjo K, Kawakami N, Tsuchiya M, Sakurai K. Association of subjective and objective socioeconomic status with subjective mental health and mental disorders among Japanese men and women. *International journal of behavioral medicine*. 2014;21(3):421-429.
48. Reitzel LR, Nguyen N, Strong LL, Wetter DW, McNeill LH. Subjective social status and health behaviors among African Americans. *American journal of health behavior*. 2013;37(1):104-111.
49. Reitzel LR, Buchanan TS, Nguyen N, Ahluwalia JS. Associations of subjective social status with nondaily and daily smoking. *American journal of health behavior*. 2014;38(2):245-253.
50. Ritterman ML, Fernald LC, Ozer EJ, Adler NE, Gutierrez JP, Syme SL. Objective and subjective social class gradients for substance use among Mexican adolescents. *Social science & medicine (1982)*. 2009;68(10):1843-1851.
51. Whembolua GL, Davis JT, Reitzel LR, et al. Subjective social status predicts smoking abstinence among light smokers. *American journal of health behavior*. 2012;36(5):639-646.

52. Kangovi S, Barg FK, Carter T, et al. Challenges faced by patients with low socioeconomic status during the post-hospital transition. *Journal of general internal medicine*. 2014;29(2):283-289.
53. Strunin L, Stone M, Jack B. Understanding rehospitalization risk: can hospital discharge be modified to reduce recurrent hospitalization? *Journal of hospital medicine : an official publication of the Society of Hospital Medicine*. 2007;2(5):297-304.
54. Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. *Public health reports (Washington, DC : 1974)*. 2014;129 Suppl 2:19-31.
55. Jackman MR, Jackman RW. An interpretation of the relation between objective and subjective social status. *American sociological review*. 1973;38(5):569-582.
56. Hegar R, Doring A, Mielck A. [Relevance of 'subjective social status' for health risks and health status - results from the KORA-F4-study]. *Gesundheitswesen*. 2012;74(5):306-314.
57. Kowall B, Rathmann W, Strassburger K, Meisinger C, Holle R, Mielck A. Socioeconomic status is not associated with type 2 diabetes incidence in an elderly population in Germany: KORA S4/F4 cohort study. *J Epidemiol Community Health*. 2011;65(7):606-612.
58. Pham-Kanter G. Social comparisons and health: can having richer friends and neighbors make you sick? *Social science & medicine (1982)*. 2009;69(3):335-344.
59. Karraker AW. *Feeling poor and being sick: Three essays on social status, psychosocial resources, and health*. US, University of Wisconsin-Madison; 2012.
60. Theodossiou I, Zangelidis A. The social gradient in health: the effect of absolute income and subjective social status assessment on the individual's health in Europe. *Econ Hum Biol*. 2009;7(2):229-237.
61. Cooper DC, Milic MS, Mills PJ, Bardwell WA, Ziegler MG, Dimsdale JE. Endothelial function: the impact of objective and subjective socioeconomic status on flow-mediated dilation. *Annals of behavioral medicine : a publication of the Society of Behavioral Medicine*. 2010;39(3):222-231.
62. Euteneuer F, Mills PJ, Rief W, Ziegler MG, Dimsdale JE. Subjective social status predicts in vivo responsiveness of beta-adrenergic receptors. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*. 2012;31(4):525-529.
63. Gruenewald TL, Kemeny ME, Aziz N. Subjective social status moderates cortisol responses to social threat. *Brain, behavior, and immunity*. 2006;20(4):410-419.
64. McEwen BS, Gianaros PJ. Central role of the brain in stress and adaptation: links to socioeconomic status, health, and disease. *Annals of the New York Academy of Sciences*. 2010;1186:190-222.
65. Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. *JAMA : the journal of the American Medical Association*. 2000;283(15):2008-2012.
66. Kilpatrick F, Cantril H. Self-anchoring scaling: A measure of individuals' unique reality worlds. *Journal of Individual Psychology*. 1960;16:158-173.
67. Demakakos P, Marmot M, Steptoe A. Socioeconomic position and the incidence of type 2 diabetes: The ELSA study. *European Journal of Epidemiology*. 2012;27(5):367-378.

68. Zhang J, Yu KF. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA : the journal of the American Medical Association*. 1998;280(19):1690-1691.
69. Adler N, Singh-Manoux A, Schwartz J, Stewart J, Matthews K, Marmot MG. Social status and health: A comparison of British civil servants in Whitehall-II with European- and African-Americans in CARDIA. *Social Science & Medicine*. 2008;66(5):1034-1045.
70. Demakakos P, Nazroo J, Breeze E, Marmot M. Socioeconomic status and health: the role of subjective social status. *Social Science & Medicine*. 2008;67(2):330-340.
71. Frerichs L, Huang TT, Chen DR. Associations of subjective social status with physical activity and body mass index across four Asian countries. *J Obes*. 2014;2014:710602.
72. Singh-Manoux A, Adler NE, Marmot MG. Subjective social status: its determinants and its association with measures of ill-health in the Whitehall II study. *Soc Sci Med*. 2003;56(6):1321-1333.
73. Subramanyam MA, Diez-Roux AV, Hickson DA, et al. Subjective social status and psychosocial and metabolic risk factors for cardiovascular disease among African Americans in the Jackson Heart Study. *Soc Sci Med*. 2012;74(8):1146-1154.
74. Woo J, Lynn H, Leung J, Wong SY. Self-perceived social status and health in older Hong Kong Chinese women compared with men. *Women Health*. 2008;48(2):209-234.
75. Cross IH. *Subjective social status: Individual and neighborhood-level determinants in association with measures of health and health promoting behaviors*. US, University of Maryland; 2010.
76. Reitzel LR, Nguyen N, Strong LL, Wetter DW, McNeill LH. Subjective social status and health behaviors among African Americans. *American Journal of Health Behavior*. 2013;37(1):104-111.
77. Manuck SB, Phillips JE, Gianaros PJ, Flory JD, Muldoon MF. Subjective socioeconomic status and presence of the metabolic syndrome in midlife community volunteers. *Psychosom Med*. 2010;72(1):35-45.
78. Duval S, Tweedie R. A nonparametric "trim and fill" method of accounting for publication bias in meta-analysis. *Journal of the American Statistical Association*. 2000;95(449):89-98.
79. Wilkinson RG, Pickett KE. The problems of relative deprivation: why some societies do better than others. *Social science & medicine (1982)*. 2007;65(9):1965-1978.
80. Brunner E. Socioeconomic determinants of health: stress and the biology of inequality. *BMJ (Clinical research ed)*. 1997;314(7092):1472.
81. Sapolsky RM. Endocrinology alfresco: psychoendocrine studies of wild baboons. *Recent progress in hormone research*. 1993;48:437.
82. Shively CA, Clarkson TB. Social status and coronary artery atherosclerosis in female monkeys. *Arteriosclerosis, Thrombosis, and Vascular Biology*. 1994;14(5):721-726.
83. Shively CA, Register TC, Clarkson TB. Social stress, visceral obesity, and coronary artery atherosclerosis: product of a primate adaptation. *American journal of primatology*. 2009;71(9):742-751.
84. Layte R, Whelan CT. Who feels inferior? a test of the status anxiety hypothesis of social inequalities in health. *European Sociological Review*. 2014;jcu057.
85. Kim D, Kawachi I, Hoorn SV, Ezzati M. Is inequality at the heart of it? Cross-country associations of income inequality with cardiovascular diseases and risk factors. *Social science & medicine (1982)*. 2008;66(8):1719-1732.

86. Hemingway H, Marmot M. Evidence based cardiology: psychosocial factors in the aetiology and prognosis of coronary heart disease. Systematic review of prospective cohort studies. *BMJ (Clinical research ed)*. 1999;318(7196):1460-1467.
87. Marmot M. *The Status Syndrome: How Social Standing Affects Our Health and Longevity*. New York: Times Books: Henry Holt and Company; 2004.
88. Bosma H, Peter R, Siegrist J, Marmot M. Two alternative job stress models and the risk of coronary heart disease. *American journal of public health*. 1998;88(1):68-74.
89. Rosenfield S. Triple jeopardy? Mental health at the intersection of gender, race, and class. *Social science & medicine (1982)*. 2012;74(11):1791-1801.
90. Wolff LS, Acevedo-Garcia D, Subramanian SV, Weber D, Kawachi I. Subjective social status, a new measure in health disparities research: do race/ethnicity and choice of referent group matter? *Journal of health psychology*. 2010;15(4):560-574.
91. Reitzes DC, Mutran EJ. Multiple roles and identities: Factors influencing self-esteem among middle-aged working men and women. *Social Psychology Quarterly*. 1994:313-325.
92. Acheson D. *Independent Inquiry into Inequalities in Health Report*. London, UK1998.
93. Marmot M. *Fair Society, Health Lives: The Marmot Review*. 2010.
94. Alter DA, Franklin B, Ko DT, et al. Socioeconomic status, functional recovery, and long-term mortality among patients surviving acute myocardial infarction. *PloS one*. 2014;8(6):e65130.
95. Bernheim SM, Spertus JA, Reid KJ, et al. Socioeconomic disparities in outcomes after acute myocardial infarction. *American heart journal*. 2007;153(2):313-319.
96. Lindenauer PK, Lagu T, Rothberg MB, et al. Income inequality and 30 day outcomes after acute myocardial infarction, heart failure, and pneumonia: retrospective cohort study. *BMJ (Clinical research ed)*. 2013;346:f521.
97. Shah SJ, Krumholz HM, Reid KJ, et al. Financial stress and outcomes after acute myocardial infarction. *PloS one*. 2012;7(10):e47420.
98. Edmondson D, Green P, Ye S, Halazun HJ, Davidson KW. Psychological stress and 30-day all-cause hospital readmission in acute coronary syndrome patients: an observational cohort study. *PloS one*. 2014;9(3):e91477.
99. Ghaed SG, Gallo LC. Subjective social status, objective socioeconomic status, and cardiovascular risk in women. *Health Psychol*. 2007;26(6):668-674.
100. Adler N, Singh-Manoux A, Schwartz J, Stewart J, Matthews K, Marmot MG. Social status and health: a comparison of British civil servants in Whitehall-II with European- and African-Americans in CARDIA. *Soc Sci Med*. 2008;66(5):1034-1045.
101. Demakakos P, Marmot M, Steptoe A. Socioeconomic position and the incidence of type 2 diabetes: the ELSA study. *Eur J Epidemiol*. 2012;27(5):367-378.
102. Demakakos P, Nazroo J, Breeze E, Marmot M. Socioeconomic status and health: the role of subjective social status. *Soc Sci Med*. 2008;67(2):330-340.
103. Tang KL, Rashid R, Godley J, Ghali WA. Association between subjective social status and cardiovascular disease and cardiovascular risk factors: a systematic review and meta-analysis. *BMJ open*. 2016;6(3):e010137.
104. Shanmugasagaram S, Oh P, Reid RD, McCumber T, Grace SL. Cardiac rehabilitation barriers by rurality and socioeconomic status: a cross-sectional study. *International journal for equity in health*. 2013;12:72.

105. Tsui CK, Shanmugasagaram S, Jamnik V, Wu G, Grace SL. Variation in patient perceptions of healthcare provider endorsement of cardiac rehabilitation. *Journal of cardiopulmonary rehabilitation and prevention*. 2012;32(4):192-197.
106. Das S, O'Keefe JH. Behavioral cardiology: recognizing and addressing the profound impact of psychosocial stress on cardiovascular health. *Current atherosclerosis reports*. 2006;8(2):111-118.
107. Gage-Bouchard EA, Devine KA. Examining parents' assessments of objective and subjective social status in families of children with cancer. *PloS one*. 2014;9(3):e89842.
108. Uphoff EP, Pickett KE, Cabieses B, Small N, Wright J. A systematic review of the relationships between social capital and socioeconomic inequalities in health: a contribution to understanding the psychosocial pathway of health inequalities. *International journal for equity in health*. 2013;12:54.
109. GRACE Variable Definitions—Version of March 2006. [http://www.outcomes-umassmed.org/grace/Files/Standard\\_Definitions.pdf](http://www.outcomes-umassmed.org/grace/Files/Standard_Definitions.pdf). Accessed February 17, 2015.
110. Pilote L, Karp I. GENESIS-PRAXY (GENdEr and Sex detErminantS of cardiovascular disease: From bench to beyond-Premature Acute Coronary SYndrome). *American heart journal*. 2012;163(5):741-746 e742.
111. Giatti L, do Valle Camelo L, de Castro Rodrigues JF, Barreto SM. Reliability of the MacArthur scale of subjective social status-Brazilian Longitudinal Study of Adult Health (ELSA-Brasil). *BMC public health*. 2012;12(1):1096.
112. Nobles J, Weintraub MR, Adler NE. Subjective socioeconomic status and health: relationships reconsidered. *Social science & medicine (1982)*. 2013;82:58-66.
113. Schnittker J, McLeod JD. The social psychology of health disparities. *Annual Review of Sociology*. 2005:75-103.
114. Taylor SE, Seeman TE. Psychosocial resources and the SES-health relationship. *Annals of the New York Academy of Sciences*. 1999;896:210-225.
115. Putnam RD. *Bowling Alone*. New York: Simon & Schuster; 2000.
116. Derose KP, Varda DM. Social capital and health care access: a systematic review. *Medical care research and review : MCRR*. 2009;66(3):272-306.
117. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS medicine*. 2010;7(7):e1000316.
118. Gage E. Abstract B20: Examining measures of socioeconomic status for cancer disparities research. *Cancer Epidemiology Biomarkers & Prevention*. 2011;20(10 Supplement):B20-B20.
119. Chew LD, Bradley KA, Boyko EJ. Brief questions to identify patients with inadequate health literacy. *Family medicine*. 2004;36(8):588-594.
120. Morris NS, MacLean CD, Chew LD, Littenberg B. The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability. *BMC family practice*. 2006;7:21.
121. Marvanova M, Roumie CL, Eden SK, Cawthon C, Schnipper JL, Kripalani S. Health literacy and medication understanding among hospitalized adults. *Journal of hospital medicine : an official publication of the Society of Hospital Medicine*. 2011;6(9):488-493.
122. Moser A, Stuck AE, Silliman RA, Ganz PA, Clough-Gorr KM. The eight-item modified Medical Outcomes Study Social Support Survey: psychometric evaluation showed excellent performance. *Journal of clinical epidemiology*. 2012;65(10):1107-1116.

123. Statistics Canada. Barriers to Care for People with Chronic Health Conditions (BCPCHC). 2012;  
<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5189&lang=en&db=imdb&adm=8&dis=2>. Accessed January 25, 2015.
124. Statistics Canada. Canadian Community Health Survey (CCHS): Healthy Aging. 2008-2009;  
[http://www23.statcan.gc.ca/imdb/pIX.pl?Function=showStaticArchiveHTML&a=1&fl=http://www23.statcan.gc.ca/imdb-bmdi/instrument/5146\\_Q1\\_V2-eng.htm&Item\\_Id=53430](http://www23.statcan.gc.ca/imdb/pIX.pl?Function=showStaticArchiveHTML&a=1&fl=http://www23.statcan.gc.ca/imdb-bmdi/instrument/5146_Q1_V2-eng.htm&Item_Id=53430). Accessed January 25, 2015.
125. Coppola F. Finland's Experiment Is Not Universal Basic Income - But It's Still Worthwhile. *Forbes*2016.
126. Theorell T, Hammarstrom A, Aronsson G, et al. A systematic review including meta-analysis of work environment and depressive symptoms. *BMC public health*. 2015;15:738.
127. Stansfeld S, Candy B. Psychosocial work environment and mental health--a meta-analytic review. *Scandinavian journal of work, environment & health*. 2006;32(6):443-462.
128. Chuang YC, Chuang KY, Yang TH. Social cohesion matters in health. *International journal for equity in health*. 2013;12:87.
129. Social isolation in community-dwelling seniors: an evidence-based analysis. *Ontario health technology assessment series*. 2008;8(5):1-49.
130. Huberty JL, Vener J, Ransdell L, Schulte L, Budd MA, Gao Y. Women bound to be active (years 3 and 4): can a book club help women overcome barriers to physical activity and improve self-worth? *Women & health*. 2010;50(1):88-106.
131. Greaves CJ, Farbus L. Effects of creative and social activity on the health and well-being of socially isolated older people: outcomes from a multi-method observational study. *The journal of the Royal Society for the Promotion of Health*. 2006;126(3):134-142.
132. DuBois DL, Portillo N, Rhodes JE, Silverthorn N, Valentine JC. How Effective Are Mentoring Programs for Youth? A Systematic Assessment of the Evidence. *Psychological science in the public interest : a journal of the American Psychological Society*. 2011;12(2):57-91.

## Appendix A: Search strategy in Medline

1. exp Social Class/
2. exp Self Concept/
3. exp Social Perception/
4. 2 or 3
5. 1 and 4
6. (social status\* or social position\* or social standing\* or social class\* or social rank\* or socioeconomic status\* or socioeconomic position\* or socioeconomic standing\* or socioeconomic class\* or socioeconomic rank\*).ti,ab.
7. (perceiv\* or subjective\* or perception\* or belief\*).ti,ab.
8. ((perceiv\* or subjective\* or perception\* or belief\*) adj4 (social status\* or social position\* or social standing\* or social class\* or social rank\* or socioeconomic status\* or socioeconomic position\* or socioeconomic standing\* or socioeconomic class\* or socioeconomic rank\*)).ti,ab.
9. 4 and 6
10. 5 or 8 or 9
11. limit 10 to ("all infant (birth to 23 months)" or "all child (0 to 18 years)")
12. 10 not 11
13. limit 10 to "all adult (19 plus years)"
14. 12 or 13

**Appendix B: Copyright permission for use of MacArthur Scales of Subjective Social Status**

**From:** Clancey, Kaitlin [redacted]  
**Subject:** RE: Permission for use of MacArthur Scales of Subjective Social Status images in MSc thesis  
**Date:** January 5, 2017 at 3:08 PM  
**To:** Karen Tang [redacted]



Hello Karen,

I can help with you this. I have attached the Ladder packet, please read through and follow the guidelines. We are okay with you using the images, we just ask you cite them.

Thank you!  
**Kaitlin Clancey**  
*Program Assistant*  
*Center for Health and Community*  
*University of California, San Francisco*



---

**From:** Da Luz, Michael  
**Sent:** Wednesday, January 04, 2017 2:49 PM  
**To:** Karen Tang  
**Cc:** Clancey, Kaitlin  
**Subject:** RE: Permission for use of MacArthur Scales of Subjective Social Status images in MSc thesis

Hello Karen,

I am no longer with the Center for Health & Community and MacArthur Research Network on SES and Health. I've forwarded this email to my old colleagues who will respond to you soon.

Thank you,

**Michael Da Luz**  
Financial Analyst  
UCSF School of Medicine  
Dean's Office Financial Affairs Unit



---

**From:** Karen Tang [redacted]  
**Sent:** Wednesday, January 04, 2017 2:44 PM  
**To:** Da Luz, Michael  
**Subject:** Permission for use of MacArthur Scales of Subjective Social Status images in MSc thesis

Dear MacArthur Research Network on SES and Health,

I am preparing my thesis as an MSc candidate at the University of Calgary. The thesis is entitled “Subjective social status and its associations with social vulnerabilities and health”.

I hope to include exact images of the SES/US and community ladders in this thesis, given its relevance and importance to the thesis. I am requesting your permission to reproduce these images in the thesis document. The images in question are from:

<http://www.macses.ucsf.edu/research/psychosocial/usladder.php>

<http://www.macses.ucsf.edu/research/psychosocial/commladder.php>

Once submitted, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

I thank-you kindly for your consideration. Please let me know if I can provide any further clarification.

Best Regards,

Karen Tang  
MSc student  
University of Calgary



1. Cover letter  
for ladders.doc



2. Ladder Figure  
Questi...res.pdf



3. Objective &  
Subjec...en.pdf



4. Subjective &  
Objecti...en.pdf



5. Singh-  
Manou...allll.pdf



6. Adolescents'  
Percep...tus.pdf



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April 24, 2017

Dear Colleague,

I'm pleased that you are interested in our measure of subjective social status. The MacArthur Subjective Status Scale (SSS) was designed to assess self-perceived social ranking. Previous research has examined social class identification, but generally found little variance in how individuals label themselves: the vast majority identify themselves as middle class. Despite the fact that there are only moderate intercorrelations amongst the different indicators of SES (income, education, occupation), each of these indicators has shown relationships with health. These associations may be due to the unique set of resources associated with each indicator and/or to the common element of social stratification represented in each measure.

The MacArthur SSS was developed to capture the common sense of social status across the SES indicators. In an easy pictorial format, it presents a "social ladder" and asks individuals to place an "X" on the rung on which they feel they stand. There are two versions of the ladder: one linked to traditional SES indicators (SES ladder) and the second linked to standing in one's community (community ladder). The difference between these two ladders may be of particular interest in poorer communities in which individuals may not be high on the SES ladder in terms of income, occupation, or education, but may have high standing within social groups such as a religious or local community. Insofar social standing has beneficial effects on biological processes related to health, standing on the community ladder may be as important as standing on the SES ladder. Ideally, it would be best to use both ladders (and, if so, one should have participants complete the community ladder first so responses to it aren't keyed to the SES indicators which are described for the SES ladder). If the research is investigating traditional SES, it will be of particular importance to use the SES ladder to be able to make comparisons between objective and subjective SES.

The scoring is simple. It is scored "1" if there is an "X" on the lowest rung or in the space just above it, "2" for the next rung or in the space above, and so on, up to the top rung which is scored "10."

Also attached are copies of four papers which report on the ladder. The four papers are:

- Adler, N.E., Epel, E. Castellazzo, G., & Ickovics, J. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy white women. *Health Psychology, 19*(6), 586-592.
- Ostrove, J.M., Adler, N.E., Kuppermann, M., & Washington, A. E. (2000). Objective and subjective assessments of socioeconomic status and their relationship to self-rated health in an ethnically diverse sample of pregnant women. *Health Psychology, 19*(6), 613-618.

Goodman, E., Adler, N.E., Kawachi, I., Frazier, A.L., Huang, B., & Colditz, G.A. (2001). Adolescents' perceptions of social standing: Development and evaluation of a new indicator. *Pediatrics*, *108*(2) Retrieved August 30, 2001, from <http://www.pediatrics.org/cgi/content/full/108/2/e31>

Singh-Manoux, A., Adler, N.E., & Marmot, M.G. (2003). Subjective social status: Its determinants and its association with measures of ill-health in the Whitehall II study. *Social Science and Medicine*, *56*, 1321-1333.

A number of researchers are now using the ladders, and it will be very valuable to be able to link the findings to examine the relationship of subjective and objective measures and of subjective rankings with health in different populations. If you use the ladder, I would appreciate it if you would let me know what you find. It would be good if you would cite it as the "MacArthur Scale of Subjective Status" with reference to the validation papers. If you would like any further collaboration on your work with the ladder, please let me know.

Sincerely,

Nancy E. Adler, Ph.D.  
Professor of Medical Psychology  
Chair, MacArthur Network on SES & Health

NEA:mv

## **Appendix C: Co-Author permissions for inclusion of manuscripts into thesis**

**From:** Jenny Godley [redacted]  
**Subject:** Re: Permission request to include manuscripts into MSc thesis  
**Date:** January 4, 2017 at 5:16 PM  
**To:** Karen Tang [redacted]



Of course!  
- Jenny

---

**From:** Karen Tang  
**Sent:** Wednesday, January 4, 2017 3:54:57 PM  
**To:** Jenny Godley  
**Subject:** Permission request to include manuscripts into MSc thesis

Hi Jenny,

I am preparing my MSc dissertation, entitled "Subjective social status and its associations with social vulnerabilities and health".

I am seeking your permission as a co-author to include our two manuscripts, titled Association between subjective social status and cardiovascular disease and cardiovascular risk factors: A systematic review and meta-analysis and An exploration of the subjective social status construct in patients with acute coronary syndrome, into the thesis. Each manuscript will form a chapter of the thesis, and comprises two of three sub-studies that are included.

Once submitted to the University of Calgary, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

Thank-you so much for your consideration,

Karen

**From:** Ruksana Shirin Rashid [redacted]  
**Subject:** Re: Permission request to include manuscript into MSc thesis  
**Date:** January 4, 2017 at 9:21 PM  
**To:** Karen Tang [redacted]



Hi Karen,

Nice to hear from you. Please go ahead.

Thanks.

Regards,  
Ruksana

Ruksana Rashid  
M.B.B.S., MPH, M.Sc.



---

**From:** Karen Tang  
**Sent:** Wednesday, January 4, 2017 4:01:13 PM  
**To:** Ruksana Shirin Rashid  
**Subject:** Permission request to include manuscript into MSc thesis

Hi Ruksana,

I am preparing my MSc dissertation, entitled "Subjective social status and its associations with social vulnerabilities and health".

I am seeking your permission as a co-author to include our manuscripts, titled Association between subjective social status and cardiovascular disease and cardiovascular risk factors: A systematic review and meta-analysis into the thesis. The manuscript will form a chapter of the thesis, and comprises one of three sub-studies that are included.

Once submitted to the University of Calgary, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

Thank-you so much for your consideration,

Karen

From: William Ghali [redacted]  
Subject: Re: Permission request to include manuscripts into MSc thesis  
Date: January 4, 2017 at 4:27 PM  
To: Karen Tang [redacted]



Thank you for your email Karen.

I grant permission for this for both manuscripts.  
Bill

---

**From:** Karen Tang  
**Sent:** Wednesday, January 4, 2017 3:56 PM  
**To:** William Ghali  
**Subject:** Permission request to include manuscripts into MSc thesis

Hi Bill,

I am preparing my MSc dissertation, entitled “Subjective social status and its associations with social vulnerabilities and health”.

I am seeking your permission as a co-author to include our manuscripts, titled Association between subjective social status and cardiovascular disease and cardiovascular risk factors: A systematic review and meta-analysis and An exploration of the subjective social status construct in patients with acute coronary syndrome, into the thesis. Each manuscript will form a chapter of the thesis, and comprises two of three sub-studies that are included.

Once submitted to the University of Calgary, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

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Thank-you,

Karen



**From:** Louise Pilote, Dr. [redacted]  
**Subject:** Re: Permission request to include manuscript into MSc thesis  
**Date:** January 4, 2017 at 3:56 PM  
**To:** Karen Tang [redacted]

---

Hi Karen  
Sure I am good with that.

Happy New Year  
Louise  
Sent from my iPhone

On Jan 4, 2017, at 5:52 PM, Karen Tang [redacted] wrote:

I am seeking your permission as a co-author to include our manuscript

**From:** Karen Tang [redacted]  
**Subject:** Permission request to include manuscript into MSc thesis  
**Date:** January 4, 2017 at 3:51 PM  
**To:** Louise Pilote - McGill [redacted]



Hi Louise,

I am preparing my MSc dissertation, entitled “Subjective social status and its associations with social vulnerabilities and health”.

I am seeking your permission as a co-author to include our manuscript, titled [An exploration of the subjective social status construct in patients with acute coronary syndrome](#), into the thesis. This manuscript will form a chapter of the thesis, and comprises one of three sub-studies that are included.

Once submitted to the University of Calgary, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

Thank-you so much for your consideration,

Karen

**Re: PRAXY "SSS Concordance"**

Hassan Behloui



**Sent:** January 10, 2017 11:05 AM

**To:** Jasmine Poole  Karen Tang

hello Karen

it is ok

good luke for your thesis

**Hassan Behloui, Ing. PhD Biostatistician**  
**Division of Clinical Epidemiology**  
**Research Institute of the McGill University Health Centre**



**From:** Karen Tang [redacted]  
**Subject:** Permission request to include manuscript into MSc thesis  
**Date:** January 4, 2017 at 3:52 PM  
**To:** Hassan Behlouli [redacted]

---



Hi Hassan,

I am preparing my MSc dissertation, entitled “Subjective social status and its associations with social vulnerabilities and health”.

I am seeking your permission as a co-author to include our manuscript, titled [An exploration of the subjective social status construct in patients with acute coronary syndrome](#), into the thesis. This manuscript will form a chapter of the thesis, and comprises one of three sub-studies that are included.

Once submitted to the University of Calgary, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

Thank-you so much for your consideration,

Karen

**From:** Maria Santana [redacted]  
**Subject:** Re: SSS and Social Vulnerabilities- Permission request and Feedback  
**Date:** February 8, 2017 at 11:35 AM  
**To:** Karen Tang [redacted], Doreen Rabi [redacted], Braden Manns [redacted]  
**Cc:** William Ghali [redacted]



Karen,

Permission granted!

Maria

Maria Jose Santana, MPharm, MRPharmS, PhD

Research Assistant Professor  
Associate Director SPOR Methods Platform

O'Brien Institute for Public Health  
Cumming School of Medicine  
University of Calgary  
[www.w21c.org](http://www.w21c.org)  
[www.themethodshub.com](http://www.themethodshub.com)



TMH logo signature



Email Signature SPOR\_platform\_methods\_support



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**From:** Karen Tang  
**Sent:** Thursday, February 2, 2017 3:36:23 PM  
**To:** Doreen Rabi [redacted]; Maria Santana; Braden Manns [redacted]  
**Cc:** William Ghali  
**Subject:** SSS and Social Vulnerabilities- Permission request and Feedback

Dear all,

As you know, I've drafted a manuscript paper, titled Subjective social status and its association with social vulnerabilities: A cross-sectional study of medical inpatients, based on our readmissions study. I have a couple of questions/requests:

1) I am seeking your permission as a co-author to include a version of this manuscript into my MSc thesis for final submission. The manuscript forms a chapter of the thesis, and comprises one of three sub-studies that are included.

Once submitted to the University of Calgary, the thesis document will be added to the University of Calgary Theses Repository (<http://theses.ucalgary.ca>) and Library and Archives Canada (<http://www.bac-lac.gc.ca/eng/services/theses/Pages/theses-canada.aspx>). By signing a non-exclusive license with Library and Archives Canada, I will be giving permission for them to save, reproduce, and make the thesis available (either electronically or in print), for non-commercial purposes, to the public.

2) Do you have any feedback about this manuscript (attached, along with the 5 tables + 1 figure)? We are hoping that it is close to being ready for submission to a journal. We do not have a single target journal in mind, though it will likely be a public health journal. Any suggestions are welcome.

Thanks so much for your support and feedback,

Karen

**From:** William Ghali [redacted]  
**Subject:** Re: SSS and Social Vulnerabilities- Permission request and Feedback  
**Date:** February 5, 2017 at 1:23 AM  
**To:** Karen Tang [redacted]



I consent to inclusion of this in the thesis.

I'll provide comments on the manuscript soon so that you can submit.

---

**From:** Karen Tang  
**Sent:** Thursday, February 2, 2017 3:36 PM  
**To:** Doreen Rabi [redacted]; Maria Santana; Braden Manns [redacted]  
**Cc:** William Ghali  
**Subject:** SSS and Social Vulnerabilities- Permission request and Feedback

Dear all,

As you know, I've drafted a manuscript paper, titled Subjective social status and its association with social vulnerabilities: A cross-sectional study of medical inpatients, based on our readmissions study. I have a couple of questions/requests:

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Thanks so much for your support and feedback,

Karen

**From:** Doreen Rabi [redacted]  
**Subject:** RE: SSS and Social Vulnerabilities- Permission request and Feedback  
**Date:** February 13, 2017 at 8:09 AM  
**To:** Karen Tang [redacted], Maria Santana [redacted], Braden Manns [redacted]  
**Cc:** [redacted]



Hi Karen-

I just wanted to close the loop on this prior to your defense.

I do grant permission to use this paper as part of the thesis.

I will be happy to provide you with comment so the manuscript just after the defense.

Best wishes, Doreen.

Doreen M. Rabi, MD MSc FRCPC  
Associate Professor  
Departments of Medicine, Community Health and Cardiac Sciences  
University of Calgary



---

**From:** Karen Tang [redacted]  
**Sent:** February 2, 2017 3:36 PM  
**To:** Doreen Rabi; Maria Santana; Braden Manns  
**Cc:** [redacted]  
**Subject:** SSS and Social Vulnerabilities- Permission request and Feedback

Dear all,

As you know, I've drafted a manuscript paper, titled Subjective social status and its association with social vulnerabilities: A cross-sectional study of medical inpatients, based on our readmissions study. I have a couple of questions/requests:

1) I am seeking your permission as a co-author to include a version of this manuscript into my MSc thesis for final submission. The manuscript forms a chapter of the thesis, and comprises one of three sub-studies that are included.

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2) Do you have any feedback about this manuscript (attached, along with the 5 tables + 1 figure)? We are hoping that it is close to being ready for submission to a journal. We do not have a single target journal in mind, though it will likely be a public health journal. Any suggestions are welcome.

Thanks so much for your support and feedback,

Karen

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**From:** Braden Manns [redacted]  
**Subject:** permission  
**Date:** February 6, 2017 at 1:30 PM  
**To:** Karen Tang [redacted]



---

Hi Karen: I would be pleased for you to include your manuscript “Subjective social status and its association with social vulnerabilities: A cross-sectional study of medical inpatients” in your graduate thesis,  
Braden

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