ABSTRACT

An emerging body of work has examined the impact of discrimination on mental health. Several of these studies, however, are limited by the inability to establish causality between self-reported discrimination and mental health, as this relationship is confounded by several sources of endogeneity. This paper employs the counterfactual framework and propensity score matching techniques to assess the causal impact of self-reported discrimination on stress, depression, and anxiety. We find using this robust statistical technique, that discrimination is associated with worse mental health for all indicators. Further, we assess the potential differential impact of discrimination by the propensity to report discrimination and find that while all groups are negatively impacted by discrimination, the magnitude of the impact is largest among persons who are least likely to report discrimination.

INTRODUCTION.

Social categories of race/ethnicity, gender, body size, and sexual orientation are salient markers along which population level health disparities are differentiated between majority and minority status groups. Categories with minority distinction (i.e. non-white, female, non-normal body mass index [BMI] and non-heterosexual) are often beset with stigma and burdened by constant threats of discrimination that may be internalized as consistent forms of social stressors (Link and Phelan 2001). Stigma involves discrimination through both objective experiences and heightened perceptions of rejection that may be associated with either acute or long-lasting effects. Thus, According to a minority-stress perspective, perceived discrimination may be interpreted as a form of social stress that disproportionally affects highly stigmatized, low status groups, placing them at increased risk for compromised mental health. Indeed, perceived discrimination as related to minority status has been consistently linked to negative mental health outcomes (Clark, Anderson, Clark, and Williams 1999; Gee 2008; Kessler, Mickelson, and Williams 1999; Pascoe and Smart Richman 2009; Williams, Neighbors, and Jackson 2008;Hatzenbuehler 2010; Paradies 2006; Williams and Mohammed 2008; Krieger 1999; Meyer 1995, 2003; Thoits 1983; Thompson 1996; Williams and Williams-Morris 2000))

Establishing a causal link between mental health and stigma is complicated by several sources of spuriousness, and the inability to untangle the overlap between gender, race/ethnicity, and socioeconomic status, that may increase discrimination and worsen mental health. Further, a full examination of the effects of discrimination on mental health requires both between- and within-group investigation, which only few studies have completed (Schwartz and Meyer 2010). To this end, we employ a counterfactual framework and propensity score matching techniques to assess the causal impact of self-reported discrimination by status categories (race/ethnicity,

gender, sexual orientation, and body mass categories) on stress, depression, and anxiety. Additionally, we investigate the role of perceived discrimination as an explanatory pathway for both between- and within- group differences in mental health, and the extent to which the effect of discrimination on mental healthy may be moderated by the likelihood of reporting discrimination.

Stigma and a Minority-Stress Paradigm

Link and Phelan (2001) argue that a key component of stigma is the experience of discrimination or status loss that leads to unequal outcomes. Stigma is nested within power relationships, whether economic, political or social, that shape general social stratification through labeling, setting apart, and devaluation (Link and Phelan 2001). This negative devaluation leads to lower status within a societal hierarchy, which in turn affects access to positions of power and prestige and leads to disadvantage in numerous life chances and compromised mental health. Thus perceived discrimination works directly as a risk factor for worse mental health by increasing stress, but also indirectly as it influences multiple factors, such as SES, related to health. Thus, discrimination may be an important, often overlooked contributor of race/ethnic health disparities (Williams, Neighbors, and Jackson 2008).

Social status categories such as race/ethnicity, SES, and sexuality place marginalized groups at heightened exposure to negative experiences and social stressors due to high levels of stigma (Dohrenwend 2000; Kessler, Mickelson, and Williams 1999; Link and Phelan 2006). A social stress perspective suggests that social environments, independent of personal events, are stressors that may impact health outcomes. That is, societal and cultural norms often reflect those of the majority groups and/or dominant identities, which are often at odds with the norms and/or

values of minority groups. Further, individual perceptions of self-worth are constructed via a process of continuous evaluation of the self against the perceived evaluation of others, not only in interpersonal situations, but also against the dominant cultural value assigned to an identity. The conflict between the norms and values of dominant identity groups and those of minority groups may lead to increased alienation and decreased feelings of self worth. Thus, social environments and the statuses within these environments may impact key social and psychological resources such as mastery, self-esteem, and support networks that may place individuals at an increasing risk of psychological distress (Aneshensel 1992; Pearlin 1989; Turner and Lloyd 1999).

Meyer (2003) adds to the social stress perspective and suggest that minority stress is the "excess stress to which individuals from stigmatized social categories are exposed as a result of their social, often a minority, position" (Meyer 2003). The minority stress perspective adds to the discussion of the relationship between identity and stress by suggesting that minority stress is a unique, additive stressor to more general forms of stress that are experienced by all persons. Further, because minority stress is related to conflict between the relatively stable norms and values of dominant groups in society and those of minority groups, minority stress is structural and chronic, and therefore inescapable for minority persons (Meyer 2003).

Structural and Interpersonal Discrimination

Theories of social stress suggest that minority groups suffer from elevated rates of both structural and interpersonal discrimination. A longstanding body of work has shown that race/ethnic minorities both historically and currently are systematically discriminated against on several dimensions (Bertrand and Mullainathan 2004; Altonji and Pierret 2011; Phelps 1972) and more

recent research has documented elevated rates of discrimination among sexual minorities (D'Augelli, Hershberger, and Pilkington 1998; Garofalo, Wolf, Kessel, Palfrey, and DuRant 1998; Herek, Gillis, and Cogan 1999) and persons who are obese (Regan 1996; Roehling 1999; Tiggemann and Rothblum 1988). For example, size-based bias and discrimination has been found in major social institutions including employment, education, and in medical and health settings (Puhl and Brownell 2001). Obese individuals have been shown to have lower acceptance rates at prestigious colleges (Canning and Mayer 1966), less opportunities for employment (Rothblum, Brand, Miller, and Oetjen 1990), and discrimination while at work (Tiggemann and Rothblum 1988). Among sexual minorities, state level policies aimed at restricting the rights of sexual minorities, such as same-sex marriage bans, are associated with worse population level mental health (Rostosky et al. 2009; Riggle, Rostosky, and Horne 2010; Hatzenbuehler, Keyes, and Hasin 2009).

In addition to structural discrimination, minority individuals report elevated rates interpersonal discrimination. Americans consistently report prejudiced attitudes towards overweight individuals net of ethnicity, gender, age, time-period, and SES (Grilo, Wilfley, Brownell, and Rodin 1994; Latner and Stunkard 2001; Neumark-Sztainer, Story, and Faibisch 1998; Puhl and Brownell 2001; Richardson, Goodman, Hastorf, and Dornbusch 1961; Wadden and Stunkard 1987). In a recent study, 76 percent of homosexual and bisexual respondents indicated personal experiences of lifetime or day-to-day discrimination compared to 65 percent of heterosexuals, with particularly high effects for feeling threatened (OR 3.43), feeling insulted (OR 3.58), and perceived feelings of inferiority from others (OR 3.65) (Mays and Cochran 2001). Research has also begun to demonstrate that high levels of BMI are associated with perceived discrimination. For example, Carr and Friedman (2005) show that obese individuals

report significantly higher levels of discrimination than normal weight individuals, with nearly gradient level patterns of discrimination by weight categories. They find that obese individuals have a 40 percent higher likelihood to experience major discrimination and a 30 percent higher likelihood of day-to-day discrimination, with higher odds for both obese II and III categories.

Discrimination and Mental Health

Studies that have focused on the link between discrimination and mental health has found that both lifetime and day-to-day perceived discrimination are associated with depression, and that day-to-day discrimination was additionally associated with generalized anxiety disorder and distress (Kessler, Mickelson, and Williams 1999). Fewer studies have examined stigma and discrimination during young adulthood. Adolescence and young adulthood are critical period of the life course which may have long-lasting impacts on health outcomes Early onset of stigma could potentially lead to long "moral careers" characterized by "impression engulfment" which continue to characterize an individual over time (Goffman 1963; Jones, Farina, Hastorf, Markus, Miller, and Scott 1984). For instance, research has shown that negative discriminatory experiences related to body weight in childhood may have lasting impacts on adult body image and self esteem (Grilo, Wilfley, Brownell, and Rodin 1994), sexual minority discrimination in childhood has been associated with suicide and mental illness (Hershberger and D'Augelli 1995), and peer and institutional discrimination has been associated with distress across ethnic minority groups (Fisher, Wallace, and Fenton 2000; Wong, Eccles, and Sameroff 2003). As such, sexual minority populations have repeatedly been documented as having higher rates of mental dysfunction when compared to heterosexuals, with lesbian, gay, and bi-sexual (LGB) individuals characterized by high risk for mental disorders and suicide (Aneshensel 1992; Cochran 2001;

Fergusson, Horwood, and Beautrais 1999; Meyer 2003), with differentials appearing early in the life course and continuing through adulthood and old age (Fergusson, Horwood, and Beautrais 1999 Fergusson, Horwood, Ridder, and Beautrais 2005).

Race/ethnic discrimination has been linked to depression and anger in adolescents, while a strong positive ethnic identity has been associated with mediating the effect of ethnic discrimination across several mental illnesses (Wong, Eccles, and Sameroff 2003). Although inconsistent links between race/ethnicity and mental health may counter the minority stress approach, research finds relatively consistent patterns of racial discrimination and rates of mental illness (Brown, Williams, Jackson, Neighbors, Torres, Sellers, and Brown 2000; Gee 2008; Schulz, Williams, Israel, Becker, Parker, James, and Jackson 2000; Williams 1997). Several studies have used prospective data to establish a link between discrimination and mental health, however these studies only examine within group differences in mental health, and not between group differences ((Brody et al. 2006; Schulz et al. 2006; Tony N. Brown et al. 2000). Other research has shown that while males are more likely to report perceived discrimination, despite occupying a non-minority status, the effects of discrimination on mental health are stronger for women (Banks, Kohn-Wood, and Spencer 2006; Borrell et al. 2006).

Testing Social Stress Theory

Testing social stress theory is a difficult task for several reasons. First, attempting to establish causality using survey data is always complicated by the fact the data in question is not derived from an experimental data set. That is, respondents cannot be randomly assigned to treatment or control groups. This is a particularly problematic when the treatment in question is plagued with several sources of selection and bias. Indeed, attempting to understand the causal role of

discrimination on mental health is limited by the fact that discrimination is not randomly distributed across the population. Rather, as previously discussed, minority individuals in the U.S. are more likely to experience and report discrimination (Altonji and Pierret 2011; Puhl and Bronell 2001; Carr and Freidman 2005; Mays and Cochran 2001). Further complicating the link between discrimination and mental health is the fact that individuals who are more likely to report discrimination may also be more likely to have fewer SES resources, which are also related to mental health (Borrell et al. 2006). Thus, for a study to establish a causal relationship between discrimination and mental health, a counterfactual approach is an important step forward.

Second, for social stress theory to be a primary explanatory pathway through which mental health disparities are manifested, researchers must address both between and within group differences (Schwartz and Meyer 2010). That is discrimination must be related to both differences at the population level in mental health disparities, and within minority group mental health disparities. Establishing minority stress or discrimination as a primary pathway for explaining group differences is complicated by the fact that some research has failed to find population level group differences in mental health (Schwartz and Meyer 2010). The ability to establish both between and within groups differences is also complicated by the fact that discrimination occurs at both the interpersonal and structural level, even if individuals do not perceive and/or report the discrimination (Meyer 2003). Thus in cases where self-reported discrimination is not assessed, individual identities are taken as a proxy for discrimination. And, the existing research has presented sometimes-conflicting results regarding whether reporting discrimination, or failing to recognize it is worse for the health of minority populations (Williams and Mohammed 2008). Thus, among people who are unlikely to report discrimination,

perceived discrimination may have a bigger impact on their mental health, as they have not developed adequate coping skills to deal with the extra stress. Populations who are most likely to report discrimination or have several indicators of minority status may be exposed to constant structural and interpersonal discrimination, and therefore the extent to which *perceived* discrimination would have a detrimental effect on their mental health may be less extensive.

Finally, the ability to investigate causality has been limited by the lack of longitudinal data sets. Indeed, many studies employ cross-sectional data that does not allow researchers to account for previous mental health states, which may be important for accounting for the fact that people who have worse mental health may be more sensitive to both perceiving discrimination and that discrimination having a worse impact on their health. Thus balancing on mental health in adolescence is an important step in establishing a causal pathway.

AIMS

Several studies suggest that discrimination is an important pathway through which mental health disparities are shaped. The effect of discrimination on mental health, however, is complicated by several sources of endogeneity and selectivity, which limit the ability to establish a causal relationship between discrimination and health. This paper advances the investigation of the role of discrimination on mental health by addressing several limitations of previous research. First, we employ a counterfactual framework to examine the causal role of discrimination on mental health among the total population, as well as within-demographic subpopulations. Second, we examine the role of self-reported discrimination on between group mental health disparities. Finally, we investigate whether the impact of discrimination varies by the likelihood of reporting discrimination. In other words, we examine whether perceived discrimination is more

detrimental to individuals mental health dependent upon whether they report discrimination or not.

DATA AND METHODS

This study uses data from Waves I and IV of the National Longitudinal Study of Adolescent Health (Add Health). The initial Add Health sample was drawn from 80 high schools and 52 middle schools, with unequal probability of selection, throughout the United States (Bearman, Jones, & Udry, 1997). Wave IV of the Add Health survey, collected between 2007 and 2008, located 92.5% of the original sample and interviewed 80.3% of the eligible respondents whose ages range from 24 to 34. . Our sample is limited to those with complete information on all covariates included in the analysis (N=14,609).[1]

Measures

Discrimination is measured using the question that asks respondents "in your day-to-day life, how often do you feel you are treated with less respect or courtesy than other people? From the responses never, rarely, sometimes, and often, we created a dummy variable created that captures whether respondents report being treated with less respect never or rarely (referent) or sometimes or often. Therefore, persons who report discrimination are considered the "treatment" group (N=3,529), and those who do not are the "control" group (N=11,080).

We focus on three dimensions of mental health: depressive symptoms, anxiety, and stress. The depressive symptoms scale follows the Center for Epidemiologic Studies Depression Scale (Radloff 1977) and ranges from 0 to 15. This item is derived from a series of questions that ask respondents "how often was each of the following things true in the past seven days: you

[1] Sample sizes vary for minority status-group specific analyses, as well as for analyses that employ nearest neighbor matching strategies. N sizes for these groups are provided in the tables.

were bothered by things that don't bother you; you could not shake off the blues; you had trouble keeping your mind on what you were doing; you felt depressed; you felt sad."

Stress is measured using the Cohen Perceived Stress Scale (Cohen et al. 1983) and ranges from 0 to 15. This item is derived from a series of questions that ask respondents to identify in the last 30 days how often "you felt you were unable to control the important things in your life; you felt confident in your ability to handle your personal problems; you felt that things were going your way; and you felt that difficulties were piling up so high that you could not overcome them." Respondent answers for each question ranged from "never" to "very often."

The anxiety is scale is derived from a series of questions that ask respondents if they: "worry about things; are not easily bothered by things; get stressed out easily; and don't worry about things that have already happened." Respondent answers for each question range from strongly agree to strong disagree and the total scale ranges from 4 to 20.

A series of controls are entered into the propensity equation to ensure balance between the persons who report discrimination and those who do not. Race/ethnicity is measured as a series of dummy variables that measures whether respondents identify as non-Hispanic white (referent); non-Hispanic black; Hispanic, Asian; or other. Age is coded as a continuous variable that ranges from 24 to 34 years of age. Sex is measured as dichotomous variable for whether respondents identify as female (referent) or male.

Sexual orientation is derived from a question where respondents are asked to "please choose the description that best fits how you think about yourself: 100% heterosexual (straight) [referent]; mostly heterosexual (straight), but somewhat attracted to people of your own sex; bisexual—that is, attracted to men and women equally; mostly homosexual (gay), but somewhat attracted to people of the opposite sex; and 100% homosexual (gay). Due to sample size

limitations, respondents who report a bisexual or mostly straight identity are collapsed into the same category, as are gay and mostly gay identified respondents[2].

Anthropometric measures of height and weight were taken at the time of interview and are used to calculate BMI for respondents and captures whether respondents are underweight (BMI<18.5), normal (BMI≥18.5 and BMI<25), overweight (BMI≥25 and BMI<30), obese class I (BMI≥30 and BMI<35), obese class II (BMI≥35 and BMI<40), or obese class III (BMI≥ 40) (referent).

Education is measured as a series of dummy variables that identifies whether respondents have less than a high school education; graduated from high school; have attended some college; or graduated from college or received post-grad education. Household income is a measured as a series of dummy variables that captures the median income of everyone who lives in the respondent's household that contributes to the household budget, before taxes and deductions. Respondents are coded as reporting less than $15,000; ≥ $15,000 and < $30,000; ≥ $30,000 and ≤ $75,000; ≥ $75,000 (referent); or missing. Living arrangement measures captures the respondent's current household arrangement and measures whether the respondent lives with their parents; lives alone in their own house; lives with a partner, spouse, or roommate(s) in their own house (referent); lives in someone else's house with a partner, spouse, or roommate(s), or whether the this information is missing.

We include a measure of victimization, which is a source of possible spuriousness between the relationship between self-reported discrimination and mental health. Victimization is a binary variable that measures "which of the following things happened in the last month: someone pull a knife or gun on you; someone shot or stabbed you; someone slapped, hit, choked,

[2] Supplementary analyses suggest that bisexual and mostly straight respondents, and gay and mostly gay identified respondents, do not statistically differ in their reports of discrimination.

or kicked you; you were beaten up?" Respondents who report at least one of these incidents coded as reporting being victimized in the last 12 months or experiencing no victimization in the last 12 months (referent). We also control for depressive symptoms reported at Wave I of the Add Health survey using the CES-D scale.

Analytical Approach

We employ a counterfactual framework that utilizes propensity scores and matching techniques to assess the effect of discrimination on mental health. In the social sciences, it is often impossible and/or unethical to randomly assign persons to "treatments" of interest, such as discrimination. Propensity score matching is an analytical approach that allows us to estimate a causal relationship between discrimination and mental health by balancing 'treatment' and 'control' groups in survey data on characteristics related to the probability of reporting the 'treatment' of interest (Rosenbaum and Rubin 1983a, 1983b). From this balanced data set, respondents with similar propensities to report discrimination in the treatment group are matched with persons in the control group and an average treatment effect (ATE) is calculated using equation 1:

$$\Gamma' = E\{Y_{1i} - Y_{0i} \mid D_i = 1\} \quad (3)$$

Where Y_1 and Y_0 are the potential outcomes in the two counterfactual situations: reporting discrimination or not; and Γ' is the average treatment effect of having a migrant child on our dependent variable of interest (stress, depression, and anxiety).

We first present descriptive statistics for the total population, as well as by whether respondents report discrimination (Y_1) or not (Y_0). We next report the means for the covariates in

the analyses for the treatment group, and the control group pre- and post- matching to assess improvements in balance.

We then present the ATE at baseline, and the ATE using two different matching strategies. The ATE at baseline is the mean difference between dependent variable of interest for the treatment group minus the control group. We also present the ATE using both nearest neighbor and subclassification matching strategies. Nearest neighbor matching selects the best control match for each treated individual based upon his or her propensity score. While this approach provides the most precise estimate of the ATE, it also reduces the sample size substantially, thus we also employ an alternative matching strategy: subclassification. Subclassification estimates the ATE within a specified distribution of the propensity score. In our case, we subclassify the propensity score by quartiles to examine not only the ATE, but also to run regression analyses by subclasses. These subclasses allow us to examine the effect of discrimination on our indicators of mental health within groups with broadly similar probabilities of being exposed to the treatment. We employ negative binomial models for our analyses of stress and depressive symptoms, and poisson regression for the analysis of anxiety. In addition to the covariates used in the analysis, respondents are also matched on population weights, and in the case of regression analyses the appropriate population weights are applied. All analyses are conducted using the "MatchIt" (Ho et al. 2007a, 2007b) and "Zelig" (Kosuke, King and Lau 2007) packages in R version 2.12.0

RESULTS

Table 1 provides information on the dependent and control variables used in the analysis for the total population and by whether the respondent reported discrimination (treatment group) or not

(control group). Bivariate tests were conducted to test whether covariate means differ by the treatment and control group. Twenty-four percent of the total sample reports experiencing discrimination and 75% report no discrimination. The results show important differences in the covariates by self-reported discrimination. Respondents who report discrimination are more likely to be non-Hispanic black and Hispanic, have lower education status, report a bisexual or mostly straight identity, and to be living with a parent. Further, respondents that report discrimination are also more likely to be in the two lowest income groups and are more likely to be obese class 1 or 2. While 20% of respondents who report no discrimination have been victimized in the previous 12 months, 25% of respondents that report discrimination have been victimized. Further, Table 1 shows that all three mental health outcomes are significantly different by reported discrimination. These differences provide compelling evidence that status categories vary in discrimination experiences and that treatment and control groups differ by covariates related to both mental health and discrimination.

(Table 1 about here)

Table 2 shows the logistic regression model used to estimate propensity scores and develop a matched sample for the total population. Women are less likely to report discrimination than men, despite the fact that males are not the minority group. This is in line with other research has shown that males are more to report discrimination than females (Borrell et al. 2006). Non-Hispanic blacks are 26% as likely to report discrimination compared to non-Hispanic whites. Bisexual and mostly straight respondents are 56% as likely to report discrimination, and respondents who are either class 2 or class 3 are also more likely to report discrimination. SES is also consistently related to discrimination: respondents with less than a high school degree are 58% as likely to report discrimination than those with a college degree

and respondents with less than $15,000 a year are twice as likely to report discrimination compared to those who report >$75,000 a year. Table 2 shows that with the exception of gender, minority statuses are indeed associated with increased odds of perceived discrimination. We therefore move on to examine the causal impact of discrimination on mental health.

(Table 2 about here)

Table 3 presents the means for variables included in the analyses pre- and post-matching. For both the nearest neighbor and subclassification matching strategies, the results show improvements in balance for several important covariates of interest. Using nearest neighbor matching yields sample means that are slightly better balanced than subclassification. For example, nearest neighbor matching improves balance on the non-Hispanic black variable by 93%, while subclassifcation improves balance by 91%. Nearest neighbor also improves balance for females by 100% compared to a 78% improvement using subclassifacation. The results similarly improve balance for obesity, but subclassifcation improves the balance better for gay respondents (83%) than nearest neighbor (-46%). Depressive symptoms measured at Wave I of the Add Health survey are also unbalanced before matching. Treated individuals report an average CES-D score of 13.1, while the mean CES-D score for those in the control group is 10.7. Nearest neighbor matching results in an average CES-D score of 13.1 and subclassification results in a mean score of 12.8, both strategies improve balance substantially. Importantly, both matching strategies improve the balance on the propensity score, but the balance is slightly better using nearest neighbor matching.

(Table 3 about here)

Average Treatment Effect

Table 4 provides estimates of the benchmark treatment effect, which is the raw mean differences between the two groups by self-reported discrimination on the dimensions of mental health, the ATE using both nearest neighbor and subclassification matching for the total population, and within several demographic subgroups. The benchmark treatment effect for stress is 1.81, however, the matched samples show that self-reported discrimination increases stress scale score by 1.35 or 1.41 points, or approximately ½ standard deviation. Thus, when the treatment and control groups are balanced on all covariates included in the analysis, the impact of discrimination is reduced by 25% ([1.81-1.35]/[1.81]*100) or 22% ([1.81-1.41]/[1.81]*100). Discrimination has a similar impact on depression: the raw difference in scores between those who report discrimination and those who do not is 1.63. The calculated average treatment effect shows that matching on propensity score reduces the impact by 22%, such that self-reported discrimination is associated with 1.27 or 1.25 point increase in the depressive symptoms scale, roughly ½ of a standard deviation. Discrimination is also associated with anxiety: the average treatment effect shows that discrimination increases the anxiety scale by 1.05 or 1.07 points. Having balanced the treatment and control group, the ATEs are reduced, however a strong causal relationship persists between discrimination and stress, depression, and anxiety.

(Table 4 about here)

Table 4 also presents the ATE of discrimination on mental health indicators within demographic subpopulations. For all demographic subgroups, the ATEs from both nearest neighbor and subclassified matching show that perceived discrimination has a strong positive impact on all three mental health scales. Discrimination has the largest impact on the stress scale of non-Hispanic whites (ATE=1.47) and women (ATE=1.37). Interestingly, whites and women are less likely to report discrimination than race/ethnic minorities and males. These results suggest that

discrimination may more strongly effect stress among demographic groups that are less likely to experience discrimination.

For depressive symptoms, however, has a bigger effect among minority groups; that is, the ATE is larger for blacks than whites, females than males, non-straight respondents than straight, and obese respondents than non-obese. For example, discrimination is associated with a 1.34 point increase among blacks and a 1.22 point increase among whites. Anxiety varies less between subgroups, however within all groups, discrimination is associated with roughly a 1-point increase in the anxiety scale.

An additional way to exploit the counterfactual framework, and to test social stress theory is to perform multivariate regression analyses to examine the mediating impact of perceived discrimination on minority groups mental health. This can be done for the total population as well as by propensity score quartiles. As stated before, subclassification matching divides respondents into quartiles based upon the distribution of the propensity score, thus allowing us to run regression analyses by subclass and therefore examine if the impact of discrimination varies by the propensity to report discrimination, for example, respondents in the first quartile are those who are the least likely to report discrimination, while those in the fourth quartile are those respondents are most likely to report discrimination. Table 5 presents the Incident Rate Ratios (IRRs) for the treatment (discrimination) and other covariates derived from negative binomial regression models for stress and depressive symptoms, and poisson regression for the anxiety scale. Model one does not controls for all covariates except discrimination and Model 2 adds discrimination to examine its mediating impact on minority mental health. Table 6 presents the IRRs for discrimination on mental health by propensity quartiles, controlling for all covariates.

Sensitivity analysis not shown tested for significant differences in the effect of discrimination by quartile and are discussed below.

For the analysis of stress, the results in Table 5 show that discrimination is associated with elevated levels of stress (IRR=1.30, p<.001). Discrimination, however, does not appear to mediate the relationship between minority groups and stress, as in some cases, minority groups are not more likely to report elevated levels. For example Non-Hispanic blacks do not report elevated stress scores compared to whites in Model 1, and only underweight respondents are more likely to report increased stress compared to respondents with normal BMIs. In fact, class 3 obese respondents have significantly lower stress scores.

Similar to the analysis of stress, among the total population discrimination is associated with elevated stress (IRR=1.52, p<.001). Unlike the results from the stress model, non-Hispanic blacks, Asians, sexual minorities, and women are all more likely to report elevated depressive symptoms, however, these effects are only marginally mediated for blacks and bisexual/mostly straight respondents, and discrimination increase the coefficients for females and gay respondents. The results from the analysis of anxiety show that discrimination is associated with increased anxiety (1.30, p<.001). Similar to other measures of mental health, in the cases where elevated anxiety is detected, it is not mediated by perceived discrimination.

(Table 5 about here)

Table 6 presents the IRRs for discrimination by subclass on our measures of mental health. Sensitivity analyses, not shown, reveal that the effect of discrimination significantly varies across subgroups for both depression and stress. The effect of discrimination on stress is significantly smaller among respondents in class 4 (IRR=1.20, p<.001) than class 1 (IRR=1.33, p<.001). This pattern holds for depressive symptoms as well: the effect of discrimination among

the respondents in highest quartile (IRR=1.42, p<.001) is significantly smaller than the effect among respondents in the lowest propensity quartile (IRR=1.55, p<.001). These results suggest that the effect of discrimination on stress and depression decreases as the likelihood of reporting discrimination increases. There are no differences by propensity quartiles for anxiety.

(Table 6 about here)

DISCUSSION, LIMITATIONS, AND CONCLUSION

The social definition of stigma is complex, multifaceted, and involves several interrelated components associated with stigma, including labeling, stereotyping, cognitive separation, emotional reactions, and status loss and discrimination (Link and Phelan ; Link, Yang, Phelan, and Collins 2004 and Collins 2004). Important to this definition is the idea that stigma is a process, created through structural power, that leads to discriminatory consequences which may place stigmatized individuals at risk for poorer outcomes. The results presented here provide evidence for a causal relationship between discrimination and mental health. The results, however, fall short of fully supporting the minority stress perspective as several minority groups are not more likely to report worse mental health, and in the cases where minority status is associated with worse mental health, self-reported discrimination does not fully mediate the relationship.

First, we find that minority status is associated with higher levels of discrimination. Non-Hispanic blacks, bisexual or mostly straight identified respondents, and obese class 1 and 2 respondents are significantly more likely to report discrimination compared to whites, straight identified respondents, and normal or overweight respondents. Similar to other studies, women are less likely to report discrimination than males (Borrell et al. 2006), and there is no difference

between gay and straight respondents reports of discrimination. The lack of discrimination reported by Hispanic and Asian minorities may reflect a variety of factors including a heterogeneous Asian population, a model-minority bias, higher SES Asians, or may be reflective of protective living context such as ethnic enclaves or wealthy areas that may mediate discrimination. Indeed, SES is strongly related to self-reported discrimination, both via educational achievement and income and may be a strong explanatory pathway for explaining discrimination.

The lack of significant difference between gay and straight respondents may be due to increase availability of social resources to gay and lesbian men and women, that may serve as a buffer against perceived discrimination by increasing self-efficacy and decreasing feelings of isolation (Ramirez-Valles 2002). Several studies suggest, however that similar resources are not available to bisexual or mostly straight identified persons (Balsam and Mohr 2007; Corliss, Shankle, and Moyers 2007; Hutchins 1996).

Second, the results presented here suggest that self-reported discrimination is associated with worse outcomes on several different dimensions related to mental health including stress, depression, and anxiety. The results provide robust and compelling evidence for a causal relationship between discrimination and mental health through the creation of a pseudo-randomized experimental data set with respondents matched by their probability to report discriminatory events. We find that self-reported discrimination increases the average stress score 1.35 to 1.41 points, the average CESD scale score by 1.25 to 1.27 points, and the average anxiety score by 1.11 to 1.15 points, depending upon the matching strategy employed. These increases represent a ½ standard deviation in the stress and depression score, and a 1/3 standard deviation increase in the anxiety score.

The results in Table 4 also show that the effect of discrimination varies by demographic subgroups. Most notably, we find that female respondents and white respondents experience the biggest effect of discrimination on stress. That is, for two demographic groups that are less likely to report discrimination compared to their minority counterparts, discrimination has a bigger impact on stress. This trend holds in Table 6, which shows that among the quartile of the propensity score (those least likely to report discrimination) the biggest effects of discrimination on stress and depression. While discrimination has a positive and significant effect across all subclass, the results from Tables 4 and 6 suggest that discrimination has the largest effect among those who are the least likely to experience discrimination. These groups may not have developed coping strategies for dealing with discrimination, which leads to worse psychosocial outcomes. Conversely, groups who are the most likely to be stigmatized may have adapted to the discrimination in ways that reduce the impact it has on their wellbeing, at least in the short-term. The effects of long-term discrimination may be more apparent with a longer follow-up period between the reported discrimination and the measurement of wellbeing.

The results, however, fall short of fully supporting the minority stress perspective as several minority groups are not more likely to report worse mental health, and in the cases where minority status is associated with worse mental health, self-reported discrimination does not fully mediate the relationship. Indeed, discrimination cannot mediate a relationship that does not exist.

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Table 1: Descriptive Statistics for the total population and by exposure to treatment

	Total N=14609	Treatment N=3,529		Control N=11,080
Self-reported discrimination (%)	24.37			
No self-reported discrimination (%)	75.63			
Female (%)	50.94	50.83		50.97
Male (%)	49.06	49.17		49.03
Race/Ethnicity (%)				
Non-Hispanic white	68.47	63.65		70.12
Non-Hispanic black	14.84	18.29	***	13.72
Hispanic	11.66	13.67	*	11.01
Asian	3.50	2.93	†	3.59
Other race	1.53	1.46		1.56
Education (%)				
Less than high school	8.32	12.21	***	7.07
High school graduate	17.06	18.28		16.66
Some college	33.69	35.05		32.83
College Degree	40.93	34.46	***	43.44
Age (μ)	28.76	28.84		28.74
Sexual Orientation (%)				
Straight	86.10	82.96	***	87.13
Gay/Mostly Gay	11.04	1.68		2.12
Bisexual/Mostly Straight	2.02	14.05	***	10.07
Other	0.84	1.31		0.68
Living Arrangement (%)				
Live with partner/spouse/roomate(s)	72.19	68.00	***	73.55
Live with parent	15.52	18.47	***	14.57
Live alone in own house	10.75	10.97		10.67
Live in someone else's house	0.94	1.73	***	0.69
Missing/Unknown	0.60	0.83		0.52
BMI (%)				
< 18.5	1.46	1.51		1.44
≥18.5 & <25	31.76	31.94		31.70
≥ 25 & < 30	28.71	25.18	***	29.85
≥ 30 & < 35, Obese class 1	18.50	18.22		18.59
> 35 & < 40, Obese class 2	9.51	11.56	**	8.85
≥ 40, Obese class 3	8.86	10.21	*	8.43
Missing	1.28	1.51		1.21
Income (%)				
< $15,000	8.05	11.61	***	6.90
≥ $15,000 and < $30,000	12.47	15.75	***	11.42
≥ $30,000 and < $75,000	44.27	41.21	**	45.25
≥ $75,000	28.35	21.33	***	30.61
Missing	6.86	10.10	***	5.82
Depressive symptoms, Wave I (μ)	10.95	12.76	***	10.36
Victimized (%)	20.88	24.94	***	19.57
Not Victimized (%)	89.05	75.06	***	80.43
Dependent Variables (μ)				
Stress	4.79	6.17	***	4.35
Depression	2.60	3.81	***	2.02
Anxiety	12.37	13.29	***	12.07

Source: Wave IV of the National Longitudinal Study of Adolescent Health
† p < .10. * p < .05 ** p < .01 *** p < .001

Table 2. Odds ratios for covariates for reporting discrimination

	OR	
Female (male)	0.84	***
Race/Ethnicity (non-Hispanic white)		
Non-Hispanic black	1.23	***
Hispanic	0.95	
Asian	0.82	*
Other race	0.96	
Education (college degree)		
Less than high school	1.40	***
High school graduate	1.12	+
Some college	1.20	***
Age	1.01	
Sexual Orientation (100% straight)		
Gay/Mostly Gay	1.04	
Bisexual/Mostly Straight	1.49	***
Other	0.86	
Living Arrangement (Own house w/ others)		
Live with parent	1.15	*
Live alone in own house	1.09	
Live in someone else's house	1.22	†
Missing/Unknown	1.18	†
BMI ($\geq$18.5 and <30)		
< 18.5	1.06	
$\geq$ 30 & < 35, Obese class 1	1.04	
> 35 & < 40, Obese class 2	1.15	*
$\geq$ 40, Obese class 3	1.12	
Missing	1.35	†
Income ($\geq$ $75,000)		
< $15,000	1.82	***
$\geq$ $15,000 and < $30,000	1.40	***
$\geq$ $30,000 and < $75,000	1.18	***
Missing	1.18	***
Victimized (no)	1.23	***
Depressive Symptoms	1.04	***

Source: National Longitudinal Study of Adolescent Health

† p < .10. * p < .05 ** p < .01 *** p < .001

Table 3. Means of covariates by treatment for total and matched sample

	Treated	Total	Nearest Neighbor Control	Sub-classifcation
	N=3,529	N=11,080	N=3,529	N=11,080
Propensity Score (μ)	26.44	23.46	26.43	26.41
Female (%)	52.27	53.38	52.27	52.51
Race/Ethnicity (%)				
Non-Hispanic black	26.15	19.84	25.70	25.58
Hispanic	15.72	16.09	16.23	15.91
Asian	4.99	6.43	4.85	5.17
Other race	1.61	1.60	1.89	1.62
Education (%)				
Less than high school	11.10	6.64	11.16	10.18
High school graduate	17.84	15.57	17.75	17.97
Some college	36.07	33.64	36.01	36.20
Age (μ)	29.05	29.00	29.09	29.05
Sexual Orientation (%)				
Gay/Mostly Gay	2.31	2.16	2.09	2.28
Bisexual/Mostly Straight	14.45	10.11	14.68	14.04
Other	0.93	0.69	0.82	0.94
Living Arrangement (%)				
Live with parent	18.26	15.44	18.77	18.25
Live alone in own house	11.27	10.78	11.10	11.28
Live in someone else's house	8.49	0.52	8.62	7.92
Missing/Unknown	0.70	0.60	0.62	0.67
BMI (%)				
< 18.5	1.44	1.33	1.32	1.40
≥ 25 & < 30	27.19	30.47	29.13	27.64
≥ 30 & < 35, Obese class 1	18.32	18.15	17.41	18.28
> 35 & < 40, Obese class 2	10.45	8.99	9.55	10.36
≥ 40, Obese class 3	10.17	8.45	10.12	10.22
Missing	1.86	1.45	1.83	1.78
Income (%)				
< $15,000	11.95	6.35	11.89	10.70
≥ $15,000 and < $30,000	14.51	11.46	14.51	14.91
≥ $30,000 and < $75,000	42.38	44.82	41.00	42.52
Missing	8.28	5.89	8.76	8.33
Depressive symptoms (μ)	13.13	10.68	13.09	12.82
Victimized (%)	25.78	20.02	26.26	25.29

Source: National Longitudinal Study of Adolescent Health

Table 4. Average treatment effects (ATEs) for discrimination on mental health

	Benchmark Treatment	Nearest Neighbor		Subclassification	
Total Population					
Stress	1.81	1.35	(1.26, 1.45)	1.41	(1.32, 1.51)
Depression	1.63	1.27	(1.19, 1.37)	1.25	(1.17, 1.32)
Anxiety	1.22	1.05	(0.93, 1.16)	1.07	(0.96, 1.18)
Non-Hispanic Whites					
Stress	1.93	1.47	(1.33, 1.61)	1.43	(1.31, 1.58)
Depression	1.63	1.22	(1.09, 1.36)	1.22	(1.11, 1.32)
Anxiety	1.35	1.15	(0.98, 1.32)	1.11	(0.96, 1.28)
Non-Hispanic Black					
Stress	1.7	1.37	(1.18, 1.57)	1.39	(1.21, 1.57)
Depression	1.62	1.34	(1.16, 1.54)	1.31	(1.14, 1.46)
Anxiety	1.23	0.99	(0.77, 1.21)	1.07	(0.85, 1.26)
Hispanic					
Stress	1.58	1.25	(1.01, 1.49)	1.28	(1.09, 1.51)
Depression	1.53	1.24	(1.02, 1.49)	1.24	(1.04, 1.42)
Anxiety	0.85	0.66	(0.34, 0.97)	0.77	(0.51, 1.09)
Male					
Stress	1.7	1.29	(1.15, 1.44)	1.3	(1.18, 1.45)
Depression	1.47	1.12	(1.00, 1.26)	1.13	(1.03, 1.25)
Anxiety	1.24	1.01	(0.84, 1.18)	1.05	(0.91, 1.23)
Female					
Stress	1.92	1.49	(1.32, 1.59)	1.49	(1.37, 1.64)
Depression	1.79	1.37	(1.23, 1.51)	1.36	(1.21, 1.46)
Anxiety	1.23	1.08	(0.91, 1.25)	1.08	(0.92, 1.23)
Straight					
Stress	1.78	1.41	(1.30, 1.52)	1.41	(1.32, 1.52)
Depression	1.58	1.31	(1.21, 1.41)	1.25	(1.15, 1.32)
Anxiety	1.17	1.05	(0.92, 1.17)	1.07	(0.95, 1.20)
Non-Straight					
Stress	1.76	1.42	(1.16, 1.69)	1.46	(1.25, 1.70)
Depression	1.63	1.34	(1.08, 1.61)	1.3	(1.10, 1.52)
Anxiety	1.17	1.05	(0.76, 1.35)	1.04	(0.77, 1.36)
Obese Class 1/2/3					
Stress	1.81	1.4	(1.24, 1.57)	1.4	(1.27, 1.55)
Depression	1.62	1.4	(1.26, 1.56)	1.25	(1.12, 1.38)
Anxiety	1.27	1.09	(0.90, 1.29)	1.08	(0.91, 1.26)
Not Obese					
Stress	1.81	1.4	(1.27, 1.54)	1.2	(1.03, 1.40)
Depression	1.62	1.27	(1.16, 1.39)	1.2	(1.03, 1.38)
Anxiety	1.17	1.11	(0.96, 1.26)	1.04	(0.90, 1.19)

Source: Wave IV of the National Longitudinal Study of Adolescent Health

Table 5. Inicident Rate Ratios (IRRs) for discrimination and sociodemographic differences in mental health

	Stress		Depression		Anxiety	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Discrimination		1.30 ***		1.52 ***		1.30 ***
Female	1.06	1.07 ***	1.14 ***	1.15 ***	1.06	1.07 ***
Race/Ethnicity						
Non-Hispanic black	1.02	1.01	1.11 ***	1.09 ***	1.02	1.01
Hispanic	0.98	0.98	1.02	1.01	0.98	0.98
Asian	1.09 **	1.10 ***	1.06	1.08 +	1.09 **	1.10 ***
Other race	1.09 +	1.09 *	1.08	1.08	1.09 +	1.09 *
Education						
Less than high school	1.21 ***	1.18 ***	1.25 ***	1.21 ***	1.21 ***	1.18 ***
High school graduate	1.10 ***	1.09 ***	1.10 ***	1.10 ***	1.10 ***	1.09 ***
Some college	1.07 ***	1.06 ***	1.04 *	1.03 +	1.07 ***	1.06 ***
Age	1.00	1.00	1.00	1.00	1.00	1.00
Sexual Orientation						
Gay/Mostly Gay	1.06	1.06 +	1.13 *	1.14 *	1.06	1.06 +
Bisxual/Mostly Straight	1.18 ***	1.16 ***	1.27 ***	1.25 ***	1.18 ***	1.16 ***
Unknown/Missing	0.86 **	0.87 **	1.00	1.01	0.86 **	0.87 **
Living Arrangement (Own house w/ others)						
Live with parent	1.17 ***	1.15 ***	1.18 ***	1.16 ***	1.17 ***	1.15 ***
Live alone in own house	0.97 ***	0.97 ***	1.03 ***	1.02	0.97 ***	0.97 ***
Live in someone else's house	1.28 +	1.21 ***	1.51 ***	1.41 ***	1.28 +	1.21 ***
Missing/Unknown	1.35 ***	1.32 *	1.03	1.02 ***	1.35 ***	1.32 *
BMI (≥18.5 and <30)						
< 18.5	1.07 +	1.07 +	1.02	1.02	1.07 +	1.07 +
≥ 30 & < 35, Obese class 1	0.99	0.99	1.01	1.01	0.99	0.99
> 35 & < 40, Obese class 2	0.94	0.98	0.99	0.97	0.94	0.98
≥ 40, Obese class 3	0.95 ***	0.94 ***	0.98	0.98	0.95 ***	0.94 ***
Missing	0.95	0.93 +	1.02	0.98	0.95	0.93 +
Income (≥ $75,000)						
< $15,000	1.42 ***	1.38 ***	1.50 ***	1.42 ***	1.42 ***	1.38 ***
≥ $15,000 and < $30,000	1.31 ***	1.28 ***	1.29 ***	1.38 ***	1.31 ***	1.28 ***
≥ $30,000 and < $75,000	1.18 ***	1.17 ***	1.10 ***	1.08 ***	1.18 ***	1.17 ***
Missing	1.32 +	1.28 ***	1.32 ***	0.98 ***	1.32 +	1.28 ***
Victimized	1.10 ***	1.09 ***	1.19 ***	1.17 ***	1.10 ***	1.09 ***
Depression	1.02 ***	1.01 ***	1.03 ***	1.03 ***	1.02 ***	1.01 ***
Intercept	2.61 ***	2.62 ***	1.36 *	1.34 *	2.61 ***	2.62 ***
AIC	70014	69449	59405	58774	70014	69449

Source: National Longitudinal Study of Adolescent Health

† p < .10. * p < .05 ** p < .01 *** p < .001

Table 6. Inicident Rate Ratios (IRRs) for the effect of discrimination on mental health

	Stress		Depression		Anxiety	
	IRR	SE	IRR	SE	IRR	SE
Class 1	1.33	(0.15)	1.55	(0.04)	1.07	(0.01)
Class 2	1.35	(0.02)	1.60	(0.03)	1.10	(0.01)
Class 3	1.28	(0.02)	1.47	(0.03)	1.10	(0.01)
Class 4	1.20	(0.02)	1.42	(0.03)	1.08	(0.01)

Source: National Longitudinal Study of Adolescent Health
IRR=Incident Rate Ratio; SE=Standard Error