THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF HEALTH POLICY AND ADMINISTRATION

EXAMINING THE CONSEQUENCES OF SKIN-DEEP RESILIENCE

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SPRING 2020

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Health Policy and Administration
with honors in Health Policy and Administration

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ABSTRACT

Background: Skin-deep resilience is a term that was coined to describe disadvantaged Black adolescents who show resilience in pursuing higher education, but as a result, suffer higher physiological stress and poorer physical health in adulthood. The goal of this research is to further examine this phenomenon and test whether skin deep resilience in adolescence is significantly associated with higher socioeconomic status (SES) and incidence of infections in adulthood.

Methods: This study uses data for Black respondents in Waves 1 and 4 of Add Health, a longitudinal and nationally representative survey. R software was used to determine the relationships between adolescent resilience and SES, and adolescent resilience and adult incidence of infections.

Results: Statistically significant results were found showing that individuals who had higher resilience in adolescence were able to achieve a higher SES status in adulthood compared to their lower resilience counterparts (p = .0001 in the full Black sample; p = .0003 in the subsample of Black respondents who were economically disadvantaged in adolescence). However, the analyses did not demonstrate a significant relationship between resilience in adolescence and the number of common infectious or inflammatory diseases in adulthood.

Conclusions: Resilience among disadvantaged Black adolescents is associated with higher SES in later life but is not associated with greater subsequent risk of infectious or inflammatory diseases. The study had some limitations, including a relatively small sample size, which may have prevented a clear and statistically significant relationship from being

demonstrated. Future research is essential to understand and combat the negative consequences of the skin-deep resilience phenomenon and could focus on chronic diseases or self-rated health.

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ACKNOWLEDGEMENTS

First, I would like to offer my sincerest thanks to my faculty thesis advisor Dr. Marianne Hillemeier for her kindness, dedication, and continuous insight as we worked together to shape and create my thesis. Dr. Hillemeier has been involved through every step of this process, working on everything from the fine details to the big picture. It was an honor to work with her and receive her feedback, and her knowledge has only enhanced this thesis. I would also like to thank my honors advisor Dr. Selena Ortiz for all that she has done to prepare me to undertake the enormous task of writing a thesis. Finding where to start is often the most difficult part of the process but her guidance and expertise helped facilitate the task and allowed me to produce well-rounded research questions.

I would like to thank Don Miller and Xi Chen from the Population Research Institute as well as Ishan "Data Boy" Muzumdar, for all of their help with the R programming portion of my thesis. Coding is no easy task but with their assistance, I was able to dive into the big data set that is Add Health, extract the variables of interest, and perform robust analyses. I want to thank my professors and advisors who have helped guide me to and through the Health Policy and Administration Department, allowing me to discover a field that I am truly passionate about and to study something that excites me every day. Finally, I'd like to thank my mom for all of her continued support in this four-year journey. Her encouragement motivates me to be the best student that I can be, setting me up for success.

Chapter 1

Introduction and Overview

We often associate achieving higher levels of education and socioeconomic status with living a longer, healthier life. However, there is literature that says this positive relationship doesn't always exist for racial/ethnic minorities from disadvantaged backgrounds. The literature focuses on the idea of skin-deep resilience, specifically among Black adolescents from disadvantaged backgrounds, in groups ranging in age from adolescence through early adulthood (Brody et al., 2013; Gaydosh et al., 2018). This phenomenon directly contradicts our expectations and thus, changes our ideas about how we can diminish health disparities. If improved SES leads to success in some areas but adverse effects in others, we need to better understand what damage is being done in order to continue improvements and reduce harm.

Previous studies have identified skin-deep resilience as a pattern of better mental health but poorer physiological health in disadvantaged racial/ethnic minorities, which suggests that these groups are not as successful at overcoming adversity as researchers have initially assumed. While mental health benefits are important, we see the negative effects of resilience through a number of physiological signs including higher metabolic syndrome (Gaydosh et al., 2018), a higher likelihood of developing type 2 diabetes (Brody et al., 2016), an increased vulnerability for upper respiratory infections (Miller et al., 2016), more rapid immune cell aging (Miller et al., 2015), an increased risk of hypertension (Gaydosh et al., 2018), and higher allostatic load (Brody et al., 2013). This paper contributes to the growing understanding of skin-deep resilience by studying a new health outcome – the number of common infectious and inflammatory diseases.

If a similar relationship is demonstrated, it will increase our knowledge about and further emphasize the specific, negative, physiological risks that the population of disadvantaged racial/ethnic minorities face.

The remainder of this thesis is organized in the following manner. Chapter 2 provides an in-depth review of the existing research that has been conducted on skin-deep resilience, as well as a review of the literature on socioeconomic (SES) disparities in health. Next, the conceptual framework guiding the thesis analyses is presented and discussed, followed by the research questions that are addressed. Chapter 3 describes the data used for the study sample and provides the questions that were used to construct the measures for the analyses. An overview of the methodology for running the analyses is also included. Chapter 4 discusses the results of the analyses and presents the findings in tables. Chapter 5 concludes this thesis with a discussion of what the results show – or don't show – and what researchers should consider moving forward.

Chapter 2

Background, Conceptual Framework, and Research Questions

Background

Healthcare in America is complex, hard to navigate, and is experienced by individuals differently on the basis of personal characteristics like sex, race, and socioeconomic background. These differences can result in discrimination (Smedley et al., 2003) and health disparities (National Academies of Science et al., 2017), which affect racial/ethnic minority communities. For Black Americans, these disparities manifest in measurable ways including life expectancy gaps (Harper et al., 2014) and increased risks for and rates of chronic diseases, such as diabetes (Signorello et al., 2007), cardiovascular disease, (Kramer et al., 2015), and hypertension (Lackland, 2015) in comparison to White Americans. Research has shown that socioeconomic status (SES) is strongly associated with health status (Phelan et al., 2010; Demakakos et al., 2008; Kawachi & Kennedy, 1999) and suggests that enabling racial/ethnic minority communities to achieve higher education – which often leads to higher income – will help to reduce some of these disparities. However, there is a small but growing body of literature that has discovered a phenomenon, known as skin-deep resilience, that may directly contradict this idea. Research that focuses on this phenomenon is reviewed below.

Skin-Deep Resilience

In a paper written in 2013, Brody et al. coined the phrase “skin-deep resilience” to describe the results of their research among black adolescents. They studied adolescents from

nine rural counties in Georgia and most were considered to be from “working poor” families. Their levels of SES disadvantage and academic and social competence were rated by their parents and teachers respectively. The authors found that black adolescents who came from socioeconomically disadvantaged situations but were able to pursue higher education had low levels of depression but high levels of physiological stress in adulthood. These individuals often showed high levels of self-control, academic achievement, and social competence in adolescence, which indicated resilience, and which were associated with improved mental health. However, this resilience was characterized as merely skin-deep because the stress they endured to build this resilience led to physiological wear and tear.

These results are consistent with theories of allostasis and John Henryism. The theory of allostasis was first developed and described by Sterling and Eyer in 1988, who argued that the body produces a physiological response to stress in order to maintain stability. They claimed that allostasis was necessary to maintain homeostasis but that when performing abnormally, could cause harm via what they termed allostatic load (McEwen, 2006). John Henryism was presented by Sherman James in a 1994 publication and was strongly tied to the idea of allostasis and allostatic load. It is a coping style based on the legend of John Henry, a Black railroad worker who was able to outperform a steam-powered drill only to then die from exhaustion. It is rooted in the idea that perseverance and self-control can lead to achievements and a stronger mental well-being, but if sustained for too long, such resilience can have physiological consequences (James, 1994).

The study by Brody et al. was particularly influential because it not only described a new phenomenon but also utilized longitudinal data, which allowed for a stronger research design. However, the study was limited to a very specific population of rural Black Americans. In 2015,

Miller et al. (2015) furthered our knowledge of skin-deep resilience by looking at consequences related to epigenetic aging. They hypothesized that self-control in adolescence would act as a double-edged sword for those of low SES backgrounds and the costs of skin-deep resilience would be evidenced in accelerated aging of immune cells. This hypothesis was based on the concept of weathering, which is rooted in the study of the health of Black women and infants. This concept was developed by Arline Geronimus to explain differences in maternal age patterns and birth outcomes between Blacks and Whites. Geronimus proposed that the disadvantage faced by Black women accumulated throughout their life deteriorates their health in early adulthood (1992).

The focus on self-control in the Miller study was driven by advocacy around programs that help train and support low SES youth in developing self-control and other character skills. The study population was from rural counties in Georgia and the data was taken from a larger study called Adults in the Making (AIM), which was a randomized trial focused on drug and alcohol abuse prevention in Black teens. The measures that were examined were self-control, socioeconomic disadvantage, DNA methylation, and epigenetic age acceleration. The authors concluded that their skin-deep resilience hypothesis was supported by the study findings, which were consistent with the pattern that had been established in Brody et al.'s previous study (i.e. connecting persistent stress with physiological consequences). Additionally, Miller et al. were able to recommend adjustments to the character skills programs to include health education and potential medical care and monitoring when possible.

In 2016, both Brody et al. and Miller et al. published papers that sought to examine skin-deep resilience with more concrete outcomes, such as actual disease diagnoses, rather than just signs of potential diseases in the future. Brody et al.'s study examined type 2 diabetes in

adulthood utilizing data from Waves I and IV of Add Health, a national and longitudinal study. They found that disadvantaged but high striving Black adolescents were more likely to have diabetes in adulthood than their high-striving peers from more privileged backgrounds. Moving forward, they suggested pediatric surveillance and screening in order to detect diabetes early as well as implementing programs and resources in schools and communities to support these high-striving individuals. Miller et al.'s study examined upper respiratory infection (URI) susceptibility among Blacks and Whites from the Pittsburgh, PA metropolitan area. They also found the same patterns of high psychosocial health and an increase in URIs among disadvantaged Blacks. Both of these studies, which furthered previous research by demonstrating these patterns, applied to populations outside of just the rural south.

Gaydosh et al. (2018) used this concept of skin-deep resilience along with weathering, allostatic load, and John Henryism to develop the hypothesis that while Whites experience universally positive returns upon finishing college, racial/ethnic minorities experience mixed returns with regard to later health, and this is especially the case among those from disadvantaged backgrounds. They also utilized Waves I and IV of Add Health and explored indicators of metabolic syndrome. These indicators include abdominal obesity, hypertension, and low levels of high-density lipoprotein cholesterol and studies have demonstrated an association between metabolic syndrome and conditions, such as cardiovascular disease and type 2 diabetes (Samson & Garber, 2014). The results of the Gaydosh study not only supported the patterns established in previous work on skin-deep resilience, but also demonstrated how the phenomenon applied to disadvantaged Hispanics. They concluded that policies that not only promote upward mobility but further support individuals who pursue upward opportunities should be implemented.

Most recently, Chen et al. (2019) took a closer look at the way stress and skin-deep resilience interact with asthma profiles, hypothesizing that the established pattern of increased mental health at the expense of physiological health would continue to be evident with a new disease. Using a sample of children and adolescents between the ages of nine and 17 from Chicago and the greater surrounding areas, the investigators measured school stress, self-control, anxiety and depression, and physiological measures of asthma. Similar to other study findings, the results showed that individuals who were Black or Latino and who experienced higher levels of struggle in school had worse asthma according to two different measures, while their White counterparts did not experience any kind of patterns of physiological consequences.

SES Disparities in Adolescent Health

In order to understand why socioeconomic status (SES) is an important variable in the present study, let us examine the research documenting the correlation between SES and health and the implications of these studies. In 1999, Goodman published one of the first studies to view SES as a gradient and then used that gradient as a lens to explain differences in US adolescent health. Prior to her research, most of the SES work focused on adults or children and ignored the adolescent transition period. Goodman utilized Wave I of Add Health and focused on health outcomes such as self-rated health, chronic disease, and acute disease. She found a linear correlation between SES and rates of some chronic diseases – obesity and depression – as well as self-rated health. The measure of self-rated health is especially important because it is very predictive of disease later in adult life. This study emphasized the importance of considering SES as a direct factor in health outcomes and also noted that some aspects of SES, like income and

education, may have different effects than others. Goodman also briefly noted the phenomenon of allostatic load and how that may have a role to play in SES-related disparities as well.

Newacheck et al. (2003) examined the role income has to play in health status, access, and utilization for adolescents. An important consideration in this study was adolescent insurance coverage, especially considering the recent roll out of the State Children's Health Insurance Plan (SCHIP) at that time. Using the 1999 and 2000 National Health Interview Surveys (NHIS), Newcheck et al. found that in over 75% of their selected health and health services measures, significant disparities existed between poor adolescents and their middle- and high-income counterparts. One of the key takeaways of their findings was that while health insurance programs are a necessary piece to improve health care access, further action is necessary to remove other remaining barriers to care.

In a paper from 2005, Goodman et al. interacted measures of race/ethnicity and SES to create a measure of social disadvantage. They posited that social disadvantage was on a gradient as well and assumed that when combined with perceived stress, a hierarchy of advantage would be produced. The investigators hypothesized that at the lower end of this hierarchy, effects of both race/ethnicity and SES on stress would be indistinguishable but would start to differentiate as you moved up the hierarchy. Their study, which included Black and White adolescents in grades seven to twelve from a suburban, mid-western public-school district, found that although social disadvantage was associated with increased stress among adolescents, it didn't matter if that disadvantage came from SES or race/ethnicity. The study also found social rankings to be predictive of stress, and for populations that were higher on the advantage hierarchy, stress levels were more attributable to either race/ethnicity or SES.

Returning to the concept of SES as a gradient, Chen et al. (2015) hypothesized that we would see different relationships between SES and health depending on both the age and health outcome of interest. They used data from the 1994 NHIS and examined both specific acute conditions and overall health as rated by parents. Overall, the aim of this study was to demonstrate the importance of studying the pathways to acute disease as they emerge in adolescence to better understand the impact of SES and develop the most appropriate interventions. The investigators found that for the overall, or global, health measure, the association with SES was similar across childhood and adolescence. However, these associations varied by age when looking at specific acute conditions such as acute respiratory illness.

In 2007, Goodman et al. published a study examining the notion of perceived SES, offering a different point of view and arguing for this new lens to become a new type of identity that would join the ranks of race/ethnicity and objective SES. They hypothesized that individuals of racial/ethnic minorities would have lower perceived SES and if they were disadvantaged in multiple dimensions (i.e. race/ethnicity, SES), then that would further lower their perceived SES. The investigators also hypothesized that low perceived SES would be associated with poor self-rated health. Using the Princeton School District Study, a survey taken annually for four years and with a subject population of adolescents in grades seven to twelve, they were able to support their hypothesis. Additionally, due to the robust nature of their findings, Goodman et al. suggested that this SES identity may be a more sensitive predictor of health status among adolescents compared to the objective SES measures being used in the past. They mention that subject perceptions may capture the nuance of how SES measures interact together and may better reflect the unique circumstances of individual lives.

More recently, Colen et al. (2018) published a paper examining racial/ethnic disparities among African Americans and Hispanics of higher economic status and the connection between discrimination and health outcomes in comparison to Whites. Using data from the National Longitudinal Study of Youth, the investigators examined this relationship within a cohort aged 14 to 21 that spanned 1986-2012. Their findings demonstrated that Black and Hispanic adolescents experienced higher levels of both acute and chronic discrimination and that this treatment increased as these minorities achieved upward mobility. However, for Whites, upward mobility had a protective effect and resulted in experiencing less discrimination. These findings align very closely with skin-deep resilience theories and support the idea that alleviating or eradicating poverty is not enough to reduce the health disparities that exist between minorities and Whites.

Conceptual Framework

This thesis further explores the hypothesis of skin-deep resilience. As shown in figure 1 below, I examine the relationships between disadvantage and resilience experienced in adolescence, and the incidence of infections in adulthood. I expect to see that disadvantage related to socioeconomic status and race is associated with the development of resilience among some adolescents. I predict that as a result, individuals who experience disadvantage but gain resilience will achieve a higher socioeconomic status level at the expense of their health, specifically with the outcome of infections. I expect the phenomenon to either be minimized or not observable among peers who either did not face disadvantage or were unable to develop resilience. Additionally, one phenomenon often seen with higher socioeconomic status is increased access and ability to use the healthcare system. This increased access influences health

as it leads to the diagnosis of health problems such as infectious diseases. Thus, I will take the level of access into account in the analyses.

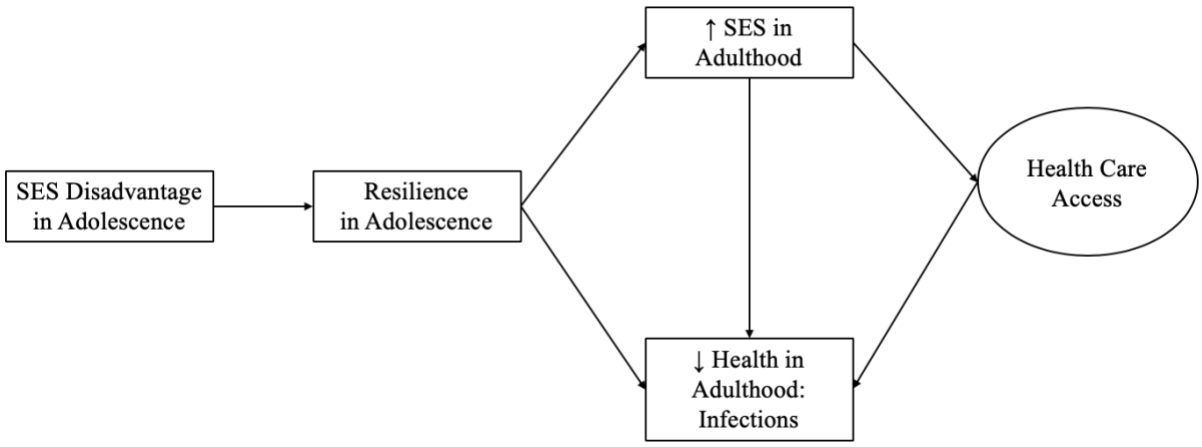

Figure 1. Conceptual Framework Guiding This Research

Research Questions

The following questions motivated and shaped the analysis that was conducted and the outcomes that were examined. First, do SES-disadvantaged African American adolescents who display high resilience attain a higher socioeconomic status in their adulthood than those African American adolescents who display lower resilience? Second, do SES-disadvantaged African American adolescents with high resilience have a higher incidence of infectious diseases compared to those who displayed lower resilience? Finally, controlling for the effects of both socioeconomic status in adulthood and access to health care, does adolescent resilience have an effect on the incidence of infectious disease in adulthood?

Chapter 3

Data and Methods

Sample

Data for the sample were pulled from Waves 1 and 4 of Add Health, a national and longitudinal school-based study with a nationally representative group of adolescents in grades seven to twelve in the US at the start of the study in 1994-95. The public use version of the data was analyzed. The study was classified as, "Not Human Research," by the Penn State IRB. Wave 1 consisted of 6,504 respondents and was broken down by the following: 4,294 respondents self-identified as White and 1,619 respondents self-identified as Black. Wave IV had 5,114 individuals participating, with 3,671 respondents identified as White by the interviewer and 1,240 respondents identified as Black by the interviewer.

Measures

Race

To determine the race of respondents, I utilized questions in Wave 1 that asked study respondents to self-identify their race. Two separate yes or no questions for the categories White and Black were utilized.

Socioeconomic Status

For Wave 1, socioeconomic status (SES) was calculated using three different questions pertaining to parental marital status, parental level of education, and parental ability to pay the

bills. If parents were unable to pay bills, were unmarried, or did not graduate from high school, that individual was labeled as having low SES.

In Wave 4, SES was calculated by looking at household income, achieved education, and self-rated SES. Household income was ascertained from a question regarding an individual's total household income before taxes and deductions. Responses were divided into 12 different brackets. The average household income in America in 2008 was approximately $52,000, so respondents with an income greater than $50,000 were categorized as high SES for the income variable. Education was measured by asking respondents about the highest level of education they had achieved, anything below a college degree was considered low SES for that variable. Finally, self-rated SES was measured using the metaphor of a ladder. Respondents were told to imagine a 10-step ladder being representative of where individuals stand in the US with the top of the ladder, step 10, representing those with the most money and education, and most respected jobs. The bottom of the ladder, step one, represented those in the US with the least amount of money and education, and least respected jobs. The study respondents were then asked to place themselves on this ladder relative to the rest of the US population. If this self-rated SES measure was below but not including step five, then these individuals were considered low SES.

Overall SES determination took this self-rated SES into account significantly and having low self-rated SES translated into automatic categorization into overall low SES. Then, if self-rated SES was higher but both income level and education level qualified an individual for low SES, then they were also labeled low SES.

Resilience

The four areas described below were compiled to create an overall resilience score. Based on the literature and previous resilience variables created and used by authors, these four

categories and subsequent 16 survey questions were selected because they were most relevant to determining an individual's level of resilience. A discussion regarding the scoring method follows.

1. Self-Esteem

To assess respondents' levels of self-esteem, six questions in Wave 1 that required respondents to agree or disagree with a statement on a scale of one to five (with one representing strongly agree and five representing strongly disagree) were used. Example statements included, "You have a lot of good qualities," "You have a lot to be proud of," and "You like yourself just the way you are."

2. School Self-Control

School self-control was measured using four different questions from Wave 1 that asked how often a specific scenario had occurred within the past school year. Answers were once again on a scale, this time ranging from zero to four with zero representing never and four representing every day. Example questions included, "How often have you had trouble paying attention in school?" and "How often have you had trouble getting your homework done?"

3. Positive Outlook

Positive outlook was determined by looking at responses to three statements in the Wave 1 questionnaire, which were rated by respondents on a scale of zero to three. Ratings indicated how often the respondents felt a certain emotion or feeling within the past week with zero representing never or rarely and three representing most of the time or all of the time. These

statements included, “You feel hopeful about the future,” “You were happy,” and “You enjoyed life.”

4. Striving

The score for striving was comprised of responses to three different questions from Wave 1. The first question referred to the self-perceived likelihood that the respondent will attend college. The next two questions asked about number of hours worked at a job, both during the summer and throughout the remainder of the year. Responses to the likelihood question were on a scale of one to five with one being low and five being high. The responses to the hours worked question ranged from zero to 145.

Resilience Score

An overall resilience score was created with a range from zero to four based on the four above components. Each component was weighted equally and either contributed a one or a zero. That number was determined by summing an individual’s total points for each component, calculating the median, and assigning a one if the summed score was above the median and a zero if the summed score was below the median. See Table 1 for more information.

Table 1. Questions Used to Create Resilience Score

Variable	Description of Variable	Response
Resilience		
Self Esteem		
H1PF30	Agree/Disagree: You have a lot of good qualities	1 = strongly agree to 5 = strongly disagree
H1PF32	Agree/Disagree: You have a lot to be proud of	1 = strongly agree to 5 = strongly disagree
H1PF33	Agree/Disagree: You like yourself just the way you are	1 = strongly agree to 5 = strongly disagree
H1PF34	Agree/Disagree: You feel like you are doing everything just about right	1 = strongly agree to 5 = strongly disagree
H1PF35	Agree/Disagree: You feel socially accepted	1 = strongly agree to 5 = strongly disagree
H1PF36	Agree/Disagree: You feel loved and wanted	1 = strongly agree to 5 = strongly disagree
School Self-Control		
H1ED15	How often have you had trouble getting along with your teachers?	0 = never to 4 = everyday

H1ED16	How often have you had trouble paying attention in school?	0 = never to 4 = everyday
H1ED17	How often have you had trouble getting your homework done?	0 = never to 4 = everyday
H1ED18	How often have you had trouble getting along with other students?	0 = never to 4 = everyday
Positive Outlook		
H1FS8	You felt hopeful about the future	0 = never/rarely to 3 = most of the time/all of the time
H1FS11	You were happy	0 = never/rarely to 3 = most of the time/all of the time
H1FS15	You enjoyed life	0 = never/rarely to 3 = most of the time/all of the time
Striving		

H1EE2	How likely is it that you will go to college?	1 = low to 5 = high
H1EE4	How many hours do you spend working for pay in a typical non-summer week?	Range of 1 hour to 145 hours
H1EE6	How many hours do you spend working for pay in a typical summer week?	Range of 1 hour to 99 hours

Health Care Access

A single question from Wave 4 was used to determine whether an individual had low or high access to health care. The question evaluated insurance coverage by asking respondents to describe their current insurance situation. Respondents indicating that they had no insurance coverage were coded as having low access.

Health Outcome: Infectious or Inflammatory Diseases

Wave 4 of Add Health had a specific subset of data relating to measures of inflammation and immune function, including the number of common infectious or inflammatory diseases of a participant. The responses range from zero to three.

Table 2. Descriptive Characteristics of African American Sample

	Number	**Percent of African American Sample**
SES at Wave 1		
Low	857	68.61 %
Not Low	392	31.39 %
SES at Wave 4		
Low	855	68.45 %
Not Low	394	31.55 %
Resilience at Wave 1		
Higher	866	69.34 %
Lower	383	30.66%
Health Care Access at Wave 4		
Higher	936	74.94%
Lower	313	25.06%
Count of Infections at Wave 4		
0	804	64.84 %
1	347	27.98 %
2	78	6.29 %
3	11	0.89 %

Methods

Wave 1 data, Wave 4 data, and the inflammation and immune function data were stored separately and so a merge had to be done before any analyses could be conducted. The data were merged by an ID number present in all three data sets. Additionally, the data was filtered to create a dataset with only the Black respondents. In order to address the first two research questions, two-by-two tables were created for the variables of interest. Additionally, an unpaired two-samples t-test was run for each table to determine significance of results. To address the third research question, two logistic regression models and a chi-square test for independence were run. The first logistic regression model used two constructed predictors – resilience and health care access – with count of infectious and inflammatory diseases serving as the dependent variable. The second logistic regression model added a third constructed predictor, Wave 4 SES, and used the same dependent variable as the first model. The chi-square test of independence was performed between the variables count of infectious and inflammatory diseases and resilience.

Once this initial analysis was run, the data was filtered again to create a dataset with only the Black respondents who qualified as low SES at Wave 1. The same analyses that were conducted on the full dataset with all Black respondents were run on this smaller dataset. This smaller dataset is important as the literature suggests this population is the group most likely to develop this skin-deep resilience as they are more disadvantaged than their counterparts who may have a background of higher SES.

Chapter 4

Results

Tables 3 and 7 contain the results from the analysis to address the first research question. I was curious to see how resilience at Wave 1 and socioeconomic status (SES) at Wave IV would be associated and I predicted that those individuals with higher resilience would achieve higher SES in adulthood. Based on the results in Table 3 below for the sample of all Black respondents, 34.8% of those who were high resilience attained high SES compared to 24.5% of those who were lower resilience. Additionally, the t-test showed that these results are statistically significant with a p-value of 0.0001. For the smaller samples of the Black respondents who were low SES at Wave I (Table 7), 32.2% of individuals with high resilience achieved high SES compared to 20.9% of individuals with low resilience. The t-test for the smaller sample also demonstrated statistic significant with a p-value of 0.0003. Therefore, the data shows support for the stated hypothesis.

Tables 4 and 8 have the results for the analysis on the factors related to the second research question. The hypothesis stated that those individuals who had higher resilience would actually have an increased incidence of infectious diseases. However, the t-test did not support statistical significance with a high p-value of 0.2894. As shown in Table 4 below, for the sample of all Black respondents, the percentage of those with at least one disease was similar. About 66.1% of those with high resilience had at least one disease and about 62.9% of those with low resilience had at least one disease. In the smaller sample of those who were Black and low SES at Wave 1 (Table 8), the percentages were also quite similar with 68.5% of individuals with high resilience having at least one disease and 63.5% of individuals with low resilience having at least

one disease. The t-test for this smaller sample also did not support statistical significance with a p-value of 0.1591.

Table 5 shows the results of the logistic regression modeling the incidence of infection among all Black respondents in ADD Health when controlling for access to health care. The coefficient on the resilience variable is 0.1349, with an associated p value of 0.293. This indicates that there is no statistically significant relationship between resilience at Wave 1 and the outcome of infections at Wave 4. Similar results were obtained when SES at Wave 4 was incorporated into the model as can be seen in Table 6.

Tables 9 and 10 present the results of the models run on the subsample of Black respondents who had low SES at Wave 1. This subsample is the most relevant to the theoretical framework for the study and to samples analyzed in previous research. In Table 9, the coefficient for the resilience variable is larger than the coefficient obtained in the analyses of the full sample of Black respondents (0.2234 compared to 0.1349), indicating a stronger effect in this subsample. However, the estimate was not statistically significant at conventional levels. This pattern was also present in the results for the regression model including Wave 4 SES, as shown in Table 10.

Overall, neither any of the logistic regression models nor the chi-squared tests of independence returned any statistically significant results at conventional levels. None of the predictors in any of the logistic regression models were significant for the outcome of numbers of infectious and inflammatory diseases for any of the combinations of predictors or respondent groups. Therefore, there is no statistical evidence that there is any relationship between resilience in adolescence and the outcome of the number of infectious and inflammatory diseases an individual has in adulthood.

Tables Containing Results of Analyses of All Black Respondents in Add Health

Table 3. Association of Resilience at Wave I and SES at Wave IV, Black respondents in Add Health

	High SES at Wave IV		**Low SES at Wave IV**		**Total N**
	Number	*Row Percent*	*Number*	*Row Percent*	
Higher Resilience at Wave I	301	34.8%*	565	65.2%	866
Lower Resilience at Wave I	93	24.5%	290	75.5%	383

*p=.0001

Table 4. Association of Resilience at Wave I and Infections at Wave IV, Black respondents in Add Health

	Infections in Adulthood				**Total N**
	Number with 1+ Infections		**Number with No Infections**		
	Number	*Row Percent*	*Number*	*Row Percent*	
Higher Resilience at Wave I	572	66.1%*	294	33.9%	866
Lower Resilience at Wave I	241	62.9%	142	37.19%	383

*p=.2894

Table 5. Simple Logistic Regression Analysis of Presence of Infectious or Inflammatory Diseases in Wave IV of Add Health, Black Respondents in Add Health

Independent Variable	Estimate	Standard Error	Z Value	p-value
Resilience at Wave I	0.1349	0.1283	1.051	0.293
Health Care Access	-0.0198	0.1373	-0.144	0.885

Table 6. Logistic Regression Analysis of Presence of Infectious or Inflammatory Diseases in Wave IV of Add Health with SES at Wave IV, Black Respondents in Add Health

Independent Variable	Estimate	Standard Error	Z Value	p-value
Resilience at Wave I	0.134053	0.128936	1.040	0.298
SES at Wave IV	0.009319	0.129303	0.072	0.943
Health Care Access	-0.018830	0.137919	-0.137	0.891

Tables Containing Results of Analyses of Low SES Black Respondents in Add Health

Table 7. Association of Resilience at Wave I and SES at Wave IV, Low SES Black Respondents in Add Health

	High SES at Wave IV		**Low SES at Wave IV**		**Total N**
	Number	*Row Percent*	*Number*	*Row Percent*	
Higher Resilience at Wave I	187	32.2%*	393	67.8%	580
Lower Resilience at Wave I	58	20.9%	219	79.1%	277

*p=.0003

Table 8. Association of Resilience at Wave I and Infections at Wave IV, Low SES Black Respondents in Add Health

	Infections in Adulthood				**Total N**
	Number with 1+ Infections		**Number with No Infections**		
	Number	*Row Percent*	*Number*	*Row Percent*	
Higher Resilience at Wave I	397	68.5%*	183	31.5%	580
Lower Resilience at Wave I	176	63.5%	101	36.5%	277

*p=.1591

Table 9. Simple Logistic Regression Analysis of Presence of Infectious or Inflammatory Diseases in Wave IV of Add Health, Low SES Black Respondents in Add Health

Independent Variable	Estimate	Standard Error	Z Value	p-value
Resilience at Wave I	0.2234	0.1543	1.448	0.148
Health Care Access	0.0474	0.1660	0.285	0.775

Table 10. Logistic Regression Analysis of Presence of Infectious or Inflammatory Diseases in Wave IV of Add Health with SES at Wave IV, Low SES Black Respondents in Add Health

Independent Variable	Estimate	Standard Error	Z Value	p-value
Resilience at Wave I	0.21156	0.15516	1.363	0.173
SES at Wave IV	0.11620	0.16449	0.706	0.480
Health Care Access	0.05963	0.16694	0.357	0.721

Chapter 5

Discussion

This research was undertaken to further explore and contribute to the understanding of the phenomenon of skin-deep resilience, specifically as it relates to health outcomes of those individuals who have this quality. While broader narratives of general resilience and health disparities are well-established, this specific consequence has only recently been called to attention. The information we know already implores us to further our understanding about the specific ways in which skin-deep resilience impacts individuals because it may mean that our previous pathways to eliminating health disparities need to be rethought. Past research has primarily studied two kinds of health outcomes – diseases and indictors for potential disease later in life (Brody et al., 2016; Gaydosh et. al, 2018). These outcomes have included type 2 diabetes, upper respiratory infections, epigenetic aging, and allostatic load. This thesis focuses on the outcome of infectious and inflammatory disease, an outcome that was measured in the dataset used. Specifically, the thesis examined how resilience developed in adolescence impacted this health outcome measured in adulthood and assessed whether there was any significant relationship between the two. Additionally, because socioeconomic status is often seen as a pathway to improving health, the thesis examined whether resilience developed in adolescence affected SES status in adulthood.

The results of the analysis were affirmative for some of the research questions but not all. I was able to demonstrate a significant relationship between adolescent resilience and SES in adulthood. This relationship showed that the individuals in this sample who had higher resilience

were more likely to attain high SES, supporting my first research question. This continues to confirm the surface level benefits of skin-deep resilience, adding to the research which already supports improved mental health benefits for these individuals. However, the results for the relationship between adolescent resilience and the health outcome of count of infectious and inflammatory diseases did not agree with expectations. First, as was previously stated, there was no statistical significance for the tables that were generated or the logistic regression models that were run. For the models, the lack of statistical significance suggests that the variables selected – including resilience – have no effect on the chosen outcome. The data also did not suggest that a significant difference in the percentages of each group that had at least one infectious or inflammatory disease existed.

There are a number of reasons for why the results may have failed to demonstrate any relationship between resilience and the selected health outcome. First, a count of common infectious and inflammatory diseases may not be a common metric used by people. Therefore, the awareness level of having this disease in comparison to something that is more chronic and impactful, such as heart disease, may be significantly decreased. Additionally, this information was reported by the individuals as they were taking the survey. Depending on the time frame the survey was looking for, it may be harder for respondents to remember when they had such a disease and how many diseases they had (i.e. recall bias). Additionally, as the focus was on the Black respondents of the survey, the sample size was fairly small and thus may be limiting the ability to detect statistical significance.

For future research, examining the effects of resilience on a host of different health outcomes is recommended to better understand the consequences of skin-deep resilience. For example, as alluded to in the previous paragraph, more substantial and significant results may be

seen if researchers decide to examine a chronic health outcome, such as heart diseases or cancer. Additionally, self-rated health may be another good outcome to consider and it was one that was initially considered. Self-rated health has been shown to be a strong indicator for life expectancy and quality of life and so it would be interesting to examine it through this lens of skin-deep resilience. This is a field that needs continued attention in order to be able to shape decisions and policies that target these specific issues, allowing for things like improved SES in adulthood while removing these physiological consequences.

Appendix A

R Input

```
install.packages("sas7bdat")
library(sas7bdat)
#install package to read in sas data

w1inhome = read.sas7bdat("w1inhome.sas7bdat")
w4inhome = read.sas7bdat("w4inhome.sas7bdat")
w4infection = read.sas7bdat("w4infection.sas7bdat")
#read in wave 1 and 4 datasets, wave 4 infectious disease data

w4people = w4inhome$AID
in_both_studies = w1inhome[w1inhome$AID %in% w4people,]
w1w4inhome = merge(in_both_studies, w4inhome, by = "AID",)
inhomeinfected = merge(w1w4inhome, w4infection, by = "AID",)
#merge wave 1 and wave 4 data by ID, then merge w1w4 & w4 infection by ID

inhomeinfected$marital_status = ifelse(is.na(inhomeinfected$PA10),
        ifelse(inhomeinfected$PA10 == 2, 1, 0))

inhomeinfected$parent_hsgrad_status = ifelse(is.na(inhomeinfected$PA12), 0,
        ifelse(inhomeinfected$PA12 <= 3, 0, 1))

inhomeinfected$parent_trouble_w_bills = ifelse(is.na(inhomeinfected$PA56), 0,
        ifelse(inhomeinfected$PA56 ==1, 1, 0))

inhomeinfected$lowSES_true = ifelse(inhomeinfected$parent_trouble_w_bills == 0, TRUE,
        ifelse(inhomeinfected$marital_status == 0, TRUE,
        ifelse(inhomeinfected$parent_hsgrad_status == 0, TRUE, FALSE)))

inhomeinfectedlowSES = which(inhomeinfected$lowSES_true == TRUE)
inhomeinfectedhighSES = which(inhomeinfected$lowSES_true == FALSE)

lowSES_people_black = which(inhomeinfected$lowSES_true == TRUE &
        inhomeinfected$H1GI6B == 1)
highSES_people_black = which(inhomeinfected$lowSES_true == FALSE &
        inhomeinfected$H1GI6B == 1)

#determining SES level
```

```
inhomeinfected$se1 = inhomeinfected$H1PF30
inhomeinfected$se2 = inhomeinfected$H1PF32
inhomeinfected$se3 = inhomeinfected$H1PF33
inhomeinfected$se4 = inhomeinfected$H1PF34
inhomeinfected$se5 = inhomeinfected$H1PF35
inhomeinfected$se6 = inhomeinfected$H1PF36

inhomeinfected$sesum = inhomeinfected$se1 + inhomeinfected$se2 + inhomeinfected$se3 +
        inhomeinfected$se4 + inhomeinfected$se5 + inhomeinfected$se6

inhomeinfected$seindex = ifelse(inhomeinfected$sesum <= 12, 1, 0)

inhomeinfected$ssc1 = inhomeinfected$H1ED15
inhomeinfected$ssc2 = inhomeinfected$H1ED16
inhomeinfected$ssc3 = inhomeinfected$H1ED17
inhomeinfected$ssc4 = inhomeinfected$H1ED18

inhomeinfected$sscsum = inhomeinfected$ssc1 + inhomeinfected$ssc2 + inhomeinfected$ssc3 +
        inhomeinfected$ssc4

inhomeinfected$sscindex = ifelse(inhomeinfected$sscsum <=4, 1, 0)

inhomeinfected$po1 = inhomeinfected$H1FS8
inhomeinfected$po2 = inhomeinfected$H1FS11
inhomeinfected$po3 = inhomeinfected$H1FS15

inhomeinfected$posum = inhomeinfected$po1 + inhomeinfected$po2 + inhomeinfected$po3

inhomeinfected$poindex = ifelse(inhomeinfected$posum >= 6, 1, 0)

inhomeinfected$s1 = inhomeinfected$H1EE2
inhomeinfected$s2index = ifelse(inhomeinfected$H1EE4 < 5, 1, ifelse(inhomeinfected$H1EE4
        >=5 && inhomeinfected$H1EE4 <=10, 2, ifelse(inhomeinfected$H1EE4 >10 &&
        inhomeinfected$H1EE4<=15, 3, ifelse(inhomeinfected$H1EE4 > 15 &&
        inhomeinfected$H1EE4 <=20, 4, ifelse(inhomeinfected$H1EE4 > 20, 5, 0)))))
inhomeinfected$s3index = ifelse(inhomeinfected$H1EE6 < 10, 1, ifelse(inhomeinfected$H1EE6
        >=10 && inhomeinfected$H1EE6 <=20, 2, ifelse(inhomeinfected$H1EE6 >20 &&
        inhomeinfected$H1EE6<=30, 3, ifelse(inhomeinfected$H1EE6 > 30 &&
        inhomeinfected$H1EE6 <=40, 4, ifelse(inhomeinfected$H1EE6 > 40, 5, 0)))))

inhomeinfected$ssum = inhomeinfected$s1 + inhomeinfected$s2index +inhomeinfected$s3index

inhomeinfected$sindex = ifelse(inhomeinfected$ssum >= 5, 1, 0)
```

```
inhomeinfected$resilienceindex = inhomeinfected$seindex + inhomeinfected$sscindex +
    inhomeinfected$poindex + inhomeinfected$sindex

inhomeinfected$low_resilience_true = ifelse(inhomeinfected$resilienceindex < 3, TRUE,
    FALSE)
low_resilience_score = which(low_resilience_true == TRUE)
high_resilience_score = which(low_resilience_true == FALSE)

low_resilience_score_blacks = which(low_resilience_true == TRUE & inhomeinfected$H1GI6B
    == 1)

high_resilience_score_blacks = which(low_resilience_true == FALSE &
    inhomeinfected$H1GI6B == 1)

#wave 1 data

inhomeinfected$income = ifelse(inhomeinfected$H4EC1 >= 9, 1, 0)

inhomeinfected$education = ifelse(inhomeinfected$H4ED2 >= 7, 1, 0)

inhomeinfected$self_rated_SES = ifelse(inhomeinfected$H4EC19 > 5, 1, 0)

inhomeinfected$w4_lowSES_true = ifelse(inhomeinfected$self_rated_SES == 0, TRUE,
    ifelse(inhomeinfected$income == 0 && inhomeinfected$education == 0, TRUE,
    FALSE))

w4_lowSES = which(w4_lowSES_true == TRUE)
w4_highSES = which(w4_lowSES_true == FALSE)

w4_lowSES_people_black = which(w4_lowSES_true == TRUE & inhomeinfected$H1GI6B ==
    1)
w4_highSES_people_black = which(w4_lowSES_true == FALSE & inhomeinfected$H1GI6B
    == 1)

#determining SES in w4

inhomeinfected$health_care_access = ifelse(inhomeinfected$H4HS1 == 1, 0, 1)
inhomeinfected$high_access_true = ifelse(inhomeinfected$health_care_access == 1, TRUE,
    FALSE)
high_access = which(high_access_true == TRUE)
low_access = which(high_access_true == FALSE)

high_access_black = which(high_access_true == TRUE & inhomeinfected$H1GI6B == 1)
low_access_black = which(high_access_true == FALSE & inhomeinfected$H1GI6B == 1)
```

```
#health care access in w4

inhomeinfected$count_infections = w4infection$C_INFECT

sum(count_infections == 0 & w1w4inhome$H4IR4 == 2, na.rm = TRUE)
sum(count_infections == 1 & w1w4inhome$H4IR4 == 2, na.rm = TRUE)
sum(count_infections == 2 & w1w4inhome$H4IR4 == 2, na.rm = TRUE)
sum(count_infections == 3 & w1w4inhome$H4IR4 == 2, na.rm = TRUE)

inhomeinfected$infections = ifelse(inhomeinfected$count_infections > 0, 1, 0)
inhomeinfected$infected_true = ifelse(inhomeinfected$infections == 1, TRUE, FALSE)
infected = which(infected_true == TRUE)
not_infected = which(infected_true == FALSE)

infected_black = which(infected_true == TRUE & inhomeinfected$H1GI6B == 1)
not_infected_black = which(infected_true == FALSE & inhomeinfected$H1GI6B == 1)

#count of infectious and inflammatory diseases in w4

#wave 4 data

install.packages("dplyr")
library(dplyr)
analysis_data = filter(inhomeinfected, H1GI6B == 1)

table(analysis_data$low_resilience_true, analysis_data$w4_lowSES_true)
table3 = t.test(low_resilience_true ~ w4_lowSES_true, data = analysis_data)
table(analysis_data$low_resilience_true, analysis_data$infected_true)
table4 = table4 = t.test(low_resilience_true ~ infected_true, data = analysis_data)

#table construction for full African American sample

logistic_model_full = glm(infected_true ~ low_resilience_true + w4_lowSES_true +
      high_access_true, family=binomial(link='logit'), data=analysis_data)

logistic_model_part = glm(infected_true ~ low_resilience_true +
      high_access_true,family=binomial(link='logit'), data=analysis_data)

chi_sq_table = table(analysis_data$low_resilience_true, analysis_data$infected_true)
chisq.test(chi_sq_table)

#logistic regression for full African American sample

analysis_data_subset = inhomeinfected[lowSES_people_black, ]
```

```
table(analysis_data_subset$low_resilience_true, analysis_data_subset$w4_lowSES_true)
table7 = t.test(low_resilience_true ~ w4_lowSES_true, data = analysis_data_subset)
table(analysis_data_subset$low_resilience_true, analysis_data_subset$infected_true)
table8 = t.test(low_resilience_true ~ infected_true, data = analysis_data_subset)

#table construction for lowSES African American sample

logistic_model_full_2 = glm(infected_true ~ low_resilience_true + w4_lowSES_true +
        high_access_true, family=binomial(link='logit'), data=analysis_data_subset)

logistic_model_part_2 = glm(infected_true ~ low_resilience_true +
        high_access_true,family=binomial(link='logit'), data=analysis_data_subset)

chi_sq_table_2 = table(analysis_data_subset$low_resilience_true,
        analysis_data_subset$infected_true)
chisq.test(chi_sq_table_2)

#logistic regression for lowSES African American sample
```

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ACADEMIC VITA

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EDUCATION

The Pennsylvania State University **Class of 2020**
Schreyer Honors College, *College of Health and Human Development* *University Park, PA*
Bachelor of Science (B.S.) in Health Policy and Administration

WORK EXPERIENCE

Aetna, a CVS Health Company **Hartford, CT**
General Management Summer Associate, National Network Delegation ***June 2019 – August 2019***

- Designed proposal for a PayFlex, a benefits administrator to introduce and implement both a college savings plan and a student loan repayment plan
- Coordinated afternoon service event for group of 5 interns at Riverfront Recapture, a local environmental nonprofit
- Compiled list of 150+ Aetna delegates for Security Scorecard tool to analyze cybersecurity posture and resulting risk rankings
- Developed weighted risk ranking with 15 predictors for list of delegates used in third party risk categorization

Center for Health Care and Policy Research **University Park, PA**
Student Research Technologist

Care Delivery Redesign Project: ***March 2019 – May 2019***

- Assessed 5 research articles per week to examine how Care Delivery Redesign is implemented in different care environments and patient populations
- Consolidated article content using a research matrix to synthesize and determine relevancy of articles for inclusion in literature review

Diabetes Prevention Program Project: ***March 2018 – December 2018***

- Analyzed over 300 research texts on chronic disease management with a focus on obesity, diabetes, and hypertension to create a chronic disease management program for current Penn State employees
- Reviewed programs implemented by 80 other universities that were developed and adapted from the CDC's Diabetes Prevention Program
- Organized 6 spreadsheets in Excel to document extracted data from literature reviews, systematic reviews, and meta-analyses of research texts

LEADERSHIP EXPERIENCE

Health Policy and Administration Club **University Park, PA**
Vice President ***March 2019 – May 2020***

- Partner with President in overseeing executive board and all club affairs, including membership bylaws, executive appointments, alumni/faculty relations, membership retention, etc.
- Facilitate executive board relations to maintain positive morale and ensure organizational efficiency and effectiveness for 40+ student members

TEDxPSU **University Park, PA**
Co-Director of Partnerships ***May 2019 – May 2020***

- Establish and build relationships with 50+ local and national companies and organizations to cultivate sponsorships
- Develop sponsorship goals and promotional materials to build partnerships and advertise conference to companies

- Coordinate with treasurer to obtain university funding and manage the $70,000 budget of the conference

Co-Director of Programming ***May 2018 – May 2019***

- Planned, designed, and organized promotional events for the 7th largest university based TEDx organization and a 600+ attendee conference
- Managed team of 6 students and planned weekly team-bonding activities to develop friendly and hardworking community environment
- Communicated with Penn State event staff to secure venues and analyze third-party business contracts

AWARDS & HONORS

The Frederick and Jeanne Riebel Lord Academic Excellence Scholarship *2018 – 2020*

Schreyer Honors College Academic Excellence Scholarship *2016 – 2020*

The Pennsylvania State University Provost Scholarship *2016 – 2020*