What are the Health Consequences of Upward Mobility?

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Abstract

Health disparities by socioeconomic status (SES) have been extensively documented, but less is known about the physical health implications of achieving upward mobility. This article critically reviews the evolving literature in this area, concluding that upward mobility is associated with a tradeoff, whereby economic success and positive mental health in adulthood can come at the expense of physical health, a pattern termed "skin-deep resilience." We consider explanations for this phenomenon, including prolonged high striving, competing demands between the environments upwardly mobile individuals seek to enter and their environments of origin, cultural mismatches between adaptive strategies from their childhood environments and those that are valued in higher SES environments, and the sense of alienation, lack of belonging, and discrimination that upwardly mobile individuals face as they move into spaces set up by and for high SES groups. These stressors are hypothesized to lead to unhealthy behaviors and a dysregulation of biological systems, with implications for cardiometabolic health.

Keywords: upward mobility; socioeconomic status; biological processes; health behaviors; cardiovascular health

What are the Health Consequences of Upward Mobility?

The American dream promises that any child, regardless of his or her family or origin, can ascend the socioeconomic ladder, and enjoy the benefits of high status. For upwardly mobile individuals, those benefits include material wealth, prestige, power, and well-being. But what about physical health?

One might assume that the answer to this question is simple. There is an extensive literature documenting health disparities by socioeconomic status (SES). Individuals of lower SES are at increased risk for chronic diseases, functional disability, and premature mortality (Adler & Stewart, 2010; Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Williams, Mohammed, Leavell, & Collins, 2010). These disparities are evident from early childhood through older adulthood (Schreier & Chen, 2013; Adler & Stewart, 2010).

Given this backdrop, one might assume that upward mobility is beneficial for physical health. But as it turns out, surprisingly little is known about the health of individuals who live the American dream, and achieve SES that is higher than their family of origin. Moreover, evidence has accrued in recent years to suggest that upward mobility may even impose "costs" to physical health, particularly for Americans of color.

The goal of this chapter is to take stock of what is known about the health consequences of upward mobility. We focus on inter-generational mobility, where individuals transition from lower (childhood) SES to higher (adulthood) SES. We first review the empirical evidence regarding links between upward mobility and physical health. Finding an association, we then consider mechanisms that might explain it, providing a theoretical overview of the

unique psychological experiences of upwardly mobile individuals, and the resulting pathways to health of these experiences.

Upward Mobility and Physical Health: Empirical Evidence

Different theoretical accounts exist about expected effects of social mobility on health (Kuh & Ben Shlomo, 2004). One theory is that it is possible to mitigate or reverse the effects of early economic hardship, and thus that those who achieve upward mobility will have better health than those who remain low in SES. This is because achieving higher SES will allow individuals access to better health care and greater opportunities for healthier lifestyles (Savelieva et al., 2017; Pudrovska & Anikputa, 2013). A second, though not inconsistent theory, is that those who achieve upward mobility will have health in between those who stay persistently low in SES and those who have consistently high SES (Pollitt, Rose, & Kaufman, 2005; Hogberg, Cnattingius, Lundholm, Sparen, & Iliadou, 2012). Finally, a third theory is that achieving upward mobility is associated with worse health compared to those who are stable in SES, because the experience of upward mobility is stressful and disrupts social connections, both of which have detrimental effects on health (Prag & Richards, 2019; Hogberg et al., 2012).

Empirical Studies on Upward Mobility and Physical Health

Below we review empirical studies that have examined the association between upward mobility and physical health. Given that a review paper was published on this topic in 2005 (Pollitt et al., 2005), we first summarize its conclusions, then focus on studies published since. The 2005 review addressed lifecourse SES and cardiovascular outcomes and found mixed evidence for social mobility hypotheses. A number of studies included in the review found that cardiovascular health for the upward mobility group was in between, and not significantly

different from, either the persistently low or persistently high SES groups. There were a roughly equivalent number of studies, however, that found some differences between the upwardly mobile group and one of the stable SES groups.

Below we focus on post-2005 articles that contained both measures of childhood and adult SES and evaluated change across these 2 periods. We focused on studies with objective health outcomes– usually physician diagnoses of disease or biomarkers. We searched for articles with terms including: lifecourse socioeconomic, socioeconomic trajectory, childhood socioeconomic, socioeconomic change, health, mortality, cardiovascular, biological. Abstracts of articles returned from searches that were published between 2006 and February 2020 were reviewed. Articles were excluded if they did not contain at least one childhood SES measurement point and at least one adult SES measurement point; if outcomes did not include objective health data (e.g., focused on self-reported health or quality of life); and if studies were published outside the U.S. or western Europe (to avoid mixing effects from developing countries or countries with potentially large cultural differences from the U.S./Europe). The majority of articles used a design in which they divided participants into groups based on childhood versus adult SES (low-low, low-high, high-low, high-high), and hence we summarize comparisons specifically between the low-high and other groups.

Of studies that observed differences in the upwardly mobile group, three focused on low-grade inflammation, a process that contributes to multiple health problems, including diabetes, heart disease, and stroke. These studies found that participants with upward mobility (low-high group) had higher levels of inflammation on at least some markers compared to those who were high SES in childhood and adulthood (high-high) (Castagne et al., 2016; Loucks

et al., 2010; Na-Ek & Demakakos, 2017). Three other studies found that the low-high group had significantly greater risk of experiencing cardiovascular disease or events than the high-high group (Kittleson et al., 2006; Tiikkaja & Hemstrom, 2008; Tiikkaja, Hemstrom, & Vagero, 2009). Finally, one study found that Black women from the low-high group had a higher risk of Type 2 diabetes than those in the high-high group (Beckles et al., 2019).

Of studies that made comparisons with a low-low group, two focused on hypertension. One observed that upward mobility was associated with a lower risk, whereas the other reported a higher risk, of hypertension compared to the group that stayed low in SES (Glover et al., 2020b; Hogberg et al., 2012). One study of obesity did not report statistical comparisons, but figures depicted similar obesity rates for the low-high group as for the low-low group, and higher rates than the high-high group (Heraclides & Brunner, 2010).

One study of mortality reported a statistically significant difference across the four groups, but no specific group comparisons. Based on the figure, the low-high group appeared to fall in between the high-high and low-low groups in risk for mortality (Pudrovska & Anikputa, 2013). Finally, one study found that those with upward mobility had more ideal cardiovascular health than those who were stable in SES across childhood and adulthood (however, stable high and stable low participants were combined into one group, complicating interpretations) (Savelieva et al., 2017).

Of studies that observed null findings, two found no differences between the low-high and high-high groups in terms of mortality (Melchior et al., 2006; Stringhini et al., 2018), and three found no differences in terms of Type 2 diabetes incidence (Lidfeldt, Li, Hu, Manson, & Kawachi, 2007; Smith et al., 2011; Stringhini et al., 2013). One study reported a 55% higher

odds of obesity for the low-high than the high-high group; however this was not significant because the low-high group sample size was very small (James, Fowler-Brown, Raghunathan, & Van Hoewyk, 2006). One study focused on allostatic load, an aggregate of biomarkers associated with disease risk. Here the upward mobility group had allostatic load levels in between the stable low and stable high groups (with no additional effect of mobility on allostatic load after controlling for childhood and adult SES) (Prag & Richards, 2019). Another study compared the upward mobility group to a stable low SES group and found no differences (after including demographic covariates) in the likelihood of having a high risk health trajectory (physician diagnosis of chronic illness across multiple years) (Wilson & Shuey, 2016).

All the studies reviewed above used observational designs, which makes causality difficult to infer. That is, with observational designs, it is possible that there could be selection effects, such that earlier health predisposes individuals to a certain socioeconomic attainment in adulthood, or residual confounding, such that third variables (e.g., genetic factors) both predispose individuals to certain health outcomes and certain socioeconomic attainment in adulthood. Experimental manipulations would provide stronger evidence, but are challenging to implement with respect to SES. One study used a natural experiment, evaluating the health impact of an increase in required years of schooling. Researchers compared the adult health of individuals born in the months after the institution of a national education reform (an increase in the amount of schooling required in France from 14 to 16 years) with those who had just missed the cutoff. They found that blood pressure was higher in those born after, relative to before, the schooling mandate went into effect. This pattern was observed for individuals who came from low social class backgrounds. Among those from high social class backgrounds, the

additional required years of schooling had no impact on blood pressure. These results suggested that upward mobility– or at least increasing one's educational attainment– increased blood pressure in later adulthood for those who grew up low in SES (Courtin et al., 2019).

Summary. Taken together, these more recent studies lead to several conclusions. First is that the health of upwardly mobile individuals tended to be worse than their counterparts who have consistently high SES. This pattern was evident for multiple biomarkers and for cardiovascular outcomes, though not for mortality. However, it is possible that longer follow-ups into older age are needed for mortality differences to be seen. Where there were mixed findings– studies of diabetes– associations between upward mobility and worse health tended to be present in populations of color. These results suggest that not all currently high SES individuals are the same, and that the process of achieving upward mobility may have some negative implications for adult health.

A second conclusion is that the health of those who are upwardly mobile is sometimes better than, but sometimes equivalent to, those who are consistently low in SES. This pattern might suggest that moving up in SES has relatively weak effects on health, given that individuals who achieve high SES in adulthood do not always appear that different from their counterparts who remain low in SES throughout their lives.

Upward Mobility and Health: Patterns in the U.S.

One limitation of the studies reviewed above, at least for understanding health disparities in the U.S., is that many studies do not address the overlap between SES and race/ethnicity because they were conducted in Europe. In the U.S., SES patterns by race/ethnicity, such that Black and Latinx individuals have 2-3 times the poverty level, lower college

graduation rates, and lower earnings and wealth compared to Whites (Williams et al., 2010; Williams, Priest, & Anderson, 2016). A second limitation is that many European studies utilize occupational class to measure SES. In the U.S., SES and mobility may be better represented by markers such as income and wealth. A final issue is that physical and mental health are seldom considered in the same study; instead they are the focus of distinct literatures.

Our group has addressed these issues across three studies. These studies have consistently observed that upward mobility has divergent associations with mental and physical health, particularly amongst individuals of color, a phenomenon we have termed 'skin-deep resilience.' For instance, in a longitudinal study of Black youth, neighborhood poverty was characterized in adolescence. Youth were followed over time to determine who attended college. In young adulthood, we measured allostatic load (a multi-system indicator of health risk, including blood pressure, obesity, and stress hormones), and mental health (substance use: smoking, alcohol and drug use). Among youth from high-poverty neighborhoods, those who made it to college showed lower levels of substance use, but at the same time, higher levels of allostatic load, compared to youth from high-poverty neighborhoods who did not make it to college, and also compared to youth from low-poverty neighborhoods in college (Chen, Miller, Brody, & Lei, 2015).

In a national longitudinal study of U.S. youth, SES in terms of household and neighborhood education, income, and employment was assessed during adolescence. Youth were followed over time and assessed on college attendance. In young adulthood, measures of metabolic syndrome (a cluster of conditions including high blood pressure, obesity, and high glucose levels that increases risk for heart disease and diabetes) and mental health (depression)

were obtained. Young adults who grew up low in SES but finished college had lower levels of depression, but a higher likelihood of metabolic syndrome, compared to young adults who grew up low in SES but did not go to college, or young adults from high SES backgrounds who finished college. These patterns were evident among Black and Latinx participants, but not Whites (Gaydosh, Schorpp, Chen, Miller, & Harris, 2018).

A third study investigated effects of upward mobility in two U.S. national longitudinal samples. SES was defined largely by income. In adulthood, physical health (metabolic syndrome) and mental health (depression, perceived stress) were measured. The upwardly mobile group had mental health profiles better than the persistently low SES group, and sometimes comparable to the persistently high SES group. For example, the low-high group was less likely to have significant depression than the low-low SES group, and was not different in depression from the high-high group across both samples. In contrast, in terms of physical health, the upwardly mobile group was more similar to the low-low group. That is, the low-high group had rates of metabolic syndrome that were significantly higher than the high-high SES group, and not statistically different from the low-low SES group across both samples. In addition, a 'tradeoff' score was created, defined as the absence of significant depression plus the presence of metabolic syndrome within one person. The upwardly mobile group was significantly more likely to display this tradeoff pattern compared to both the persistently high and persistently low SES groups across both samples (Miller, Chen, Yu, & Brody, 2020).

Summary. The results of these studies suggest that upward mobility is associated with a tradeoff, where economic success and good mental health come at the expense of physical health. We refer to this pattern as skin-deep resilience because it suggests that above the skin,

upwardly mobile youth appear to be doing well and achieving successes by many external metrics (going to college, earning good incomes, having positive mental health). However, below the skin, they appear to be struggling physiologically in terms of their physical health, thus displaying resilience that is only skin-deep.

In considering these results, it is important to be cautious about interpretations. Because of their observational designs and the lack of childhood health measures, causality cannot be inferred. It is possible that early childhood health, or other genetic or environmental factors (e.g., genes or exposures that both influence health and one's likelihood of upward mobility) drove the findings. The natural experiment of schooling in France (Courtin et al., 2019), described above, suggests that a causal interpretation is plausible. From a replicability standpoint, the fact that the tradeoff study replicated the same pattern of findings across two different national samples is encouraging. Finally, there is also evidence supporting a causal interpretation from a recent monozygotic twin study of low-grade inflammation. It found that after accounting for potential genetic and environmental confounds, skin-deep resilience patterns were still evident (Chen et al., in press). In addition, alternative explanations, while certainly possible, are somewhat difficult to envision, because they would have to involve a confounding variable that leads to upward mobility at the same time that it leads to poor adult health.

SES and Race/Ethnicity

One question that arises in reviewing this literature is who experiences the health costs of mobility. Is it any low SES individual who has ascended the socioeconomic ladder? What about individuals who are members of underrepresented, marginalized racial/ethnic groups,

who in the U.S. share many experiences with low SES individuals? Extensive research has documented that those from underrepresented racial/ethnic groups (particularly Blacks) are at greater risk of infant mortality, cardiovascular diseases, respiratory diseases, and all-cause mortality (Williams et al., 2010; Williams et al., 2016). Both are important determinants of health: racial/ethnic disparities in health exist at all levels of SES, and SES disparities in health are observed within racial/ethnic groups (Williams et al., 2010; Williams et al., 2016). So are the costs of upward mobility most apparent at the intersection of identities related to both race and class?

Indeed, to date, mobility costs have been most frequently demonstrated among low SES individuals of color (Gaydosh et al., 2018; Brody et al., 2013; Miller, Cohen, Janicki-Deverts, Brody, & Chen, 2016a; Chen et al., 2019). However, there are some recent studies that have observed health costs across all upwardly mobile individuals, regardless of race/ethnicity (Chen et al., in press; Miller et al., 2020). We also note that the COVID-19 pandemic has highlighted the increased risk of infection among populations of color in the U.S. Though no research has been conducted linking COVID-19 outcomes to skin-deep resilience, previous research has demonstrated the skin-deep resilience phenomenon with respect to the risk of upper respiratory infection after exposure to a rhinovirus among low SES African Americans (Miller et al., 2016a), suggesting that the pandemic might further highlight disparities related to skin-deep resilience.

Throughout this review, we focus primarily on findings related to low SES, given our central interest in upward mobility. However, where data exist, we present evidence that addresses the intersectionality of race/ethnicity and SES. In some cases, we also draw in

literature on race/ethnicity mechanisms when we believe it is germane to the discussion of upward mobility.

Psychological Mechanisms Explaining Health Disparities

The question that arises from these findings– assuming they are causal– is how and why upward mobility could have negative health effects. To provide background for this discussion, we begin this section with a brief overview of psychosocial mechanisms that have been proposed to explain the SES and physical health gradient (see Figure 1 for a graphical depiction).

It is important to acknowledge that low and high SES individuals experience vastly different contexts and structural conditions that shape their day-to-day lives and contribute to health disparities. There are differential exposures in terms of physical environmental conditions (e.g., pollution, housing conditions) (Diez Roux & Mair, 2010; Hajat, Hsia, & O'Neill, 2015), access to resources (e.g., health care access and quality, availability of grocery stores with healthy food options) (Diez Roux & Mair, 2010; Smedley, Stith, & Nelson, 2003), and social environment conditions (e.g., exposure to violence) (Wright & Steinbach, 2001) in low and high SES environments that play an important role in shaping how health outcomes can diverge between these two groups (Schreier & Chen, 2013).

Characteristics of High SES Individuals

Many of the above structural conditions also play a role in shaping psychological experiences within an individual that are thought to be important contributors to health disparities (Adler & Snibbe, 2003). For example, one commonly discussed pathway is high SES individuals experiencing better mental health- fewer negative mood states such as depression,

anger, and anxiety (Gallo & Matthews, 2003). In turn, a large literature has linked these negative emotions to cardiovascular disease, all-cause mortality, and other health outcomes (see (Gallo & Matthews, 2003; Everson-Rose & Lewis, 2005) for reviews).

A second commonly discussed pathway is high SES individuals possessing more psychological resources– higher mastery or self-esteem, perceived control, and optimism– that help protect them from adverse health outcomes (Matthews & Gallo, 2011; Finkelstein, Kubzansky, Capitman, & Goodman, 2007). Evidence for psychological resources as a mediator of the SES and health relationship appears to be relatively strong (Matthews, Gallo, & Taylor, 2010).

In addition, some researchers have posited that high SES individuals are more likely to engage in proactive coping behaviors– actions that prevent stressors or diminish their impact (Aspinwall & Taylor, 1997)– and that proactive coping promotes better health behaviors and health (Aspinwall, 2011; Finkelstein et al., 2007). In terms of cognition, an emerging literature suggests that there are robust differences by SES in executive functioning and working memory (Farah, 2017), which could have implications for future health behaviors and health.

Overlaying these differences is the idea that cultural contexts can help explain differences in thoughts, emotions, and behaviors between groups (Markus, Ryff, Curhan, & Palmersheim, 2004). In American society, high SES individuals are thought to value independence and a focus on the self (Markus, Ryff, Curhan, & Palmersheim, 2004). These values may explain why perceived control and proactive coping increase in tandem with SES. Furthermore, emerging data suggests that among higher SES individuals, holding beliefs related to independence is associated with lower allostatic load (Levine, Atkins, Waldfogel, & Chen,

2016), though more work is needed to substantiate this.

In sum, higher SES individuals in the U.S. exhibit a constellation of characteristics focused around autonomy and independence. This includes psychological resources, such as mastery, control, and optimism, as well as proactive coping tendencies. These characteristics are thought to underlie the SES variations in negative mood (less depression, anxiety, anger), executive function, and working memory, which in turn relate to health behaviors and disease outcomes.

Characteristics Engendered by Low SES Environments

Because low SES individuals are at risk for a number of poor health outcomes, mechanistic explanations have often been framed in terms of the 'deficits' or negative characteristics that low SES individuals possess. However, more nuanced perspectives are emerging, which emphasize the ways in which the characteristics more often found amongst low SES individuals can be viewed as adaptive within their contexts (Frankenhuis & Nettle, in press; Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017). See Figure 1.

In terms of cognition, research indicates that low SES individuals are better at certain types of attention and memory tasks. Low SES individuals are more adept at attending to cues of threat, which presumably has adaptive value in the environments in which they live (Frankenhuis & de Weerth, 2013; Frankenhuis & Nettle, in press). Additionally, individuals who grow up in chaotic households are cognitively more efficient at shifting between tasks during laboratory conditions of uncertainty, compared to those who grew up in stable households (Mittal, Griskevicius, Simpson, Sung, & Young, 2015). The ability to shift between goals and strategies may be particularly adaptive within frequently changing low SES environments.

Furthermore, they are also better at working memory updating (changing and updating what they remember in the face of changing information), particularly during laboratory conditions of uncertainty (Young, Griskevicius, Simpson, Waters, & Mittal, 2018). Again it would be advantageous to track and rapidly update information about one's environment, particularly when environments are unpredictable.

One can see how these strategies would be adaptive in many aspects of the daily lives of low SES individuals. However, these benefits may come at a cost to physical health. For example, vigilance for threat has been linked to increases in cardiovascular reactivity during laboratory stressors (Smith, Ruiz, & Uchino, 2000). Threat vigilance also statistically mediates associations between low SES and acute stressor cardiovascular reactivity, and expression of genes that regulate inflammatory processes (Chen, Langer, Raphaelson, & Matthews, 2004; Chen et al., 2009).

Emotionally, low SES individuals are better at recognizing negative emotions, and have better memories for negatively valenced emotional information (Frankenhuis & de Weerth, 2013; Pollak & Kistler, 2002). Low SES individuals are also better at reading others' emotions, and have greater empathic accuracy than high SES individuals (Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012). Being able to perceive and remember emotion-relevant information may be adaptive for responding quickly to situations that could involve potential danger.

Despite their adaptive value in low SES contexts, these traits may nonetheless entail a health cost. Recognizing negative emotions in faces elicits greater autonomic reactivity than perceiving threats in other sources (e.g., pictures of snakes) (Hariri, Tessitore, Mattay, Fera, &

Weinberger, 2002). In addition, high levels of empathy have been associated with more low-grade inflammation in healthy individuals (Manczak, DeLongis, & Chen, 2016).

When managing life stressors, low SES individuals are also more likely to use disengagement coping strategies (e.g., distraction, denial), and less likely to use active coping strategies (e.g., problem-solving) (Finkelstein et al., 2007). In terms of health, problem-focused coping is associated with better outcomes, whereas avoidance-type strategies are associated with poorer outcomes (Penley, Tomaka, & Wiebe, 2002).

However, research indicates that there is a set of coping strategies that can be beneficial to health amongst lower SES individuals. These strategies have been termed shift-and-persist, and refer to simultaneously adjusting the self to stressors by changing one's thoughts and feelings (shifting), and a broader outlook on life that entails finding meaning and maintaining optimism (persisting) (Chen & Miller, 2012). Among low SES individuals, those who shift-and-persist have better health, as reflected in less obesity and better asthma outcomes (Chen et al., 2011; Kallem et al., 2013). Furthermore, high SES individuals who shift-and-persist do not show health benefits.

These patterns can also be understood through a cultural lens (Markus, Ryff, Curhan, & Palmersheim, 2004). Lower SES individuals in the U.S. value interdependence and social connections with others (Markus, Ryff, Curhan, & Palmersheim, 2004). This may explain why they are more attuned to the thoughts and feelings of others and more likely to value adjusting themselves in interpersonal situations. Moreover, among lower SES individuals, holding beliefs related to interdependence is associated with lower allostatic load (Levine et al., 2016).

In sum, lower SES individuals possess characteristics related to interdependence and a

focus on their external environments. These include attending to and remembering the emotions of others, the details of changing circumstances, and adjusting to situational demands. These characteristics have adaptive value in the contexts in which low SES individuals live, but may at the same time have negative implications for health behaviors and health profiles in this group.

The Psychological Experiences of Upward Mobility: A Theoretical Account

Turning next to mechanisms related to upward mobility, what are the psychological experiences of someone pursuing upward mobility? We theorize that it involves simultaneous "pulls" toward the higher SES environments that one is seeking to enter, and "pushes" back toward one's family/neighborhood environment of origin. Figure 1 depicts key factors that we propose characterize the upwardly mobile, with a focus on defining qualities (striving for success), environmental demands, and environmental fit (mismatch of traits and lack of belonging).

Striving

Youth seeking upward mobility often exhibit a hard-driving work ethic that includes high levels of prolonged striving and efforts at self-control. These qualities help them achieve successes in life, but over time, can take a cumulative toll on them physically, taxing physiological systems that contribute to later health problems (Brody et al., 2013). Particularly in resource-poor environments that have insufficient supports, low SES youth must put in disproportionately large amounts of effort, largely on their own, to achieve similar academic outcomes as their more privileged counterparts. These efforts may have to be expended largely independently by low SES youth because their families do not have as much available

time or personal experience with college to help youth with schoolwork and future academic plans as high SES caregivers do (Duncan & Murnane, 2011). In addition, many schools in low SES neighborhoods do not have the resources to provide the level of college preparation and advanced academic opportunities that higher SES schools do, constraining students' options for academic achievement (Duncan & Murnane, 2011). More broadly, low-income youth need to mobilize self-control in order to avoid peer influences and behaviors related to crime, violence, and substance use that are more prevalent in low SES neighborhoods (Sampson, Raudenbush, & Earls, 2019). Thus, to achieve success, low SES youth may have to exhibit high levels of independent striving, with few resources and supports, and simultaneously maintain high levels self-control to stay on track with their long-term goals. Over time, we postulate that these sustained efforts create wear-and-tear on youths' physiological systems.

Empirically, the evidence for this wear-and-tear scenario emerges in statistical interactions between family SES and variables reflecting striving and self-control. These interactions show that for high SES youth, striving is associated with better outcomes across multiple domains. In contrast, for low SES youth, there appears to be a tradeoff, with striving presaging more academic success and better well-being, in tandem with worse physical health (skin-deep resilience). For example, a prospective analysis found that low SES Black adolescents who engaged in high striving were more likely to finish college, earn higher incomes, and have less depression in young adulthood compared to low SES Black individuals with low striving. However, these same youth were also more likely to develop diabetes by age 29 compared to their counterparts who were also low in SES but had low levels of striving. In contrast, among high SES Black youth, striving was beneficial for both life outcomes and diabetes (Brody, Yu,

Miller, & Chen, 2016). Similarly, other prospective studies have found that low SES Black youth who show high self-control had lower levels of internalizing and externalizing problems, but higher levels of allostatic load and faster epigenetic aging of immune cells (based on DNA methylation patterns that reflect the discrepancy between a person's biological and chronological age) compared to low SES Black youth who had low self-control. In contrast, among high SES Black youth, self-control was either beneficial or unrelated to mental and physical health (Brody et al., 2013; Miller, Yu, Chen, & Brody, 2015). Similarly, in chronically ill populations, Black and Latinx youth with asthma who exhibit high self-control under stressful school conditions have better mental health (less anxiety and depression) but worse asthma inflammatory profiles compared to those who show low self-control under stressful school conditions (Chen et al., 2019).

Studies that have investigated related constructs find similar patterns. For example, conscientiousness is a personality trait that overlaps with striving and self-control, and interacts with SES in the same manner. In one study, Blacks who had low childhood SES, but were high in conscientiousness, reported more educational attainment and fewer depressive symptoms as adults (compared to those low in conscientiousness.) But after being administered an experimental virus, they were more likely to develop a verified respiratory infection. The opposite pattern was observed among Black adults with high childhood SES: conscientiousness was protective against viral infection (Miller et al., 2016a). In another study, low SES Black men high in conscientiousness had better psychological well-being but also higher metabolic syndrome scores than Black men who were low in SES and low in conscientiousness (Duggan, Jennings, & Matthews, 2019). Furthermore, a monozygotic twin study found that

conscientiousness was associated with higher educational attainment, fewer depressive symptoms, and less problematic alcohol use across all twins. However, discordance analyses revealed that among low SES twin pairs, the one with higher conscientiousness had more low-grade inflammation (higher C-reactive protein, CRP) in adulthood relative to their less conscientious twin. In contrast, among high SES twins, the twin with higher conscientiousness had lower CRP levels, thus bolstering evidence for skin-deep resilience through a twin design that reduced the possibility of genetic and environmental confounds (Chen et al., in press). In related studies, low SES Black adults who show high levels of high-effort coping, hard work, and a single-minded determination to succeed (John Henryism) evinced higher blood pressure and a greater risk of hypertension compared to those with low levels of John Henryism (James, Strogatz, Wing, & Ramsey, 1987; James, Keenan, Strogatz, Browning, & Garrett, 1992). Lastly, we note that conceptually, constructs such as striving, self-control, and conscientiousness all have overlap with the construct of grit. Grit has been studied largely in the educational domain (Duckworth, 2016), with very little data linking grit to physical health outcomes (see (Pena et al., 2019) for an exception). However, we would hypothesize that such studies might reveal similar skin-deep resilience patterns as with striving.

More generally, research points to the idea that prolonged high levels of effort/striving have physiological costs. The literature on effort-reward imbalance indicates that when people exert high levels of effort at work (including having an excessive overcommitment to work), and don't feel appropriately rewarded for their efforts, this predicts an increased risk of cardiovascular disease, myocardial infarction, and diabetes, and elevated levels of ambulatory blood pressure, stress hormones, and biomarkers of inflammation (see (Siegrist, 2010; Siegrist

& Li, 2016) for reviews). There is also evidence of physiological consequences of goal-striving stress (the discrepancy between one's aspirations and one's achievements). Higher levels of goal-striving stress predict increased risks of obesity, hypertension, and coronary heart disease (Glover et al., 2020a; Sellers, Neighbors, Zhang, & Jackson, 2012). Goal-striving stress may be more evident in lower SES youth, given the additional barriers and constraints they face in their academic pursuits.

Taken together, this research suggests a scenario where the high levels of sustained effort that lower SES students exert to achieve academic successes- combined with the fewer supports and resources they receive relative to higher SES students- contributes to a skin-deep resilience pattern. Skin-deep resilience fosters successes throughout life but simultaneously takes a toll on physiological processes and physical health in upwardly mobile individuals.

Competing Demands

As youth are striving for upward mobility through educational efforts, they are often being pulled back toward their home environments through competing demands. For example, low SES families often need youth to work and contribute to family finances, creating competing demands between school and work (Fuligni & Pedersen, 2002). Efforts to balance school, work, and home demands may create additional pressures that many higher SES youth do not have to face. For example, lower SES individuals are more likely to report having multiple roles that conflicted with one another (Stephens, Townsend, Martire, & Druley, 2001). Many low SES youth have obligations around the house, such as childcare (of younger siblings) and meal preparation (Fuligni & Pedersen, 2002), particularly when low SES parents have to work multiple jobs or non-traditional shifts. Additionally, some low SES youth may feel

pressures to succeed in order to not to disappoint family members who take pride in and derive self-esteem from their child's accomplishments (Tesser, 1988). Moreover, when success happens, these individuals may feel obligated to give back by taking care of family members and their communities of origin (Cole & Omari, 2003), creating an additional layer of demands that many higher SES individuals do not have to shoulder.

In turn, these competing demands are theorized to be detrimental to health because of the ways they drain time, energy, and resources (Martire & Stephens, 2003). For example, experiencing high demands at work– such as an excessive workload and conflicting demands, combined with having low control, is associated with an increased risk for cardiovascular diseases (myocardial infarction, stroke, and hypertension), as well as with higher blood pressure (see (Backe, Seidler, Latza, Rossnagel, & Schumann, 2012; Gilbert-Ouimet, Trudel, Brisson, Milot, & Vezina, 2014) for reviews). Other studies have found that related constructs, including role overload (having too many demands, for example, in one's job) are associated with greater health problems (Shultz, Wang, & Olson, 2010). Furthermore, both vital exhaustion (the experience of being excessively fatigued), and burnout (a chronic state of emotional exhaustion and physical fatigue) are associated with an increased risk of coronary heart disease and cardiovascular-related events (Frestad & Prescott, 2017; S., Shirom, Toker, Berliner, & Shapira, 2006).

In adolescence, one daily diary study found that adolescents who spent more time helping their family (e.g., cooking, cleaning, caring for siblings) had higher levels of low-grade inflammation (higher CRP) (Fuligni et al., 2009). Moreover, a second daily diary study demonstrated that adolescents who both experienced a high frequency of daily demands from

family and who spent a lot of time (>1 hour/day) helping their family had the highest levels of low-grade inflammation and the largest pro-inflammatory cytokine responses to an in vitro bacterial challenge, compared to those who experienced fewer demands or provided less help (Levine, Hoffer, & Chen, 2017).

Thus, while most students in high achieving schools have to work hard for academic success, low SES students must juggle academic demands with numerous other challenges in their lives. Work demands and family/home life demands also necessitate their attention, meaning that academic success has to be achieved over and above successfully managing and balancing other life demands. This creates a greater overall burden of persistent competing demands, leading to insufficient time for leisure or restorative activities, and taking a physiological toll on the health of low SES youth.

Mismatches: Carryover of Earlier Strategies for Success

Low and high SES youth adopt different strategies for dealing with demands based on what is adaptive within the environments they grow up in. However, difficulties may arise if low SES youth continue to utilize the strategies they developed in childhood once they enter higher SES settings (e.g., high achieving schools).

Within educational settings, the phenomenon of low SES students using strategies that are not adaptive in their current environment has been termed 'cultural mismatch' (Stephens, Markus, & Phillips, 2014; Stephens, Townsend, & Dittmann, 2019). In such settings, higher SES students have been described as typically exhibiting 'expressive independence,' which includes a focus on expressing the self's desires and goals, influencing situations, and assumptions of equality with others. These qualities are conveyed as valued in the school setting by reinforcing

students who speak up in class, who pose questions to teachers, and who approach teachers for help (Stephens et al., 2014). Lower SES students in contrast, have been described as exhibiting 'hard interdependence,' which includes a focus on adjusting to situations, being connected to others in part through an awareness of the social hierarchy, and staying tough in the face of challenges. This is manifest as lower SES students being more deferential to authorities, being less likely to speak up in class or when they need help, and placing more of a priority on following rules than asking questions (Stephens et al., 2014). These traits are not typically reinforced in higher education settings, leading lower SES students to potentially feel disadvantaged with the approaches they use in these settings. The implications of this cultural mismatch have been examined primarily within the educational domain, with research consistently demonstrating that cultural mismatches are associated with worse academic performance throughout the college years (Phillips, Stephens, Townsend, & Goudeau, 2020).

However, though not yet well-studied, cultural mismatch could also plausibly have implications for health. That is, the mismatch between one's traits and one's environment creates additional stress as students realize that the traits they learned to exhibit in their childhood environments are not as valued in their new environment, and may be detrimental to their academic success in high-achieving settings. The struggles these students experience with cultural mismatches may add to the physiological toll of striving for success. For example, one study found that first-generation students showed greater cortisol increases to an acute stressor task of having to give a speech about their college goals compared to continuing-generation students, particularly when information was conveyed that emphasized typical norms expressed in college environments (e.g., encouraging students to explore personal

interests and express their ideas and opinions) (Stephens, Townsend, Markus, & Phillips, 2012). These findings suggest that the experience of cultural mismatch could bring about physiological changes that increase vulnerability to later life health problems (Adam et al., 2017). Further evidence supporting the cultural mismatch hypothesis comes from another study documenting that when students of color attend schools that emphasize the value of diversity, they have lower levels of inflammation and fewer signs of metabolic syndrome compared to those who attend schools that don't explicitly acknowledge diversity values (Levine, Markus, Austin, Chen, & Miller, 2019).

There is also evidence of the health consequences of environmental 'mismatch' from animal studies (Bateson, Gluckman, & Hanson, 2014). The idea is that cues from the environment calibrate the phenotype of developing organisms to match their anticipated ecological demands. Numerous examples abound whereby different species evolve different phenotypes (e.g., fur or shell color/thickness, tendencies toward shelter-seeking behaviors, thrifty metabolic phenotype), depending on the environmental conditions when they were born. These phenotypes are adaptive for their initial environmental conditions, and persist even if environmental conditions change later in life. When later environmental conditions are different from what an organism prepared for, this is called a mismatch and can have detrimental consequences, for example, leading to being more vulnerable to predation, being less likely to reproduce, and poor health outcomes such as obesity (Bateson et al., 2014).

In humans, there is evidence from prospective studies that mismatches between child and adult environments forecast increased risk of later-life health problems (Bateson et al., 2014). During gestation mothers are thought to signal the developing fetus about expected

environmental conditions (e.g., nutritional scarcity). But if the environment the child is raised in turns out to be different (e.g., nutritional abundance), poor health outcomes later in life, including obesity, diabetes, and cardiovascular disease are more likely to occur (Bateson, 2007), because the child's metabolism was calibrated for nutrient scarcity. For example, those who were born during the Dutch Hunger famine of World War II were more likely to have impaired glucose tolerance in adulthood compared to those born right before or right after the famine period (Ravelli et al., 1998). Because nutrition improved after the famine, this is taken to be an example of how the mismatch between an earlier and later environment can be detrimental to health.

Lack of Belonging

Cultural mismatch can also contribute to feeling a lack of belonging in higher education settings. As low SES youth strive for upward mobility, they may experience a lack of belonging in two ways. First is with their new academic environment. As they progress into high-achieving environments, low SES youth may see fewer and fewer students who come from similar backgrounds as they do. The sense of being different from their peers in turn contributes to feeling a lack of belonging, questioning their belonging, and experiencing a stigmatized identity in these contexts (Johnson, Richeson, & Finkel, 2011; Ostrove & Long, 2007). For example, low SES students may experience lifestyles very different from what they were brought up with (e.g., in terms of wealth), that make them feel out of place (Browman & Destin, 2016; Cole & Omari, 2003). Furthermore, these feelings are not just experienced upon college entry, but persist throughout the college years (Pascarella, Pierson, Wolniak, & Terenzini, 2004). In addition, low SES student of color experience discrimination and

microaggressions relatively frequently in higher education settings (Cole & Omari, 2003). One study found that as education increases, instances of racial microaggressions increase, such that among college graduates of color, racial microaggressions comprised ~40% of the stress they experienced (Smith, Hung, & Franklin, 2011). Another study revealed that amongst a general sample of college students at a wealthy, elite private school, over 50% reported experiencing discrimination including disparaging comments about the poor, and dismissiveness about one's social class (Langhout, Rosselli, & Feinstein, 2007).

A second way that low SES students striving for upward mobility may experience a sense of alienation is from their neighborhood of origin. As they move into different educational spaces, these youth may experience a weakening of connections with their communities of origin (Destin, Rheinschmidt-Same, & Richeson, 2017; Van Laar, Bleeker, Ellemers, & Meijer, 2014). They may start to be treated differently by peers, and be perceived as having adopted different characteristics associated with their higher SES contexts (Destin et al., 2017). These students may begin to feel a disconnect between their communities of origin and their environments in college (Destin & Debrosse, 2017; Cole & Omari, 2003). This can create identity pressures on upwardly mobile youth– to continue to associate with their group of origin may lead to rejection in their new context, but to disassociate may lead to a loss of important sources of support (Van Laar et al., 2014). As a result, these youth may experience a growing sense of social isolation (not fitting with their neighborhood of origin, but also not fitting in their new academic environments either). Or these students may have to work especially hard to effectively switch identities between school and home, acting one way in their neighborhoods and a different way at school (Cole & Omari, 2003), which may create

additional sources of stress.

In turn, experiences with discrimination, microaggressions, and a lack of belonging or social isolation all have implications for health. Discrimination has been associated with risk for a number of physical health problems (Williams & Mohammed, 2009), and is thought to be a significant contributor to explaining both racial and socioeconomic disparities in health (Myers, 2009). Chronic or lifetime discrimination has been associated with coronary artery calcification (Lewis et al., 2006), new-onset cardiovascular events (e.g., heart attacks) in those initially free of cardiovascular disease (Everson-Rose et al., 2015), and diabetes onset over a 10 year follow-up period (Whitaker et al., 2017). Everyday discrimination has been associated with markers of low-grade inflammation (Kershaw et al., 2016), and with increases in blood pressure over a 10 year follow-up period (Moody et al., 2019). Discrimination is also consistently associated with poor sleep (Slopen, Lewis, & Williams, 2016). Amongst younger populations, one daily diary study of adolescents found that acts of discrimination were associated with greater self-reported health complaints (Huynh & Fuligni, 2010). Further, an experimental study of college students of color found that those who were assigned to write about experiences of discrimination produced significantly fewer antibodies in response to a flu vaccine compared to students of color who wrote about a neutral topic (Stetler, Chen, & Miller, 2006). It has been argued that experiences with discrimination elicit physiological responses that over time create challenges for biological systems, resulting in increased allostatic load and greater risk for chronic diseases in the long-term (Mays, Cochran, & Barnes, 2007). Further, the effects of discrimination are not limited to race/ethnicity, as effects of SES-based discrimination have also been documented on markers of inflammation (Van Dyke et al., 2017).

There is also a voluminous literature demonstrating the health consequences of social isolation. One meta-analysis concluded that social isolation, both objectively defined and subjectively experienced, is associated with an increased risk for early mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). Subjectively experienced social isolation is conceptually related to lack of belonging. Moreover, social isolation effects are strongest amongst those who live in poverty and people of color (Cacioppo & Hawkley, 2003). Social isolation has detrimental effects on both stress physiology and restorative processes such as sleep (Cacioppo & Hawkley, 2003; Cacioppo & Cacioppo, 2014). Furthermore, loneliness uniquely predicts health above and beyond other social relationship characteristics, such as social connections (Cacioppo & Cacioppo, 2014). Finally, amongst college students, a sense of belonging, more so than other types of social support (e.g., tangible support, social intimacy), predicts self-reported physical health (Hale, Hannum, & Espelage, 2005).

Thus the experience of striving for upward mobility can lead socially to feelings of alienation, a lack of belonging, and social isolation, with evidence that these types of social experiences are associated with poorer health. Further compounding these difficulties are the structural contexts that shape experiences with discrimination and microaggressions as upwardly mobile individuals enter spaces that were set up by and for those high in SES, with these experiences also linked to detrimental health effects.

Summary

In sum, we theorize that upwardly mobile individuals have a set of experiences that are distinct from those who are stably high or low in SES, and that have implications for physical health (Figure 1). Psychologically, upwardly mobile individuals are more likely to exhibit

prolonged, high levels of striving and self-control. These determined, persistent efforts are hypothesized to result in a tradeoff, where academic successes come at a cost to physical health, a pattern termed 'skin-deep resilience.' From a replicability standpoint, the striving findings are strengthened by the fact that similar patterns have emerged consistently across multiple study samples. Environmentally, upwardly mobile individuals experience a larger set of competing demands from both the higher SES context they seek to enter as well as from their families and communities of origin. The combination of school, work, and home demands means that academic successes have to be achieved over and above other life demands, which creates a greater overall burden and less time for restorative activities, and we suggest, results in wear-and-tear on physiological systems. Culturally, upwardly mobile individuals are more likely to experience a mismatch between the adaptive strategies they learned to exhibit in their childhood environments and the strategies that are valued in higher SES environments, creating added struggles that are presumed to affect physiological systems. Finally, structurally, the experience of moving into high SES spaces set up by and for majority groups results in upwardly mobile individuals experiencing discrimination, microaggressions, and a sense of alienation and lack of belonging, all of which have associations with physical health.

In addition, it is important to note that financially, upwardly mobile individuals do not have the same wealth profiles as stably high SES individuals (Cole & Omari, 2003). Because of student loan debt, a lack of family wealth, and limited savings, their financial situations are often quite tenuous, even once they enter high-earning professions. Additionally, feelings of obligation to help families members and communities of origin financially place a greater strain on the wealth that they do have. This can result in economic stressors, even as these

individuals are currently high in SES, that then take an additional toll on health.

Finally, one question that might arise is why, given all the challenges identified above, upwardly mobile individuals would not experience worse (rather than better) mental health? We hypothesize that this is in part because these upwardly mobile individuals are achieving a multitude of successes in their lives, in terms of education, occupations, and incomes. These successes make them and their families proud. We speculate that the praise from others and boosts to self-esteem that result from these successes help foster positive mental health profiles. In addition, the idea that exposure to numerous environmental adversities might not necessarily result in poorer mental health can be seen in the literature, whereby Blacks have lower levels of major depression than Whites, despite the greater stress exposure, marginalized status, and fewer resources they typically experience (Barnes & Bates, 2017). This also may be in part because of protective factors, such as religiosity, self-esteem, or coping behaviors (Barnes & Bates, 2017).

Pathways to Health

Next we address the mechanistic question of how the stressful psychological experiences related to upward mobility come to affect physical health. We focus this discussion on cardiometabolic health, because nearly all of the literature on upward mobility and skin-deep resilience is in that domain. In health psychology, there are two pathways commonly proposed as mechanisms. One is an effect of stress on physiological systems, and the second is an effect of stress on health behaviors. See Figure 2.

There are two categories of stressors relevant to upward mobility that likely impact biological and behavioral pathways. The first is a general set of chronic stressors that occur

more frequently in the low SES contexts that upwardly mobile individuals come from, including economic hardship, community disadvantage, and discrimination (Brody, Chen, & Kogan, 2010). The second is the specific stressors described above experienced by those pursuing upward mobility. Below we provide an overview of how these stressors impact both health behaviors and physiological systems.

Health Behaviors

Health behaviors, such as exercise, diet, and sleep, are shaped in part by the contexts in which individuals reside. For example, the lack of green spaces and sidewalks as well as violence found in many low SES communities create constraints on options for physical activity (Boone-Heinonen & Gordon-Larsen, 2011; Coombes, Jones, & Hillsdon, 2010). Food deserts, with a lack of healthy food options and an abundance of high-calorie, energy dense foods, are more prominent in low SES neighborhoods (Walker, Keane, & Burke, 2010). In addition, physical and social environmental conditions such as noise and density, as well as violence, can disrupt sleep for those in low SES neighborhoods (Johnson, Billings, & Hale, 2018).

At the individual level, these contextual factors contribute to the general chronic stress that upwardly mobile individuals experience. These and other upward mobility-specific stressors are then hypothesized to have direct effects on the health behaviors that individuals practice. In turn, patterns of diet, physical activity, and sleep have consistent associations with longer-term cardiometabolic outcomes ranging from diabetes to cardiovascular disease to mortality (Warburton, Nicol, & Bredin, 2006; Loef & Walach, 2012; Gallicchio & Kalesan, 2009; Itani, Jike, Watanabe, & Kaneita, 2017)}.

Stress-Reducing Health Behaviors. Broadly speaking, we hypothesize that stressors that

are uncontrollable will trigger behaviors such as unhealthy eating, as one means of relieving the negative emotions associated with uncontrollable stress. Uncontrollable stressors include the contextual stressors associated with poverty and racism, which have many structural and societal root causes. In addition, the upward mobility-specific stressors of social exclusion, lack of belonging, and mismatches in fit, and the accompanying experiences with discrimination and microaggressions, are also hypothesized to be stressors outside of upwardly mobile individuals' control, given that they stem from interactions with higher SES individuals and the cultural norms found within higher SES settings.

When one cannot mitigate a stressor, the best one can do is to alleviate one's emotional reactions, in part through behaviors that are pleasurable in the moment and stress-relieving. The overeating of comfort foods (i.e., foods high in refined sugars and fat, and foods that are highly processed) represents one socially sanctioned way to do this (Jackson, Knight, & Rafferty, 2010). Chronic stress is associated with snacking, as well as craving and consuming foods that are high in sugar and fat (Araiza & Lobel, 2018; Torres & Nowson, 2007) in children as well as adults (Hill, Moss, Sykes-Muskett, Conner, & O'Connor, 2018). These patterns are thought to arise in part because stress triggers the release of cortisol, which stimulates hunger and feeding behaviors; increases a drive toward pleasurable activities; and leads to an increase in visceral fat storage (Adam & Epel, 2007; Sominsky & Spencer, 2014). In response to high calorie food images, individuals high in chronic stress show greater activity of reward and motivation regions of the brain, and decreased activity in executive control regions, compared to individuals low in chronic stress (Tryon, Carter, DeCant, & Laugero, 2013). Eating in response to stress is thought to occur for a number of reasons: helping to alleviate negative emotions;

serving as an emotion-focused coping approach; and because of the burdens on cognitive load imposed by stress, which decrease one's ability to engage in self-restraint when it comes to food (Araiza & Lobel, 2018).

These patterns may also be more prevalent in certain groups that are more likely to experience uncontrollable stressors, such as individuals of color and those low in SES (Jackson et al., 2010). For example, Blacks have been theorized to use coping strategies for dealing with chronic environmental stressors that preserve mental health at the expense of physical health (Jackson et al., 2010). Thus life stress is associated with depression only among Blacks who do not engage in unhealthy behaviors; in contrast, stress is not associated with depression for Blacks who do engage in unhealthy behaviors. Furthermore, these patterns are specific to Blacks and not found amongst Whites (Mezuk et al., 2010; Jackson et al., 2010). In addition, epidemiological research has documented that Black-White disparities in obesity are greatest among high SES adults (Gordon-Larsen, Adair, & Popkin, 2003). This is consistent with skin-deep resilience patterns, whereby achieving mobility (high adult SES) for individuals of color comes at a cost to physical health, and suggests that unhealthy eating may be one pathway explaining skin-deep resilience effects. Taken together, these studies suggest that comfort eating may represent a good fit as a coping strategy for the numerous uncontrollable stressors associated with upward mobility, but with consequences for obesity and related chronic diseases down the line.

We note that previous literature has also shown that Blacks are more likely to engage in substance use as a way of coping with contextual stressors (Jackson et al., 2010; Mezuk et al., 2010). The use of substances may also help alleviate stress and negative emotions in the short-

term (Jackson et al., 2010); however, in the case of individuals pursuing upward mobility, we hypothesize that they gravitate toward the overeating of comfort foods, rather than substance use, as a more socially sanctioned way of dealing with stress. For example, low SES individuals who make it to college show lower levels of substance use compared to those who do not go to college (Chen et al., 2015). Similarly, low SES individuals who have high self-control show lower levels of substance use than those who are low in self-control (Miller et al., 2015). Thus while substance use as a coping strategy may be used by some, it appears to be less likely as a health behavior pathway among low SES individuals of color who are pursuing upward mobility.

Lack of Restorative Health Behaviors. Health behaviors can also serve a second function, as a way of restoring physical and mental well-being. Behaviors such as adequate sleep, physical activity, and other leisure activities can help individuals maintain good health despite stress in their lives. Here, we suspect that upwardly mobile individuals are less likely to engage in restorative health behaviors because of the frequency (rather than controllability) of life stressors. That is, the high number of competing demands that upwardly mobile individuals have to balance between school, work, family responsibilities, and financial needs consume time and energy in ways that leave little room for engaging in restorative health behaviors. In addition, the disproportionately large amounts of effort that upwardly mobile individuals must expend in striving for similar academic outcomes as their more privileged counterparts mean that restorative health behaviors often have to be sacrificed to achieve academic successes.

In general, the literature shows that those who experience high competing demands have less time for exercise and leisure pursuits (Nomaguchi & Bianchi, 2004; Pearson, 2008). A lack of time is one of the principal reasons for not engaging in sufficient physical activity, and is

a bigger factor for low SES than high SES individuals (Chinn, White, Harland, Drinkwater, & Raybould, 1999). A review found that among Black women, lack of time is a key barrier to physical activity and is primarily due to the competing demands and fatigue that these women experience as they balance multiple roles related to work and family caretaking (Joseph, Ainsworth, Keller, & Dodgson, 2015). Furthermore, when work and family demands are high and in conflict with one another, people often sacrifice sleep in order to manage their demands (Barnes, Wagner, & Ghumman, 2012). For example, those who work longer, extended hours report shorter sleep durations (Jackson, Redline, & Emmons, 2015; Akerstedt, 2006). High demands, particularly in terms of being overcommitted, preoccupied with demands, and suffering from burnout, are all associated with greater sleep disturbances (Akerstedt, 2006). Finally, frequent life stressors have been theorized and found to contribute to SES disparities in sleep (Jackson et al., 2015).

Furthermore, certain groups that experience more frequent life stressors are also less likely to engage in restorative health behaviors. For example, both low SES individuals and individuals of color experience more negative life events than high SES or White individuals (Hatch & Dohrenwend, 2007). In turn, low SES individuals are less likely to engage in vigorous activity or achieve recommended levels of physical activity compared to high SES individuals (Delva, O'Malley, & Johnston, 2006), both among adults and adolescents (Hanson & Chen, 2007b). Those who are upwardly mobile have physical activity levels in between the stable low and stable high SES groups (Elhakeem et al., 2017). With race/ethnicity, using accelerometry, Blacks were found to engage in less moderate-to-vigorous physical activity compared to Whites (Tucker, Welk, & Beyler, 2011). Black and Latinx women also report exercising less frequently

(Delva et al., 2006), and show greater declines in exercise over time compared to White women (Clarke, O'Malley, Johnston, Schulenberg, & Lantz, 2009). Finally, in adolescents, lower levels of physical activity mediated race differences in obesity (Hanson & Chen, 2007a).

With respect to sleep, reviews have found that both low SES and racial/ethnic minority status are associated with higher rates of sleep disturbances, shorter sleep duration, and poorer sleep quality (Grandner, Williams, Knutson, Roberts, & Jean-Louis, 2016; Jackson et al., 2015). Both lower SES adults and women of color show greater declines in adequate sleep over time (Clarke et al., 2009). In addition, Black-White disparities in the occurrence of short sleep are greatest in high SES adults (Jackson, Redline, Kawachi, Williams, & Hu, 2013). That is, the likelihood of regularly experiencing short sleep decreased as SES increased among Whites; in contrast, the likelihood of short sleep increased as SES increased among Blacks. This is consistent with other skin-deep resilience patterns (i.e., individuals of color who achieve high SES in adulthood having poor health), and suggests that inadequate sleep may serve as one pathway explaining skin-deep resilience effects.

Summary. In sum, individuals pursuing upward mobility experience two types of stressors that have implications for health behaviors (see Figure 2). The first is uncontrollable stressors, stemming from upward mobility-specific experiences with mismatches in fit and lack of belonging as well as discrimination. We postulate that uncontrollable stressors lead to engagement in unhealthy behaviors, such as the overeating of comfort foods, as a way to relieve stress and negative emotions. The second is the high frequency of stressors that upwardly mobile individuals experience in terms of the competing demands in their lives and their prolonged, effortful striving, both of which leave little time for restorative health

behaviors, such as physical and leisure activities and sleep. In turn, unhealthy eating, physical inactivity, and inadequate sleep are key lifestyle contributors to cardiometabolic health problems (Itani et al., 2017; Warburton et al., 2006; Torres & Nowson, 2007), and explain a substantial fraction of racial and economic health disparities in the U.S. (Bancks et al., 2017; Krishnan, Cozier, Rosenberg, & Palmer, 2010).

Biological Pathways

The final portion of our model depicts biological mechanisms that might explain how upward mobility comes to affect physical health. See Figure 2. Again, we focus on health problems in the cardiometabolic realm, as they have been the focus of upward mobility research to date. Because research on biological pathways is just emerging, we keep this section intentionally brief, and acknowledge that much of it is speculative. Still, we believe it is useful to offer some general hypotheses, which can function as a roadmap for future hypothesis testing around skin-deep resilience mechanisms.

So what are the plausible biological mechanisms through which achieving upward mobility could undermine cardiometabolic health? To answer this question, we draw upon the handful of studies reviewed above which measured biological processes, and integrate their findings with more general knowledge of the mechanisms by which early experiences come to affect these conditions (Danese & McEwen, 2012; Miller, Chen, & Cole, 2009; Suglia et al., 2018). This synthesis suggests a scenario whereby the challenges, struggles, and behaviors associated with upward mobility dysregulate activity of the body's primary stress-response systems, the autonomic nervous system and the hypothalamic pituitary adrenocortical axis (Brody et al., 2013; Chen et al., 2015). Persistent changes in the outflow of these axes'

hormonal products– epinephrine, norepinephrine, and cortisol– should alter the behavior of target cells in many tissues and organs, including the heart, lungs, blood vessels, immune system, and skeletal muscle, to name a few.

The nature of these changes will likely differ somewhat by tissue and also depend on host genetics, other exposures, and additional factors. However, based on the available evidence, we would hypothesize that upward mobility accelerates the epigenetic aging of immune cells (Miller et al., 2015), and is manifest in alterations in the way that immune cells respond to and recover from challenges (McEwen & Seeman, 1999). In cells of the innate immune system, this would likely involve exaggerated cytokine responses to threats– both microbial and sterile– which contribute to chronic low-grade inflammatory processes (Irwin & Cole, 2011). In cells of the adaptive immune system, chronic stress research suggests it would likely entail weaker cellular and humoral responses to pathogens, lowering host resistance to infectious diseases, and reducing the protective value of vaccinations (Glaser & Kiecolt-Glaser, 2005). In cells that comprise the vascular system, excessive hormonal stimulation might compromise the vessel's elasticity to dilate when blood flow increases, an early sign of cardiovascular risk known as endothelial dysfunction (Harris & Matthews, 2004). And in cells that make up adipose tissue and skeletal muscle, persistent hormonal and inflammatory exposures would presumably decrease sensitivity to insulin, in the process impairing the metabolism of fats and the regulation of glucose (Sjostrand & Eriksson, 2009), processes that if sustained would increase subsequent risk of diabetes, coronary heart disease, and stroke, among other cardiometabolic health problems.

Besides altering the way that cells function, variations in stress-hormone outflow might

also be expected to change the composition of tissues. There are two tissues where this seems particularly likely to occur, given the broader literature: the gut, where initial evidence suggests that adversities reduce the diversity of the microbial population (He et al., 2018; Miller et al., 2016b), with implications for microbiome-immune communication (Cruz-Pereira et al., 2020), and increasing risk for a variety of chronic health problems involving dysbiosis (Gilbert et al., 2018); and in the immune system, where they selectively mobilize immature myeloid cells into circulation, which have a strong pro-inflammatory skew in their activity (Powell et al., 2013; Miller et al., 2008). In animal models, these cells migrate into developing atherosclerotic plaques, accelerating the progression of heart disease (Heidt et al., 2014).

Conclusions and Future Directions

In sum, the physical health of individuals who achieve upward mobility from childhood to adulthood is often not equivalent to their peers who have had consistently high SES. In fact, upward mobility appears to be associated with a tradeoff, whereby economic success and good mental health come at the expense of physical health, a pattern we have termed “skin-deep resilience.” We hypothesize that skin-deep resilience emerges from a set of psychological experiences that are distinct from those who are stably high or low in SES. These experiences include prolonged high levels of striving; competing demands between the environments these individuals seek to enter and their environments of origin; mismatches between the adaptive strategies upwardly mobile individuals learned to exhibit in their childhood environments and those that are valued in higher SES environments; and the sense of alienation, lack of belonging, and experiences with discrimination that upwardly mobile individuals face as they move into high SES spaces set up by and for majority groups. In turn, stressors that are

uncontrollable lead upwardly mobile individuals to engage in unhealthy behaviors, such as the overeating of comfort foods, as a way to relieve negative emotions. Further, the high frequency of stressors that upwardly mobile individuals experience leaves little time for physical and leisure activities or sleep. These health behaviors are key contributors to cardiometabolic health problems. Biologically, these stressors contribute to the dysregulation of stress-response systems, which over time alters the behaviors of target cells in many tissues and organs, eventually leading to preclinical manifestations and subsequent risk of diabetes, coronary heart disease, and stroke, among other cardiometabolic health problems.

Future directions include the need for additional studies that can ascertain mechanisms and causality. Longitudinal studies are needed to determine when during development skin-deep resilience emerges, what mechanisms drive its development, and whether effects can be demonstrated above and beyond baseline health measures. Natural experiments, where possible, that take advantage of the rollout of new federal or state programs that could affect mobility would help answer questions about causality. Additional twin studies would also be helpful in this regard, as they can minimize genetic and environmental confounding.

Even more definitive would be experiments that manipulate potential skin-deep resilience mechanisms. These could take the form of interventions designed to mitigate the physical health costs of skin-deep resilience through addressing targeted mechanisms. For example, at the individual level, teaching coping strategies for dealing with the uncontrollable stressors that individuals seeking upward mobility confront could help reduce their health effects (Antoni, 2012). At the interpersonal level, interventions that provide social support might help mitigate the health consequences related to alienation and perceived lack of

belonging for low SES individuals striving for success (Chen et al., under review). And at the structural level, interventions that seek to change the climate of higher education institutions to be more inclusive of lower SES students could have health benefits as well (Browman & Destin, 2016; Stephens, Hamedani, & Destin, 2014). Finally, future interventions that seek to improve students' academic outcomes in educational settings (Harackiewicz & Priniski, 2018) may want to be mindful more broadly of potential physical health consequences.

If successful, these approaches could lead to new programs that consider youth more holistically, supporting academic endeavors and pathways to successful lives at the same time as they monitor and consider the physical well-being of youth. Programs could be designed at the individual, family, and/or school level that would provide additional resources and supports for youth who are striving for upward mobility, with the hope that in the future, achieving the American dream will not have to come at the cost of one's health.

Summary of Key Points

1. Upward mobility, particularly in low-income individuals of color, is associated with a tradeoff, whereby individuals achieve economic success, good mental health, and other positive life outcomes, but are more likely to have poor physical health. This pattern has been termed "skin-deep resilience."
2. Psychological explanations include the role of striving – the idea that the high levels of sustained effort that lower SES individuals exert to achieve their academic successes leads to positive life outcomes but at the same time takes a physiological toll on their health.
3. Low SES students striving for academic success often have to juggle academic demands with numerous other work and family demands. Balancing these competing demands creates an overall higher burden that contributes to the physiological health costs.
4. Culturally, upwardly mobile individuals are more likely to experience a mismatch between the adaptive strategies they learned to exhibit in their childhood environments and the strategies that are valued in higher SES environments, creating additional stress on these individuals, with potential physiological implications.
5. As low SES individuals striving for upward mobility move into new spaces, they often experience both a lack of belonging with peers in their new (e.g., college, workplace) environments, and as well, greater alienation from their family and neighborhood of origin. In turn, experiences with lack of belonging, social isolation, and discrimination all have been linked to poor physical health.
6. Pathways to health include health behaviors – the idea that upwardly mobile individuals experience uncontrollable stressors (e.g., lack of belonging) that predispose them toward unhealthy behaviors (e.g., comfort eating) in an effort to cope with these stressors, and that the high frequency of stressors that upwardly mobile individuals experience (e.g., competing demands) make it difficult for them to engage in restorative health behaviors such as exercise and adequate sleep.
7. A second pathway is through biology – that the stressors associated with upward mobility dysregulate activity of the body's stress-response systems, and that persistent changes in these systems alter the behavior of target cells in tissues and organs, leading eventually to preclinical manifestations and subsequent risk of cardiometabolic diseases.

Future Directions

1. Additional studies are needed to determine the boundaries or parameters around skin-deep resilience – that is, when during development it emerges, and which demographic groups are at greatest risk for skin-deep resilience.
2. Future longitudinal studies are needed to test the specific psychological and biological mechanisms theorized in this review.
3. Natural experiment studies of skin-deep resilience – for example testing programs or policies that promote upward mobility – would allow researchers to gain a better handle on causality.
4. Experimental studies are also needed that focus on interventions designed to mitigate the physical health costs of skin-deep resilience through addressing targeted mechanisms.

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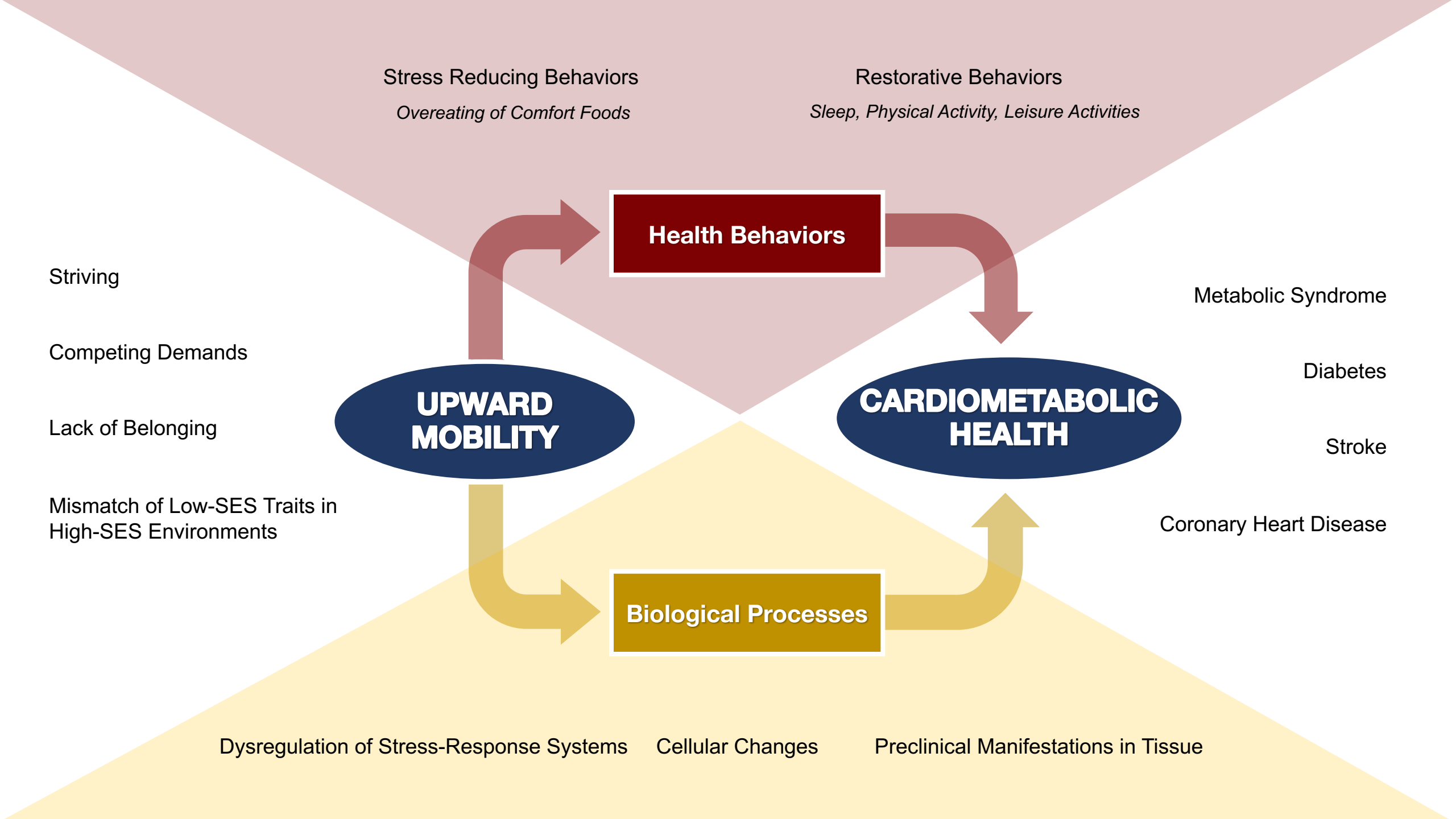
Figure Captions

Figure 1. Model depicting psychological mediators associated with both low SES and high SES that explain SES disparities in physical health. The upwardly mobile group is depicted in between the low and high SES groups, experiencing pulls toward each. The upwardly mobile group is hypothesized to have its own set of unique psychological experiences that have implications for physical health.

Figure 2. Model of pathways from the psychological experiences of upwardly mobile individuals to physical health. These pathways include health behaviors (both behaviors that help to reduce stress and restorative health behaviors) and biological processes (acute dysregulation of the autonomic nervous system and hypothalamic pituitary adrenal axis; cellular changes, such as epigenetic aging; and over time, preclinical manifestations of disease in tissues) that have implications for cardiometabolic health in adulthood.


Adaptive High SES Characteristics
Independence
Proactive Coping
Emotional States
Psychological Resources
Executive Function/Memory
UPWARD MOBILITY
Striving
Competing Demands
Lack of Belonging
Mismatch of Low-SES Traits in High-SES Environments
Adaptive Low SES Characteristics
Interdependence
Shift-and-Persist
Emotion Perception/Memory
Attention Shifting
Working Memory Updating


Stress Reducing Behaviors
Overeating of Comfort Foods
Restorative Behaviors
Sleep, Physical Activity, Leisure Activities
Health Behaviors
Striving
Competing Demands
Lack of Belonging
Mismatch of Low-SES Traits in High-SES Environments
UPWARD MOBILITY
CARDIOMETABOLIC HEALTH
Metabolic Syndrome
Diabetes
Stroke
Coronary Heart Disease
Biological Processes
Dysregulation of Stress-Response Systems
Cellular Changes
Preclinical Manifestations in Tissue