7-4-2024

Comorbidity of disordered eating and depression: Examining intersectional inequities and cardiometabolic health consequences across the life course

Franklin Hunter McGuire
Washington University in St. Louis - Brown School of Social Work, f.hunter.mcguire@gmail.com

Washington University in St. Louis

The Brown School

Doctoral Program in Public Health Sciences

Dissertation Examination Committee:

Alexis E. Duncan, PhD, MPH (Chair)

Darrell L. Hudson, PhD, MPH

Derek S. Brown, PhD, MA

Jules K. Wood, PhD, MS

Jason Nagata, MD, MSc

Comorbidity of disordered eating and depression: Examining intersectional inequities and cardiometabolic health consequences across the life course

By

F. Hunter McGuire, MPH

A dissertation presented to the Brown School at Washington University in St. Louis in partial fulfillment of the requirements for the degree of Doctor of Philosophy

April 2024

St. Louis, Missouri, USA

Acknowledgements

This dissertation was supported by the National Institute of Mental Health [grant number T32MH19960]. I would like to thank Drs. Matthew R. Williams and Ariel L. Beccia for their statistical and methodological support over the past three years. Without their assistance, this dissertation would not have been possible.

Table of Contents

List of Tables

Chapter 1

Chapter 2 (Aim 1)

Chapter 3 (Aim 2)

Chapter 4 (Aim 3)

List of Figures

Chapter 2 (Aim 1)

Chapter 3 (Aim 2)

Chapter 4 (Aim 3)

Abbreviations

Add Health = National Longitudinal Study of Adolescent to Adult Health

AN = anorexia nervosa

BED = binge eating disorder

BN = bulimia nervosa

CI = credible interval

DE = disordered eating

DEB(s) = Disordered eating behavior(s)

MAIHDA = multilevel analysis of individual heterogeneity and discriminatory accuracy

MCMC = Markov chain Monte Carlo

NHANES = National Health and Nutrition Examination Survey

OSFED = Other specified feeding or eating disorder

PCV = proportional change in variance

PD = prevalence difference

pp = percentage point

PR = prevalence ratio

RD = risk difference

RR = risk ratio

VPC = variance partition coefficient

Abstract

Comorbidity of disordered eating and depression: Examining intersectional inequities and cardiometabolic health consequences across the life course

By

F. Hunter McGuire, MPH

Doctor of Philosophy in Public Health Sciences

The Brown School, Washington University in St. Louis, 2024

Professor Alexis E. Duncan, Chair

Traditional epidemiologic research has often neglected the degree to which interlocking systems of oppression may (1) describe the distribution of population health inequities and (2) moderate health exposure-outcome associations. Grounded in an intersectional framework, this three-aim dissertation used an intersectional multilevel modeling approach (i.e., intersectional MAIHDA) and US nationally representative data to answer a series of intersectionality-informed research questions relevant to disordered eating, depression, and cardiometabolic health. With data from the National Health and Nutrition Examination Survey, **Aim 1** quantified the population distribution of weight loss-oriented disordered eating behaviors (DEBs) among US adults across intersectional groups defined by race/ethnicity, sex/gender, sexual orientation, and weight status. Using the same data source and intersectional group definitions as the prior analysis, **Aim 2** examined comorbidity patterns between DEBs and depression and estimated whether the association between DEBs and depression varied across intersectional groups. With data from the National Longitudinal Study of Adolescent to Adult Health, **Aim 3** estimated whether disordered eating, depression, and their comorbidity (assessed in adolescence/young

adulthood) were prospectively associated with incident risk of diabetes, hypertension, and/or hyperlipidemia (assessed in middle adulthood). Using intersectional groups defined by race/ethnicity, gender identity, and weight status, effect modification of these longitudinal associations was assessed. Overall, this dissertation highlights the importance of considering the role of interlocking systems of oppression when conducting both descriptive and analytical epidemiologic research. In particular, these studies offer insights into how an intersectional lens can advance the equitable design and distribution of policy and public health intervention efforts.

Chapter 1: Introduction

This dissertation applied an intersectional lens to the study of (1) disordered eating, (2) the comorbidity of disordered eating and depression, and (3) the longitudinal impact of disordered eating, depression, and their comorbidity (during adolescence and young adulthood) on the development of poor cardiometabolic health (by middle adulthood). This first section of this chapter introduces and defines these topics, which will receive further discussion in Chapters 2-4. Intersectionality theory and research methods will be discussed later in this chapter. With intersectional groups defined by race/ethnicity, sex/gender, sexual orientation, and weight status, Chapter 2 (Aim 1) examined the social patterning of disordered eating behaviors (DEBs), while Chapter 3 (Aim 2) quantified intersectional group differences in the association between DEBs and depression. Lastly, Chapter 4 (Aim 3) assessed whether the longitudinal impact of disordered eating and depression on incident cases of diabetes, hypertension, and hyperlipidemia differed across intersectional groups defined by race/ethnicity, gender identity, and weight status.

Substantive health issue areas

Disordered eating

In this dissertation, I defined disordered eating as a spectrum of unhealthy and/or irregular eating patterns that indicate disruptions in one's relationship with food, eating habits, body image, and/or overall wellbeing. To assess this construct, this dissertation employed a variety of indicators for disordered eating, including unhealthy weight loss behaviors (e.g., self-induced vomiting, laxative misuse, fasting or skipping meals to lose weight), binge eating (i.e., eating large amounts of food with loss of control), and self-reported diagnosis of an eating disorder (i.e., diagnosis of anorexia nervosa [AN], bulimia nervosa [BN], binge eating disorder [BED], other specified feeding or eating disorder [OSFED] by a healthcare professional). For

Aims 1 and 2, disordered eating was measured as DEBs, specifically, unhealthy weight loss behaviors. For Aim 3, I used measures of DEBs (unhealthy weight loss behaviors and binge eating) and self-reported eating disorder (ED) diagnosis.

Prior clinical studies of diagnosed EDs have documented adverse health consequences, including cardiovascular,[1] gastrointestinal,[2] and renal[3] complications. In particular, people living with AN have 5.9 times the risk of all-cause mortality and 31.0 times the risk of death by suicide compared to the general population.[4] In the United States, the societal burden of diagnosed eating disorders is estimated to total nearly $400 billion per year attributable to economic costs (i.e., healthcare costs, worker productivity) and reduced wellbeing (i.e., premature death, disability).[5] Taken together, diagnosed EDs represent a substantial public health, social, and economic concern in the United States.

DEBs are associated with increased odds of substance use disorders,[6] binge drinking,[7] mood and anxiety disorders,[6] and suicidality.[8] Relative to diagnosed eating disorders, which are estimated to affect between 2 to 8 percent of the general population,[9] DEBs are much more prevalent. Across racial/ethnic identities (i.e., White, Black/African-American, and Hispanic/Latine), data from the 2013 Youth Risk Behavior Surveillance System indicate that 20.4-29.9 percent of adolescent girls and 8.1-13.4 percent of adolescent boys reported past 30-day DEBs, which were defined as any engagement in purging, fasting, or diet pill use to lose weight or keep from gaining weight.[10] Overall, prior studies indicate the need to address DEBs through screening, prevention, and intervention to reduce overall morbidity and mortality.

Mental and behavioral health comorbidities: Disordered eating and depression

Globally, evidence from nationally representative surveys suggest that comorbidity among mental and behavioral health conditions is the norm rather than the exception.[11–13] In this

dissertation, I defined comorbidity as the lifetime occurrence of two or more health conditions in the same individual. Among US adults screening positive for a past-year mental or behavioral health condition, the US National Comorbidity Survey Replication (NCS-R) found that 45 percent met criteria for two or more mental/behavioral health conditions.[12] In particular, comorbid conditions among individuals with diagnosed EDs are extremely common. Results from the adolescent supplement to the US NCS-R found that between 55.2 to 88.0 percent of US adolescents with a positive ED screening had a comorbid mental health condition.[14] A recent systematic review estimated that 25.1% of adults with EDs will have a lifetime substance use disorder diagnosis.[15] A Swedish medical registry study indicated that approximately half of patients with a diagnosed ED also had a diagnosis of a mood disorder (women: 43.1%; men: 40.0%) or an anxiety disorder (women: 53.3%; men: 52.8%).[16] Overall, these findings suggest that mental and behavioral health comorbidities represent a substantial population health burden deserving intervention.

Comorbidities may place individuals with EDs at increased risk for more severe symptoms,[17–19] longer illness duration,[17] and reduced quality of life.[20] In a cluster analysis of US adults with a lifetime ED diagnosis, Van Alsten and Duncan found that having a mental health diagnosis before the onset of an ED was associated with more severe symptoms and greater length of symptom duration.[17] Similarly, in a sample of patients with BED, Grilo et al. (2009) found that those with current mental health comorbidities had worse eating-related psychopathology, greater depression symptoms, and lower self-esteem.[18] Among US adult women with AN, having comorbid major depressive disorder at clinical intake longitudinally predicted the persistence of AN symptoms at follow-up.[19] In the same study, women with

comorbid BN and substance use disorder at intake had more persistent BN symptoms at follow-up.[19]

Among all mental and behavioral health conditions, mood disorders, such as depression, are among the most likely conditions to cooccur with EDs.[14] Prior research indicates that disordered eating and depression may share transdiagnostic common causes, including genetic, biological, and social factors. For genetic risk, a twin study found that depression (44%) and overeating-binge eating (39%) were highly heritable with a strong genetic correlation (r=0.62) between the two conditions.[21] A longitudinal neuroimaging study of 1,386 adolescents also found that DEBs (defined as binge eating, purging, and dieting behaviors) and depression symptoms often developed concurrently.[22] Neuroimaging data revealed that brain area alterations preceded the development of DEBs and depression symptoms,[22] and behavioral concerns such as attention-deficit/hyperactivity disorder and conduct disorder symptoms also preceded development of comorbid disordered eating and depression.[22] Social factors found to be associated with increased risk of both disordered eating and depression include child maltreatment,[23,24] discrimination,[25,26] poverty and economic inequities,[27,28] food insecurity,[29,30] and structural stigma (i.e., discriminatory social and political climates).[31,32] Overall, evidence suggests that the comorbidity of disordered eating and depression may be rooted in a complex interplay of genetic, biological, and social factors.

Prior work has also examined the potential for a bidirectional relationship between disordered eating and depression. An 8-year follow-up study of US adolescents found a bidirectional, positive association between BN symptoms and depression symptoms.[33] However, another study documented a unidirectional association from depression symptoms to later development of disordered eating, while the association from disordered eating to subsequent

depression symptoms was minimal.[34] Similarly, a unidirectional path from increased depression symptoms to increased ED symptoms was found in a 5-year longitudinal study of adolescent girls.[35] Finally, a 5-year longitudinal study of Canadian adolescents found that DEBs predicted future depression symptoms at subsequent follow-up surveys, while pathways from depression symptoms to future DEBs were not significant.[36] While there is some variation concerning their exact temporal ordering, the evidence base suggests that disordered eating and depression are linked to one another in ways that may produce and sustain their comorbidity.

Cardiometabolic health

Building on the first two aims, Aim 3 (Chapter 4) estimated the longitudinal impact of disordered eating, depression, and their comorbidity on new onset cardiometabolic health conditions. Cardiometabolic health refers to range of interrelated conditions characterized by their effects on the body's cardiovascular system and energy utilization/homeostasis, including blood sugar regulation, blood pressure control, and lipid balance. This dissertation focused specifically on the development of diabetes, hypertension, and hyperlipidemia by the time individuals reached middle adulthood.

Of particular concern, people living with diabetes,[37] hypertension,[38] and hyperlipidemia[39] are at increased risk of all-cause mortality. Poor cardiometabolic health also presents a substantial economic burden to society. For example, diagnosed diabetes was estimated to cost the US economy $327 billion in 2017.[40] Of relevance to this dissertation, emerging research has also documented that disordered eating[41–44] and depression[45,46] are associated with poor cardiometabolic health outcomes. To reduce their population health burden and alleviate associated social and economic costs, disordered eating and depression may serve as useful intervention targets to delay or prevent the onset of poor cardiometabolic health. Notable gaps in

the cardiometabolic health literature concern the degree to which (1) the incident risk of diabetes, hypertension, and hyperlipidemia are socially patterned at the intersection of race/ethnicity, gender identity, and weight status, (2) the comorbidity of disordered eating and depression may increase this incident risk, and (3) longitudinal associations (from disordered eating and depression to poor cardiometabolic health) may be moderated by one's intersectional social position. Therefore, the third aim was designed to address these gaps.

The next section of this chapter introduces intersectionality theory, which served as the guiding theoretical framework of the dissertation. I then conceptually introduce and discuss the statistical approaches applied under an intersectional framework throughout the dissertation.

Intersectionality: Theory and methods

Emerging from Black feminist scholarship and activism,[47–49] intersectionality is a theoretical orientation detailing the interwoven ways in which identities and positions at the individual level (e.g., race/ethnicity, sex/gender, sexual orientation, weight status) relate with one another under interlocking systems of oppression (e.g., racism, sexism, heterosexism, fatphobia) and socially produce patterns of power, health, and wellbeing.[50,51] Individuals hold mutually-constitutive identities within power structures whereby they may experience relative privilege (e.g., White people under racism) or marginalization (e.g., women under sexism). Across various social, political, and economic institutions, this results in variations in lived experiences that are driven in part by an individual's specific location within systems of oppression. As such, research findings increasingly suggest that privilege and disadvantage across systems of oppression produce population-level health inequities.[52–54] In particular, the combination of multiple systems of oppression may disproportionately burden people in certain intersectional social positions.

At its roots, intersectionality emerged as a critical evaluation of existing race-based and gender-based research that neglected the experiences of Black women, who hold multiple marginalized social positions at the intersection of race and gender.[55] Harkening back to Sojourner Truth's "Ain't I A Woman?" speech at the 1851 Women's Rights Convention,[56] intersectionality recognizes systems of oppression as irretrievably bound together such that the experience of a Black woman's oppression is not simply the experience of racial oppression paired with the experience of gender-based oppression – it can take on a form that is unique to their intersectional position.[47,50,51] Dependent on the substantive topic under study, this framework can be expanded to consider a variety of social identities and positions, including race/ethnicity (structural racism), sex and gender identity (structural sexism and/or transphobia), sexual orientation (structural heterosexism), and weight status (structural fatphobia and weight stigma). Critically, adopting an intersectional lens can shift analysis away from the "tyranny of the averages"[57] towards nuanced considerations of how health and wellbeing are patterned across social locations within systems of oppression. Overall, intersectionality theory posits that the complexity of social, cultural, and political life can only begin to be understood by considering the ways in which "many axes [of social division] work together and influence each other."[58]

Methodological approaches to study intersectionality

Intersectionality, particularly in quantitative research settings, poses certain methodological challenges. Namely, as more and more categories of social identity or position are included, the complexity of analysis substantially increases. Leslie McCall summarized three methodological approaches to frame and conduct intersectional analysis.[55] At one end, with its roots in postmodernism and poststructuralism, the anticategorical approach rejects categories as a meaningful way to study social phenomena. Rather than taking them as preexisting ground truth,

categories are socially produced through language and social interactions. Methodologically, proponents argue that research using social categories like race/ethnicity necessarily reinforce inequalities through practices of demarcation and exclusion. By challenging the "singularity, separateness, and wholeness" of identity, this approach highlights how category definitions are fluid across time and context, such as the ever-changing classifications of race/ethnicity in the US Census.[59] As such, rather than lumping diverse individuals into broad categories, the complexity of individual experiences is privileged in analysis.[55] In effect, the ultimate goal of anticategorical analysis is to dismantle social hierarchies by liberating individuals and groups from dominant social norms and practices ascribed to their identities.

While acknowledging the arbitrary definition of categorical boundaries, the intracategorical approach adopts categories to identify and center marginalized and/or minoritized groups (e.g., Black women of lower SES).[55] This approach was borne out of critiques from feminists of color calling attention to the ways in which white feminists invoked the term "woman" as a uniform experience of all women; namely, the social experience and definition of womanhood was assumed to be invariant across other dimensions like race/ethnicity and socioeconomic status.[55] Intracategorical analysis has been particularly widespread in qualitative research, which allows for a "thick description" of both the commonalities experienced by group members as well as the heterogeneity of lived experiences.[55] As such, this approach can minimize analytic complexity by focusing on a particular intersectional position.

Lastly, the intercategorical approach, which served as the guiding methodology of this dissertation, pragmatically adopts existing social categories to study broad patterns of power relations and inequities.[55] While acknowledging the anticategorical view that categories are socially constructed and have time- and context-dependent definitions, intercategorical methods

use social categories as "anchor points" to identify and explain complex patterns of power relations.[55] Thus, between-group relations and the ways in which they may change across time and context serve as the primary focus of analysis.

The intercategorical approach holds a few key advantages from an epidemiologic research standpoint. First, through its comparative methodology, the unit of analysis is multigroup as opposed to the single group focus of intracategorical methods.[55] Thus, it allows for a more complete understanding of power relations and inequities are distributed at the population level. Second, intercategorical analysis seeks to simultaneously model patterns of privilege and marginalization.[55] Rather than centering analysis solely on the deficits or strengths specific to certain intersections, the positions of advantaged groups are made visible within power structures to then explore the mechanisms by which these groups unduly benefit from the existing set of power relations.

Quantitative methods for intercategorical intersectional research

In recent years, a host of quantitative methods have been used to study intersectionality from the intercategorical perspective. These methods broadly fall into following groups: main effects models with interaction terms, machine learning (decision tree methods), and multilevel (hierarchical) models.[60] Below I provide a brief description of each method along with a summary of their benefits and drawbacks. As this dissertation focuses on binary health outcomes, I will focus on the applicability of methods to this data type.

Mahendran et al.[60] conducted a simulation study evaluating the performance and accuracy of these methods for descriptive intersectional studies with binary outcomes. Models were evaluated in reference to estimates obtained from non-intersectional main effects models. Non-intersectional main effects models include each social identity or position variable as a

covariate, and variable coefficients represent the average difference in the outcome relative to the reference group. These models do not include interaction terms and thus can be considered misspecified under the assumption that two-way or higher interactions between the social position variables exist. Given that intersectional analyses of binary outcomes are often limited by low sample sizes across intersectional groups, Mahendran et al. also evaluated the degree to which bias and variance estimation were sensitive to sample size. The results of this study are described in **Table 1.1** below.

Table 1.1 Evaluation of quantitative methods to model intercategorical intersectionality with binary health data (adapted from Mahendran et al.[60])

Model type	**Description**	**Benefits**	**Drawbacks**
Main effects models *(Non-intersectional comparison)*	A statistical model (e.g., logistic regression) with each social position variable included as a predictor of the outcome. Social position interaction terms are not included. If X1 is a binary race/ethnicity variable and X2 is a binary sex/gender variable, then an example model form is: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2$	Relative to the fully saturated model (see below), it may encounter fewer statistical estimation issues since fewer terms are estimated.	Since each social position variable term is fixed across intersectional positions, intersection-specific estimates will be fixed to the mean value (e.g., mean for Black people + mean for women = predicted value for Black women). Thus, this method cannot be considered intersectional.
Main effects models with interaction terms (i.e., fully saturated model)	A main effects model with all possible interaction terms for social position variables. This is also referred to as a "fully saturated" model. For categorical social position variables, the main effects terms represent the average difference in the odds (or risk) the outcome relative to a reference group (e.g., Black vs. White for race/ethnicity). Interaction terms are included to allow estimates to vary across intersections (e.g., estimate for Black women is not fixed to "Black" + "Woman").	Accurate for intersection-specific estimation given that sample sizes are large.	Not recommended for small sample sizes since this can introduce estimation issues for accuracy and precision. Does not directly partition outcome variance into within-group vs. between-group differences.

	If X1 is a binary race/ethnicity variable, X2 is binary sex/gender variable, and X1*X2 is their interaction, an example model form is: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 (X_1 * X_2)$		
Machine learning (Decision tree methods)	"Data-driven non-parametric methods that apply decision rules to partition data into a single final decision tree, can incorporate any level of interaction, and can identify subgroups for further study or intervention"[60] *Examples:* Classification and regression trees (CART), Conditional inference trees (CTree), and Chi-square automatic interaction detector (CHAID).	Allows for inductive analysis, which can be useful if (1) there isn't consensus on the relevant social position variables to include or (2) the aims of the study are to identify the most relevant social positions in explaining health outcome variance.	Not recommended for small sample sizes. The variables selected by the statistical model may not have direct public health policy or practice relevance. Higher computational demand.
Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA)	In most MAIHDA applications, a two-level model is fit whereby individuals (level 1) are nested within socially-defined intersectional groups (level 2). In the random intercepts model, a main effects (i.e., average) intercept and intersection-specific random intercepts are jointly estimated. For binary outcomes, intersection-specific predicted prevalence estimates are obtained by combining the main effects intercept and random intercept. In the random slopes model, a main effects exposure-outcome association and intersection-specific random slopes are jointly estimated. This can be used to study effect modification (moderation) of the exposure-outcome association dependent on the intersectional social position.	Overall, MAIHDA is the most accurate method for intersection-specific estimation, regardless of sample size. Multilevel models utilize partial pooling to generate precision-weighted estimates. This can produce more stable estimates for intersectional positions with smaller sample sizes.	Higher computational demand, particularly if Bayesian statistical methods are used (which is currently the most popular approach in the literature).

Overall, the intercategorical intersectional methods outperformed the non-intersectional main effects model in terms of estimation accuracy.[60] However, multilevel models had the best overall performance for estimating bias and variance, particularly in scenarios where intersectional group sample sizes were small. Specifically, Mahendran et al.[60] evaluated a novel method known as multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) under an intersectional framework (hereafter, intersectional MAIHDA).[61–63] This method will be used each aim of this dissertation.

Intersectional MAIHDA uses the multilevel model to nest individuals, at level 1, within mutually-exclusive intersectional groups, at level 2. This differs conceptually from traditional multilevel models that nest individuals within administratively- or geographically-defined level 2 units (e.g., neighborhoods, schools) or those that nest repeated observations within individuals (e.g., longitudinal data). Here, researchers typically use individual-level identities and positions to define intersectional groups, which are used to approximate each individual's relative social position under interlocking systems of oppression. As a simplified example, the intersection of race/ethnicity (with two options: White or Black), a proxy for racism, and gender identity (with two options: cisgender men or cisgender women), a proxy for sexism, would result in four intersectional groups: White cisgender men, White cisgender women, Black cisgender men, and Black cisgender women. Using the intercategorical analysis approach,[55] intersectional groups serve as categorical "anchor points" and can be used to analyze patterns of population health inequities.

The intersectional MAIHDA model structure allows researchers to (1) identify the general contextual effect (GCE) of the intersectional group structure (i.e., degree to which outcomes are clustered within, or dispersed across, intersectional groups), (2) map the social

patterning of population health inequities (i.e., intersection-specific predicted prevalence or risk estimates), and (3) decompose between-group differences into those explained by (1) additive main effects versus interaction effects or (2) specific health-related exposures. Concerning health-related exposures, Evans et al.[64] recently proposed a random slopes application of intersectional MAIHDA. Here, random slopes for the exposure variable were used to allow exposure-outcome associations to vary across the level 2 units (i.e., intersectional groups). Thus, this can be used to assess evidence of effect modification by one's intersectional social position. In Chapters 2-4, I will discuss these methods in greater detail and how they are specifically applied in each dissertation study.

Specific aims

Grounded in an intersectional framework[47–49] and using the intersectional MAIHDA methodology,[61–64] the specific aims of this dissertation were as follows:

Aim 1 (Chapter 2): "Disordered eating behaviors at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status in a nationally representative sample of US adults"

- Quantify the degree to which DEBs are socially patterned at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status.
- Quantify the degree to which inequities in DEBs across intersectional groups are explained by main effects versus interaction effects (i.e., two-way or higher interactions of social identity/position variables).

Aim 2 (Chapter 3): "Intersectional differences in the association between disordered eating behaviors and depression in a nationally representative sample of US adults"

- Quantify the degree to which depression is socially patterned at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status.
- Using random slopes, evaluate effect modification of the cross-sectional association between DEBs and depression at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status.
- Estimate the prevalence of depression for each intersectional group and exposure status (no DEBs vs. DEBs).
- For each intersectional group and the overall sample, estimate prevalence ratios and prevalence differences in depression relative to those without DEBs.

Aim 3 (Chapter 4): "Disordered eating, depression, and incident risk of diabetes, hypertension, and hyperlipidemia at the intersection of race/ethnicity, gender identity, and weight status: A longitudinal intersectional MAIHDA from adolescence to middle adulthood"

- Quantify the degree to which incident cases of poor cardiometabolic health indicators (diabetes, hypertension, hyperlipidemia) are socially patterned at the intersection of race/ethnicity, gender identity, and weight status.
- Estimate the longitudinal association from disordered eating, depression, and their comorbidity (in adolescence and young adulthood) to incident risk of poor cardiometabolic health (in middle adulthood).
- Using random slopes, evaluate effect modification of longitudinal associations (disordered eating, depression, and their comorbidity → poor cardiometabolic health) at the intersection of race/ethnicity, gender identity, and weight status.

- Estimate incident risk of diabetes, hypertension, and hyperlipidemia for each intersectional group and exposure level (neither, disordered eating only, depression only, disordered eating and depression).
- For each intersectional group and exposure level, estimate risk ratios and risk differences in diabetes, hypertension, and hyperlipidemia relative to those without disordered eating or depression.

To address these aims, I used two data sources. For Aims 1 and 2, I used repeated, cross-sectional data from the National Health and Nutrition Examination Survey (NHANES) collected from 2005 to 2016 (Aim 1 n = 17,614; Aim 2 n = 17,578). To assess longitudinal associations, Aim 3 used data from the National Survey of Adolescent to Adult Health (Add Health), which was a prospective cohort study of US middle and high school students followed from 1994-95 (Wave 1) to 2016-2018 (Wave 5). Sample sizes for Aim 3 were defined according to the specific cardiometabolic health outcome: diabetes (n=8,878), hypertension (n=8,393), hyperlipidemia (n=8,462). Both data sources were US nationally representative, with NHANES being representative of non-institutionalized US residents and Add Health being representative of US residents enrolled in middle and high school (ages 11-21) in the 1994-1995 school year.

For each aim, I used individual-level demographic measures to approximate each participant's relative social position under interlocking systems of oppression. For Aims 1-2, participants were sorted into intersectional groups defined by race/ethnicity, sex/gender, sexual orientation, and weight status. The term "sex/gender" was used in Aims 1-2 given measurement decisions made by NHANES staff that conflated sex assigned at birth with gender identity.

For Aim 3, intersectional groups were defined by race/ethnicity, gender identity, and weight status. Add Health included items for both sex assigned at birth and gender identity, so I opted to combine reports from both items to classify participants as either cisgender men ("male" sex assigned at birth and "male" gender identity) or cisgender women ("female" sex assigned at birth and "female" gender identity). Due to low sample size, transgender and gender expansive participants were excluded from analysis. Owing to sample size limitations, sexual orientation was not included to define intersectional groups in Aim 3. Instead, sexual orientation, along with measures of neighborhood socioeconomic status (SES) and household SES, was identified as a confounder variable and included in models to estimate confounder-adjusted longitudinal associations.

Structure of the dissertation

This dissertation was organized according to the three-paper dissertation model, with Chapter 2 addressing Aim 1, Chapter 3 addressing Aim 2, and Chapter 4 addressing Aim 3. Going forward, Chapters 2-4 were designed to be standalone manuscripts that can be submitted to a peer-reviewed journal for publication. As such, there was some repetitive text and background information included in these chapters. Separate supplementary appendices also accompanied Chapters 2-4, respectively. Each supplementary appendix contained technical details and statistical information. Finally, in Chapter 5, this dissertation ended with a summary and synthesis of the primary research findings as well as next steps for future intersectionality-informed quantitative research.

Chapter 2: Disordered eating behaviors at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status in a nationally representative sample of US adults

Abstract

Background: Disordered eating behaviors (DEBs) are characteristic of eating disorders and associated with adverse health consequences. The social epidemiology of DEBs remains understudied, which limits intervention efforts. With a nationally representative US sample, I examined how race/ethnicity, sex/gender, sexual orientation, and weight status intersect under interlocking systems of oppression to produce DEB inequities.

Methods: Cross-sectional data were drawn from US adults (18-59) in the National Health and Nutrition Examination Survey (NHANES; n=17,614) 2005-2016. I conducted intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) for four past-year, weight loss-oriented DEBs (skipping meals, non-prescription weight loss supplements/pills, purging behaviors, smoking to lose weight) and a catch-all any DEBs variable. For each outcome, I estimated intersectional group-specific prevalence and excess/reduced prevalence due to two-way or higher interaction effects.

Results: DEBs exhibited complex patterns, with prevalence of any DEBs ranging from 5.2% (Hispanic/Latine smaller-bodied heterosexual men) to 22.3% (Black larger-bodied sexual minority women). Between-group differences accounted for 7.6-21.7% of the population-level variation in DEBs with the largest differences for purging behaviors. Additive main effects indicated increased burden among Black people, women, sexual minority people, and larger-bodied people. While main effects explained most between-group differences (78.1-91.7%), nonadditive interaction effects modified group-specific burden, highlighting unique positions within interlocking systems of oppression.

Conclusions: Findings emphasize the importance of an intersectional approach to accurately describe population mental and behavioral health inequities. To reduce DEB-related morbidity and mortality, results support prevention efforts that address interlocking systems of oppression and adopt a mix of population-wide and targeted approaches.

Introduction

Disordered eating behaviors (DEBs, e.g., self-induced vomiting, skipping meals to lose weight) are a range of behavioral patterns associated with eating disorders. While the past-year prevalence of eating disorders meeting clinical diagnostic criteria is relatively low (i.e., 0.7% [men], 2.2% [women]) in the United States (US),[9] DEBs are much more common.[65,66] DEBs are associated with adverse mental and behavioral health concerns, including psychological distress,[67] poor self-rated health status,[67] mood and anxiety disorders,[6,66,68] substance use disorders,[6] binge drinking,[7] and suicidality.[8] Addressing DEBs through screening, prevention, and intervention has strong potential to reduce the population burden of DEB-related morbidities and mortality. However, the epidemiology of DEBs remains understudied. Moreover, the current evidence base broadly relies on clinical and convenience samples that may not be representative of the general population.[69] Most epidemiological evidence is concentrated on adolescents and young adults,[69] which limits understanding of DEBs across the life course. Therefore, additional efforts are needed to describe the population distribution and determinants of DEBs among US adults.

Social epidemiology of DEBs in the United States

In scientific literature and mass media, eating disorders and DEBs are often stereotyped as primarily affecting White, heterosexual, smaller-bodied women,[70,71] and marginalized and minoritized populations have been underrepresented and understudied in eating disorder research.[28,72–78] However, recent studies have documented prevalence differences in weight loss-oriented DEBs across demographic subgroups defined by race/ethnicity,[10,73,79] sex/gender,[10,72,73,79] sexual orientation,[72,79,80] and weight status[72,80] that counter prevailing stereotypes. The term "sex/gender" is used to acknowledge the conflation of sex assigned at birth

with gender identity that impacted data from the current study and, where relevant, prior studies. Building on community knowledge and activism, these demographic differences have been conceptualized as health inequities attributable to interlocking systems of oppression (i.e., racism, sexism, heterosexism, fatphobia).[28,72]

While nationally representative US data suggests that Black adults and Hispanic/Latine adults, relative to White adults, have lower odds of screening positive for a DSM-5-defined eating disorder,[81] studies examining DEBs have documented more complex patterns. For example, data from the US Youth Risk Behavior Surveillance System indicated a higher prevalence of DEBs (i.e., purging behaviors and non-prescription weight loss supplement/pill use) among Black and Hispanic/Latine boys compared to White boys, while Black girls may have lower prevalence and Hispanic/Latine girls similar prevalence versus White girls.[79] Interactions between race/ethnicity and other aspects of social position may multiply the disproportionate burden of DEBs for marginalized groups (i.e., those with more than one marginalized social position). For instance, Beccia et al. (2021) found excess prevalence of DEBs (i.e., purging behaviors, fasting to lose weight, non-prescription weight loss supplement/pill use) among Hispanic/Latine girls.[10] These results suggest that the experience of sexism may depend on one's exposure to racism, or vice versa. Failure to consider the intersection of race/ethnicity with other social positions may thus conceal DEB inequities relevant to public health prevention and intervention efforts.

Prior research has documented DEB inequities by sexual orientation, with results generally finding higher prevalence among sexual minority versus heterosexual people.[82,83] However, when stratified by sex/gender, findings are more consistent for sexual orientation inequities (i.e., sexual minority > heterosexual) among boys/men relative to girls/women.[82,83] For

weight status, there is evidence of greater prevalence of DEBs among larger-bodied compared to smaller-bodied people.[72,80] This may arise from a broader social context encouraging weight loss among larger-bodied people, including public health campaigns targeting obesity,[84] barriers to health services based on weight status,[85,86] and increasing trends in perceived weight discrimination.[87] While evidence of inequities by race/ethnicity, sex/gender, sexual orientation, and weight status is increasingly clear, the degree to which these social positions and their related systems of oppression combine and contribute to DEB inequities remains understudied.

Intersectionality theory and its implications for epidemiological research

There is limited use of intersectionality theory in the design, analysis, and interpretation of eating disorder-related research.[77] Originating in Black feminist scholarship and activism,[49,88,89] intersectionality theory posits that systems of oppression (i.e., racism, sexism, heterosexism, fatphobia) are bound together and cannot be fully understood in isolation. Interlocking systems of oppression produce a complex set of power relations where individuals can experience relative privilege or marginalization across various systems of oppression. These patterns shape one's access to health-promoting resources (e.g., housing, employment, nutrition, health services),[90] and across the life course, differential access to resources compound to produce health inequities.[91] Ultimately, intersectionality theory advocates for social change by calling attention to and dismantling interlocking systems of oppression that produce and maintain inequities.[92]

In prior epidemiological research, the intercategorical (i.e., between-group) approach[93] is frequently applied to study intersectional inequities.[94,95] Quantitative studies adopting the intercategorical approach traditionally implement statistical models of the main effects of each social position along with interaction terms between all possible social position intersections.[94,95]

Thus, model estimates can vary based on one's intersectional group. This also allows the estimation of excess or reduced prevalence of the outcome due to two-way or higher interactions between social position variables. However, this approach has several limitations. First, the number of interaction terms increases multiplicatively as more social positions are analyzed, and small group sample sizes can lead to unstable prevalence and interaction estimates.[63] Second, social positions are modeled as individual-level "risk factors" to calculate average health outcome differences between categories,[61] yet these average difference measures, also known as specific contextual effects (SCEs),[61,96] withhold information about the distribution of health outcomes within a social category. For instance, it may be the case that, on average, women have greater eating disorder symptoms relative to men, but the same average difference value can arise from many underlying distributions.[61,96]

Clustering of health outcomes within intersectional groups holds relevant information for public policy and public health practice. If the distribution of health outcomes is strongly driven by between-group differences (e.g., non-overlapping distributions between men and women), also known as the general contextual effect (GCE), knowing an individual's intersectional group gives greater confidence in the presence of the health outcome, which can inform taking a targeted prevention approach to improve overall population health and, consequently, health equity. In the case of highly overlapping distributions, or lower GCE, a population approach would be more efficient. Understanding the distribution of health outcomes within versus between intersectional groups can provide vital information for the design and implementation of prevention efforts.

In recent years, intersectional MAIHDA (multilevel analysis of individual heterogeneity and discriminatory accuracy)[61–63] has been applied to study intersectional health inequities,[97–99]

including DEBs.[72] As a reorganization of multilevel analysis concepts under an intersectional framework, individuals are nested within socially-defined intersectional groups to produce traditional measures of association while partitioning within-group (individual heterogeneity) and between-group (discriminatory accuracy) health outcome variation.[61] The current analysis builds upon a prior intersectional MAIHDA examining DEBs among US young people (ages 14-31) at the intersection of gender identity, sexual orientation, and weight status,[72] which found that multiply marginalized groups were disproportionately burdened by DEBs.[72] Owing to limited racial/ethnic diversity within the study sample,[72] this analysis did not include race/ethnicity in the model. This is a notable limitation given how structural racism continues to shape daily life in the US.[53] Additionally, the prior analysis used a non-probability sample of young people, so the degree to which DEBs are patterned across intersectional groups in a nationally representative sample of US adults remains unknown.

Current study

In response to calls for increased public health surveillance of eating disorders,[101] particularly from an intersectional perspective,[77] I utilized the best available, nationally representative data from US adults to study how past-year, weight loss-oriented DEBs (here, skipping meals, non-prescription weight loss supplements/pills, purging behaviors, smoking to lose weight) are patterned at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status. I implemented intersectional MAIHDA to estimate intersectional group SCEs (i.e., prevalence of DEBs, interaction effects), social position variable SCEs (i.e., main effects), and the degree to which DEBs may be clustered within intersectional groups (i.e., GCE).[61,63,97,99] Intersectional groups were conceptualized as a contextual factor, similar to geographic features like neighborhoods, that can describe the population distribution of DEBs.[61–63] Under an

intersectional framework,[49,88,89] individual-level social position measures were used as proxies for interlocking systems of oppression. To estimate excess/reduced prevalence, I separated prevalence into portions explained by the additive contribution of social position main effects (i.e., race/ethnicity + sex/gender + sexual orientation + weight status) versus two-way or higher interaction effects.

Methods

Data

The current analysis used six cross-sectional waves from the National Health and Nutrition Examination Survey (NHANES): 2005-06, 2007-08, 2009-10, 2011-12, 2013-14, 2015-16. Sexual orientation data collection began in 2005-06 but is not publicly available beyond 2015-16, so later years of NHANES are not feasible for this analysis. Data were pooled across waves to increase sample sizes and estimate precision. NHANES is collected using in-person interviews, employs multistage probability sampling methods and provides analytic weights. Appropriate statistical analysis may generate nationally representative estimates of the resident, noninstitutionalized US population.[102]

Analytic sample. From an overall NHANES 2005-2016 sample of n=60,936, I excluded those aged younger than 18 and older than 59 (n=35,979) because sexual orientation was not assessed in these age groups. Due to the inability to interpret results in a defined social/cultural context, I excluded "Other/Multiracial" participants (n=2,899). After excluding participants with missing data for weight status (n=8), sexual orientation (n=4,404), and DEBs (n=32), the analytic sample consisted of n=17,614 participants.

Measures

Disordered eating behaviors (DEBs). Participants reporting past-year attempted or intentional weight loss were asked "How did you try to lose weight?". I classified DEBs as: "skipped meals," "started to smoke or began to smoke again" (hereafter, smoking to lose weight), "took laxatives or vomited," and "took other pills, medicines, herbs, or supplements not needing a prescription" (hereafter, non-prescription weight loss supplements/pills). I analyzed DEB items individually and derived an "any DEB" variable to capture participants reporting any of the DEBs items.

Race/ethnicity. Participants self-reported their race with "What race do you consider yourself to be?" which had the response options: White, Black/African-American, Indian (American), Alaska Native, Native Hawaiian, Guamanian, Samoan, Other Pacific Islander (Specify), Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian, or Some Other Race. Participants were asked about their ethnicity with "Do you consider yourself to be Hispanic or Latino?". NHANES staff categorized participants into mutually exclusive race/ethnicity groups: Non-Hispanic/Latine (NHL) White, NHL Black/African-American, NHL Other/Multiracial, or Hispanic/Latine. For brevity, descriptors for racial/ethnic categories without the "NHL" qualifier are used.

Sex/gender. NHANES interviewers assigned participants as either "male" or "female" and were instructed to "ask if not obvious."[103] Given presumed conflation of sex and gender and in line with prior research,[97,104] I refer to this construct as "sex/gender" and use the terms "man" and "woman."

Sexual orientation. As sexual orientation encompasses multiple dimensions (i.e., identity, behavior, and attraction), I used sexual identity and past-year sexual behavior to classify participants into two groups: "heterosexual" or "sexual minority". Sexual attraction was not

assessed. Participants self-reported their sexual identity with "Do you think of yourself as…" with options: "heterosexual or straight," "homosexual or gay (lesbian)," "bisexual," "something else," or "unsure." Responses of "something else" or "unsure" were recoded as missing given prior research documenting diverse reasons (e.g., misunderstanding the question, having a unlisted sexual identity, rejection of sexual identity labels).[105] I therefore defined "heterosexual" as participants selecting "heterosexual or straight" and "sexual minority" as participants selecting "homosexual or gay (lesbian)" or "bisexual." I then used two sex/gender-specific questions to classify past-year sexual behavior: "In the past 12 months, with how many men have you had anal or oral sex?" (for men) and "In the past 12 months, with how many women have you had sex? By sex, we mean sexual contact with another woman's vagina or genitals" (for women). Any participants self-reporting "heterosexual or straight" who also reported 1+ past-year same-sex/gender sexual partners were recoded as "sexual minority".

Weight status. Objectively measured height and weight were used to calculate body mass index (BMI).[106] In line with prior intersectional MAIHDA,[72] I used BMI as a proxy for exposure to fatphobia and weight discrimination. Participants were classified as either smaller-bodied (BMI < 30.0) or larger-bodied (BMI ≥ 30.0).

Intersectional groups. Participants were sorted into 24 intersectional groups using mutually exclusive combinations of three race/ethnicity, two sex/gender, two sexual orientation, and two weight status categories. Unweighted group sample counts ranged from 18 to 2,574 (Table 2.1).

Analysis

Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA). With individuals (level 1) nested within intersectional groups (level 2), I used

design-weighted Bayesian statistical methods[97,107,108] to estimate the predicted probability of each DEB outcome with two-level logistic models specified with random intercepts for intersectional groups.[99] To summarize posterior distributions, means and 95% credible intervals (CI) were used. In line with prior intersectional MAIHDA applications,[72,97–99] I fit a null model (no level 1 covariates) and a full model (all social position main effects as level 1 covariates). The null model was used to quantify the general contextual effect (GCE) and estimate outcome prevalence as predicted probabilities. The full model was used to estimate the specific contextual effects (SCEs) of each social position variable and decompose the GCE and prevalence estimates into those explained by the social position main effects versus two-way or higher interaction components.

General contextual effect (GCE). GCE was estimated through two measures of discriminatory accuracy: variance partition coefficients (VPC) and the area under the receiver operator characteristic curve (AUC). The VPC measures the percentage of total outcome variance found comparing intersectional groups to one another (i.e., level 2 or between-group variance). I used the latent variable method to approximate level 1 variance in two-level logistic models.[109] I used the following interpretation thresholds to determine the GCE estimated by the VPC: absent (0–1%), very small (>1–5%), small (>5–10%), moderate (>10–20%), fairly large (>20–30%), very large (>30%).[110] The AUC assesses how well the predicted probabilities for intersectional groups distinguish between those with/without the outcome through plots comparing true positives (i.e., sensitivity) against false positives (i.e., 1 – specificity). With values ranging from 0.5 (i.e., random classifier) to 1.0 (i.e., perfect classifier), I used the following interpretation thresholds: absent (0.5–0.55), very small (>0.55–0.61), small (>0.61–0.66), moderate (>0.66–0.72), fairly large (>0.72–0.77), very large (>0.77).[110] To quantify how

much the social position main effects explained intersectional inequities observed in the null model, the proportional change in variance (PCV) was calculated as the full model between-group variance subtracted from the null model between-group variance and divided by the null model between-group variance.

Specific contextual effects (SCE). I calculated odds ratios (ORs) with 95% CI to summarize main (additive) effects estimates from the full model. Intersectional group SCEs were estimated with (1) model-predicted prevalence and (2) interaction effects (i.e., excess/reduced prevalence attributable to two-way or higher interactions of social position variables). From null models, I calculated model-predicted prevalence as the combination of the main effects intercept and group-specific random intercepts. From full models, I isolated interaction effects, which are represented by residual values in group-specific random intercepts, as the difference between model-predicted prevalence estimated via main effects and model-predicted prevalence estimated via total effects (i.e., main effects + interaction effects).[99]

Estimation procedures. Models were fit with a Hamiltonian Monte Carlo (HMC) estimation algorithm with a Bernoulli distribution and logit link function.[111] I specified weakly informative priors on model parameters: half student-t distribution (degrees of freedom=3, location=0, scale=2.5, lower bound=0) for non-negative variance parameters and a Gaussian distribution (mean=0, standard deviation=2.5) for logit-scaled main effects. Four Markov chains were run for 4,000 iterations including 2,000 warmups (post-warmup iterations per chain = 2,000). In line with prior intersectional MAIHDA using complex sample survey data,[97] I used the "csSampling"[112] package to account for the NHANES sampling design and generate design-weighted, nationally representative estimates.[107,108] Model convergence was evaluated using Gelman-Rubin r-hat diagnostics, effective sample size, and visual inspection of trace and

autocorrelation plots.[113] Analyses were conducted in R 4.2.2. Model equations and convergence diagnostics are available in Supplementary Materials (Appendix A).

Results

Sample characteristics

Comparing design-weighted percentages, most participants were White (70.9%), heterosexual (94.7%), and smaller-bodied (63.5%), and there was roughly equal breakdown between women and men (Table 2.1). DEB outcome prevalence ranged from 0.4% (purging behaviors) to 8.0% (skipped meals), with 11.2% of US adults reporting one or more DEBs in the past year.

General contextual effect (GCE)

The GCE varied by outcome. Differences between intersectional groups were fairly large for purging behaviors (VPC=21.27%, AUC=0.735); however, differences were less large for non-prescription weight loss supplements/pills (VPC=12.56%; AUC=0.676) and small for skipped meals (VPC=9.48%; AUC=0.655), smoked to lose weight (VPC=7.61%; AUC=0.668), and any DEBs (VPC=9.06%; AUC=0.658) (Table 2.1; Figure A-S1). This indicates that some DEBs may be more concentrated in specific intersectional groups. Following adjustment for all social position variables, 91.73% of between-group differences in any DEBs were attributable to the additive contribution of the social position main effects; thus, 8.27% was attributable to

Table 2.1 Sample characteristics, NHANES 2005-2016 (n=17,614)

Variables	n (weighted %)
Dimensions of social identity/position	
Race/ethnicity	
Non-Hispanic/Latine (NHL) White	8,069 (70.9%)
NHL Black	4,302 (12.8%)
Hispanic/Latine	5,243 (16.3%)
Sex/gender	
Man	8,632 (50.2%)
Woman	8,982 (49.8%)
Sexual orientation	
Heterosexual	16,689 (94.7%)
Sexual minority	925 (5.3%)
Weight status	
Smaller-bodied	10,814 (63.5%)
Larger-bodied	6,800 (36.5%)
Outcomes (past-year)	
Any disordered eating behaviors (Overall)	2,010 (11.2%)
Skipped meals	1,467 (8.0%)
Non-prescription weight loss supplements/pills	714 (4.1%)
Purging behaviors	89 (0.4%)
Smoked to lose weight	108 (0.6%)
NHANES data collection year	
2005-06	2,741 (16.6%)
2007-08	3,044 (16.4%)
2009-10	3,418 (16.4%)
2011-12	2,689 (16.8%)
2013-14	3,062 (17.4%)
2015-16	2,660 (16.4%)
Intersectional groups defined by race/ethnicity, sex/gender, sexual orientation, and weight status	**n**
White men	
Smaller-bodied & Heterosexual	2,574
Smaller-bodied & Sexual minority	121
Larger-bodied & Heterosexual	1,277
Larger-bodied & Sexual minority	57
Hispanic/Latine men	
Smaller-bodied & Heterosexual	1,574
Smaller-bodied & Sexual minority	64
Larger-bodied & Heterosexual	893
Larger-bodied & Sexual minority	18

Black men	
Smaller-bodied & Heterosexual	1,230
Smaller-bodied & Sexual minority	62
Larger-bodied & Heterosexual	754
Larger-bodied & Sexual minority	21
White women	
Smaller-bodied & Heterosexual	2,425
Smaller-bodied & Sexual minority	160
Larger-bodied & Heterosexual	1,336
Larger-bodied & Sexual minority	119
Hispanic/Latine women	
Smaller-bodied & Heterosexual	1,502
Smaller-bodied & Sexual minority	61
Larger-bodied & Heterosexual	1,102
Larger-bodied & Sexual minority	54
Black women	
Smaller-bodied & Heterosexual	962
Smaller-bodied & Sexual minority	93
Larger-bodied & Heterosexual	1,091
Larger-bodied & Sexual minority	96

Note: NHANES = National Health and Nutrition Examination Survey. Percentages are design-weighted to account for NHANES complex sampling design. "Any disordered eating behaviors (overall)" were defined past-year engagement in any of the following methods to lose weight: skipped meals, non-prescription weight loss supplements/pills, purging behaviors, or smoked to lose weight. Purging behaviors were inclusive of self-induced vomiting or laxative use to lose weight.

Table 2.2 Intersectional MAIDHA of past-year disordered eating behaviors among US adults by race/ethnicity, sex/gender, sexual orientation, and weight status, NHANES 2005-2016 (n=17,614)

	Disordered eating behaviors (Any)	Skipped meals	Non-prescription weight loss supplements/pills	Purging behaviors	Smoked to lose weight
Null model					
Main effects, OR (95% CI)					
Intercept	0.15 (0.12, 0.20)	0.11 (0.08, 0.14)	0.05 (0.04, 0.07)	0.00 (0.00, 0.01)	0.01 (0.00, 0.01)
Random effects					
Between-group variance (SD)	0.3322 (0.5665)	0.35 (0.5807)	0.4831 (0.6811)	0.9497 (0.9394)	0.2834 (0.4959)
VPC, % (95% CI)	9.06 (4.62, 16.7)	9.48 (4.64, 17.78)	12.56 (6.09, 23.23)	21.27 (7.74, 41.87)	7.61 (0.90, 20.82)
Full model					
Main effects, OR (95% CI)					
Intercept	0.12 (0.11, 0.13)	0.08 (0.07, 0.09)	0.04 (0.03, 0.05)	0.00 (0.00, 0.00)	0.01 (0.00, 0.01)
Race/ethnicity [ref=White]					
Black	1.25 (0.98, 1.59)	**1.39 (1.05, 1.85)**	0.99 (0.63, 1.46)	**3.10 (1.45, 6.24)**	1.49 (0.85, 2.63)
Hispanic/Latine	0.96 (0.75, 1.22)	0.88 (0.66, 1.20)	1.09 (0.70, 1.63)	1.67 (0.71, 3.62)	0.65 (0.32, 1.25)
Sex/gender [ref=Man]					
Woman	**1.54 (1.24, 1.87)**	1.27 (0.98, 1.61)	**1.87 (1.28, 2.59)**	**2.94 (1.50, 6.11)**	**1.97 (1.22, 3.23)**
Sexual orientation [ref=Heterosexual]					
Sexual minority	**1.47 (1.14, 1.90)**	**1.43 (1.07, 1.93)**	**1.81 (1.21, 2.70)**	1.50 (0.56, 3.56)	1.34 (0.63, 2.65)
Weight status [ref=Smaller-bodied]					
Larger-bodied	**2.34 (1.92, 2.88)**	**2.34 (1.87, 3.04)**	**2.32 (1.66, 3.36)**	**2.09 (1.12, 4.10)**	**1.68 (1.04, 2.75)**
Random effects					
Between-group variance (SD)	0.0275 (0.1562)	0.0405 (0.1874)	0.0919 (0.2832)	0.137 (0.2912)	0.0621 (0.1981)
VPC, % (95% CI)	0.82 (0.15, 2.4)	1.21 (0.15, 3.68)	2.68 (0.30, 7.8)	3.67 (0.00, 18.02)	1.78 (0.00, 8.99)
PCV, %	91.73	88.43	80.97	85.57	78.10

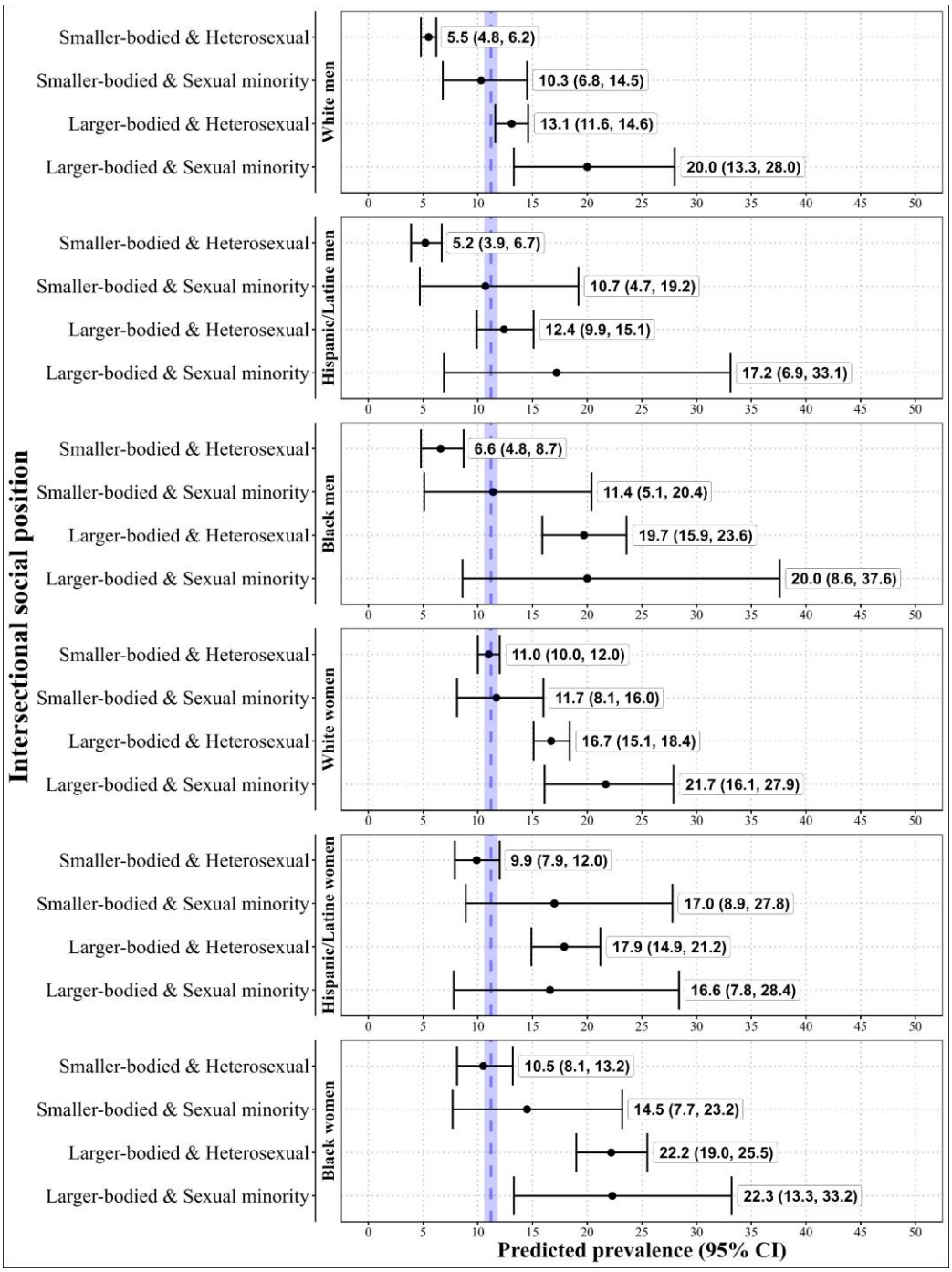
Note: MAIHDA = Multilevel analysis of individual heterogeneity and discriminatory accuracy. NHANES = National Health and Nutrition Examination Survey. OR = odds ratio. CI = credible interval. VPC = variance partition coefficient. PCV = proportional change in variance. The null intersectional model was a two-level (i.e., individuals nested within intersectional groups) logistic model specified with random intercepts for each intersectional group and no level 1 covariates. The intersectional interaction model added race/ethnicity, sex/gender, sexual orientation, and weight status as level 1 covariates to the null intersectional model specification. All models are design-weighted to account for the NHANES complex sample survey design. Bold font denotes social identity main effects coefficients whose 95% CI does not cross the null value (1).

interaction effects (Table 2.2). A similar pattern was found for the individual DEBs where there were some residual between-group differences unexplained by model main effects.

Specific contextual effects (SCEs)

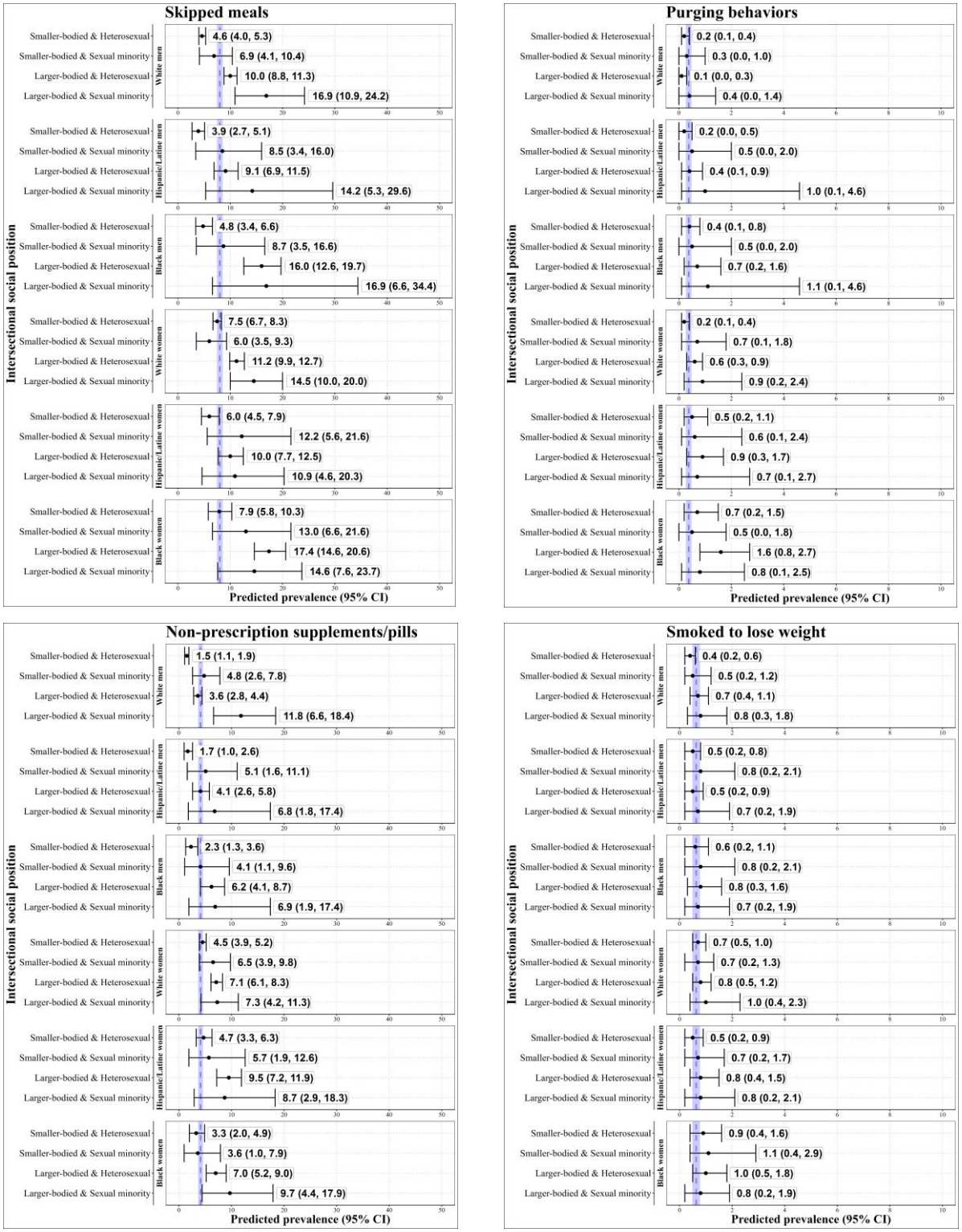
Model-predicted prevalence varied considerably across intersectional groups. For any DEBs, estimates ranged from 5.2% (Hispanic/Latine smaller-bodied heterosexual men) to 22.3% (Black larger-bodied sexual minority women) (Figure 2.1). In particular, intersectional groups inclusive of women (vs. men), larger-bodied (vs. smaller-bodied) people, and sexual minority (vs. heterosexual) people had higher prevalence of any DEBs. Within racial/ethnic and sex/gender groups, a general pattern emerged where smaller-bodied & heterosexual participants had the lowest prevalence and larger-bodied & sexual minority participants had the highest prevalence, and estimates for the other intersections (i.e., "smaller-bodied & sexual minority" and "larger-bodied & heterosexual") fell in between these groups. However, the strength of this pattern varied by racial/ethnic and sex/gender group. For example, among Black women and Black men, respectively, prevalence estimates for larger-bodied people were similarly high regardless of their sexual orientation. For the individual DEBs (Figure 2.2), skipping meals (range: 3.9–17.4%) and using non-prescription weight loss supplements/pills (range: 1.5–11.8%) were more common than purging behaviors (range: 0.1–1.6%) and smoking to lose weight (range: 0.3–1.2%). Compared to any DEBs, patterns by sexual orientation and weight status within racial/ethnic and sex/gender groups were broadly similar for skipped meals and non-prescription weight loss supplements. Owing to lower overall prevalence, absolute value prevalence differences were attenuated for purging behaviors and smoking to lose weight; however, Black heterosexual larger-bodied women had elevated prevalence of purging behaviors (1.6%, 95% CI: 0.8–2.7%) compared to the population average (0.4%, 95% CI: 0.3–0.5%).

Figure 2.1 Predicted prevalence of any past-year disordered eating behaviors among US adults, NHANES 2005-2016 (n=17,614)



Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval. The dashed line represents the US population average prevalence with 95% CI (shaded region). "Any disordered eating behaviors" were defined past-year engagement in any of the following methods to lose weight: skipped meals, non-prescription weight loss supplements/pills, purging behaviors, or smoked to lose weight. Purging behaviors were inclusive of self-induced vomiting or laxative use to lose weight.

Figure 2.2 Predicted prevalence of past-year individual disordered eating behaviors among US adults, NHANES 2005-2016 (n=17,614)



Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval. The dashed line represents the US population average prevalence with 95% CI (shaded region). Due to lower overall prevalence, X axis values for purging behaviors and smoking to lose weight range from 0 to 10. Purging behaviors were inclusive of self-induced vomiting or laxative use to lose weight.

Table 2.3 Two-way or higher interaction effects among race/ethnicity, sex/gender, sexual orientation, and weight status: Past-year disordered eating behaviors, NHANES 2005-2016 (n=17,614).

Intersectional group				Interaction Effects (95% CI)				
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Any disordered eating behaviors**	**Skipped meals**	**Non-prescription weight loss supplements/pills**	**Purging behaviors**	**Smoked to lose weight**
Men	White	Smaller-bodied	Heterosexual	-0.8 (-2.8, 1.2)	-0.1 (-1.9, 1.8)	-0.7 (-2.0, 0.4)	0.1 (-0.1, 0.5)	0.0 (-0.2, 0.2)
			Sexual Minority	0.5 (-3.1, 4.7)	-0.1 (-3.2, 3.2)	1.0 (-1.8, 4.9)	0.0 (-0.4, 0.4)	0.0 (-0.4, 0.4)
		Larger-bodied	Heterosexual	0.0 (-4.0, 3.7)	-0.3 (-4.0, 3.2)	-1.2 (-4.5, 1.5)	-0.1 (-0.7, 0.2)	0.1 (-0.3, 0.7)
			Sexual Minority	1.2 (-4.4, 7.9)	1.9 (-3.6, 9.1)	3.8 (-2.2, 12.5)	0.0 (-0.8, 1.0)	0.0 (-0.5, 0.9)
	Hispanic/Latine	Smaller-bodied	Heterosexual	-0.8 (-3.3, 1.3)	-0.5 (-2.6, 1.2)	-0.7 (-2.6, 0.8)	0.0 (-0.5, 0.3)	0.0 (-0.2, 0.2)
			Sexual Minority	0.0 (-3.9, 4.3)	0.2 (-3.0, 4.1)	0.3 (-3.1, 4.9)	0.0 (-0.6, 1.0)	0.0 (-0.2, 0.4)
		Larger-bodied	Heterosexual	-0.3 (-4.9, 3.6)	-0.2 (-4.5, 3.2)	-0.9 (-5.2, 2.3)	0.0 (-0.9, 0.9)	0.0 (-0.4, 0.3)
			Sexual Minority	0.4 (-5.7, 7.5)	0.8 (-5.1, 8.5)	0.5 (-6.5, 9.5)	0.3 (-1.1, 3.5)	0.0 (-0.5, 0.7)
	Black	Smaller-bodied	Heterosexual	-1.3 (-5.3, 2.5)	-1.8 (-5.3, 1.1)	0.2 (-2.5, 3.4)	0.1 (-1.9, 2.9)	0.0 (-0.8, 1.0)
			Sexual Minority	-0.1 (-4.7, 4.8)	-0.1 (-4.6, 4.7)	-0.1 (-3.2, 3.8)	0.0 (-1.1, 1.6)	0.1 (-0.5, 0.9)
		Larger-bodied	Heterosexual	3.1 (-1.6, 8.7)	2.1 (-2.8, 7.6)	1.9 (-1.7, 6.3)	0.1 (-1.3, 2.0)	0.0 (-0.7, 0.8)
			Sexual Minority	0.7 (-5.8, 8.2)	1.1 (-6.2, 10.2)	0.7 (-5.8, 10.0)	0.4 (-1.8, 5.1)	0.0 (-1.0, 1.4)
Women	White	Smaller-bodied	Heterosexual	2.7 (-0.2, 6.1)	2.1 (-0.2, 4.9)	1.7 (-0.9, 4.4)	-0.1 (-0.8, 0.4)	0.1 (-0.4, 0.6)
			Sexual Minority	-0.6 (-5.3, 3.8)	-1.5 (-5.4, 1.7)	0.7 (-3.9, 5.9)	0.2 (-0.8, 1.8)	0.0 (-0.8, 0.6)
		Larger-bodied	Heterosexual	-2.4 (-7.4, 2.0)	-1.7 (-6.1, 2.2)	-0.9 (-6.2, 3.3)	0.0 (-1.5, 1.2)	-0.1 (-1.2, 0.5)
			Sexual Minority	-1.3 (-8.1, 4.7)	-1.0 (-7.4, 4.5)	-4.6 (-13.7, 2.4)	0.2 (-1.9, 2.9)	0.1 (-1.1, 1.5)
	Hispanic/Latine	Smaller-bodied	Heterosexual	0.9 (-2.2, 4.2)	0.5 (-1.9, 3.0)	1.1 (-2.0, 4.3)	0.0 (-1.2, 1.2)	0.0 (-0.4, 0.3)
			Sexual Minority	1.0 (-3.8, 7.1)	1.0 (-2.6, 6.3)	0.0 (-5.5, 6.5)	0.1 (-1.9, 2.6)	0.0 (-0.6, 0.7)
		Larger-bodied	Heterosexual	-0.1 (-5.3, 4.7)	-1.2 (-6.1, 2.6)	1.7 (-3.9, 6.8)	-0.1 (-2.8, 2.0)	0.1 (-0.6, 0.8)
			Sexual Minority	-0.8 (-8.2, 6.0)	-0.6 (-7.7, 6.2)	-0.3 (-10.0, 9.8)	0.0 (-4.0, 4.5)	0.1 (-0.8, 1.4)
	Black	Smaller-bodied	Heterosexual	-0.5 (-4.3, 3.2)	-0.1 (-3.5, 3.2)	-0.3 (-3.1, 2.4)	-0.1 (-2.2, 1.7)	0.0 (-0.8, 0.8)
			Sexual Minority	0.0 (-5.8, 6.0)	1.0 (-3.8, 7.2)	-1.2 (-6.6, 4.1)	-0.2 (-3.7, 2.8)	0.2 (-0.9, 2.3)
		Larger-bodied	Heterosexual	0.0 (-5.3, 5.3)	0.9 (-4.5, 6.3)	-0.7 (-6.3, 3.7)	0.0 (-4.4, 3.4)	-0.2 (-1.9, 0.9)
			Sexual Minority	-0.9 (-8.3, 6.1)	-1.6 (-10.0, 5.7)	-0.2 (-9.0, 8.8)	-0.6 (-7.7, 4.6)	-0.1 (-2.3, 1.9)

Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval. Negative values (shaded blue) indicate lower than expected (reduced) prevalence in the intersectional group based on the additive contribution of the social position main effects. Positive values (shaded orange) indicate higher than expected (excess) prevalence in the intersectional group based on the additive contribution of the social position main effects. "Any disordered eating behaviors" were defined past-year engagement in any of the following methods to lose weight: skipped meals, non-prescription weight loss supplements/pills, purging behaviors, or smoked to lose weight. Purging behaviors were inclusive of self-induced vomiting or laxative use to lose weight.

Across outcomes, main effects indicated that women (ORs=1.27–2.94), sexual minority people (ORs=1.34–1.81), and larger-bodied people (ORs=1.68–2.34) had greater odds of past-year DEBs (Table 2). For race/ethnicity, Hispanic/Latine (vs. White) people had similar odds of any DEBs, skipping meals, and non-prescription weight loss supplement/pill use (ORs=0.88–1.09) while having higher odds of purging behaviors (OR=1.67) and lower odds of smoking to lose weight (OR=0.65). While having similar odds of non-prescription weight loss supplements/pills (OR=0.99), Black (vs. White) people had higher odds of all other outcomes (ORs=1.39–2.88), particularly purging behaviors (OR=2.88, 95% CI: 1.14–6.79).

Compared to expectations based on the additive social position main effects, some groups had higher (excess) or lower (reduced) prevalence of DEBs (Table 2.3). For example, White heterosexual larger-bodied women had 2.4 percentage points (95% CI: -7.4, 2.0) lower prevalence of any DEBs, while Black heterosexual larger-bodied men had 3.1 percentage points (95% CI: -1.6, 6.1) higher prevalence. While none of the group-specific interaction effects were significant at a traditional 95% CI level, estimates should be viewed in light of sample-level interaction effects quantified in the full model VPCs and PCVs. These suggested that the additive main effects insufficiently described the total prevalence of DEBs within each group, particular for groups with deviation values further away from the null value of 0.

Discussion

The current study examined how race/ethnicity, sex/gender, sexual orientation, and weight status (as proxies for racism, sexism, heterosexism, and fatphobia) combine to produce inequities in past-year DEBs among US adults using nationally representative data drawn from NHANES. I documented prevalence estimates of past-year DEBs ranging from 5.2% (Hispanic/Latine smaller-bodied heterosexual men) to 22.3% (Black larger-bodied sexual

minority women). Generally, groups inclusive of individuals with multiply marginalized social positions, especially sexual minority and larger-bodied people, had greater burden of DEBs. I also found evidence of clustering of specific DEBs within intersectional groups, with between-group difference measures being largest for purging behaviors and smallest for smoking to lose weight.

Findings suggest that epidemiological studies would benefit from an intersectional lens to uncover heterogeneity within and between social groups. While popular narratives of eating disorders and DEBs often focus on White, smaller-bodied, heterosexual women,[70,71] the prevalence of any DEBs in this group was 11.0% and near the population average. Yet when intersectional groups are compared within overall sex/gender categories, for instance, I found stark prevalence differences in past-year any DEBs among men (range: 5.2–20.3%) and women (range: 9.8–22.4%). This suggests that while prevalence was on average higher among women, the distributions within each sex/gender category largely overlapped; however, groups who were marginalized within multiple systems of oppression were disproportionately burdened by DEBs. When stratified by racial/ethnic and sex/gender groups, smaller-bodied & heterosexual groups had lower prevalence with greater prevalence among larger-bodied & sexual minority groups. Sex/gender differences were more pronounced among smaller-bodied & heterosexual groups (e.g., 5.5% vs. 11.0% for White men vs. women) compared to larger-bodied & heterosexual groups (e.g., 20.0% vs. 21.7% for White men vs. women).

Overall, prevalence patterns broadly reflected additive main effects showing greater odds of engaging in past-year DEBs among groups with women, sexual minority people, and larger-bodied people. I found less evidence of racial/ethnic inequities, with the exception of purging behaviors and skipping meals where Black (vs. White) people had elevated odds. When

examining prevalence differences across individual groups, however, more complicated patterns emerged. While sexual minority people generally had greater prevalence of any DEBs, sexual orientation differences were less apparent among Black larger-bodied men, Black larger-bodied women, Hispanic/Latine larger-bodied women, and White smaller-bodied women. The experiences of heterosexism and how heterosexism manifests may be unique to a group's position within other systems of oppression. For example, prior research has found increased prevalence of DEBs among sexual minority (vs. heterosexual) men at levels comparable to heterosexual women,[82,114] while sexual orientation differences among women are less consistent.[82] A potential explanation is that both sexual minority men and heterosexual women experience greater social pressures to fit culturally-defined body ideals. For sexual minority men, this is typically lean and muscular physique, while heterosexual women more often feel pressure to achieve a thin body ideal.[75] Explanations for increased body image social pressures include objectification theory, which posits that women are sexualized through a variety of social process (e.g., sexual violence, mass media representations) and treated such that their bodies are viewed, evaluated, and used by men.[115] This theory has also been extended to the experience of sexual minority men, who, relative to heterosexual men, report heightened self-objectification (i.e., treating oneself as an object to be evaluated based on physical appearance) and have stronger associations between self-objectification and disordered eating.[116] Overall, these findings provide evidence that considering social positions in isolation can impair the identification of disproportionately burdened groups.

While none of the group-specific interaction effects were significant at a canonical 95% CI level, full model PCV's indicated that between 8-22% of between-group differences in the null model were due to nonadditive interactions between intersecting social positions. Thus, at

the sample level, I found evidence that the additive main effects insufficiently describe the total prevalence of DEBs within each group, with this being more evident for groups with greater absolute value interaction effects. As others have noted,[72,98,117] the absence of "significant" interactions in statistical models does not conflict with intersectionality theory. For example, results indicate that the effect of being "larger-bodied" was associated with similarly elevated burden of DEBs across all groups with larger-bodied people. However, this does not mean that the lived experiences of all intersectional groups in this study inclusive of larger-bodied people are the same. Conversely, the presence of an interaction does not necessarily indicate that a group is more/less advantaged at the population level; thus, interaction effects should be interpreted in reference to the overall group prevalence to inform prevention efforts.[72,98,117]

Based on VPC and AUC findings of small-to-moderate differences between groups for most DEBs in this study, policy and public health efforts related to DEB prevention should strike a balance between population and targeted approaches to prevention.[118] A potentially useful framework to address this public health issue is the proportionate universalism approach,[119] which involves the implementation of universal strategies acting on broad social determinants of DEBs (e.g., workplace weight discrimination protections) in combination with tailored efforts proportional to the needs of groups experiencing excess burden. I note, however, that extra effort using a targeted approach is necessary for the prevention of purging behaviors due to findings of "fairly large" differences between groups. For instance, Black heterosexual larger-bodied women may be particularly burdened by purging behaviors, so designing policies and programs to address the needs of this group is warranted to improve health equity between groups and reduce overall DEB-related morbidity and mortality.

Limitations & Strengths

This analysis was limited to the study of specific weight loss-oriented DEBs; thus, results may not apply to all weight loss-oriented DEBs or other DEB forms (e.g., muscularity-oriented DEBs, which are more prevalent among men versus women).[75] Relatedly, DEBs were measured in the context of intentional or attempted weight loss, which may result in an undercount of DEBs by excluding those who used DEBs to prevent weight gain or due to social/economic circumstances (e.g., food insecurity). I used individual-level social positions as a proxy measure for interlocking systems of oppression; therefore, I encourage future research to develop and apply more direct measures of racism, sexism, heterosexism, fatphobia and their intersections. Relatedly, I was limited to broad racial/ethnic, sex/gender, and sexual orientation categories that may not be reflective of individual's identities and lived experiences, and I collapsed weight status into binary categories that may conceal meaningful within-group differences among smaller-bodied and larger-bodied people. As a common practice in federal health surveys,[104] sex/gender was interviewer-assigned rather than self-reported, so some participants may have been misclassified in a sex/gender category that doesn't align with their gender identity. Finally, data came from 2005-2016, so results may not necessarily generalize to the current day due to secular trends and exogenous shocks (e.g., COVID-19 pandemic).

However, there were critical strengths of this analysis. In particular, this is the first study to report US nationally representative estimates of intersectional inequities in DEBs. This analysis builds upon prior intersectional MAIHDA of DEBs to include a wider age range of participants (ages 18-59 vs. 14-31).[72] Given the importance of racism in structuring US society and power relations,[53] I also extend prior studies[72] by considering race/ethnicity and its intersections with sex/gender, sexual orientation, and weight status.

Conclusions

This analysis uncovered considerable inequities in DEBs at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status. Findings complicate narratives of the types of people who have traditionally been viewed as disproportionately burdened by DEBs (i.e., White heterosexual smaller-bodied women). In general, intersectional groups with Black people, women, sexual minority people, and larger-bodied people had increased prevalence of DEBs. Multiply marginalized groups, particularly those who were sexual minority and larger-bodied, had consistently elevated prevalence relative to the population average. To reduce DEB-related morbidity and mortality, findings support approaches pairing population-wide prevention efforts with interventions targeting groups in proportion to their level of need. Overall, I call on public health professionals and policymakers to identify and intervene upon the structural mechanisms driving intersectional health inequities.

Chapter 3: Intersectional differences in the association between disordered eating behaviors and depression in a nationally representative sample of US adults

Abstract

Background: The association between disordered eating behaviors (DEBs) and depression is well-established; however, prior studies have neglected how intersectional positions within interlocking systems of oppression may moderate this association.

Methods: I sorted US adults aged 18-59 (n=17,578) from the 2005-2016 National Health and Nutrition Examination Survey (NHANES) into 24 intersectional groups defined by race/ethnicity, sex/gender, sexual orientation, and weight status (proxies for racism, sexism, heterosexism, fatphobia). I defined DEBs as past-year engagement in one or more of the following weight loss methods: skipped meals, laxative misuse, self-induced vomiting, smoking, or non-prescription diet supplements/pills. I used intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) with random slopes to estimate (1) the prevalence of depression (moderate-to-severe symptoms assessed via Patient Health Questionnaire [PHQ-9] sum score ≥ 10) by DEB status, (2) whether DEBs explained between-group differences in depression, and (3) whether the association between DEBs and depression varied across groups.

Results: Depression cases were moderately clustered within groups (variance partition coefficient [VPC]=10.60%), with prevalence ranging from 4.95–23.91% (without DEBs) and 7.69–25.33% (with DEBs). While DEBs explained a small portion (3.66%) of between-group differences, depression inequities were greater among those with DEBs (VPC=12.52% vs. 10.93%). Overall, prevalence was higher among those with DEBs (prevalence ratio [PR]: 1.58, 95% CI: 1.38–1.80). The association varied across groups, with differences being greatest among Hispanic/Latine heterosexual smaller-bodied men (8.44% vs. 4.95%; PR: 1.72, 95% CI: 1.04–2.97) and smallest among White sexual minority larger-bodied women (21.53% vs. 22.45%; PR: 0.98, 95% CI: 0.50–1.44).

Conclusions: DEBs were, on average, associated with greater depression prevalence, but this association was weaker for groups experiencing the greatest burden of depression. Targeted interventions that prevent DEBs and address interlocking systems of oppression may be needed to reduce intersectional inequities in depression.

Introduction

Disordered eating behaviors (DEBs), such as self-induced vomiting and skipping meals to lose weight, are unhealthy behavioral patterns commonly seen eating disorders (EDs). The population disease burden of DEBs is substantial, with a recent analysis of nationally representative data placing the past-year prevalence of DEBs among US adults at 11.2%.[120] Contrary to prevailing stereotypes of the typical person experiencing DEBs (e.g., White heterosexual smaller-bodied women),[70,121] emerging scholarship has documented that a DEBs are common across the US adult population along axes of race/ethnicity, sex/gender, sexual orientation, and weight status.[120] Of particular concern, DEBs are associated with a range of serious mental and behavioral health issues, including mood and anxiety disorders,[6] substance use disorders,[6] binge drinking,[7] and suicidality.[8]

Globally, evidence from nationally representative surveys suggests that mental and behavioral health comorbidities are the norm rather than the exception.[11–13] Concerningly, a population-based cohort study which followed participants from 11 to 45 years old found that 85% accumulated more than one mental disorder diagnosis.[122] For people with EDs, comorbidities may place individuals at increased risk for more severe symptoms,[17–19] longer illness duration,[17] and reduced quality of life.[20]

Across mental and behavioral health conditions, mood disorders are among the most likely to be comorbid with EDs.[14] Depression, a particularly common mood disorder, is estimated to affect approximately 7.4% (past-year) and 14.2% (lifetime) of US adults.[97] Using 2023 dollars, the social and economic burden of depression in 2019 was approximately $382 billion attributable to healthcare costs and reduced worker productivity.[123] A meta-analysis found evidence of a bidirectional, longitudinal relationship between eating pathology (defined as a

diagnosed eating disorder or DEBs) and depression.[124] Given this finding, DEBs and depression may share transdiagnostic common causes, including genetic risk,[21] neurological,[22] and social (e.g., child maltreatment,[23,24] discrimination[25,26]) factors. Broadly, the evidence base suggests that DEBs and depression are linked to one another in complex ways that may produce and sustain their comorbidity.

Social epidemiology of DEBs, depression, and their comorbidity

In recent years, researchers have documented prevalence differences in DEBs and depression across social positions defined by race/ethnicity,[10,79,125–127,73,128–135] sex/gender,[10,72,73,127,128,136–139] sexual orientation,[72,82,126,140–143] and weight status.[80,144–147] While most prior work has quantified prevalence differences using one aspect of social position at a time, emerging studies have increasingly considering the intersection of multiple social position variables to provide a more comprehensive understanding of how these health issues are patterned across the population.

For DEBs, studies have examined various combinations of social position variables. In a nationally representative sample of US high school students, Beccia et al. (2019) documented a positive interaction between race/ethnicity and sex/gender such that Hispanic/Latine girls had excess prevalence of DEBs.[10] Relatedly, Beccia et al. (2021) found a complex array of DEB prevalence estimates among US young adults at the intersection of gender identity, sexual orientation, and weight status,[72] while McGuire et al. (in preparation) found similar patterns among US adults at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status.[120] In both studies, two-way or higher interactions were present that modified the prevalence of DEBs in each intersectional group in contrast to the average values associated with each unidimensional social position variable.

Researchers have similarly examined the patterning of depression at the intersection of multiple social position variables. Among US young adults, Evans and Erickson (2018) examined depression symptom score differences by race/ethnicity, sex/gender, immigration status, socioeconomic status (SES), and their intersections.[98] They found considerable differences across intersectional groups, with elevated depression symptoms concentrated among groups with women, people of color, immigrants, and low SES individuals.[98] With nationally representative data from US adults, McGuire et al. (in press) estimated the prevalence of lifetime and past-year major depressive episode at the intersection of race/ethnicity, sex/gender, and sexual orientation.[97] Similar to Evans & Erickson (2018), estimates were highly variable across groups, ranging from 4.5% (Black heterosexual men) to 36.5% (White bisexual women) for lifetime major depressive episode.[97]

Overall, these studies provide strong evidence that social position variables may interact in ways that produce a complex social patterning of DEBs and depression. However, a notable gap is the degree to which the comorbidity between DEBs and depression is patterned at the intersection of multiple social positions. In particular, traditional analyses of the association between DEBs and depression assume a fixed value across the population. This necessarily overlooks how an individual's position within interlocking systems of oppression may exacerbate, or mitigate, their likelihood of experiencing one of these health issues conditional on the other occurring. To reduce the population burden of this comorbidity, identifying groups experiencing a stronger association between DEBs and depression may inform how interventions can be tailored and equitably distributed.

Intersectionality theory and quantitative research applications

Grounded in Black feminist scholarship and activism,[49,88,89,92] intersectionality theory draws attention to the ways in which systems of oppression (e.g., racism, sexism, heterosexism, fatphobia) are intricately linked to produce hierarchies of power relations that privilege and/or marginalize certain social groups.[92] These macro-level power relations subsequently shape and constrain individuals' social identities and positions (e.g., race/ethnicity, sex/gender, sexual orientation, weight status) and their lived experiences in social systems (e.g., healthcare, education, labor market).[95] Thus, a complex patterning of social, economic, and health inequities is theorized to result from variations in privilege and marginalization within interlocking systems of oppression.

An intersectional framework has increasingly been employed in the analysis and interpretation of quantitative research.[95] Given its more natural alignment with traditional quantitative methods, the intercategorical approach[93] is especially popular.[94] This approach provisionally adopts social categories to analyze between-group differences and illuminate how power relations and resulting health inequities are patterned across the population.[93] Guided by intersectionality theory,[49,88,89,92] I adopted the intercategorical approach by using race/ethnicity, sex/gender, sexual orientation, weight status and their intersections to approximate social positions within interlocking systems of oppression. This rests on the assumption that individuals occupying the same social position share health-related exposures and lived experiences in ways that are meaningful for describing inequities in DEBs and depression.

As a reframing of preexisting multilevel analysis concepts,[57,148–151] multilevel analysis of individual heterogeneity and discriminatory accuracy under an intersectional framework[61–63] (hereafter, intersectional MAIHDA) has been used to describe patterns of health inequities, including those observed for DEBs[72,120] and depression.[97,98] Briefly, intersectional MAIHDA

with binary outcomes permits flexible estimation of health outcome prevalence at the intersection of multiple social identities/positions. To inform the choice of high-risk vs. population prevention strategies, it quantifies individual variation in health outcomes found when comparing group averages (i.e., between-group differences, discriminatory accuracy) vs. individual heterogeneity around group averages (i.e., within-group differences). Health outcome prevalence can then be decomposed to evaluate two-way or higher interaction effects unique to each group, which provides evidence of excess or reduced prevalence of the outcome. Thus, this approach challenges the "tyranny of the averages"[57] associated with traditional main effects analysis by considering each group's unique position within interlocking systems of oppression.

Notably, Evans et al.[64] recently extended the intersectional MAIHDA framework beyond its descriptive origins to include exposure variables hypothesized to explain between-group differences (inequities) in the outcome. By specifying the exposure variable with random slopes, this approach allows exposure-outcome associations to vary across intersectional groups,[64] permitting the investigation of exposure effect modification. This information is critical for the design and implementation of intervention efforts such that certain groups, as a product of their unique experiences and social position, may benefit more (or less) from interventions addressing the exposure. Overall, intersectional MAIHDA with exposure variable random slopes opens opportunities to simultaneously describe health inequities and assess relevant factors that may drive these inequities.

Current study

Building on prior multilevel analysis of population health data under an intersectional framework,[61–64,72,97,99,120] I applied intersectional MAIHDA with random slopes[64] to describe the social patterning of depression across joint identities of race/ethnicity, sex/gender, sexual

orientation, and weight status. I classified probable cases of depression as those with moderate-to-severe depressive symptoms assessed via the Patient Health Questionnaire (PHQ-9). Individual-level demographic measures were used as imperfect proxies for intersectional social positions within interlocking systems of oppression. With nationally representative data from US adults, the current study aimed to estimate: (1) the prevalence of depression by intersectional group and DEB status, (2) whether DEBs explained between-group inequities in depression, and (3) whether the association between DEBs and depression varied across groups, which I assessed using random slopes for the DEBs variable.[64]

Methods

Technical Details

To enhance accessibility for readers, additional technical details on the statistical approaches can be found in Supplementary Materials (Appendix B), which includes model equations, convergence diagnostics, and estimate calculations.

Data

Data were drawn from six cross-sectional waves of the National Health and Nutrition Examination Survey (NHANES) collected biannually from 2005-06 to 2015-16.[102] Participants were selected via multistage probability sampling methods to obtain a sample representative of the US non-institutionalized population. Sexual orientation data were collected among adults aged 18-59 and is not publicly available following the 2015-16 wave; therefore, I limited analysis to this time period (2005-2016) and participant age range (18-59).

From the 60,939 individuals who participated in NHANES from 2005-2016, I first excluded those younger than 18 or older than 59 (n=35,979). I then excluded those with an "Other/Multiracial" race/ethnicity (n=2,899) due to the difficulty of interpreting results in a

defined social context. After further removing those with missing data on model variables (sexual orientation [n=4,404], weight status [n=8], DEBs [n=32], depression [n=36]), there were 17,578 in the analytic sample.

Measures

Depression. The Patient Health Questionnaire (PHQ-9) assessed the frequency of nine DSM-IV-defined depression symptoms over the past two weeks.[152,153] Response categories were "not at all" (0), "several days" (1), "more than half the days" (2), and "nearly every day" (3). To identify those with moderate-to-severe symptoms, I calculated a total sum score (range=0-27) and created a binary variable, with scores ≥10 coded as screening positive for depression. This cutoff value has been shown to have good sensitivity and specificity (both 88%) for distinguishing cases from non-cases of major depressive disorder.[152] The term "depression" is used for brevity.

Disordered eating behaviors (DEBs). Participants reporting past-year attempted or intentional weight loss were asked "How did you try to lose weight?" and presented with 17 weight loss methods (select all that apply). I classified participants as engaging in DEBs if they reported any of the following weight loss methods: "skipped meals," "started to smoke or began to smoke again", "took laxatives or vomited," and "took other pills, medicines, herbs, or supplements not needing a prescription". Participants who did not report past-year attempted or intentional weight loss or did not endorse any of the methods above were classified as not engaging in DEBs [reference group].

Race/ethnicity. Participants were asked "What race do you consider yourself to be?" and could select one or more of the following options: "American Indian or Alaskan Native", "Asian", "Black or African American", "Native Hawaiian or Pacific Islander", "White", or

"Other". Hispanic/Latine ethnicity was assessed with "Do you consider yourself to be Hispanic, Latino, or of Spanish origin?". NHANES staff used race and ethnicity data to construct four mutually exclusive categories: Non-Hispanic (NH) White, NH Black/African-American, NH Other/Multiracial, Mexican American, or Other Hispanic. To ensure sufficient sample size, I collapsed the two latter groups into a single Hispanic/Latine group. As stated previously, I excluded NH Other/Multiracial participants.

Sex/gender. As part of household screening procedures, NHANES interviewers assigned participants as either "male" or "female" and were told to "ask [participants] if not obvious".[103] Given the potential conflation between sex assigned at birth and gender identity,[104] I refer to this measure as "sex/gender" and use the terms "man" and "woman."

Sexual orientation. I used information on sexual identity and past-year sexual behavior to classify participants as either "heterosexual" or "sexual minority." Sexual identity was self-reported as "heterosexual or straight," "homosexual or gay (lesbian)," "bisexual," "something else," or "unsure." Past-year sexual behavior was self-reported with two sex/gender-specific items (Men: "In the past 12 months, with how many men have you had anal or oral sex?"; Women: "In the past 12 months, with how many women have you had sex? By sex, we mean sexual contact with another woman's vagina or genitals"). Using sexual identity responses, I first categorized participants as "heterosexual" if they selected "heterosexual or straight" or as "sexual minority" if they selected "homosexual or gay (lesbian)" or "bisexual." Next, participants whose sexual identity was "heterosexual", "something else", or "unsure" but reported one or more past-year same-sex/gender sexual partners were recoded as "sexual minority."

Weight status. Height and weight were objectively measured by mobile examination center staff and used to calculate body mass index (BMI) using CDC guidelines.[106] In line with prior intersectional MAIHDA incorporating weight status as a social position dimension,[72] I used BMI to categorize respondents as smaller-bodied (BMI < 30.0) or larger-bodied (BMI ≥ 30.0) as a proxy for exposure to fatphobia and weight discrimination.

Intersectional groups. To approximate participants' relative social position within interlocking systems of oppression, I classified participants into 24 intersectional groups defined by three race/ethnicity, two sex/gender, two sexual orientation, and two weight status categories. Group sample sizes ranged from n=18 to n=2,570 (Table 3.3).

Analysis

Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA). All analyses were conducted in R version 4.2.2.[154] Using the MAIHDA analysis framework,[61–63,99] I sequentially fit five, two-level logistic models with Bayesian statistical methods to predict depression cases, with participants (level 1) nested within intersectional groups (level 2). Random intercepts were specified for intersectional groups, allowing estimation of the general contextual effect (GCE) and the prevalence of depression in each group.[61–63,99] The GCE assesses the degree to which individual differences in depression across the sample could be attributed to between-group (i.e., discriminatory accuracy) vs. within-group (i.e., individual heterogeneity) differences.[96] I used the "csSampling"[108,112] package to generate design-weighted, nationally representative estimates accounting for the NHANES survey design.[120]

Model 1 was a null intersectional model (i.e., no level 1 covariates) used to quantify baseline between-group differences in depression. Model 2 added the main (fixed) effect of DEBs and was used to quantify the degree to which DEBs described between-group differences

observed in Model 1. Model 3 subsequently added the main effects of the social position variables used to construct intersectional groups, which was used to quantify interaction effects for each group (overall, not distinguished by DEB status) between the social position variables. Building on Model 2's specification, Model 4 included random slopes for DEBs in addition to the main effect, allowing the association between DEBs and the outcome to vary in strength/direction across groups. Finally, Model 5 added the social position main effects and the random slopes for the DEBs variable, which were used to quantify interaction effects for all combinations of intersectional groups and DEB status.

I estimated the GCE through the variance partition coefficient (VPC), a measure of discriminatory accuracy. The VPC measures the percentage of individual outcome variance found when comparing intersectional group averages to one another (i.e., between-group variance). I used the latent variable method to approximate level 1 variance (i.e., $\frac{\pi^2}{3} \approx 3.29$) in two-level logistic models.[109] For Models 1-3, the VPC was calculated as the random intercepts (level 2) variance divided by total model variance (level 1 + level 2) and multiplied by 100 to obtain a percentage value. For Models 4 and 5, which included random slopes variances and random effects covariance, VPCs were separately calculated for those with vs. without DEBs using methods described in prior research[64] (see Appendix B).

To interpret VPC estimates, I used the following thresholds: absent (0–1%), very small (>1–5%), small (>5–10%), moderate [equivalent of "less large" proposed by Merlo Wagner, & Leckie (2019)] (>10–20%), fairly large (>20–30%), very large (>30%).[110] To quantify the percentage reduction in between-group differences in depression relative to Model 1 (for Models 2-3) and Model 4 (for Model 5), I calculated the proportional change in variance (PCV) as the adjusted model between-group variance subtracted from the referent model between-group

variance and divided by the referent model between-group variance. For Model 5, separate calculations were conducted for those with vs. without DEBs (see Appendix B).[64]

Table 3.1 Sample characteristics, NHANES 2005-2016 (n=17,578).

Variables	No DEBs, n=15,573 (88.8%)	DEBs, n=2,005 (11.2%)	Overall, n=17,578
	n (weighted %)		
Outcome			
Depression	1,387 (7.4%)	268 (11.7%)	1,655 (7.8%)
Dimensions of social identity/position			
Race/ethnicity			
Non-Hispanic/Latine (NHL) White	7,217 (71.3%)	841 (68.1%)	8,058 (70.9%)
NHL Black/African-American	3,675 (12.2%)	615 (16.7%)	4,290 (12.7%)
Hispanic/Latine	4,681 (16.4%)	549 (15.3%)	5,230 (16.3%)
Sex/gender			
Man	7,884 (51.7%)	732 (38.6%)	8,616 (50.3%)
Woman	7,689 (48.3%)	1,273 (61.4%)	8,962 (49.7%)
Sexual orientation			
Heterosexual	14,800 (95.0%)	1,857 (92.4%)	16,657 (94.7%)
Sexual minority	773 (5.0%)	148 (7.6%)	921 (5.3%)
Weight status			
Smaller-bodied	9,963 (65.7%)	829 (46.4%)	10,792 (63.5%)
Larger-bodied	5,610 (34.3%)	1,176 (53.6%)	6,786 (36.5%)
NHANES data collection year			
2005-06	2,354 (16.1%)	378 (20.4%)	2,732 (16.5%)
2007-08	2,692 (16.5%)	347 (15.6%)	3,039 (16.4%)
2009-10	3,111 (16.8%)	305 (13.2%)	3,416 (16.4%)
2011-12	2,420 (17.3%)	262 (12.9%)	2,682 (16.8%)
2013-14	2,723 (17.6%)	333 (16.5%)	3,056 (17.4%)
2015-16	2,273 (15.8%)	380 (21.4%)	2,653 (16.4%)

Note: NHANES = National Health and Nutrition Examination Survey. Percentages are weighted to account for the NHANES complex sample survey design. Depression cases were identified using the Patient Health Questionnaire (PHQ-9) with a sum score cutoff of ≥ 10 (i.e., moderate-to-severe symptoms).

Results

Sample characteristics. Approximately 11.2% of the sample reported engaging in past-year DEBs, and 7.8% screened positive for depression (Table 3.1). At the sample-level, the prevalence of depression was higher among those with (11.7%) vs. without (7.4%) DEBs. The majority of the sample was White (70.9%), heterosexual (94.7%), and smaller-bodied (63.5%), and there was near-equal breakdown by sex/gender.

Social position main effects. Independent of DEB status, main effects for social position variables in Models 3 and 5 indicated that women (ORs=1.90–1.91), sexual minority people (ORs=2.31–2.37), and larger-bodied people (ORs=1.28–1.29) had higher odds of depression (Table 3.2). While Black/African-American people (ORs=1.24–1.27) and Hispanic/Latine people (ORs=1.10–1.12) also had higher odds of depression, results were not significant at a 95% CI level.

Between-group differences in depression. There were considerable between-group differences in the prevalence of depression (Table 3.2). In the null model (Model 1), approximately 10.60% of individual differences in depression were found comparing group averages, indicating moderate clustering of the outcome within groups. After adding the main effect of DEBs in Model 2, the variance attributable to between-group differences in depression was reduced by 3.66% compared to Model 1, indicating that DEB status accounted for a small proportion of between-group depression differences. The inclusion of random slopes for DEBs in Model 4 showed that between-group differences in depression were greater among those with DEBs (VPC=12.52%) compared to those without DEBs (VPC=10.93%). This suggests that between-group differences were greater when DEBs were present.

Table 3.2 Intersectional MAIHDA of depression among US adults predicted by DEB status, NHANES 2005-2016 (n=17,578).

	Model 1	Model 2	Model 3	Model 4	Model 5
Main effects, OR (95% CI)					
Intercept	0.12 (0.09, 0.16)	0.12 (0.09, 0.16)	0.08 (0.07, 0.09)	0.12 (0.09, 0.16)	0.08 (0.07, 0.09)
DEBs [Ref: No DEBs]					
DEBs	--	**1.44 (1.24, 1.68)**	**1.42 (1.22, 1.65)**	**1.31 (1.00, 1.67)**	**1.32 (1.02, 1.64)**
Race/ethnicity [Ref: White]					
Black/African-American	--	--	1.24 (0.95, 1.64)	--	1.27 (0.96, 1.66)
Hispanic/Latine	--	--	1.10 (0.84, 1.43)	--	1.12 (0.86, 1.45)
Sex/gender [Ref: Man]					
Woman	--	--	**1.90 (1.52, 2.39)**	--	**1.91 (1.55, 2.38)**
Sexual orientation [Ref: Heterosexual]					
Sexual minority	--	--	**2.31 (1.79, 2.98)**	--	**2.37 (1.83, 3.06)**
Weight status [Ref: Smaller-bodied]					
Larger-bodied	--	--	**1.29 (1.04, 1.60)**	--	**1.28 (1.03, 1.60)**
Random effects					
Random intercepts variance	0.3963	0.3818	0.0339	0.4109	0.0319
Random slopes variance	--	--	--	0.1133	0.0897
Random effects covariance (correlation)	--	--	--	-0.0230 (-0.37)	-0.0003 (0.06)
VPC and PCV summaries					
VPC, Overall (%, 95% CI)	10.60 (5.26, 19.45)	10.25 (5.06, 18.87)	1.01 (0.22, 2.77)		
PCV, Overall (%)	--	3.66	91.45		
VPC, No DEBs (%, 95% CI)				10.93 (5.29, 20.14)	0.95 (0.16, 2.89)
PCV, No DEBs (%)				--	92.24
VPC, DEBs (%, 95% CI)				12.52 (6.39, 21.07)	3.48 (0.65, 10.17)
PCV, DEBs (%)				--	74.69

Note: MAIHDA = multilevel analysis of individual heterogeneity and discriminatory accuracy. NHANES = National Health and Nutrition Examination Survey. OR = odds ratio. CI = credible interval. DEB(s) = disordered eating behavior(s). VPC = variance partition coefficient. PCV = proportional change in variance. For main effects, bold font indicates a statistically significant result at a 95% CI level. Depression cases were identified using the Patient Health Questionnaire (PHQ-9) with a sum score cutoff of ≥ 10 (i.e., moderate-to-severe symptoms

Table 3.3 Comparison of predicted prevalence of depression by intersectional group and DEB status, NHANES 2005-16.

Rank[1]	Intersectional Group	N	PP (95% CI), No DEBs	PP (95% CI), DEBs	PD (95% CI), DEBs vs. No DEBs	PR (95% CI), DEBs vs. No DEBs	Higher & lower than expected prevalence (95% CI), DEBs
---	Overall sample	17,578	7.57 (7.15, 7.98)	11.97 (10.42, 13.67)	**4.40 (2.91, 6.00)**	**1.58 (1.38, 1.80)**	---
1	Hispanic/Latine heterosexual smaller-bodied men	1,564	4.95 (3.64, 6.49)	8.44 (4.80, 14.34)	**3.49 (0.16, 9.32)**	**1.72 (1.04, 2.97)**	1.98 (-1.32, 7.87)
2	White heterosexual larger-bodied men	1,276	4.96 (4.01, 5.99)	7.69 (5.33, 10.62)	**2.73 (0.35, 5.70)**	**1.56 (1.07, 2.23)**	1.21 (-1.32, 4.47)
3	White heterosexual smaller-bodied men	2,570	5.37 (4.65, 6.14)	8.26 (5.69, 11.51)	**2.89 (0.33, 6.08)**	**1.54 (1.06, 2.18)**	1.27 (-1.44, 4.68)
4	Hispanic/Latine heterosexual larger-bodied men	888	5.70 (3.98, 7.77)	9.13 (5.44, 14.26)	3.43 (-0.02, 8.60)	**1.63 (1.00, 2.65)**	1.72 (-1.73, 7.06)
5	Black heterosexual smaller-bodied men	1,224	6.33 (4.53, 8.39)	9.06 (5.03, 14.37)	2.73 (-1.05, 7.77)	1.44 (0.83, 2.30)	0.84 (-2.89, 5.87)
6	White heterosexual smaller-bodied women	2,422	6.86 (6.04, 7.71)	8.57 (6.24, 11.04)	1.71 (-0.68, 4.13)	1.25 (0.90, 1.62)	-0.32 (-3.18, 2.44)
7	Black heterosexual larger-bodied men	752	7.54 (5.15, 10.49)	9.86 (5.78, 14.70)	2.31 (-1.90, 6.69)	1.33 (0.78, 2.00)	0.12 (-4.21, 4.64)
8	Hispanic/Latine heterosexual smaller-bodied women	1,495	8.28 (6.43, 10.37)	10.00 (5.68, 14.67)	1.72 (-2.86, 6.11)	1.22 (0.68, 1.77)	-0.68 (-5.27, 3.70)
9	Hispanic/Latine sexual minority smaller-bodied men	64	10.03 (4.10, 18.61)	12.75 (5.06, 24.45)	2.73 (-4.25, 10.58)	1.32 (0.66, 2.22)	-0.03 (-7.17, 7.16)
10	White sexual minority larger-bodied men	57	10.11 (5.36, 16.28)	13.38 (6.87, 22.11)	3.27 (-2.85, 10.28)	1.36 (0.76, 2.21)	0.47 (-5.91, 7.47)
11	White sexual minority smaller-bodied men	121	10.12 (6.50, 14.43)	13.30 (7.07, 21.35)	3.17 (-2.71, 10.05)	1.33 (0.75, 2.07)	0.34 (-5.31, 7.14)
12	Black sexual minority larger-bodied men	21	10.84 (3.38, 23.68)	13.94 (4.64, 29.20)	3.09 (-4.59, 11.94)	1.36 (0.67, 2.41)	0.20 (-7.68, 8.40)
13	Black heterosexual larger-bodied women	1,083	11.03 (8.54, 13.86)	15.22 (10.71, 20.50)	4.18 (-0.36, 9.53)	1.39 (0.97, 1.95)	1.12 (-3.58, 6.96)
14	Black heterosexual smaller-bodied women	960	11.18 (8.55, 14.08)	11.71 (5.84, 17.78)	0.52 (-5.85, 5.96)	1.06 (0.51, 1.55)	-2.56 (-8.90, 2.33)
15	White heterosexual larger-bodied women	1,334	11.69 (10.11, 13.31)	19.04 (15.17, 23.48)	**7.35 (3.31, 12.10)**	**1.64 (1.27, 2.10)**	4.12 (-0.42, 9.79)
16	Black sexual minority smaller-bodied men	61	12.05 (5.27, 22.06)	14.70 (5.84, 28.15)	2.65 (-5.60, 11.27)	1.26 (0.62, 2.08)	-0.55 (-9.01, 7.51)
17	Hispanic/Latine sexual minority smaller-bodied women	59	12.68 (5.46, 23.07)	15.54 (6.46, 28.55)	2.86 (-5.35, 11.40)	1.27 (0.66, 2.07)	-0.46 (-8.60, 7.78)
18	Hispanic/Latine heterosexual larger-bodied women	1,089	13.66 (10.69, 16.86)	16.11 (10.68, 22.08)	2.46 (-3.37, 8.11)	1.19 (0.77, 1.64)	-1.17 (-7.22, 4.43)
19	White sexual minority smaller-bodied women	159	16.70 (12.07, 21.91)	21.47 (13.26, 32.02)	4.78 (-3.30, 14.63)	1.30 (0.82, 1.95)	0.55 (-7.08, 10.66)
20	Black sexual minority larger-bodied women	96	16.87 (9.08, 27.41)	19.75 (10.01, 33.17)	2.89 (-7.31, 12.84)	1.20 (0.64, 1.89)	-1.28 (-11.31, 8.27)
21	Hispanic/Latine sexual minority larger-bodied men	18	19.85 (7.66, 39.69)	22.94 (9.05, 45.46)	3.09 (-10.14, 15.62)	1.21 (0.62, 1.97)	-1.44 (-14.64, 10.60)
22	Hispanic/Latine sexual minority larger-bodied women	53	20.21 (9.78, 34.64)	22.68 (10.03, 40.59)	2.46 (-10.49, 14.11)	1.15 (0.57, 1.80)	-2.22 (-14.55, 8.58)
23	White sexual minority larger-bodied women	119	22.45 (16.08, 29.57)	21.53 (11.76, 32.02)	-0.91 (-12.86, 8.85)	0.98 (0.50, 1.44)	-6.05 (-18.25, 2.40)
24	Black sexual minority smaller-bodied women	93	23.91 (13.71, 36.31)	25.33 (12.20, 41.82)	1.43 (-13.33, 13.64)	1.08 (0.54, 1.63)	-3.84 (-17.85, 7.18)

[1] Groups are ranked in ascending order based on the PP of moderate-to-severe depression symptoms among those without DEBs.

Note: PP = predicted prevalence. CI = credible interval. PD = prevalence difference. PR = prevalence ratio. DEBs = disordered eating behaviors. Estimates obtained from Model 4, which included the overall main effect of DEBs and random slopes for DEBs. For each intersectional group, PD and PR estimates are in reference to the PP without DEBs. Higher & lower than expected prevalence estimates are the percentage point difference between the overall PP with DEBs (i.e., main effects + random effects) minus the expected prevalence based on the additive main effect of DEBs, where positive values indicate higher than expected prevalence and negative values indicate lower than expected prevalence. For PD and PR, bold font indicates a statistically significant result at a 95% CI level. Depression cases were identified using the Patient Health Questionnaire (PHQ-9) with a sum score cutoff of ≥ 10 (i.e., moderate-to-severe symptoms).

The main effects of the social position variables were added in Models 3 and 5. Results from Model 3, which included the main effect of DEBs without random slopes, showed that the social position variables reduced between-group differences by 91.45%. This means 8.55% (i.e., 100% - 91.45%) of between-group differences were attributable to two-way or higher interactions between the social position variables, regardless of DEB status. However, Model 5, which included the random slopes for DEBs, signaled that the social position variables accounted for a greater percentage of between-group differences among those without DEBs (PCV=92.24%) compared to those with DEBs (PCV=74.69%). Therefore, the interaction components are especially important to describe the patterning of depression symptom inequities among those with DEBs.

Prevalence of depression by DEB status. Using estimates from Model 4 (i.e., main effect of and random slopes for DEBs), prevalence differences by intersectional group and DEB status are visually presented in Figure 3.1 and summarized in Table 3.3. Groups are sorted in ascending order by the prevalence of depression in those without DEBs. With the exception of White sexual minority larger-bodied women (rank=23), prevalence estimates were higher among those with DEBs, ranging from 7.69% (White heterosexual larger-bodied men) to 25.33% (Black sexual minority smaller-bodied women). Among those without DEBs, prevalence ranged from 4.95% (Hispanic/Latine heterosexual smaller-bodied men) to 23.91% (Black sexual minority smaller-bodied women). Generally, groups inclusive of women (vs. men) and sexual minority (vs. heterosexual) people had increased prevalence of depression, while racial/ethnic and weight status differences were less consistent.

Figure 3.2 compares the expected (main effects) prevalence difference between with vs. without DEBs to the predicted prevalence estimated by the random slopes for each group (also

Figure 3.1 Predicted prevalence of depression among US adults by intersectional group and DEB status, NHANES 2005-2016 (n=17,578).

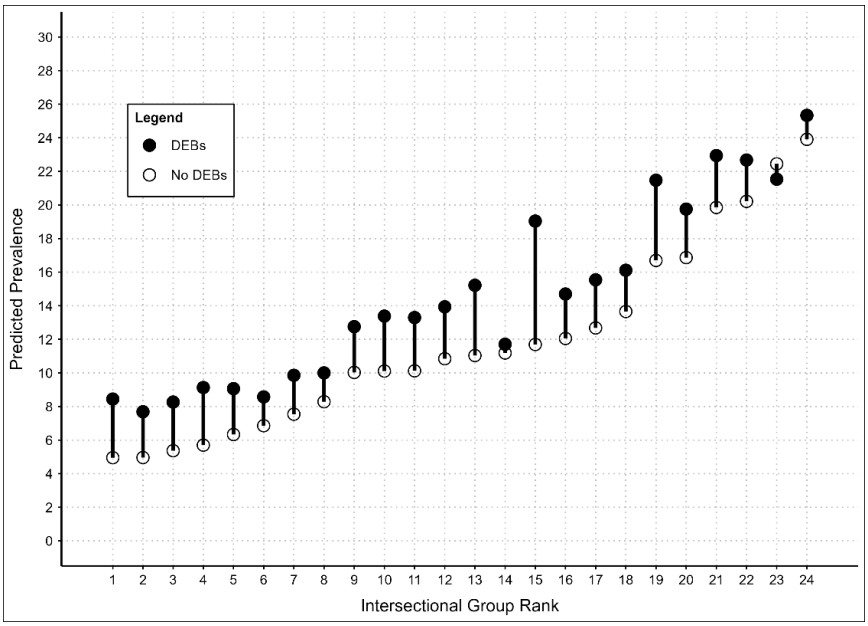
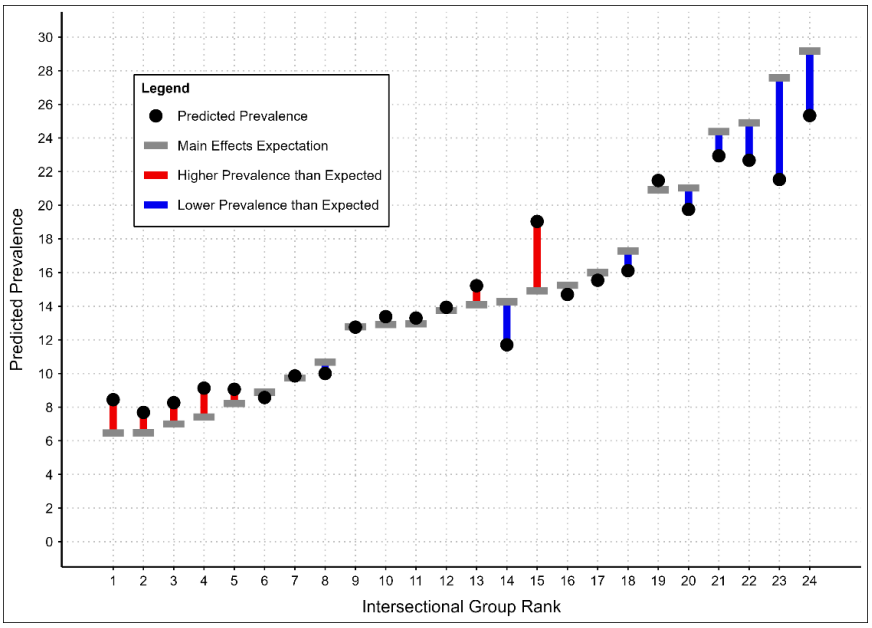


Figure 3.2 Higher & lower than expected prevalence of moderate-to-severe depression symptoms among those with DEBs compared to the main effects predicted prevalence, NHANES 2005-2016 (n=17,578).



Rank	Intersectional Group
1	Hispanic/Latine heterosexual smaller-bodied men
2	White heterosexual larger-bodied men
3	White heterosexual smaller-bodied men
4	Hispanic/Latine heterosexual larger-bodied men
5	Black heterosexual smaller-bodied men
6	White heterosexual smaller-bodied women
7	Black heterosexual larger-bodied men
8	Hispanic/Latine heterosexual smaller-bodied women
9	Hispanic/Latine sexual minority smaller-bodied men
10	White sexual minority larger-bodied men
11	White sexual minority smaller-bodied men
12	Black sexual minority larger-bodied men
13	Black heterosexual larger-bodied women
14	Black heterosexual smaller-bodied women
15	White heterosexual larger-bodied women
16	Black sexual minority smaller-bodied men
17	Hispanic/Latine sexual minority smaller-bodied women
18	Hispanic/Latine heterosexual larger-bodied women
19	White sexual minority smaller-bodied women
20	Black sexual minority larger-bodied women
21	Hispanic/Latine sexual minority larger-bodied men
22	Hispanic/Latine sexual minority larger-bodied women
23	White sexual minority larger-bodied women
24	Black sexual minority smaller-bodied women

Note: NHANES = National Health and Nutrition Examination Survey. DEBs = disordered eating behaviors. CI = credible interval. Estimates obtained from Model 4, which included the overall main effect of DEBs and random slopes for DEBs. Intersectional groups are sorted in ascending order based on the predicted prevalence of depression among those without DEBs. Depression cases were identified using the Patient Health Questionnaire (PHQ-9) with a sum score cutoff of ≥ 10 (i.e., moderate-to-severe symptoms). In Figure 3.2, main effects expectation is the fixed effects intercept + random effects intercept + main effects slope of DEBs. Predicted prevalence is the fixed effects intercept + random effects intercept + main effects slope of DEBs + random effects slopes of DEBs.

summarized in Table 3.3). Blue (red) lines denote lower (higher) than expected prevalence of depression in the group. Deviations ranged from -6.05 percentage points (95% CI: -18.25, 2.40) for White sexual minority larger-bodied women (rank=23) to 4.12 percentage points (95% CI: -0.42, 9.79) for White heterosexual larger-bodied women (rank=15). This provides evidence that, depending on a group's position within social hierarchies, the main effect of DEBs may incorrectly estimate depression prevalence.

Effect modification by intersectional group. Across models, the main effect of the DEBs variable indicated that those with DEBs had, on average, greater odds of depression (ORs=1.31–1.44; Table 3.2). Prevalence ratio (PR) estimates comparing depression prevalence among those with vs. without DEBs signaled variation in the magnitude of the association across groups. As such, PRs ranged from 0.98 to 1.72 (Table 3.3), while the population average was 1.57 (95% CI: 1.38–1.80). Differences in depression symptom prevalence by DEB status were more pronounced for groups with lower depression prevalence, which is evidenced by the random effects correlation in Model 4 (-0.37), showing that groups with higher depression prevalence in the "No DEBs" condition (i.e., random intercepts) had weaker associations between DEBs and depression (i.e., random slopes). Differences were largest for the following groups: Hispanic/Latine heterosexual smaller-bodied men (PR=1.72, 95% CI: 1.04–2.27), White heterosexual larger-bodied women (PR=1.64, 95% CI: 1.27–2.10), Hispanic/Latine heterosexual larger-bodied men (PR=1.63, 95% CI: 1.00, 2.65), White heterosexual larger-bodied men (PR=1.56, 95% CI: 1.07–2.23), and White heterosexual smaller-bodied men (PR=1.54, 95% CI: 1.06–2.18). Conversely, differences were smallest for White sexual minority larger-bodied women (PR=0.98, 95% CI: 0.50–1.44), Black heterosexual smaller-bodied women (PR=1.06,

95% CI: 0.51–1.55), and Black sexual minority smaller-bodied women (PR=1.08, 95% CI: 0.54–1.63).

Discussion

With a nationally representative sample of US adults, the current study found sizable differences in the prevalence of probable depression cases across groups defined at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status. Using social position variables as proxy measures for interlocking systems of oppression, I extend the literature on intersectional inequities in depression in three critical ways. First, I build upon prior intersectional MAIHDA of depression[97,98] by including weight status in the intersectional group definitions. With this approach, I documented higher prevalence of depression, on average, among those who were larger-bodied as well as substantial heterogeneity within each weight status category when combined with the other social position variables. Second, using a random slopes application[64] of intersectional MAIHDA,[61–63,99] I add complexity to prior work documenting a positive association between DEBs and depression.[124] Namely, I found evidence of effect modification depending on one's position with interlocking systems of oppression. Third, I quantified the degree to which DEBs may describe patterns of intersectional inequities in depression, finding that between-group differences were greater among those with DEBs; however, DEBs explained a relatively small portion of between-group differences (i.e., 3.66%) observed in null model, indicating that other factors beyond DEBs may play a greater role in describing how depression is patterned across groups.

Depression prevalence was, on average, greater among those with (11.97%) vs. without (7.57%) DEBs. In line with prior research, model main effects of the social position variables indicated that women (vs. men),[128,136–139] sexual minority (vs. heterosexual) people,[140–143] and

larger-bodied (vs. smaller-bodied) people[145–147] had greater odds of depression. However, there was substantial variation when estimates were stratified by intersectional group and DEB status (Without DEBs range=4.95–23.91%; DEBs range=7.69–25.33%). Results suggested that group-specific associations (i.e., random slopes) varied considerably around the additive main effect of DEBs. Prevalence differences by DEB status were particularly pronounced for some groups, such as Hispanic/Latine heterosexual smaller-bodied men (8.44% vs. 4.95%; PR=1.72), compared to others, such as White sexual minority larger-bodied women (21.53% vs. 22.45%; PR=0.98). On the percentage point scale, differences were largest for White heterosexual larger-bodied women (19.04% vs. 11.69%; PD=7.35). In general, groups with lower baseline (i.e., without DEBs) depression prevalence had a stronger association between DEBs and depression, and they tended to be those with a lower number of marginalized social identities and positions. Visually, this pattern was evident in Figure 3.2, where the predicted prevalence estimates for some groups differed substantially from those predicted based on the main effects alone. Thus, these results may signal that interventions designed to reduce engagement in DEBs may have a greater impact on reducing depression prevalence for certain groups compared to others; however, longitudinal studies are needed to evaluate this claim.

In line with a prior intersectional MAIHDA predicting past-year and lifetime depression,[97] I found that between-group difference measures indicated moderate clustering of depression symptoms within intersectional groups as defined in this study. Approximately 10.60% of individual differences in depression were found comparing group averages. The prior study, which defined intersectional groups using race/ethnicity, sex/gender, and sexual orientation, found similar estimates of 12.7% (past-year depression) and 12.5% (lifetime depression).[97] VPC estimates may vary due to differences in depression measurement tools;

namely, the prior study used a module that produced a categorical result in which anhedonia and/or depressed mood must be present to screen positive,[155] whereas the current study used a dimensional measure of nine depression symptoms with a cutoff sum score value.[152,153]

This study is not without limitations. First, measurement of the social position variables and classification decisions made by the research team may conceal meaningful within-group heterogeneity. For race/ethnicity, I was limited to broad categories such as Hispanic/Latine. As such, prior research has found depression prevalence differences among Hispanic/Latine subgroups (e.g., Puerto Ricans vs. Mexican Americans).[132] Moreover, I excluded participants who were classified by NHANES as "Other/Multiracial," which combined individuals into a category with diverse racial/ethnic identities, including Asian, Native American or Alaska Native, and Native Hawaiian or Pacific Islander. Sex assigned at birth and gender identity were not self-reported by participants in the NHANES study, so misclassification may be present, and findings may not be representative of transgender and nonbinary individuals. For sexual orientation, I used a catch-all "sexual minority" category that included people with diverse sexual identities (i.e., gay, lesbian, bisexual) and behavioral patterns. For weight status, I dichotomized a continuous BMI measure into two groups, and I note evidence of greater depression prevalence at higher BMI cutoff values (e.g., BMI $\geq$ 40.0) than used in the current study.[156] Additionally, DEBs in the NHANES study were limited to four items that were all weight loss-oriented; therefore, findings may not necessarily apply to muscle-building or weight gain-oriented behaviors (e.g., anabolic-androgenic steroid use).

The current study documented considerable inequities in the prevalence of depression among US adults at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status. In particular, depression inequities were greater among those who engaged in DEBs.

Using a random slopes application[64] of intersectional MAIHDA,[61–63,99] I found differences in the association between DEBs and depression across intersectional groups. Results signaled that effect modification may be present such that groups with lower baseline depression prevalence had a stronger association between DEBs and depression. I cautiously note that public health and clinical interventions aimed at reducing engagement in DEBs may therefore have greater (or reduced) benefits for certain groups concerning their comorbid depression symptoms. However, longitudinal research is needed to confirm whether effect modification is present and distinguish temporal ordering of DEBs and depression. Overall, findings underscore the urgency of adopting intersectional approaches to describe complex patterns of health exposures and outcomes in epidemiological research. Given the large depression inequities observed in the current study, I call on US policymakers to support programs and policies aimed at dismantling interlocking systems of oppression and the social factors influencing the development of depression.

Chapter 4: Disordered eating, depression, and incident risk of diabetes, hypertension, and hyperlipidemia at the intersection of race/ethnicity, gender identity, and weight status: A longitudinal intersectional MAIHDA from adolescence to middle adulthood

Abstract

Background: Emerging evidence suggests that disordered eating (DE) and depression are associated with increased risk of poor cardiometabolic health; however, prior studies have neglected (1) the comorbidity of DE and depression and (2) the degree to which incident risk estimates may be moderated by an individual's position within interlocking systems of oppression.

Methods: With data from five waves of a nationally-representative longitudinal cohort study (Add Health), I estimated the longitudinal impact of DE, depression, and their comorbidity on incident risk of diabetes (n=8,878), hypertension (n=8,393), and hyperlipidemia (n=8,462). The exposure period was defined as adolescence and young adulthood (Waves 1-3; 1994-2002; ages 11-26), wherein participants were classified into four exposure groups: neither DE nor depression, DE only, depression only, and DE & depression. Incident outcome cases were defined as those developing after Wave 3 until the follow-up period ended (Wave 5; 2016-2018; ages 33-44). Cases were identified using self-reported diagnosis, self-reported medication use, and objectively-measured biomarkers. With 16 intersectional groups defined by race/ethnicity, gender identity, and weight status, intersectional MAIHDA (multilevel analysis of individual heterogeneity and discriminatory accuracy) with random slopes was used to estimate (1) between-group inequities in poor cardiometabolic health, (2) whether exposure-outcome associations differed across groups, and (3) whether sample-level (average) exposure-outcome associations correctly estimated risk of poor cardiometabolic health across groups.

Results: Incident cases of diabetes (4.6–33.3%), hypertension (14.7–45.8%), and hyperlipidemia (21.5–39.1%) were complexly patterned across intersectional groups. At the sample level, DE (only) was associated with 21% increased risk of diabetes. Depression (only) was associated with 18% increased risk of hypertension and hyperlipidemia. Comorbid DE and depression were associated with 45% increased risk of hypertension and 26% increased risk of hyperlipidemia. Notable exposure-outcome association differences emerged; for example, risk ratio (RR) estimates of the association between depression (only) and incident diabetes ranged from 0.38 to 2.84. Conversely, there was limited evidence of effect modification for other associations (e.g., depression (only) and incident hypertension [sample-level RR=1.18; group-specific RR range=1.09–1.24]). Models indicated that relying on sample-level exposure-outcome associations would incorrectly estimate risk patterns across groups and exposure levels.

Conclusions: As individuals enter middle adulthood, substantial cardiometabolic health inequities were present at the intersection of race/ethnicity, gender identity, and weight status. DE, depression, and their comorbidity during adolescence and young adulthood were associated with poor cardiometabolic health. However, these associations may vary considerably across intersectional groups. Thus, exploring the nuanced dynamics of these associations with an intersectional lens is imperative for developing targeted interventions aimed at promoting cardiometabolic health equity across the lifespan.

Introduction

Cardiometabolic health refers to range of interrelated conditions characterized by their effects on the body's cardiovascular system and energy utilization/homeostasis, including blood sugar regulation, blood pressure control, and lipid balance. Maintaining good cardiometabolic health is therefore critical for daily functioning and healthy longevity. Cardiometabolic health conditions are estimated to impact 4.6% (diabetes; ages 18-44),[157] 7.2% (hypertension; ages 18-39),[158] and 8.2-10.9% (hyperlipidemia; ages 20-39)[159] of younger adults in the US. Concerningly, diabetes,[37] hypertension,[38] and hyperlipidemia[39] are associated with increased risk of all-cause mortality. In particular, diabetes may increase risk of cancer diagnosis and mortality,[37] while hypertension and hyperlipidemia are associated with higher risk of cardiovascular disease-related mortality.[39,160] Poor cardiometabolic health also presents a substantial economic burden to society. For instance, diagnosed diabetes was estimated to have a total economic cost of $327 billion in 2017, including $237 billion in direct medical expenditures.[40] Moreover, individuals with diabetes have medical costs that are more than double those of the non-diabetic population.[40] Thus, early prevention through the identification of modifiable risk factors for diabetes, hypertension, and hyperlipidemia are of vital public health concern.

Disordered eating and depression as risk factors for poor cardiometabolic health

Emerging research suggests that mental and behavioral health concerns, such as disordered eating[41–44] and depression,[45,46] may place individuals at increased risk for developing poor cardiometabolic health. The current study defines disordered eating as a broad spectrum of eating-related pathology, including binge eating behaviors, unhealthy weight control methods (e.g., self-induced vomiting), and diagnosed eating disorders (i.e., a diagnosis of an eating

disorder, such as anorexia nervosa [AN], bulimia nervosa [BN], binge eating disorder [BED], from a healthcare professional). Among US adults, nationally representative surveys indicate that 11.2%[120] and 2.1%[161] may engage in past-year unhealthy weight control behaviors and binge eating behaviors, respectively, while lifetime eating disorder diagnoses are estimated to impact 14.3% of men and 19.7% of women.[162] While social and economic cost estimates are not broadly available for this definition of disordered eating, diagnosed eating disorders in the 2018-19 fiscal year were estimated to cost the US health system $64.7 billion in direct medical costs and $326.5 billion in reduced wellbeing.[5]

Those with disordered eating frequently experience comorbid mental and behavioral health conditions.[14] Comorbidity is defined in this study as the lifetime occurrence of two or more health conditions in the same individual. Among those with diagnosed eating disorders, comorbidities are of particular concern as they may place individuals at increased risk for greater symptom severity,[17–19] longer illness duration,[17] and reduced quality of life.[20] Across mental and behavioral health conditions, depression is among the most likely conditions to be comorbid in individuals with diagnosed eating disorders.[14] Depression is a serious psychiatric disorder characterized by persistent low mood and loss of interest/pleasure in daily activities. In 2022, 8.8% of US adults experienced a past-year major depressive episode.[163] As a leading cause of disability, its impact on US adults was associated an annual cost of $326.2 billion in 2018.[164]

Review of prior literature on disordered eating, depression, and cardiometabolic health

Concerning disordered eating and cardiometabolic health, prior longitudinal evidence suggests that binge eating behaviors may be associated with increased risk of diabetes, hypertension, and high triglycerides after 2-years follow-up.[41] In a sample of larger-bodied young adult men, binge eating behaviors (OR=1.90), but not unhealthy weight control behaviors

(OR=0.98), were prospectively linked to incident hyperlipidemia, while findings for incident diabetes (ORs=1.10-1.11) and hypertension (ORs=0.81-0.92) were non-significant.[165] Similarly, a matched cohort study found that those with diagnosed BED, compared to healthy controls, were more likely to develop diabetes (hazard ratio [HR]=1.7) and dyslipidemia (HR=2.2; i.e., unhealthy imbalance of blood lipid measures);[43] however, the same study found increased, but non-significant, risk for developing hypertension (HR=1.5).[43] People with restrictive EDs such as AN may also have increased risk of dyslipidemia arising from liver dysregulation or delayed cholesterol metabolism.[166,167] Heterogeneity in the association between diagnosed eating disorders and diabetes may also be present. For example, a meta-analysis inclusive of cross-sectional and longitudinal cohort studies found that diagnosed BED (cross-sectional OR=3.67; cohort OR=3.34) and diagnosed BN (cross-sectional OR=3.45; cohort OR not reported) may increase risk of diabetes, while diagnosed AN (cross-sectional OR=0.86; cohort OR=0.71) may decrease risk of diabetes.[168] Overall, these studies suggest that disordered eating, particularly binge eating behaviors, BN, and BED, may be associated with increased risk of diabetes, while findings are more mixed concerning the impact of disordered eating on hypertension and hyperlipidemia risk.

Relative to disordered eating, there are more high-quality studies linking depression with poor cardiometabolic health. Compared to those without depression, meta-analyses of longitudinal cohort studies have documented 38% increased risk of incident diabetes[45] and 42% increased risk of incident hypertension[169] among those with depression. Similarly, an umbrella review of five meta-analyses estimated that depression was associated with 18% to 60% increased risk of incident diabetes.[46] Contrary to findings regarding diabetes and hypertension, a meta-analysis of cross-sectional studies found that higher total cholesterol was associated with

lower prevalence of depression.[170] Longitudinal studies are relatively limited concerning depression and hyperlipidemia, and a systematic review of articles published through the end of 2019 found no longitudinal studies of the association between total cholesterol and depression symptoms among young adults.[171] To date, only one cohort study examined the prospective association between depression and total cholesterol, finding that baseline depression symptoms did not predict 2-year changes in total cholesterol.[172] Moreover, prior work has often focused on the impact of various cholesterol subtypes (e.g., low-density lipoprotein cholesterol [LDL-C]) on subsequent depression risk rather than the pathway from depression to cholesterol-related outcomes. For instance, a longitudinal cohort study of middle-aged and older adult women found that lower LDL-C was associated with increased risk of incident depression.[173] In summary, extant literature suggests that depression predicts incident cases of diabetes and hypertension, respectively, while findings for a longitudinal association between depression and incident hyperlipidemia are less clear.

Literature gaps

Two notable gaps in the literature concern the associations among disordered eating, depression, and poor cardiometabolic health. First, it is unknown whether the comorbidity of disordered eating and depression during adolescence and young adulthood may increase risk of poor cardiometabolic health as individuals age into middle adulthood. Disordered eating[161,174] and depression[174,175] often first appear during this critical developmental period. In particular, among adolescents with a diagnosed eating disorder, 8.7% (AN) to 35.4% (BED) also had a lifetime diagnosis of depression.[14] As such, disordered eating and depression may share transdiagnostic common causes, including genetic,[21] biological (e.g., brain area alterations[22]), and social (e.g., child maltreatment,[23,24] discrimination,[25,26]) factors. Among those with

cardiometabolic health issues, mental and behavioral health comorbidities are also known to be associated with poor outcomes, such as mortality risk,[176] emergency room visits,[176] and impaired health-related quality of life.[177,178] To address this gap, the current study uses longitudinal data collected from adolescence to middle adulthood to estimate whether disordered eating, depression, and their comorbidity may place individuals at increased risk of developing poor cardiometabolic health.

The second gap concerns the degree to which associations between disordered eating, depression, and cardiometabolic health may differ at the intersection of multiple axes of social position. With its origins in Black feminist scholarship and activism,[49,88,89] intersectionality is a critical social theory describing the ways in which systems of oppression (e.g., racism, sexism, fatphobia) are bound together and interact in complex ways with individual-level identities and positions (e.g., race/ethnicity, gender identity, weight status).[92] These interlocking systems subsequently produce and reinforce a hierarchy of power relations whereby certain individuals experience relative privilege or disadvantage. Population-level patterns of privilege/disadvantage are thus theorized to produce economic, political, and health inequities. Of note, intersectionality theory stresses that lived experiences at the intersection of multiple systems of oppression are not simply the experience under one system of oppression coupled with the experience of another (i.e., the experience of Black women ≠ Black + woman).[50] In population health research, intersectionality theory thus provides a toolkit to critically examine the distribution and complex causes of health inequities under interlocking systems of oppression.

In recent years, intersectional MAIHDA (multilevel analysis of individual heterogeneity and discriminatory accuracy)[61–63] has been used to examine how intersectional positions under interlocking systems of oppression can describe inequities in depression,[97,98] disordered

eating,[28,72,120] and cardiometabolic health.[179–182] Using an intercategorical (i.e., between-group comparison)[93] approach under an intersectional framework,[49,88,89] this method sorts individuals (level 1) into mutually-exclusive intersectional groups (level 2) defined by existing social position categories. From here, a two-level model is specified with random intercepts for each intersectional group, which allows researchers to (1) map outcome averages (e.g., risk, prevalence) across groups, (2) quantify outcome variability attributable to between-group (discriminatory accuracy) vs. within-group (individual heterogeneity) differences, and (3) decompose between-group differences into those explained by two-way or higher interaction effects (e.g., race/ethnicity*gender identity*weight status).[61–63]

While traditionally applied in descriptive epidemiology, Evans et al.[64] recently extended the intersectional MAIDHA framework into analytic settings by including an exposure variable (twin vs. singleton birth status) to predict intersectional inequities in an outcome (birthweight).[64] Here, they included random slopes, which vary around the main effects slope (i.e., sample-level average association), to assess whether the association between birth status and birthweight differed in strength and magnitude across intersectional groups.[64] Thus, the random slopes application of intersectional MAIHDA can be used to evaluate hypotheses related to (1) effect modification of exposure-outcome associations by intersectional group and (2) the ability of the average exposure-outcome association to accurately predict outcome risk across groups. Overall, intersectional MAIHDA, in both its descriptive and analytic forms, has promise to inform the design and implementation of interventions addressing disordered eating, depression, and cardiometabolic health.

Current study

With a US nationally representative cohort followed from adolescence into middle adulthood, I sought to quantify the causal effect of disordered eating, depression, and their comorbidity on incident risk of three cardiometabolic health conditions: diabetes, hypertension, and hyperlipidemia. Using intersectional MAIHDA,[61–63] I first estimated the degree to which risk of each outcome was patterned across mutually-exclusive intersectional groups defined by race/ethnicity (White, Black, Latine, Multiracial/Other Race), gender identity (cisgender man, cisgender woman), and weight status (smaller-bodied, larger-bodied). These intersections were conceptualized as imperfect proxy measures for interlocking systems of oppression, namely, racism, sexism, and fatphobia. Second, using a random slopes application of intersectional MAIHDA,[64] I evaluated whether each group's unique position within social hierarchies moderated estimates of the causal effect of disordered eating, depression, and their comorbidity on cardiometabolic health risk. Lastly, I quantified whether specific intersectional groups experienced higher, or lower, than expected total risk of each outcome (i.e., inclusive of the main effects [sample-level average] slope and group-specific random slopes for the exposure variable) in comparison the risk estimated from the main effects slope. Therefore, if a particular group had higher-than-expected risk, this would indicate that the exposure-outcome association is stronger than average, providing critical insights for the development and delivery of interventions.

Methods

Technical Details

To enhance article accessibility, additional technical details on statistical approaches (e.g., code, model equations, convergence diagnostics, estimate formulas) can be found in Supplementary Materials (Appendix C).

Data

Data came from five waves of the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a prospective cohort study of a nationally representative sample of US middle and high school students enrolled in the 1994-95 school year. Participants were selected to participate through a school-based, multistage probability sampling design stratified by geographic region, urbanicity, school type, racial/ethnic demographics, and student body size. Since 1994-95 (Wave 1), participants have been followed for up to 24 years with data collection occurring in 1996 (Wave 2), 2001-02 (Wave 3), 2008-09 (Wave 4), and 2016-18 (Wave 5). The Institutional Review Board of the University of North Carolina at Chapel Hill (UNC-Chapel Hill) approved Add Health study procedures. De-identified, restricted use data were obtained through a data use agreement with UNC-Chapel Hill.

Inclusion criteria

The study flowchart is presented in Figure 4.1. From n=20,744 participants, I first excluded those who did not respond to Wave 1 (n=29) and those with missing data on Wave 1 neighborhood socioeconomic status (SES; n=216) or household SES (n=1,395). Next, I excluded those who did not respond to Wave 3 (n=5,011), did not respond to Wave 5 (n=4,530), or had missing Wave 5 sampling weights (n=203). I then excluded those with missing data on demographic variables (race/ethnicity [n=1], gender identity [n=23], weight status [n=242], sexual orientation [n=79]) or the exposure variable (n=6).

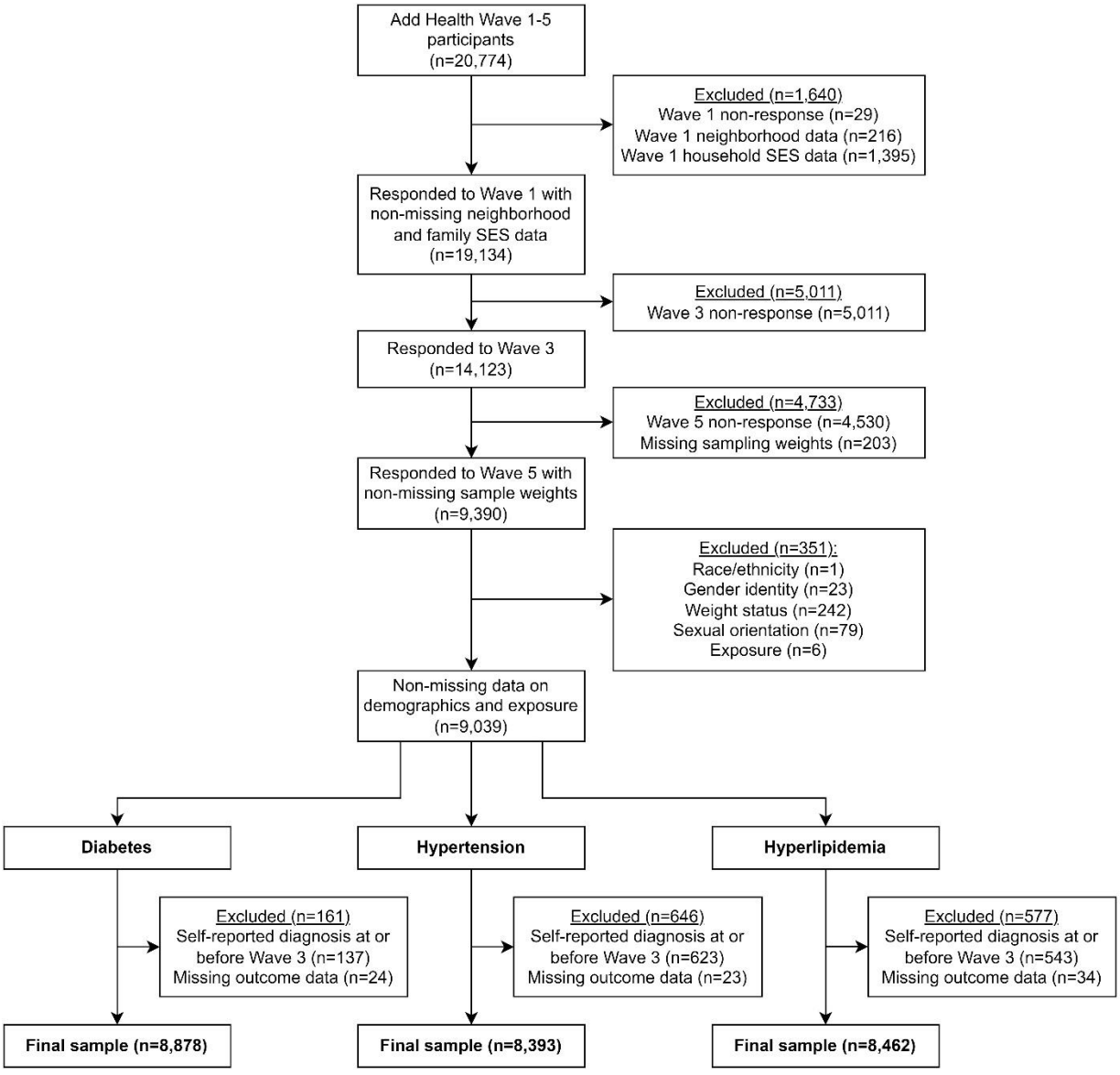
From the remaining sample (n=9,039), I defined analytic samples for each cardiometabolic health outcome measure. Participants were excluded if they self-reported a diagnosis of the outcome that occurred at or before Wave 3 (i.e., the exposure period) or if they had missing outcome data. The final analytic samples for each outcome were as follows: Diabetes (n=8,878), Hypertension (n=8,393), and Hyperlipidemia (n=8,462).

Measures

I. Outcomes

All outcome cases were identified using self-reported lifetime diagnosis (Wave 3-5), self-reported age at first diagnosis (Wave 4-5), self-reported past 4-week medication use (Waves 4-5), and objectively measured biomarker data (Waves 4-5).

Figure 4.1 Study flowchart.



Note: Add Health = National Longitudinal Study of Adolescent to Adult Health.

Incident diabetes. Diabetes cases met at least one of the following criteria: (1) self-reported first diagnosis (when not pregnant) after their age at Wave 3, (2) self-reported past 4-week use of anti-diabetic medication, (3) fasting glucose ≥ 126 milligrams per deciliter (mg/dL), (4) non-fasting glucose ≥ 200 mg/dL, or (5) hemoglobin A1c (HbA1c) ≥ 6.5%.[183]

Incident hypertension. Hypertension cases met at least one of the following criteria: (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hypertensive medication, or (3) measured blood pressure classified as hypertension stage 1 or 2 (i.e., systolic ≥ 140 millimeters of mercury (mmHg) or diastolic ≥ 90 mmHg).

Incident hyperlipidemia. Hyperlipidemia cases met at least one of the following criteria: (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hyperlipidemic medication, or (3) measured total cholesterol (TC) ≥ 240 mg (based on National Cholesterol Education Program (NCEP) Adult Treatment Plan (ATP) III guidelines).[184] At Wave 4, TC deciles were released instead of continuous values. I used cutoffs normed to the prevalence of hyperlipidemia (TC ≥ 240 mg) among US young adults aged 20-39 (women: 8.2%; men: 10.9%).[159] Therefore, TC values in the top decile were considered evidence of hyperlipidemia. At Wave 5, I classified continuous TC values ≥ 240 mg as evidence of hyperlipidemia.

II. Exposures

Eating disorder diagnosis. At Wave 5, participants self-reported a lifetime eating disorder diagnosis with "Has a doctor, nurse, or other health care provider ever told you that you have or had anorexia, bulimia or binge eating?" and their age at first diagnosis with "How old were you when you were diagnosed by a doctor, nurse or other health care provider with

anorexia, bulimia or binge eating?" Those reporting a lifetime diagnosis that first occurred at or before their age at Wave 3 were coded as having an eating disorder.

Unhealthy weight control behaviors (UWCBs). At Waves 1-3, participants self-reported past 7-day UWCBs with "During the past seven days, which of the following things did you do in order to lose weight or to keep from gaining weight?" (options: "made yourself vomit", "took diet pills", "used laxatives"). At Wave 3, three additional past 7-day UWCBs were measured: "took food supplements (powders, herbal supplements, mineral pills, or vitamins that are supposed to take the place of meals or reduce appetite)", "fasted or skipped meals", "used diuretics". Those who endorsed any of the measured UWCBs from Waves 1-3 were coded as having UWCBs.

Binge eating. At Wave 3, participants self-reported past 7-day binge eating with two items: "Have you eaten so much in a short period that you would have been embarrassed if others had seen you do it?" (options: "yes" or "no") and "Have you been afraid to start eating because you thought you wouldn't be able to stop or control your eating?" (options: "yes" or "no"). Those responding "yes" to either item were coded as having binge eating.

Depression diagnosis. At Waves 4 and 5, participants self-reported a lifetime depression diagnosis with "Has a doctor, nurse, or other health care provider ever told you that you have or had depression?" and their age at first diagnosis with "How old were you when you were diagnosed by a doctor, nurse or other health care provider with depression?" Those reporting a lifetime diagnosis that first occurred at or before their age at Wave 3 were coded as having depression.

Moderate-to-severe depression symptoms. Across Waves 1-3, participants completed 9 items from the 20-item Center for Epidemiological Studies Depression (CESD) scale, which

assessed past 7-day depression symptoms ("bothered by things that usually don't bother you", "could not shake off the blues", "felt that you were just as good as other people", "had trouble keeping your mind on what you were doing", "felt depressed", "were too tired to do things", "enjoyed life", "felt sad", "felt that people disliked you"). Participants reported how frequently each symptom occurred (0="never", 1="rarely", 2="most of the time", 3="all of the time"). After positively worded items were reverse coded, I created a sum score (range=0-27). In line with prior Add Health analysis of the 9-item CESD scale,[185,186] I derived a binary variable using gender-specific sum score cutoffs (≥ 11 for women; ≥ 10 for men) indicating moderate-to-severe depression symptoms.

Combined exposure variable: Comorbidity of disordered eating and depression. Using the exposure indicators described above, I defined "Disordered Eating" as any reports of eating disorder diagnosis, UWCBs, or binge eating. I defined "Depression" as any reports of depression diagnosis or moderate-to-severe depression symptoms. I then categorized participants into four mutually-exclusive exposure groups: "Neither", "Disordered Eating only", "Depression only", "Disordered Eating & Depression".

III. Social position variables

Race/ethnicity. At Wave 1, participants self-reported their race with "What is your race?", choosing from one or more the following options: "White", "Black or African-American", "American Indian or Native American", "Asian or Pacific Islander", or "Other". Participants self-reported their ethnicity with "Are you of Hispanic or Latino origin?" (options: "yes" or "no"). I combined responses from these two questions into four mutually-exclusive categories: Hispanic/Latine (any race), Non-Hispanic/Latine (NHL) White, NHL Black/African-American, or NHL Multiracial/Other Race. Due to small sample sizes, participants who (1)

identified as “Asian or Pacific Islander”, “American Indian or Native American”, or “Other” or (2) reported more than one racial identity were classified as NHL Multiracial/Other Race.

Gender identity. Gender identity was not self-reported in Add Health until Wave 5. Therefore, I used Wave 5 self-reported sex (“What sex were you assigned at birth, on your original birth certificate?” with options of “male” or “female”) and self-reported gender identity (“What is your gender?” with options of “male” or “female”) to classify participants as cisgender men (“male” sex and “male” gender identity), hereafter “men”, or cisgender women (“female” sex and “female” gender identity), hereafter “women”. Due to low sample size (n=28), non-cisgender participants excluded from analysis.

Weight status. Aligning with prior intersectional MAIHDA using weight status to approximate exposure to fatphobia and weight discrimination,[72] I used participants’ Wave 1 self-reported height and weight to calculate body mass index (BMI) as kilograms divided by meters squared. Those who reported being currently pregnant (n=12) were set to missing. For participants aged 19 or younger, I used the *cdcanthro* package to generate BMI percentiles according to CDC growth charts.[187] Those with an age- and sex-standardized BMI percentile ≥ 85.0 were coded as “larger-bodied”. Participants aged 20 or older were coded as “larger-bodied” if they had BMI ≥ 25.0 using CDC criteria. All other participants with non-missing BMI data were coded as “smaller-bodied” (BMI percentile < 85.0; BMI < 25.0).

IV. Covariates

Neighborhood SES. Principal component analysis (PCA) was used to combine data from six indicators of Wave 1 neighborhood SES measured at the census tract-level: (1) proportion of vacant housing units, (2) proportion of households receiving public assistance or welfare, (3) proportion of adults living at or below the federal poverty level, (4) proportion of children living

at or below the federal poverty level, (5) proportion of adults aged 25 or older without a high school diploma, and (6) proportion of adults aged 25 or older who are unemployed. Prior to PCA, each indicator was standardized with mean=0 and standard deviation=1. Using 33.3% and 66.6% quantile values, the first principal component (variance explained=69.9%) was split into three categories ("Lower SES", "Average SES", "Higher SES") based on the Wave 1 sample with non-missing neighborhood SES data (n=20,529).

Household SES. I used the Social Origins Scale,[188] which was previously derived using PCA[189] of four Wave 1, parent-reported household SES indicators: (1) parental education, (2) parental occupation, (3) household income, (4) household receipt of public assistance or welfare. Similar to Neighborhood SES, the first principal component (variance explained=53%) was split into three categories ("Lower SES", "Average SES", "Higher SES") using the 33.3% and 66.6% quantile values based on the Wave 1 sample with non-missing household SES data (n=19,324).

Sexual orientation. At Waves 3-5, participants self-reported their sexual orientation with "Please choose the description that best fits how you think about yourself" (options: 1="100% heterosexual (straight)", 2="mostly heterosexual (straight), but somewhat attracted to people of your own sex", 3="bisexual, that is, attracted to men and women equally", 4="mostly homosexual (gay), but somewhat attracted to people of the opposite sex", 5="100% homosexual (gay)", or 6="not sexually attracted to either males or females"). Responses of 6 were set to missing. Participants who reported 1 at each wave were coded as "heterosexual", while those who reported 2, 3, 4, or 5 at any wave were coded as "sexual minority".

Analysis

All analysis was conducted in R version 4.2.2.[154]

Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA). I fit two-level log-binomial models using the Hamiltonian Monte Carlo[111] algorithm for Markov chain Monte Carlo (MCMC) to predict incident risk of diabetes, hypertension, and hyperlipidemia, respectively. I used the *csSampling* package[112] to generate design-weighted, nationally representative estimates to account for the Add Health complex sample survey design.[97] Outcomes were specified with a binomial distribution and a log link function to directly estimate risk ratios (RR), since odds ratios obtained with a logit link function overestimate risk when outcome prevalence is relatively high (≥10%),[190] which is the case in the current study. To aid model convergence and ensure that exponentiated risk estimates fall within a valid probability space (i.e., 0 to 1), I set a maximum value of the linear predictor term on the log scale to -0.015, where $e^{-0.015} \approx 0.985$. Model main effects were summarized with RR means and 95% credible intervals (CI). MCMC model convergence was evaluated using Gelman-Rubin r-hat diagnostics, effective sample size, and visual inspection of trace plots.

In line with prior MAIHDA applied under an intersectional framework,[61–63,72,97–99,191] I nested participants (level 1) within intersectional groups (level 2) and specified random intercepts for level 2 units. Model 1 was a null model (i.e., no level 1 covariates) used to quantify the general contextual effect[96] of the intersectional group structure and estimate the incident risk of the outcomes by international group, irrespective of exposure status. Model 2 added the exposure variable main effects. Model 3 added the confounder variable main effects (i.e., neighborhood SES, household SES, sexual orientation). Model 4 added the exposure variable random effects (i.e., random slopes for each level 2 unit) to assess effect measure modification by intersectional group. Finally, Model 5 added the social position variable main effects to estimate the degree to which they explain between-group differences in outcome risk patterns.

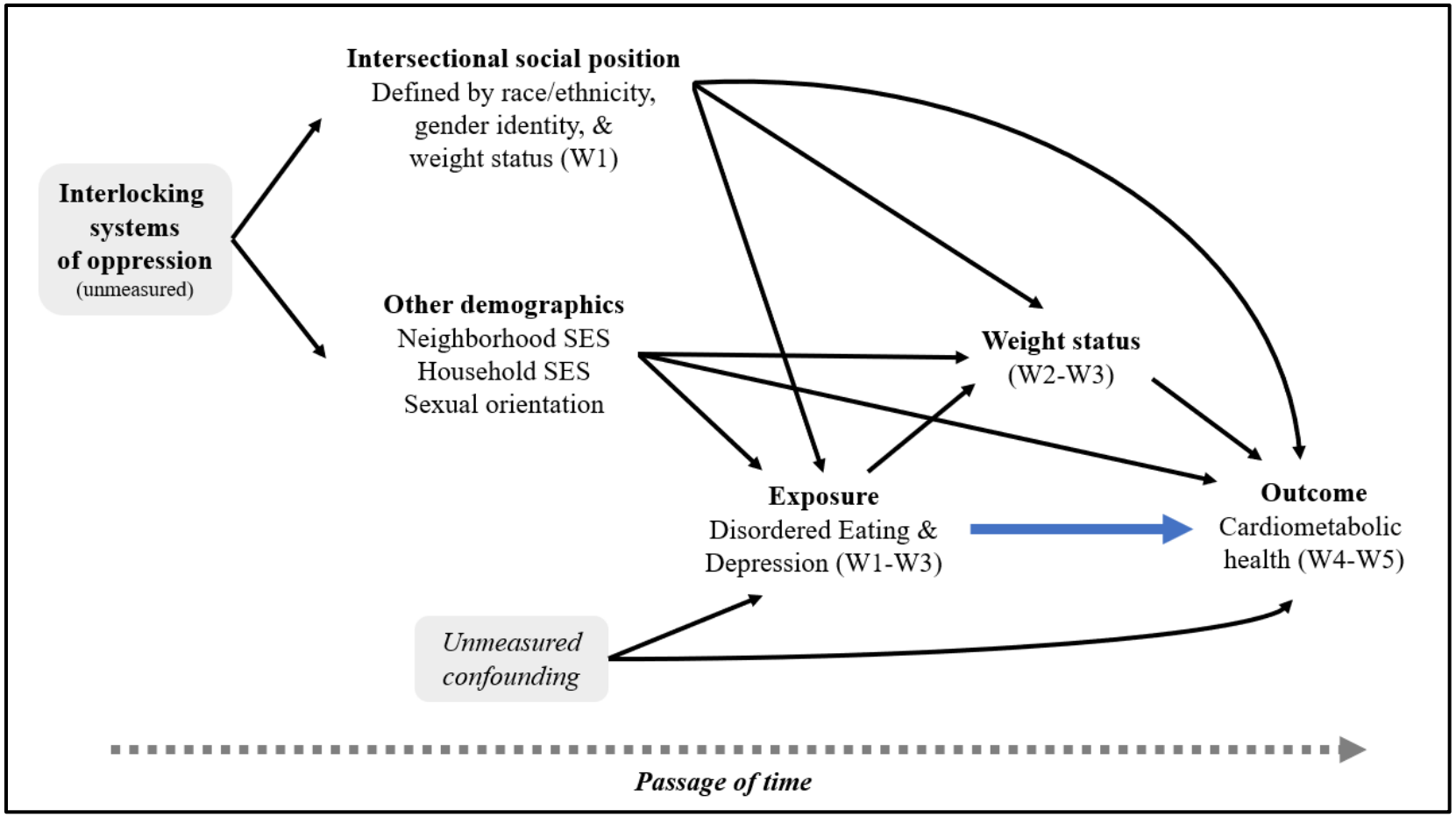
In two-level models, the general contextual effect (GCE) quantifies the degree to which variation in individual outcome risk can be attributed to between-group vs. within-group differences.[96] I estimated the GCE using the variance partition coefficient (VPC), which is the level 2 (between-group) variance divided by the total model variance and multiplied by 100%. Since log-binomial models do not produce level 1 variance estimates, I approximated this as the variance of the theoretical binomial distribution.[192] This produced estimates on the probability scale, while the models produced level 2 variance estimates on the log scale. Therefore, I converted level 2 variance estimates to the probability scale prior to calculating VPCs (Appendix C).

The following interpretation thresholds were used for the VPC: absent (0–1%), very small (>1–5%), small (>5–10%), moderate [equivalent of "less large" proposed by Merlo Wagner, & Leckie (2019)] (>10–20%), fairly large (>20–30%), very large (>30%).[110] I estimated the proportional change in variance (PCV) as the percentage reduction in between-group outcome differences relative to Model 1 (for Models 2-3) and Model 4 (for Model 5). For Model 5, separate variance calculations were conducted for each exposure level (Appendix C).[64]

Covariate selection. I used a directed acyclic graph (DAG) to identify the minimal set of covariates to adjust for in the models (Figure 4.2). In addition to the social position variables, I identified neighborhood SES, household SES, and sexual orientation as potential confounders of the causal association between disordered eating, depression, and their comorbidity (assessed in Waves 1-3) with incident cardiometabolic health cases (assessed after Wave 3).

Marginal standardization of predicted risk estimates. Predicted risk estimates were obtained from Model 4, which included confounder covariates and random slopes for the

Figure 4.2 Directed acyclic graph.



Note: W = Wave (e.g., W1 = Wave 1). "Disordered Eating & Depression" represents the exposure measured in Waves 1-3. "Cardiometabolic health" represents incident cases of diabetes, hypertension, or hyperlipidemia that developed after Wave 3. The blue arrow represents the causal effect of the exposure on the outcome. Constructs in light gray (interlocking systems of oppression, unmeasured confounding) are unmeasured variables. The DAG implies that intersectional social position and the other demographic variables (neighborhood SES, household SES, sexual orientation) should be included to estimate the causal effect of the exposure on the outcome. Weight status at Wave 2-3 is a mediator along the causal pathway and should not be included in the model. Unmeasured confounding is included in the DAG to make it explicit that confounding of the association between the exposure and outcome will be present in all observational studies.

exposure variable. To ensure risk estimates were directly comparable, I used marginal standardization to obtain predicted risk estimates for each intersectional group and exposure level (Appendix C). First, I calculated 18 weights proportional to the design-weighted, multivariate distribution of the three covariates (i.e., 3 neighborhood SES categories * 3 household SES categories * 2 sexual orientation categories). Second, for each covariate combination, intersectional group, and exposure level, I extracted posterior samples and summed the main effects intercept, random effects intercepts, main effects slopes, random effects slopes, and covariate main effects. Third, I exponentiated these sums and multiplied them by their respective covariate combination weight. Finally, I summed the 18 weighted posterior samples to obtain predicted risk estimates. For each intersectional group and exposure level, I calculated risk difference (RD) and risk ratio (RR) measures in reference to the unexposed ("Neither") category. Risk, RD, and RR were summarized with means and 95% CI.

Results

Sample characteristics. Across the three outcome samples, most participants were White (67.9–68.1%) and small-bodied at Wave 1 (74.1–75.5%), while a slight majority were cisgender women (50.2–50.4%) (Table 4.1). During the exposure period, approximately 55% had no evidence of disordered eating or depression, 12% had disordered eating only, 23% had depression only, and 10% had evidence of both. After up to 17 years of follow-up (2001 to 2018) and excluding those who developed outcomes during the exposure period, 9.3% developed diabetes, 24.9% developed hypertension, and 25.2% developed hyperlipidemia by the time they approached middle adulthood (Wave 5 age range=33.5-44.2).

Incident risk of diabetes, hypertension, and hyperlipidemia. Model 1 incident risk estimates for each outcome and intersectional group, irrespective of exposure status, are

Table 4.1 Sample characteristics, National Longitudinal Study of Adolescent to Adult Health.

Variables	Diabetes (n=8,878)	Hypertension (n=8,393)	Hyperlipidemia (n=8,462)
Outcome & Exposure			
Outcome (Incident cases after Wave 3)	862 (9.3%)	2,051 (24.9%)	2,148 (25.2%)
Exposure (Wave 1-3)			
Neither	4,753 (54.8%)	4,544 (55.5%)	4,553 (55.2%)
Disordered Eating only	1,117 (12.1%)	1,036 (12.0%)	1,064 (12.1%)
Depression only	2,045 (22.9%)	1,926 (22.6%)	1,948 (22.8%)
Disordered Eating & Depression	963 (10.2%)	887 (10.0%)	897 (9.9%)
Exposure definitions			
Disordered Eating[1]	2,080 (22.3%)	1,923 (22.0%)	1,961 (22.0%)
Unhealthy weight control behaviors	*1,473 (15.2%)*	*1,371 (15.2%)*	*1,398 (15.2%)*
Binge eating	*683 (7.6%)*	*619 (7.2%)*	*631 (7.4%)*
Self-reported eating disorder diagnosis[2]	*225 (2.5%)*	*210 (2.5%)*	*211 (2.5%)*
Depression[1]	3,008 (33.1%)	2,813 (32.6%)	2,845 (32.7%)
Moderate-to-severe symptoms[3]	*2,279 (24.1%)*	*2,129 (23.8%)*	*2,146 (23.7%)*
Self-reported depression diagnosis[2]	*1,356 (16.4%)*	*1,264 (16.1%)*	*1,285 (16.2%)*
Dimensions of social position			
Race/ethnicity			
Black or African-American	1,534 (12.7%)	1,413 (12.5%)	1,469 (13.0%)
Hispanic or Latine	1,221 (11.0%)	1,160 (11.1%)	1,152 (11.0%)
Multiracial or Other Race	957 (8.2%)	906 (8.3%)	912 (8.1%)
Asian or Pacific Islander	*535 (3.4%)*	*509 (3.5%)*	*507 (3.4%)*
Native American or Alaska Native	*36 (0.5%)*	*30 (0.4%)*	*32 (0.4%)*
Other Race	*64 (0.7%)*	*61 (0.7%)*	*60 (0.6%)*
Multiracial	*322 (3.6%)*	*306 (3.7%)*	*313 (3.7%)*
White	5,166 (68.1%)	4,914 (68.1%)	4,929 (67.9%)
Gender identity			
Cisgender man	3,851 (49.8%)	3,594 (49.6%)	3,651 (49.7%)
Cisgender woman	5,027 (50.2%)	4,799 (50.4%)	4,811 (50.3%)
Weight status (Wave 1)			
Smaller-bodied	6,718 (74.1%)	6,460 (75.5%)	6,458 (74.8%)
Larger-bodied	2,160 (25.9%)	1,933 (24.5%)	2,004 (25.2%)

Other demographics			
Neighborhood SES (Wave 1)			
Higher SES	3,277 (37.6%)	3,149 (38.3%)	3,111 (37.2%)
Average SES	2,995 (33.6%)	2,834 (33.5%)	2,864 (33.8%)
Lower SES	2,606 (28.8%)	2,410 (28.2%)	2,487 (29.0%)
Household SES (Wave 1)			
Higher SES	3,544 (37.6%)	3,386 (38.1%)	3,372 (37.4%)
Average SES	2,849 (32.4%)	2,699 (32.7%)	2,706 (32.5%)
Lower SES	2,485 (30.0%)	2,308 (29.2%)	2,384 (30.2%)
Sexual orientation			
Heterosexual	6,971 (79.2%)	6,608 (79.7%)	6,652 (79.3%)
Sexual minority	1,907 (20.8%)	1,785 (20.3%)	1,810 (20.7%)
Age (years)			
Wave 1 mean (range)	15.8 (11.4, 21.3)	15.8 (11.4, 21.3)	15.8 (11.4, 21.3)
Wave 2 mean (range)	16.3 (12.6, 21.9)	16.3 (12.6, 21.2)	16.3 (12.6, 21.9)
Wave 3 mean (range)	22.2 (18.2, 28.0)	22.1 (18.2, 28.0)	22.1 (18.2, 28.0)
Wave 4 mean (range)	28.6 (24.5, 34.1)	28.6 (24.5, 33.9)	28.6 (24.5, 34.1)
Wave 5 mean (range)	37.7 (33.5, 44.2)	37.7 (33.5, 44.2)	37.7 (33.5, 44.2)

[1] Indicators for Disordered Eating (i.e., unhealthy weight control behaviors, binge eating, self-reported eating disorder diagnosis) and Depression (i.e., moderate-to-severe depression symptoms, self-reported depression diagnosis) were not mutually exclusive, so total counts and percentages may be less than the sum of the indicator values.

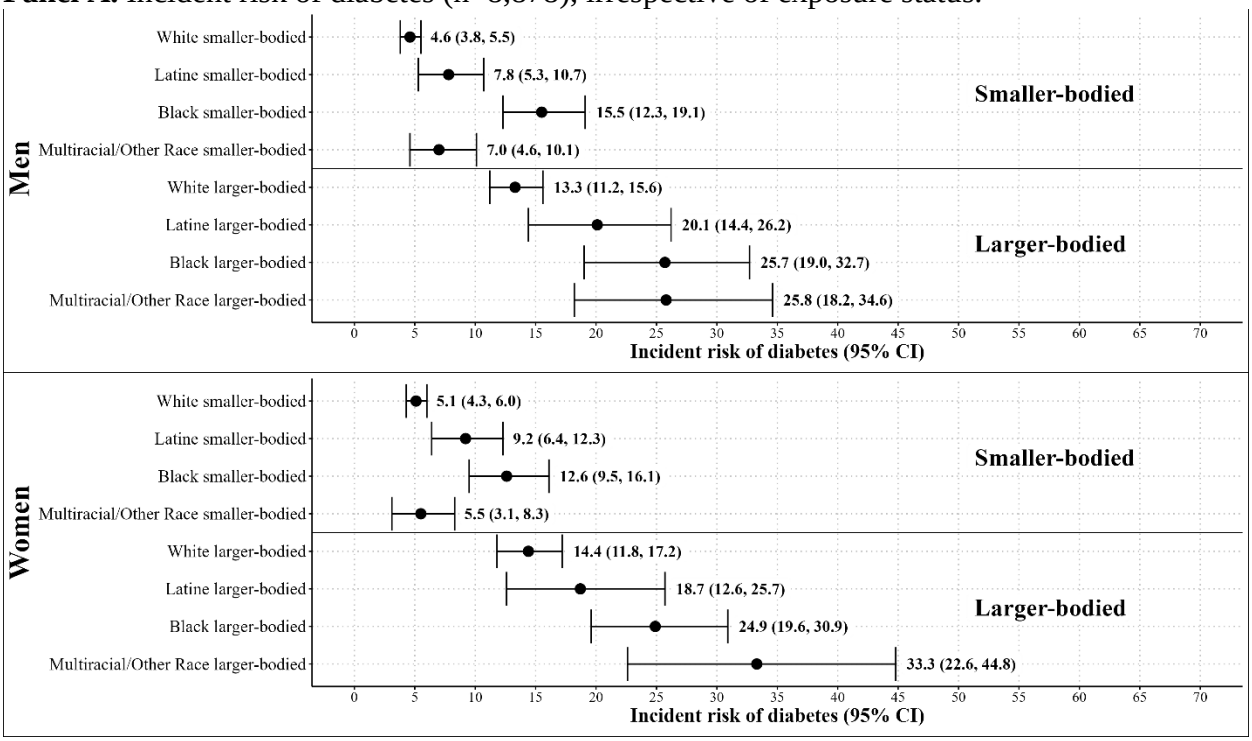
[2] Estimates represent participants who self-reported a *first* diagnosis of an eating disorder or depression at or before their age at Wave 3 (i.e., end of exposure period). Those who self-reported a *first* diagnosis after their age at Wave 3 are not included in this estimate.

[3] Depression symptoms were assessed at Waves 1-3 using 9 items from the Center for Epidemiologic Studies Depression (CESD) scale. Moderate-to-severe symptoms were identified with gender-specific CESD sum score cutoffs (men: sum score ≥ 10; women: sum score ≥ 11).

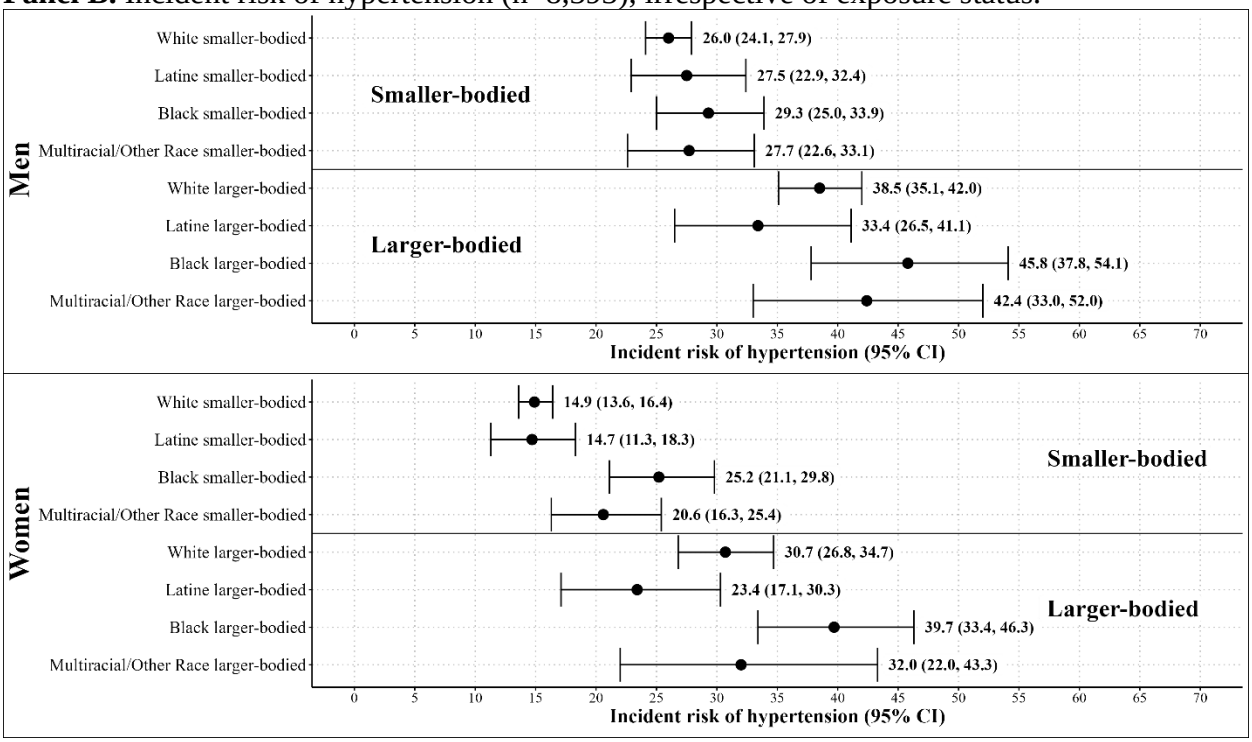
Note: SES = socioeconomic status. All percentages were weighted to account for the complex sample survey design. Neighborhood SES and household SES were estimated as latent constructs using principal component analysis (PCA). Both variables were z-transformed (mean=0; standard deviation=1) based on all available observations at Wave 1. Values were then split into three quantiles (i.e., Higher SES, Average SES, Lower SES). Neighborhood SES input variables (measured at the census tract-level at Wave 1) were the proportion of adults living below the federal poverty line, proportion of children living below the federal poverty line, proportion of households receiving public assistance or welfare, proportion of vacant homes, and unemployment rate. Household SES input variables (parent-reported at Wave 1) were parental education status, parental occupation status, annual household income, and receipt of public assistance or welfare

Figure 4.3 Incident risk of diabetes, hypertension, and hyperlipidemia from Wave 3 (2001-02) to Wave 5 (2016-18) at the intersection of race/ethnicity, gender identity, and weight status in the National Longitudinal Study of Adolescent to Adult Health.

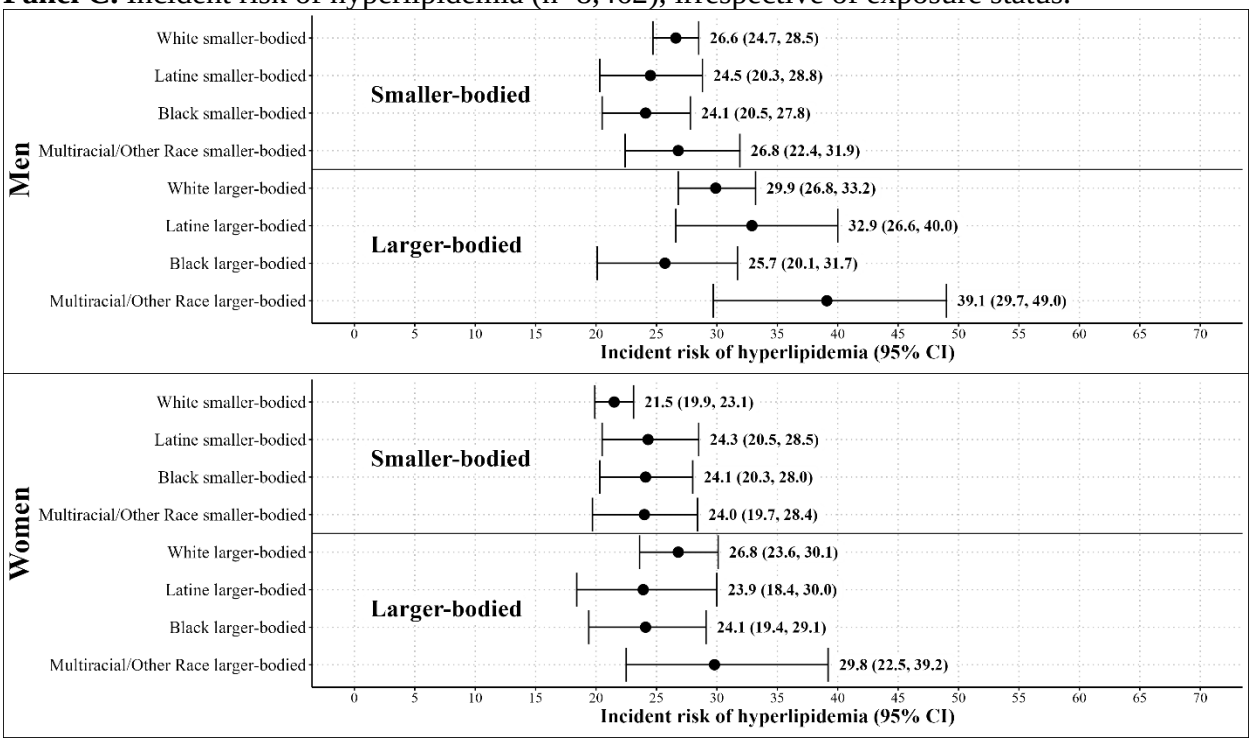
Panel A. Incident risk of diabetes (n=8,878), irrespective of exposure status.



Panel B. Incident risk of hypertension (n=8,393), irrespective of exposure status.



Panel C. Incident risk of hyperlipidemia (n=8,462), irrespective of exposure status.



Note: CI = credible interval. Incident cases of each outcome were defined as new onset cases that developed after the exposure period (Wave 1-3; ages 11-28) and at or before Wave 5 (ages 33-44). Participants who self-reported a diagnosis of the outcome at or prior to their age at Wave 3 were excluded from analysis. Diabetes was defined as (1) self-reported first diagnosis (when not pregnant) after their age at Wave 3, (2) self-reported past 4-week use of anti-diabetic medication, (3) fasting glucose ≥ 126 milligrams per deciliter (mg/dL), (4) non-fasting glucose ≥ 200 mg/dL, or (5) hemoglobin A1c (HbA1c) ≥ 6.5%. Hypertension was defined as (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hypertensive medication, or (3) measured blood pressure classified as hypertension stage 1 or 2 (i.e., systolic ≥ 140 millimeters of mercury (mmHg) or diastolic ≥ 90 mmHg). Hyperlipidemia was defined as (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hyperlipidemic medication, or (3) measured total cholesterol ≥ 240 mg. For participants aged 19 or younger at Wave 1, larger-bodied was defined as having a body mass index percentile at or above the 85th percentile for their age and sex based on CDC growth charts. For participants aged 20 or older at Wave 1, larger-bodied was defined as having a body mass index value ≥ 25.0. All other participants with non-missing weight status data were classified as smaller-bodied.

presented in Figure 4.3. Risk estimates ranged from 4.6% (White smaller-bodied men) to 33.3% (Multiracial/Other Race larger-bodied women) for diabetes, 14.7% (Latine smaller-bodied women) to 45.8% (Black larger-bodied men) for hypertension, and 21.5% (White smaller-bodied women) and 39.1% (Multiracial/Other Race larger-bodied men). Approximately 9.65% (diabetes), 13.20% (hypertension), and 6.47% (hyperlipidemia) of individual differences in outcome risk were attributable to between-group differences (Model 1 in Tables S1A-C in Appendix C), indicating small-to-moderate clustering of outcomes within intersectional groups.

I. Incident risk by exposure status and intersectional group

For each outcome, incident risk estimates by exposure status and intersectional group were obtained from Model 4 which included exposure variable random slopes (Tables 4.2A-C).

Diabetes. Compared to the "Neither" exposure level within the overall sample, individuals with "Disordered Eating only" had 21% (2.39 percentage point [pp]) increased risk of diabetes. There were no significant differences comparing "Depression only" and "Disordered Eating & Depression" (vs. "Neither") in the overall sample; however, differences were present for specific intersectional groups. For "Disordered Eating only", there was variability across RR (range=1.04–1.37) and RD (range=0.30–6.81) estimates. All group-specific "Disordered Eating only" estimates were in the same positive direction as the sample-level estimate, but none were significantly different from the null value.

For "Depression only", estimate variability was greater (RR range=0.38–2.84; RD range=-29.73, 10.98). Here, White larger-bodied women and Multiracial/Other Race smaller-bodied men had 3.80 pp (95% CI: 0.98, 7.03) and 10.98 pp (95% CI: 1.30, 25.14) higher risk, respectively, while White larger-bodied men (-9.10 pp, 95% CI: -14.90, -3.21), Black larger-bodied men (-14.23 pp, 95% CI: -28.12, -0.22), and Multiracial/Other Race larger-bodied women

Table 4.2A Incident diabetes: Risk differences (RD) and risk ratios (RR) by intersectional group in reference to the "Neither" exposure category.

			Neither (ref)	**Disordered Eating only**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8878		11.25 (9.50, 13.25)	13.64 (10.60, 17.18)	**2.39 (0.00, 5.11)**	**1.21 (1.00, 1.45)**
White smaller-bodied men	1686	2	6.19 (4.60, 8.10)	8.22 (5.14, 12.75)	2.03 (-0.54, 6.20)	1.33 (0.92, 2.02)
White larger-bodied men	609	11	18.70 (14.28, 23.78)	23.25 (16.21, 32.10)	4.55 (-1.49, 12.55)	1.25 (0.92, 1.70)
White smaller-bodied women	2346	1	5.51 (4.07, 7.24)	7.49 (4.96, 10.97)	1.98 (-0.17, 5.33)	1.37 (0.97, 2.05)
White larger-bodied women	525	9	16.86 (12.14, 22.78)	19.49 (12.32, 28.15)	2.63 (-4.15, 9.53)	1.16 (0.77, 1.61)
Black smaller-bodied men	418	10	18.28 (13.39, 24.11)	19.16 (10.33, 28.55)	0.87 (-8.50, 7.98)	1.05 (0.57, 1.44)
Black larger-bodied men	152	14	31.29 (21.19, 43.34)	38.10 (22.91, 57.87)	6.81 (-6.41, 24.31)	1.23 (0.80, 1.86)
Black smaller-bodied women	647	7	13.35 (8.94, 18.62)	17.57 (10.57, 27.71)	4.22 (-1.08, 14.05)	1.33 (0.92, 2.14)
Black larger-bodied women	317	13	29.94 (21.27, 40.27)	34.52 (23.14, 48.32)	4.59 (-6.83, 16.50)	1.17 (0.79, 1.62)
Latine smaller-bodied men	350	5	8.41 (4.88, 12.83)	10.30 (5.05, 17.89)	1.89 (-2.75, 7.88)	1.24 (0.69, 1.99)
Latine larger-bodied men	188	12	24.48 (16.35, 34.68)	25.77 (14.32, 38.99)	1.29 (-11.06, 10.92)	1.06 (0.60, 1.46)
Latine smaller-bodied women	519	6	10.68 (6.94, 15.30)	12.38 (6.73, 19.28)	1.70 (-3.43, 6.99)	1.17 (0.70, 1.70)
Latine larger-bodied women	164	8	15.74 (8.45, 24.71)	16.04 (7.02, 26.74)	0.30 (-10.11, 7.69)	1.04 (0.48, 1.55)
Multiracial/Other Race smaller-bodied men	328	3	6.75 (3.45, 10.98)	8.05 (3.56, 14.49)	1.30 (-2.52, 5.95)	1.21 (0.65, 1.93)
Multiracial/Other Race larger-bodied men	120	15	37.09 (23.88, 53.06)	41.14 (22.52, 64.17)	4.05 (-13.88, 21.57)	1.12 (0.66, 1.61)
Multiracial/Other Race smaller-bodied women	424	4	7.31 (3.93, 11.83)	8.53 (3.87, 15.03)	1.21 (-3.07, 5.53)	1.18 (0.62, 1.81)
Multiracial/Other Race larger-bodied women	85	16	47.14 (30.34, 68.06)	48.89 (27.41, 74.04)	1.75 (-23.02, 21.06)	1.05 (0.58, 1.50)
			Neither (ref)	**Depression only**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8878		11.25 (9.50, 13.25)	11.04 (8.72, 13.74)	-0.21 (-1.95, 1.71)	0.98 (0.83, 1.15)
White smaller-bodied men	1686	2	6.19 (4.60, 8.10)	6.04 (3.74, 8.93)	-0.15 (-2.71, 2.59)	0.99 (0.61, 1.46)
White larger-bodied men	609	11	18.70 (14.28, 23.78)	9.60 (5.24, 15.16)	**-9.10 (-14.90, -3.21)**	**0.52 (0.29, 0.81)**

White smaller-bodied women	2346	1	5.51 (4.07, 7.24)	9.31 (6.53, 12.73)	**3.80 (0.98, 7.03)**	**1.71 (1.16, 2.44)**
White larger-bodied women	525	9	16.86 (12.14, 22.78)	21.95 (14.36, 31.28)	5.08 (-3.37, 14.53)	1.33 (0.82, 2.00)
Black smaller-bodied men	418	10	18.28 (13.39, 24.11)	16.16 (8.92, 25.59)	-2.13 (-10.47, 7.34)	0.89 (0.48, 1.43)
Black larger-bodied men	152	14	31.29 (21.19, 43.34)	17.06 (8.11, 29.07)	**-14.23 (-28.12, -0.22)**	**0.56 (0.26, 0.99)**
Black smaller-bodied women	647	7	13.35 (8.94, 18.62)	13.04 (7.33, 20.50)	-0.31 (-7.21, 7.53)	1.00 (0.54, 1.68)
Black larger-bodied women	317	13	29.94 (21.27, 40.27)	19.88 (10.80, 31.20)	-10.06 (-22.75, 2.62)	0.68 (0.36, 1.11)
Latine smaller-bodied men	350	5	8.41 (4.88, 12.83)	9.11 (4.29, 15.70)	0.70 (-5.25, 7.45)	1.13 (0.50, 2.17)
Latine larger-bodied men	188	12	24.48 (16.35, 34.68)	18.57 (8.31, 33.49)	-5.91 (-18.60, 9.11)	0.77 (0.34, 1.44)
Latine smaller-bodied women	519	6	10.68 (6.94, 15.30)	8.87 (3.94, 15.62)	-1.81 (-8.12, 5.11)	0.85 (0.36, 1.57)
Latine larger-bodied women	164	8	15.74 (8.45, 24.71)	26.35 (12.95, 45.35)	10.61 (-4.51, 30.24)	1.79 (0.77, 3.69)
Multiracial/Other Race smaller-bodied men	328	3	6.75 (3.45, 10.98)	17.73 (8.29, 31.52)	**10.98 (1.30, 25.14)**	**2.84 (1.16, 6.10)**
Multiracial/Other Race larger-bodied men	120	15	37.09 (23.88, 53.06)	21.99 (10.55, 37.19)	-15.10 (-32.96, 3.16)	0.61 (0.28, 1.10)
Multiracial/Other Race smaller-bodied women	424	4	7.31 (3.93, 11.83)	5.84 (1.92, 11.61)	-1.47 (-6.97, 4.21)	0.84 (0.27, 1.75)
Multiracial/Other Race larger-bodied women	85	16	47.14 (30.34, 68.06)	17.41 (5.65, 33.77)	**-29.73 (-52.97, -8.85)**	**0.38 (0.12, 0.77)**
			Neither (ref)	**Disordered Eating & Depression**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8878		11.25 (9.50, 13.25)	11.43 (8.44, 15.07)	0.18 (-2.34, 3.22)	1.02 (0.79, 1.28)
White smaller-bodied men	1686	2	6.19 (4.60, 8.10)	7.06 (3.26, 13.14)	0.87 (-2.94, 6.67)	1.15 (0.55, 2.10)
White larger-bodied men	609	11	18.70 (14.28, 23.78)	14.98 (6.77, 24.88)	-3.72 (-12.64, 5.32)	0.81 (0.37, 1.29)
White smaller-bodied women	2346	1	5.51 (4.07, 7.24)	5.83 (3.47, 8.92)	0.31 (-2.17, 3.29)	1.07 (0.64, 1.65)
White larger-bodied women	525	9	16.86 (12.14, 22.78)	13.72 (8.73, 19.59)	-3.15 (-10.16, 3.13)	0.83 (0.50, 1.21)
Black smaller-bodied men	418	10	18.28 (13.39, 24.11)	16.20 (5.76, 30.20)	-2.08 (-13.15, 11.28)	0.89 (0.32, 1.64)
Black larger-bodied men	152	14	31.29 (21.19, 43.34)	39.54 (18.66, 70.60)	8.25 (-11.71, 39.38)	1.29 (0.65, 2.40)
Black smaller-bodied women	647	7	13.35 (8.94, 18.62)	14.70 (7.44, 25.42)	1.35 (-6.09, 11.81)	1.12 (0.58, 1.98)
Black larger-bodied women	317	13	29.94 (21.27, 40.27)	21.95 (11.57, 34.03)	-7.98 (-22.03, 4.71)	0.75 (0.37, 1.18)
Latine smaller-bodied men	350	5	8.41 (4.88, 12.83)	16.87 (6.65, 36.72)	8.47 (-1.24, 28.53)	2.11 (0.86, 5.16)
Latine larger-bodied men	188	12	24.48 (16.35, 34.68)	23.71 (10.35, 43.16)	-0.77 (-15.32, 17.26)	0.98 (0.44, 1.74)
Latine smaller-bodied women	519	6	10.68 (6.94, 15.30)	12.58 (6.40, 21.97)	1.90 (-4.28, 11.01)	1.20 (0.64, 2.14)

Latine larger-bodied women	164	8	15.74 (8.45, 24.71)	23.24 (11.87, 39.44)	7.50 (-4.28, 24.89)	1.57 (0.78, 3.19)
Multiracial/Other Race smaller-bodied men	328	3	6.75 (3.45, 10.98)	8.12 (2.20, 19.69)	1.37 (-4.65, 12.35)	1.23 (0.38, 3.00)
Multiracial/Other Race larger-bodied men	120	15	37.09 (23.88, 53.06)	39.31 (17.12, 74.20)	2.22 (-21.29, 34.89)	1.07 (0.49, 1.99)
Multiracial/Other Race smaller-bodied women	424	4	7.31 (3.93, 11.83)	8.80 (3.42, 18.15)	1.49 (-3.94, 10.46)	1.24 (0.52, 2.61)
Multiracial/Other Race larger-bodied women	85	16	47.14 (30.34, 68.06)	42.93 (20.29, 69.39)	-4.21 (-30.71, 22.38)	0.93 (0.44, 1.57)

Note: CI = credible interval. Estimates were obtained from Model 4 via marginal standardization. Diabetes was defined as (1) self-reported first diagnosis (when not pregnant) after their age at Wave 3, (2) self-reported past 4-week use of anti-diabetic medication, (3) fasting glucose ≥ 126 milligrams per deciliter (mg/dL), (4) non-fasting glucose ≥ 200 mg/dL, or (5) hemoglobin A1c (HbA1c) ≥ 6.5%. “Rank” is the ascending rank of intersectional groups from lowest to highest risk in the “Neither” exposure category.

Table 4.2B Incident hypertension: Risk differences (RD) and risk ratios (RR) by intersectional group in reference to the "Neither" exposure category.

			Neither (ref)	**Disordered Eating only**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8393		28.69 (26.34, 31.29)	29.89 (25.62, 34.71)	1.20 (-2.30, 5.06)	1.04 (0.92, 1.17)
White smaller-bodied men	1611	8	32.48 (28.61, 36.75)	34.45 (26.53, 43.30)	1.97 (-5.41, 10.04)	1.06 (0.84, 1.32)
White larger-bodied men	544	15	44.92 (38.99, 51.20)	51.39 (41.21, 63.17)	6.47 (-3.10, 17.83)	1.15 (0.93, 1.42)
White smaller-bodied women	2282	2	17.23 (14.74, 19.96)	16.63 (12.32, 21.34)	-0.60 (-5.08, 3.67)	0.97 (0.72, 1.22)
White larger-bodied women	477	12	36.25 (29.68, 44.12)	34.03 (24.02, 44.44)	-2.22 (-13.79, 6.84)	0.94 (0.65, 1.20)
Black smaller-bodied men	394	6	30.13 (24.78, 36.10)	27.92 (17.61, 38.38)	-2.21 (-12.79, 6.68)	0.93 (0.59, 1.23)
Black larger-bodied men	132	16	47.82 (37.35, 59.69)	54.22 (36.90, 76.89)	6.40 (-9.21, 27.56)	1.14 (0.82, 1.60)
Black smaller-bodied women	607	5	25.51 (20.24, 31.60)	27.08 (18.58, 38.10)	1.57 (-6.12, 12.00)	1.06 (0.77, 1.50)
Black larger-bodied women	280	13	40.04 (31.74, 49.69)	39.38 (27.36, 52.46)	-0.65 (-13.65, 10.95)	0.99 (0.68, 1.29)
Latine smaller-bodied men	332	7	31.42 (24.70, 38.78)	40.98 (26.95, 61.49)	9.56 (-2.87, 30.90)	1.31 (0.91, 2.06)
Latine larger-bodied men	163	11	35.09 (26.37, 45.02)	31.96 (19.08, 45.55)	-3.13 (-16.97, 7.80)	0.92 (0.55, 1.23)
Latine smaller-bodied women	508	1	15.47 (11.24, 20.22)	15.01 (8.63, 22.33)	-0.45 (-6.67, 5.86)	0.98 (0.59, 1.41)
Latine larger-bodied women	157	3	21.98 (14.53, 30.51)	20.00 (10.61, 30.39)	-1.98 (-11.62, 5.67)	0.92 (0.52, 1.28)
Multiracial/Other Race smaller-bodied men	312	10	34.48 (27.05, 42.74)	32.87 (20.55, 45.39)	-1.62 (-14.51, 8.57)	0.96 (0.60, 1.26)
Multiracial/Other Race larger-bodied men	106	14	43.52 (31.80, 56.52)	43.95 (25.81, 64.79)	0.43 (-16.43, 18.36)	1.01 (0.64, 1.44)
Multiracial/Other Race smaller-bodied women	414	4	23.89 (18.03, 30.70)	28.66 (18.95, 43.19)	4.77 (-3.34, 19.51)	1.21 (0.87, 1.89)
Multiracial/Other Race larger-bodied women	74	9	33.25 (21.51, 46.70)	36.76 (21.06, 57.85)	3.51 (-8.89, 22.29)	1.12 (0.74, 1.73)
			Neither (ref)	**Depression only**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8393		28.69 (26.34, 31.29)	33.95 (30.19, 38.09)	**5.26 (2.27, 8.48)**	**1.18 (1.08, 1.30)**
White smaller-bodied men	1611	8	32.48 (28.61, 36.75)	33.82 (28.18, 39.97)	1.34 (-4.21, 7.17)	1.04 (0.88, 1.23)
White larger-bodied men	544	15	44.92 (38.99, 51.20)	52.50 (42.41, 63.45)	7.59 (-2.49, 18.13)	1.17 (0.95, 1.42)

White smaller-bodied women	2282	2	17.23 (14.74, 19.96)	23.42 (19.17, 28.20)	**6.19 (1.76, 10.90)**	**1.36 (1.10, 1.67)**
White larger-bodied women	477	12	36.25 (29.68, 44.12)	37.15 (27.25, 47.51)	0.90 (-10.69, 11.68)	1.03 (0.73, 1.35)
Black smaller-bodied men	394	6	30.13 (24.78, 36.10)	48.32 (35.78, 62.29)	**18.19 (5.70, 32.20)**	**1.61 (1.18, 2.15)**
Black larger-bodied men	132	16	47.82 (37.35, 59.69)	50.89 (36.50, 66.60)	3.07 (-13.50, 19.23)	1.07 (0.75, 1.45)
Black smaller-bodied women	607	5	25.51 (20.24, 31.60)	33.50 (24.27, 44.28)	7.99 (-1.50, 18.68)	1.32 (0.94, 1.79)
Black larger-bodied women	280	13	40.04 (31.74, 49.69)	50.40 (36.27, 65.56)	10.36 (-4.07, 25.89)	1.27 (0.90, 1.72)
Latine smaller-bodied men	332	7	31.42 (24.70, 38.78)	26.47 (17.58, 36.45)	-4.94 (-15.73, 5.86)	0.85 (0.55, 1.20)
Latine larger-bodied men	163	11	35.09 (26.37, 45.02)	55.59 (37.51, 76.65)	**20.49 (3.32, 41.54)**	**1.60 (1.09, 2.33)**
Latine smaller-bodied women	508	1	15.47 (11.24, 20.22)	20.09 (12.48, 29.62)	4.62 (-2.87, 13.77)	1.31 (0.83, 1.99)
Latine larger-bodied women	157	3	21.98 (14.53, 30.51)	36.21 (22.00, 53.98)	**14.23 (1.22, 32.27)**	**1.69 (1.05, 2.77)**
Multiracial/Other Race smaller-bodied men	312	10	34.48 (27.05, 42.74)	36.19 (24.30, 49.52)	1.70 (-11.26, 14.21)	1.06 (0.70, 1.44)
Multiracial/Other Race larger-bodied men	106	14	43.52 (31.80, 56.52)	67.66 (48.31, 88.06)	**24.14 (4.21, 46.86)**	**1.58 (1.08, 2.30)**
Multiracial/Other Race smaller-bodied women	414	4	23.89 (18.03, 30.70)	24.76 (15.93, 35.35)	0.87 (-8.70, 10.83)	1.05 (0.66, 1.49)
Multiracial/Other Race larger-bodied women	74	9	33.25 (21.51, 46.70)	44.11 (25.14, 68.14)	10.86 (-6.11, 34.17)	1.35 (0.83, 2.19)
			Neither (ref)	**Disordered Eating & Depression**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8393		28.69 (26.34, 31.29)	41.45 (35.67, 47.73)	**12.76 (7.72, 18.19)**	**1.45 (1.27, 1.63)**
White smaller-bodied men	1611	8	32.48 (28.61, 36.75)	52.48 (40.75, 66.82)	**20.00 (9.04, 33.75)**	**1.62 (1.28, 2.06)**
White larger-bodied men	544	15	44.92 (38.99, 51.20)	60.77 (44.76, 77.12)	**15.85 (0.21, 31.20)**	**1.36 (1.00, 1.72)**
White smaller-bodied women	2282	2	17.23 (14.74, 19.96)	23.35 (18.15, 28.82)	**6.12 (0.89, 11.43)**	**1.36 (1.05, 1.70)**
White larger-bodied women	477	12	36.25 (29.68, 44.12)	44.12 (34.68, 53.97)	7.87 (-3.48, 17.96)	1.23 (0.91, 1.54)
Black smaller-bodied men	394	6	30.13 (24.78, 36.10)	40.25 (23.68, 60.66)	10.12 (-6.39, 29.36)	1.34 (0.80, 1.96)
Black larger-bodied men	132	16	47.82 (37.35, 59.69)	61.51 (38.39, 83.96)	13.69 (-10.18, 34.31)	1.29 (0.80, 1.76)
Black smaller-bodied women	607	5	25.51 (20.24, 31.60)	33.62 (22.28, 45.76)	8.11 (-3.37, 19.56)	1.33 (0.87, 1.82)
Black larger-bodied women	280	13	40.04 (31.74, 49.69)	50.52 (35.66, 65.54)	10.49 (-5.73, 24.92)	1.27 (0.87, 1.68)
Latine smaller-bodied men	332	7	31.42 (24.70, 38.78)	60.55 (39.28, 87.31)	**29.13 (9.02, 56.84)**	**1.95 (1.28, 2.98)**
Latine larger-bodied men	163	11	35.09 (26.37, 45.02)	42.76 (24.08, 62.01)	7.67 (-11.96, 25.11)	1.23 (0.68, 1.75)
Latine smaller-bodied women	508	1	15.47 (11.24, 20.22)	24.10 (15.52, 36.01)	**8.63 (0.70, 19.98)**	**1.58 (1.04, 2.42)**

Latine larger-bodied women	157	3	21.98 (14.53, 30.51)	32.61 (20.65, 47.25)	10.63 (-0.17, 24.94)	1.51 (0.99, 2.36)
Multiracial/Other Race smaller-bodied men	312	10	34.48 (27.05, 42.74)	47.63 (28.39, 71.63)	13.14 (-5.87, 35.59)	1.39 (0.83, 2.04)
Multiracial/Other Race larger-bodied men	106	14	43.52 (31.80, 56.52)	63.01 (37.06, 95.97)	19.49 (-4.12, 51.35)	1.46 (0.91, 2.26)
Multiracial/Other Race smaller-bodied women	414	4	23.89 (18.03, 30.70)	34.71 (22.81, 48.87)	10.82 (-0.63, 24.25)	1.47 (0.98, 2.11)
Multiracial/Other Race larger-bodied women	74	9	33.25 (21.51, 46.70)	57.93 (32.82, 94.21)	**24.68 (4.70, 61.05)**	**1.78 (1.14, 3.16)**

Note: CI = credible interval. Estimates were obtained from Model 4 via marginal standardization. Hypertension was defined as (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hypertensive medication, or (3) measured blood pressure classified as hypertension stage 1 or 2 (i.e., systolic ≥ 140 millimeters of mercury (mmHg) or diastolic ≥ 90 mmHg). Hyperlipidemia was defined as (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hyperlipidemic medication, or (3) measured total cholesterol ≥ 240 mg. "Rank" is the ascending rank of intersectional groups from lowest to highest risk in the "Neither" exposure category.

Table 4.2C Incident hyperlipidemia: Risk differences (RD) and risk ratios (RR) by intersectional group in reference to the "Neither" exposure category.

			Neither (ref)	**Disordered Eating only**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8462		26.65 (24.44, 28.91)	24.64 (20.90, 28.73)	-2.01 (-5.09, 1.32)	0.92 (0.81, 1.05)
White smaller-bodied men	1618	11	29.03 (25.43, 32.69)	26.57 (20.13, 33.82)	-2.46 (-8.66, 4.34)	0.92 (0.71, 1.15)
White larger-bodied men	560	14	31.99 (27.52, 36.82)	27.22 (19.93, 34.84)	-4.77 (-12.69, 2.43)	0.85 (0.62, 1.08)
White smaller-bodied women	2260	2	23.18 (20.35, 26.16)	21.06 (16.46, 25.98)	-2.11 (-6.83, 2.53)	0.91 (0.71, 1.11)
White larger-bodied women	491	10	27.27 (22.47, 32.46)	25.01 (17.65, 33.26)	-2.25 (-10.16, 5.93)	0.92 (0.65, 1.23)
Black smaller-bodied men	404	8	24.64 (20.26, 29.40)	23.63 (15.80, 33.40)	-1.01 (-8.87, 8.68)	0.96 (0.65, 1.37)
Black larger-bodied men	147	9	25.33 (18.72, 32.62)	26.31 (16.57, 41.37)	0.98 (-8.52, 16.10)	1.05 (0.69, 1.68)
Black smaller-bodied women	617	3	23.54 (18.67, 28.62)	25.21 (17.15, 37.21)	1.67 (-5.84, 14.37)	1.08 (0.76, 1.66)
Black larger-bodied women	301	7	24.41 (18.67, 30.76)	22.68 (14.98, 31.75)	-1.73 (-10.52, 7.66)	0.94 (0.61, 1.35)
Latine smaller-bodied men	331	5	23.95 (18.85, 29.33)	24.73 (16.06, 37.76)	0.78 (-7.34, 13.68)	1.04 (0.70, 1.60)
Latine larger-bodied men	168	15	39.43 (30.05, 50.34)	26.80 (11.93, 40.90)	-12.62 (-31.78, 1.08)	0.69 (0.29, 1.03)
Latine smaller-bodied women	498	1	22.63 (17.69, 27.84)	24.49 (16.67, 36.00)	1.86 (-5.55, 13.87)	1.09 (0.77, 1.68)
Latine larger-bodied women	155	4	23.55 (16.61, 31.29)	21.76 (13.10, 31.92)	-1.78 (-11.02, 7.97)	0.93 (0.58, 1.39)
Multiracial/Other Race smaller-bodied men	319	12	29.43 (23.49, 36.41)	27.30 (17.51, 38.96)	-2.13 (-12.73, 9.49)	0.93 (0.60, 1.35)
Multiracial/Other Race larger-bodied men	104	16	41.83 (30.61, 55.14)	46.20 (27.73, 76.32)	4.37 (-12.99, 35.60)	1.12 (0.70, 1.94)
Multiracial/Other Race smaller-bodied women	411	6	24.23 (18.68, 30.15)	23.62 (15.61, 34.14)	-0.61 (-8.60, 9.77)	0.98 (0.67, 1.44)
Multiracial/Other Race larger-bodied women	78	13	31.85 (22.37, 43.94)	25.28 (12.08, 39.34)	-6.57 (-23.66, 5.28)	0.80 (0.36, 1.18)
			Neither (ref)	**Depression only**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8462		26.65 (24.44, 28.91)	31.57 (28.01, 35.34)	**4.92 (2.24, 7.80)**	**1.18 (1.08, 1.29)**
White smaller-bodied men	1618	11	29.03 (25.43, 32.69)	35.80 (30.58, 41.45)	**6.77 (2.46, 12.00)**	**1.24 (1.08, 1.43)**

White larger-bodied men	560	14	31.99 (27.52, 36.82)	38.49 (31.26, 46.56)	**6.51 (0.34, 13.90)**	**1.21 (1.01, 1.46)**
White smaller-bodied women	2260	2	23.18 (20.35, 26.16)	27.45 (23.46, 31.93)	**4.27 (0.67, 8.08)**	**1.19 (1.03, 1.37)**
White larger-bodied women	491	10	27.27 (22.47, 32.46)	30.07 (22.89, 37.17)	2.80 (-4.68, 8.11)	1.11 (0.84, 1.31)
Black smaller-bodied men	404	8	24.64 (20.26, 29.40)	29.62 (22.97, 37.44)	4.98 (-0.64, 11.91)	1.20 (0.97, 1.51)
Black larger-bodied men	147	9	25.33 (18.72, 32.62)	27.42 (18.10, 36.87)	2.08 (-7.59, 8.03)	1.09 (0.72, 1.32)
Black smaller-bodied women	617	3	23.54 (18.67, 28.62)	26.92 (20.22, 33.85)	3.38 (-2.98, 8.56)	1.15 (0.88, 1.38)
Black larger-bodied women	301	7	24.41 (18.67, 30.76)	28.23 (20.39, 36.72)	3.82 (-2.69, 9.68)	1.16 (0.89, 1.43)
Latine smaller-bodied men	331	5	23.95 (18.85, 29.33)	29.39 (22.61, 37.45)	**5.44 (0.17, 13.30)**	**1.23 (1.01, 1.60)**
Latine larger-bodied men	168	15	39.43 (30.05, 50.34)	45.07 (32.06, 59.48)	5.65 (-6.93, 16.75)	1.15 (0.84, 1.45)
Latine smaller-bodied women	498	1	22.63 (17.69, 27.84)	26.37 (19.53, 33.96)	3.74 (-2.23, 9.52)	1.17 (0.91, 1.44)
Latine larger-bodied women	155	4	23.55 (16.61, 31.29)	26.88 (17.85, 37.18)	3.34 (-3.95, 9.65)	1.15 (0.84, 1.43)
Multiracial/Other Race smaller-bodied men	319	12	29.43 (23.49, 36.41)	32.15 (22.98, 41.50)	2.72 (-6.97, 9.19)	1.10 (0.78, 1.32)
Multiracial/Other Race larger-bodied men	104	16	41.83 (30.61, 55.14)	47.37 (33.22, 62.32)	5.53 (-8.39, 16.71)	1.14 (0.82, 1.44)
Multiracial/Other Race smaller-bodied women	411	6	24.23 (18.68, 30.15)	27.83 (20.65, 35.83)	3.61 (-3.00, 9.21)	1.15 (0.88, 1.40)
Multiracial/Other Race larger-bodied women	78	13	31.85 (22.37, 43.94)	36.54 (24.36, 51.76)	4.69 (-5.28, 13.82)	1.15 (0.84, 1.45)
			Neither (ref)	**Disordered Eating & Depression**		
Intersectional group	**N**	**Rank**	**Risk (95% CI)**	**Risk (95% CI)**	**RD (95% CI)**	**RR (95% CI)**
Overall sample	8462		26.65 (24.44, 28.91)	33.67 (28.65, 39.18)	**7.02 (2.73, 11.58)**	**1.26 (1.10, 1.44)**
White smaller-bodied men	1618	11	29.03 (25.43, 32.69)	28.87 (19.31, 39.46)	-0.15 (-9.62, 10.16)	1.00 (0.67, 1.36)
White larger-bodied men	560	14	31.99 (27.52, 36.82)	52.77 (36.27, 71.51)	**20.78 (4.39, 39.24)**	**1.66 (1.13, 2.27)**
White smaller-bodied women	2260	2	23.18 (20.35, 26.16)	26.40 (20.98, 32.20)	3.22 (-2.25, 8.94)	1.14 (0.91, 1.40)
White larger-bodied women	491	10	27.27 (22.47, 32.46)	35.52 (27.81, 43.85)	8.26 (-0.78, 17.45)	1.31 (0.97, 1.70)
Black smaller-bodied men	404	8	24.64 (20.26, 29.40)	41.75 (23.62, 68.35)	17.10 (-0.73, 44.18)	1.71 (0.97, 2.87)
Black larger-bodied men	147	9	25.33 (18.72, 32.62)	43.35 (24.64, 71.02)	18.02 (-0.88, 45.55)	1.74 (0.97, 2.95)
Black smaller-bodied women	617	3	23.54 (18.67, 28.62)	32.34 (21.04, 45.57)	8.80 (-3.21, 22.26)	1.39 (0.87, 2.03)
Black larger-bodied women	301	7	24.41 (18.67, 30.76)	29.21 (18.23, 41.47)	4.80 (-7.32, 17.68)	1.21 (0.72, 1.81)
Latine smaller-bodied men	331	5	23.95 (18.85, 29.33)	44.61 (26.86, 68.05)	**20.66 (3.01, 44.17)**	**1.88 (1.12, 2.97)**
Latine larger-bodied men	168	15	39.43 (30.05, 50.34)	27.20 (9.75, 46.98)	-12.23 (-33.74, 9.63)	0.70 (0.24, 1.27)

Latine smaller-bodied women	498	1	22.63 (17.69, 27.84)	39.83 (27.37, 54.57)	**17.20 (4.30, 32.40)**	**1.78 (1.18, 2.57)**
Latine larger-bodied women	155	4	23.55 (16.61, 31.29)	31.45 (19.14, 45.88)	7.91 (-5.85, 23.24)	1.36 (0.78, 2.16)
Multiracial/Other Race smaller-bodied men	319	12	29.43 (23.49, 36.41)	39.26 (20.44, 64.89)	9.83 (-9.39, 35.51)	1.34 (0.69, 2.24)
Multiracial/Other Race larger-bodied men	104	16	41.83 (30.61, 55.14)	44.09 (19.97, 73.78)	2.25 (-25.00, 31.42)	1.07 (0.46, 1.84)
Multiracial/Other Race smaller-bodied women	411	6	24.23 (18.68, 30.15)	37.59 (24.39, 53.93)	13.36 (-0.32, 29.75)	1.57 (0.99, 2.37)
Multiracial/Other Race larger-bodied women	78	13	31.85 (22.37, 43.94)	38.68 (19.58, 64.22)	6.82 (-15.50, 32.60)	1.24 (0.58, 2.17)

Note: CI = credible interval. Estimates were obtained from Model 4 via marginal standardization. Hyperlipidemia was defined as (1) self-reported first diagnosis after their age at Wave 3, (2) self-reported past 4-week use of anti-hyperlipidemic medication, or (3) measured total cholesterol ≥ 240 mg. "Rank" is the ascending rank of intersectional groups from lowest to highest risk in the "Neither" exposure category.

(-29.73 pp, 95% CI: -52.97, -8.85) had decreased risk, respectively. All group-specific RR and RD estimates were non-significant for "Disordered Eating & Depression"; however, there was considerable estimate variability (RR range=0.75–2.11; RD range=-7.98, 8.47).

Hypertension. Compared to the "Neither" exposure level within the overall sample, individuals with "Depression only" and "Disordered Eating & Depression" had 18% (5.26 pp) and 45% (12.76 pp) increased risk of hypertension, respectively. Sample-level (RR=1.04; RD=1.20) and group-specific (RR range=0.92–1.31; RD range=-3.13, 6.47) estimates were non-significant for the "Disordered Eating only" exposure.

For the "Depression only" exposure level, the following groups had evidence of increased hypertension risk: White smaller-bodied women (RD=6.19, 95% CI: 1.76–10.90), Black smaller-bodied men (RD=18.19, 95% CI: 5.70–32.20) Latine larger-bodied men (RD=20.49, 95% CI: 3.32–18.47), Latine larger-bodied women (RD=14.23, 95% CI: 1.22–32.27), and Multiracial/Other Race larger-bodied men (RD=24.14, 95% CI: 4.21–46.86).

For "Disordered Eating & Depression", the following groups had evidence of increased hypertension risk: White smaller-bodied men (RD=20.00, 95% CI: 9.04–33.75), White larger-bodied men (RD=15.85, 95% CI: 0.21–31.20), White smaller-bodied women (RD=6.12, 95% CI: 0.89–11.43), Latine smaller-bodied men (RD=29.13, 95% CI: 9.02–56.84), Latine smaller-bodied women (RD=8.63, 95% CI: 0.70–19.98), and Multiracial/Other Race larger-bodied women (RD=24.68, 95% CI: 4.70–61.05).

Hyperlipidemia. Compared to the "Neither" exposure level within the overall sample, individuals with "Depression only" and "Disordered Eating & Depression", respectively, had 18% (4.92 pp) and 26% (7.02 pp) increased risk of hyperlipidemia. Those with "Disordered

Eating only" had 8% (-2.01 pp) decreased risk of hyperlipidemia; however, these estimates were non-significant (RR 95% CI: 0.81–1.05; RD 95% CI: -5.09, 1.32).

Although all group-specific estimates were non-significant for "Disordered Eating only", there was heterogeneity across groups in terms of effect size and direction (RR range=0.69–1.08; RD range=-12.62, 4.37). For "Depression only", White smaller-bodied men (RD=6.77, 95% CI: 2.46–12.00), White larger-bodied men (RD=6.51, 95% CI: 0.34–13.90), White smaller-bodied women (RD=4.27, 95% CI: 0.67–8.08), and Latine larger-bodied men (RD=5.44, 95% CI: 0.17–13.30) had increased risk. All other group-specific estimates (RR range=1.09–1.24; RD range=2.08–6.77) were non-significant, positive, and had limited variability around the sample-level estimates. For "Disordered Eating & Depression", increased risk was found among White larger-bodied men (RD=20.78, 95% CI: 4.39–39.24), Latine larger-bodied men (RD=20.66, 95% CI: 3.01–44.17), and Latine smaller-bodied women (RD=17.20, 95% CI: 4.30–32.40). All other group-specific estimates (RR range=0.70–1.88; RD range=-12.23, 20.78) were non-significant and, with the exception of White smaller-bodied men and Latine larger-bodied men, indicated a positive association.

II. Higher (lower) than expected risk in each intersectional group compared to the exposure variable main effects

Results from Model 4 indicated that some groups experienced higher, or lower, than expected total risk of the outcomes relative to the risk predicted from the exposure variable main effects (i.e., sample-level average association) (Table 3). The total risk of each outcome included the exposure variable random slopes, which allowed associations between exposures and outcomes to vary across intersectional groups. For diabetes in the "Depression only" exposure level, White smaller-bodied women and Multiracial/Other Race smaller-bodied men,

Table 4.3 Higher and lower than expected risk of cardiometabolic health outcomes by intersectional group and exposure status.

Intersectional group	Diabetes Disordered Eating, pp diff. (95% CI)	Depression, pp diff. (95% CI)	Disordered Eating & Depression, pp diff. (95% CI)
White smaller-bodied men	1.02 (-1.34, 5.19)	0.52 (-2.98, 3.45)	0.52 (-3.84, 5.83)
White larger-bodied men	1.51 (-5.12, 10.38)	-7.10 (-17.52, 0.17)	-4.79 (-16.81, 4.12)
White smaller-bodied women	1.08 (-0.90, 4.60)	**4.39 (1.20, 7.67)**	0.00 (-3.26, 2.95)
White larger-bodied women	-0.09 (-7.08, 7.01)	6.90 (-2.91, 16.66)	-4.08 (-14.62, 2.77)
Black smaller-bodied men	-2.10 (-11.52, 4.05)	-0.17 (-10.86, 10.09)	-3.12 (-16.46, 9.17)
Black larger-bodied men	1.75 (-11.30, 19.84)	-10.84 (-30.26, 3.93)	6.54 (-14.62, 36.25)
Black smaller-bodied women	2.06 (-2.89, 11.98)	1.14 (-7.19, 8.90)	0.63 (-7.84, 10.64)
Black larger-bodied women	-0.23 (-12.72, 12.94)	-6.83 (-24.06, 7.30)	-9.64 (-29.39, 3.24)
Latine smaller-bodied men	0.53 (-3.51, 6.21)	1.63 (-4.65, 8.11)	8.02 (-0.76, 27.49)
Latine larger-bodied men	-2.64 (-15.07, 5.86)	-3.28 (-18.86, 11.76)	-2.14 (-18.97, 15.26)
Latine smaller-bodied women	-0.02 (-4.84, 5.11)	-0.65 (-7.85, 6.05)	1.32 (-5.49, 9.84)
Latine larger-bodied women	-2.20 (-12.19, 3.92)	12.35 (-2.47, 31.29)	6.73 (-4.52, 23.32)
Multiracial/Other Race smaller-bodied men	0.21 (-3.28, 4.54)	**11.73 (2.37, 25.55)**	1.00 (-5.12, 11.49)
Multiracial/Other Race larger-bodied men	-1.94 (-20.08, 15.11)	-11.06 (-34.00, 7.63)	0.21 (-25.43, 31.19)
Multiracial/Other Race smaller-bodied women	0.04 (-4.02, 4.10)	-0.67 (-6.73, 4.76)	1.09 (-4.84, 9.52)
Multiracial/Other Race larger-bodied women	-5.80 (-32.71, 12.90)	**-24.67 (-58.04, -3.22)**	-6.77 (-39.29, 19.76)
Intersectional group	**Hypertension** **Disordered Eating, pp diff. (95% CI)**	**Depression, pp diff. (95% CI)**	**Disordered Eating & Depression, pp diff. (95% CI)**
White smaller-bodied men	1.19 (-6.92, 10.06)	-6.35 (-17.01, 2.14)	6.49 (-5.04, 21.87)
White larger-bodied men	5.41 (-4.61, 18.67)	-3.03 (-18.17, 10.14)	-2.82 (-22.65, 14.34)
White smaller-bodied women	-1.01 (-5.75, 3.39)	2.13 (-3.73, 7.54)	-1.04 (-8.29, 4.89)
White larger-bodied women	-3.06 (-15.39, 6.06)	-7.67 (-23.87, 4.63)	-7.17 (-24.85, 4.57)
Black smaller-bodied men	-2.90 (-13.49, 5.52)	11.08 (-2.04, 25.41)	-2.40 (-19.24, 14.59)
Black larger-bodied men	5.27 (-10.28, 27.06)	-8.20 (-29.96, 9.58)	-6.18 (-34.73, 15.41)
Black smaller-bodied women	0.97 (-6.86, 11.53)	1.98 (-9.01, 13.08)	-2.49 (-16.20, 8.86)
Black larger-bodied women	-1.57 (-14.73, 9.68)	0.94 (-15.85, 18.02)	-6.10 (-26.85, 9.22)
Latine smaller-bodied men	8.83 (-2.77, 30.37)	**-12.37 (-27.23, -0.52)**	16.09 (-3.18, 44.84)
Latine larger-bodied men	-3.93 (-17.82, 6.18)	12.25 (-5.46, 33.61)	-6.89 (-28.69, 9.65)
Latine smaller-bodied women	-0.81 (-6.89, 5.18)	0.99 (-7.06, 10.10)	2.23 (-6.29, 13.32)
Latine larger-bodied women	-2.47 (-11.49, 4.69)	9.09 (-4.43, 27.17)	1.55 (-10.47, 16.32)
Multiracial/Other Race smaller-bodied men	-2.42 (-15.54, 7.55)	-6.44 (-23.16, 6.85)	-1.18 (-21.38, 20.20)
Multiracial/Other Race larger-bodied men	-0.56 (-16.64, 17.16)	13.94 (-6.99, 37.65)	1.46 (-23.61, 32.13)
Multiracial/Other Race smaller-bodied women	4.22 (-3.59, 18.96)	-4.76 (-16.73, 5.41)	0.91 (-12.33, 14.46)

Multiracial/Other Race larger-bodied women	2.75 (-9.04, 20.70)	3.05 (-15.48, 26.10)	10.94 (-8.77, 47.67)
		Hyperlipidemia	
Intersectional group	**Disordered Eating, pp diff. (95% CI)**	**Depression, pp diff. (95% CI)**	**Disordered Eating & Depression, pp diff. (95% CI)**
White smaller-bodied men	-0.39 (-8.07, 7.10)	2.25 (-2.04, 8.99)	-9.24 (-23.74, 2.85)
White larger-bodied men	-2.48 (-11.99, 4.65)	1.54 (-4.16, 9.80)	10.78 (-7.11, 30.85)
White smaller-bodied women	-0.46 (-6.61, 4.92)	0.67 (-2.98, 5.25)	-4.02 (-14.32, 4.40)
White larger-bodied women	-0.29 (-8.39, 7.94)	-1.41 (-8.47, 3.15)	-0.24 (-13.58, 11.66)
Black smaller-bodied men	0.75 (-7.20, 10.18)	1.15 (-3.80, 8.60)	9.41 (-8.72, 36.42)
Black larger-bodied men	2.81 (-6.01, 17.18)	-1.82 (-10.80, 3.33)	10.15 (-9.73, 38.04)
Black smaller-bodied women	3.36 (-3.80, 16.09)	-0.26 (-6.11, 5.00)	1.47 (-12.89, 15.72)
Black larger-bodied women	0.03 (-8.56, 9.28)	0.04 (-5.79, 6.23)	-2.78 (-17.38, 11.14)
Latine smaller-bodied men	2.50 (-5.40, 14.97)	1.72 (-3.00, 10.28)	13.19 (-4.79, 37.34)
Latine larger-bodied men	-9.79 (-29.97, 2.44)	-0.46 (-12.63, 10.75)	**-24.50 (-52.37, -1.08)**
Latine smaller-bodied women	3.48 (-3.44, 15.14)	0.23 (-5.06, 6.23)	10.14 (-3.74, 26.36)
Latine larger-bodied women	-0.08 (-9.34, 9.19)	-0.31 (-6.76, 5.98)	0.61 (-15.09, 16.52)
Multiracial/Other Race smaller-bodied men	-0.01 (-10.35, 11.53)	-1.82 (-10.68, 3.83)	0.67 (-20.16, 25.78)
Multiracial/Other Race larger-bodied men	7.37 (-9.58, 38.24)	-0.92 (-14.56, 10.81)	-10.76 (-41.51, 18.74)
Multiracial/Other Race smaller-bodied women	1.14 (-6.77, 11.04)	-0.14 (-5.99, 5.45)	5.82 (-9.38, 22.96)
Multiracial/Other Race larger-bodied women	-4.26 (-20.68, 6.09)	-0.24 (-9.66, 8.73)	-3.06 (-28.41, 22.78)

Note: pp diff. = percentage point difference. CI = credible interval. Estimates were obtained from Model 4 for each outcome. All values are percentage point differences in reference the predicted risk based on the main effects of each exposure level (i.e., total predicted risk minus the predicted risk calculated from the exposure variable main effects). The total predicted risk includes the random slopes, which allows the association between the exposure and outcome to vary across intersectional groups. Positive (negative) values indicate higher (lower) than expected risk of the outcome.

respectively, had 4.39 pp (95% CI: 1.20–7.67) and 11.73 pp (95% CI: 2.37–25.55) higher-than-expected risk. Conversely, Multiracial/Other Race larger-bodied women had -24.67 pp (95% CI: -58.04, -3.22) lower-than-expected risk of diabetes. For hypertension in the "Depression only" exposure level, Latine smaller-bodied men had -12.37 pp (95% CI: -27.23, -0.52) lower-than-expected risk. Lastly, for hyperlipidemia in the "Disordered Eating & Depression" exposure level, Latine larger-bodied men had -24.50 pp (95% CI: -52.37, -1.08) lower-than-expected risk. All other estimates were non-significant at a 95% CI level.

III. Social position main effects

Model 5 evaluated the degree to which the main effects of social position variables that were used to construct intersectional groups explained between-group differences in each outcome by exposure level (Supplementary Tables S1A-C in Appendix C). Relative to Model 4, the percentage of between-group differences explained by social position main effects varied considerably. For diabetes, Model 4 VPCs indicated slightly smaller between-group differences present in the "Neither" exposure level (10.28% vs. 12.62–15.73%). The social position main effects explained the smallest amount of between-group differences in the "Depression only" exposure level (PCV=-22.21% vs. -69.22% ["Neither"], -56.29% ["Disordered Eating only"], -48.25% ["Disordered Eating & Depression]).

Similarly, for hypertension, between-group differences were smaller in the "Neither" exposure level compared to other levels (14.01% vs. 21.10–23.08%). Again, social position main effects explained a greater proportion of between-group differences in the "Neither" exposure (PCV=-68.12%) vs. the other exposure levels (PCVs=-42.18% to -54.66%). Finally, for hyperlipidemia, a similar pattern emerged where between-group differences were smallest for the "Neither" exposure level (8.23% vs. 11.73–19.24%), with social position main effects explaining

a larger amount of between-group differences in the "Neither" exposure (PCV=-64.32% vs. PCVs=-31.58% to -41.50%).

Discussion

Grounded in an intersectional framework[49,88,89,92] and using the intersectional MAIHDA approach,[61–63] I utilized data from a US nationally representative longitudinal cohort study to (1) uncover substantial inequities in the development of new-onset cases of diabetes, hypertension, hyperlipidemia, (2) estimate whether disordered eating, depression, and their comorbidity predicted incident risk of each outcome, and (3) assess whether one's position within interlocking systems of oppression moderated these associations.

Using an intercategorical approach,[93] I defined 16 mutually-exclusive intersectional groups by race/ethnicity, gender identity, and weight status, which served as proxy measures for racism, sexism, and fatphobia. For each cardiometabolic health outcome, incident risk estimates varied widely from 4.6–33.3% for diabetes (sample mean=9.3%), from 14.7–45.8% for hypertension (sample mean=24.9%), and from 21.5–39.1% for hyperlipidemia (sample mean=25.2%). While groups with larger-bodied participants generally had elevated risk of each outcome, there were substantial inequities when considering the intersection of weight status with race/ethnicity and gender identity. For instance, when stratified by weight status, hypertension risk estimates for each group ranged from 14.7% to 29.3% among smaller-bodied people and from 23.4% to 45.8% among larger-bodied people. Intersectional inequities were most pronounced in models of incident diabetes and incident hypertension, which indicated moderate clustering of these outcomes within intersectional groups. Between-group differences were present but relatively smaller for incident hyperlipidemia. Findings suggest that considering the intersection of race/ethnicity, gender identity, and weight status provides meaningful insight

into how cardiometabolic health risk, particularly risk of diabetes and hypertension, are socially patterned across the US population.

This study provides some of the strongest evidence to date of a longitudinal association from disordered eating, depression, and their comorbidity during adolescence and young adulthood (ages 11-26) to the incident risk of cardiometabolic health outcomes by middle adulthood. In particular, this analysis adds to the paucity of longitudinal studies evaluating the impact of disordered eating and depression on incident hyperlipidemia. Nearly half of participants (45.2%) had evidence of either disordered eating or depression. At the sample level, I found that disordered eating (only) was associated with 21% increased risk of diabetes, while depression (only) was associated with 18% increased risk of hypertension and hyperlipidemia, respectively. Having comorbid disordered eating and depression during the exposure period was associated with 45% increased risk of hypertension and 26% increased risk of hyperlipidemia. These sample-level measures align with prior evidence of longitudinal associations from disordered eating subtypes (binge eating behaviors,[41] BED[43], BN[168]) to diabetes and from depression to incident hypertension.[169] In models predicting incident diabetes, I found a null association for both depression (only) and the comorbidity of disordered eating and depression. This stands in contrast to an umbrella review of meta-analyses that found depression increased incident risk of diabetes by 18% to 60%.[46]

To my knowledge, this is the first study to use a random slopes application[64] of intersectional MAIHDA to estimate effect modification of exposure-outcome associations with a longitudinal cohort study. As such, results add substantial complexity to the sample-level associations described above and indicate areas of opportunity to address intersectional cardiometabolic health inequities. For instance, while there was a null association between

depression (only) and incident diabetes, relative risk estimates varied widely across intersectional groups, such that some experienced increased risk (White smaller-bodied women [RR=1.71], Multiracial/Other Race smaller-bodied men [RR=2.84]) while others had decreased risk (White larger-bodied men [RR=0.52], Black larger-bodied men [RR=0.56], Multiracial/Other Race larger-bodied women [RR=0.38]). As displayed in Table 3, failing to account for differences in the magnitude of associations had the consequence of incorrectly estimating group-specific risk estimates by their exposure status. For example, relying on the main effects (sample-level average) association between depression (only) and incident diabetes would underestimate diabetes risk by -4.39 pp among White smaller-bodied women and -11.73 pp among Multiracial/Other Race smaller-bodied men. Notably, intersectional group variation was less pronounced for certain exposure-outcome associations. For depression (only) and incident hyperlipidemia, group-specific estimates ranged from 9% to 24% increased risk, while the sample-level average was 18%. In the context of disordered eating and depression, considering the intersection of race/ethnicity, gender identity, and weight status is necessary to accurately describe cardiometabolic health risk patterns, but for some exposure-outcome associations, findings were more tightly centered on the sample-level average.

These findings have considerable implications for interventions and public policy. At the sample level, disordered eating only (with diabetes), depression only (with hypertension and hyperlipidemia), and their comorbidity (with hypertension and hyperlipidemia) were associated with increased risk of poor cardiometabolic health. Therefore, implementing programs and policies that address disordered eating and depression during adolescence and young adulthood may be particularly important to reduce the societal burden of poor cardiometabolic health. This is especially critical given that nearly half of participants in this study had evidence of disordered

eating or depression. Actionable interventions to prevent disordered eating and/or depression in adolescence and young adulthood include school anti-bullying policies, restricting the sale of weight loss supplements to minors, and codifying and enforcing anti-discrimination protections.[36,193] Relatedly, findings of intersectional inequities in both overall cardiometabolic health risk and exposure-outcome associations indicate that prevention scientists and policymakers must intervene upon interlocking systems of oppression that socially produce cardiometabolic health inequities. Using the proportionate universalism approach,[119] a varied toolkit inclusive of broad, population-level interventions (e.g., poverty reduction, affordable housing, neighborhood safety) paired with targeted interventions for groups experiencing disproportionate cardiometabolic health burden may be necessary.

Limitations

This study was not without limitations. Despite prior evidence of SES- and sexual orientation-based inequities in disordered eating,[28,72,120] depression,[97,194] and cardiometabolic health,[195–197] these variables could not be included in the definition of intersectional groups due to small cell sizes when stratified by other social position variables. Relatedly, transgender and gender expansive participants were excluded due to low sample size, so the current study's findings may not generalize to these individuals. Race/ethnicity categories were broad and may conceal meaningful heterogeneity that was missed in this analysis. In particular, Asian, Native American or Alaska Native, Other Race, and Multiracial individuals were combined into a single analytic category. Thus, future analysis is needed to study more granular within-group differences, especially given evidence from the current study that certain intersections inclusive of Multiracial/Other Race people had elevated risk of cardiometabolic health concerns. Additionally, as with all observational studies, exposure-outcome estimates may be biased due to

residual confounding; however, I sought to address this by adjusting models for common risk factors of disordered eating, depression, and cardiometabolic health. Relatedly, loss to follow-up and missing data may have biased estimates. Lastly, given relatively long periods between each data collection wave, exposure and outcome cases may be misclassified. To address this, I utilized multiple indicators of each exposure and outcome reported across waves, including symptom measures, self-reported diagnosis, medication use, and objectively-measured biomarkers. Wave 4 measurement issues prohibited the use of continuous total cholesterol in favor of deciles; however, I used a binary cutoff normed to nationally-representative data for this age cohort.

Conclusions

The current study highlights the benefits of using an intersectional approach to study population health inequities. With a US nationally-representative longitudinal cohort followed for up to 17 years, I documented substantial inequities in incident risk of diabetes (range=4.6–33.3%), hypertension (14.7–45.8%), and hyperlipidemia (21.5–39.1%) across intersectional groups defined by race/ethnicity, gender identity, and weight status. At the sample level, disordered eating (for diabetes), depression (for hypertension and hyperlipidemia), and their comorbidity (for hypertension and hyperlipidemia) during the exposure period (ages 11-26) were longitudinally associated with increased risk of poor cardiometabolic health as participants entered middle adulthood (ages 33-44). Notably, this study added complexity to these results by using a random slopes application of intersectional MAIHDA to uncover effect modification at the intersection of multiple systems of oppression. As such, some exposure-outcome associations (e.g., depression (only) and diabetes) varied widely across each intersection, indicating complex patterns of increased, or decreased, risk. In order to reduce poor cardiometabolic health incidence

among US adults, findings provide strong evidence that sustained policy efforts, particularly those that consider disproportionate burden faced by structural marginalized groups, are needed to reduce disordered eating and depression during adolescence and young adulthood.

Chapter 5: Conclusions

Using intersectionality-informed analytic approaches applied to US nationally-representative data, the purpose of this dissertation was to critically examine and add complexity to dominant narratives of the types of people who experience and are disproportionately burdened by mental, behavioral, and cardiometabolic health concerns. Specifically, I examined how disordered eating, depression, diabetes, hypertension, and hyperlipidemia are socially patterned under interlocking systems of oppression. To this end, I uncovered considerable intersectional inequities in the prevalence of DEBs (Aim 1) and the comorbidity of DEBs and depression (Aim 2) at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status. With longitudinal cohort data, I subsequently found that having evidence of disordered eating, depression, and their comorbidity during adolescence/young adulthood was associated with increased risk of poor cardiometabolic health as participants transitioned into middle adulthood (Aim 3). Namely, there was evidence of differential risk patterns depending on one's intersectional social position defined by race/ethnicity, gender identity, and weight status.

This chapter begins by summarizing the substantive research findings from each study as well as this dissertation's methodological innovations concerning the intersectional MAIHDA framework. I then conclude by discussing the implications of this dissertation for future intersectionality-oriented quantitative research.

Summary of substantive research findings and their implications

Aim 1 (Chapter 2). With a US nationally-representative sample of adults (NHANES) surveyed from 2005-2016, the first aim sought to describe the social patterning of past-year engagement in weight loss-oriented DEBs (i.e., skipping meals to lose weight, purging behaviors [self-induced vomiting or using laxatives to lose weight], smoking to lose weight, or using non-

prescription weight loss pills or supplements). To evaluate existing narratives of individuals assumed to be at greatest risk of engaging in DEBs (i.e., White smaller-bodied heterosexual women),[70,77] I estimated prevalence inequities at the intersection of race/ethnicity (White, Black/African-American, Hispanic/Latine), sex/gender (man, woman), sexual orientation (heterosexual, sexual minority), and weight status (smaller-bodied, larger-bodied). Specifically, I used intersectional MAIHDA specified with random intercepts to predict the log-odds of each DEB outcome for each intersection. Critically, by partitioning model variance into between-group vs. within-group differences, this approach provides complementary measures of the clustering of DEBs within intersections to inform whether targeted (i.e., "high-risk") or population-wide interventions are warranted.

Looking across the models for each DEB outcome, main effects estimates indicated that, on average, prevalence was greater among Black (vs. White) people, women (vs. men), sexual minority (vs. heterosexual), and larger-bodied (vs. smaller-bodied). However, prevalence inequities were starkly patterned across intersections, with the prevalence of any DEBs ranging from 5.2% (Hispanic/Latine smaller-bodied heterosexual men) to 22.3% (Black sexual minority larger-bodied women). Between-group difference measures indicated that there was a small-to-moderate degree of clustering of DEBs within intersectional groups. In particular, between-group differences were greatest for purging behaviors, indicating that targeted prevention efforts may be needed to prevent purging behaviors in certain intersections. Overall, findings from Aim 1 contradict pervasive stereotypes of the types of people who may be disproportionately burdened by DEBs. Thus, prevention scientists and policymakers should consider the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status when designing/implementing DEB-related prevention and intervention efforts.

Aim 2 (Chapter 3). Using the same data source and intersectional group definitions as in Aim 1, the second aim assessed whether there were intersectional differences in the association between any past-year weight loss-oriented DEBs and past 2-week symptoms of depression. To accomplish this, I used a random slopes application of intersectional MAIHDA recently proposed by Evans et al.[64] to evaluate effect modification across intersectional groups. By allowing both the model intercepts and slopes to vary across intersections, it was possible to estimate intersection-specific associations between DEBs and depression as well as predicted prevalence of depression for those with and without DEBs.

Results indicated that depression cases were moderately clustered within intersectional groups defined by race/ethnicity, sex/gender, sexual orientation, and weight status. When the DEBs main effects slope and random slopes were added to the model, the prevalence of depression at the sample-level was 58% (4.40 percentage points [pp]) higher among those with (11.97%) vs. without (7.57%) DEBs. This finding broadly aligns with prior research documenting a positive association between DEBs and depression.[124] However, considering each intersection, a complex pattern of associations emerged, such that some groups had stronger-than-average associations while others had weaker-than-average associations. For instance, compared to those without DEBs, the prevalence of depression was 72% (3.49 pp) higher among Hispanic/Latine heterosexual smaller-bodied men with DEBs and 64% (7.35 pp) higher among White heterosexual larger-bodied women. Meanwhile, White sexual minority larger-bodied women had 2% (-0.91 pp) lower prevalence of depression with vs. without DEBs, though this difference was not statistically significant. In general, intersections with lower-than-average prevalence of depression without DEBs (i.e., Hispanic/Latine and White heterosexual men, regardless of weight status) had stronger-than-average associations between DEBs and

depression. The prevalence of depression was higher-than-expected in these groups when DEBs were present, which may indicate that preventing DEBs could have a larger impact on reducing depression prevalence in these groups compared to the overall population. While DEBs (the predictor) were measured in the past-year and depression (the outcome) was measured in the past 2-weeks, causal interpretations of association differences observed in this cross-sectional study should be limited until the findings have been replicated by longitudinal studies.

Aim 3 (Chapter 4). Based on evidence obtained from Aim 1 and 2 concerning intersectional inequities in disordered eating, depression, and their comorbidity, the third aim used data from a US nationally-representative cohort to quantify the longitudinal associations of these factors with the development of new onset cases of diabetes, hypertension, and hyperlipidemia. In addition to calculating sample-level associations, I examined whether intersectional groups defined by race/ethnicity, gender identity, and weight status moderated these associations. To complete this, I used a longitudinal, random slopes application of intersectional MAIHDA to estimate the risk of each cardiometabolic health outcome by intersectional group and exposure status.

Similar to Aim 1 & 2, substantive findings indicated that incident risk of diabetes (4.6–33.3%), hypertension (14.7–45.8%), and hyperlipidemia (21.5–39.1%) by middle adulthood was complexly patterned across intersectional groups as defined in the study. During adolescence and young adulthood, slightly under half of participants (45.2%) had evidence of either disordered eating or depression. Across up to 17 years of follow-up and relative to those without disordered eating or depression, participants who had evidence of disorder eating only (for diabetes), depression only (for hypertension and hyperlipidemia), and both disordered eating and depression (for hypertension and hyperlipidemia) had increased risk of poor cardiometabolic

health. Using random slopes, this analysis uncovered patterns of effect modification of risk estimates by intersectional group and exposure status. For certain exposure-outcome associations, such as the association between depression only and incident diabetes, relative risk estimates varied considerably from -62% decreased risk (RR=0.38, 95% CI: 0.12–0.77) to 184% increased risk (RR=2.84, 95% CI: 1.16–6.10). Concurrently, the sample-level association from depression only to incident diabetes indicated similar risk (RR=0.98, 95% CI: 0.83–1.15) compared to those without disordered eating and depression. For other exposure-outcome associations, group-specific estimates were more tightly centered on the sample-level association. For example, group-specific associations between depression only and incident hypertension ranged from 9% to 24% increased risk, while the sample-level association was 18% (RR=1.18, 95% CI: 1.08–1.29).

Overall, these results demonstrate that, under interlocking systems of oppression, the intersection of race/ethnicity, gender identity, and weight status may place certain individuals at increased risk for poor cardiometabolic health by middle adulthood. Differential risk patterns emerged as a function of each individual's intersectional position and their experience of disordered eating and depression during adolescence/young adulthood. Therefore, findings from this study signal that preventing disordered eating and depression could substantially reduce risk of poor cardiometabolic health; however, given evidence of stronger associations for certain intersections, prevention efforts that address and eliminate interlocking systems of oppression are needed to achieve equity in cardiometabolic health outcomes.

Methodological innovations for intersectional MAIHDA

Building off my prior work incorporating complex sample survey weights in intersectional MAIHDA using Bayesian statistical methods,[97] this dissertation made three

methodological contributions to the intersectional MAIHDA framework: (1) longitudinal analysis of intersectional inequities in exposure-outcome associations, (2) log-binomial modeling to directly estimate outcome risk, and (3) marginal standardization.

Longitudinal analysis. To my knowledge, this is the first intersectional MAIHDA study to use prospective cohort data to estimate intersectional differences in longitudinal exposure-outcome associations. This work builds on the random slopes application of intersectional MAIHDA, proposed by Evans et al.,[64] that evaluated effect modification of the association between birth status (twin vs. singleton) and birthweight at the intersection of maternal age, race/ethnicity, education, and nativity status.[64]

Log-binomial models. Prior applications of intersectional MAIHDA with binary outcomes have typically modeled log-odds and odds ratios from logistic regression.[60,72,99,191] However, in cases where outcome risk or prevalence is relatively high (i.e., above 10%), odds ratios will overestimate risk ratios.[190] Given that outcome risk was well above this threshold in Aim 3 (i.e., 24.9% [hypertension] and 25.2% [hyperlipidemia]), I modeled the outcomes using a log-binomial distribution, which directly estimates outcome risk.[198]

I encountered two issues when conducting this analysis. First, despite their common use in epidemiologic research, log-binomial models are notoriously difficult to fit.[198] Namely, the model's linear predictor term on the log scale is not constrained (i.e., can take on all real values x), but by using the log link function (i.e., e^x) rather than the logit link (i.e., $\frac{1}{1+e^{-x}}$) used in logistic regression, the transformed linear predictor term can produce risk estimates outside the 0 to 1 probability space. Therefore, I proposed an adjustment which truncated the log scale linear predictor so that exponentiated values produced valid probability estimates, and this adjustment

produced conditions for convergence of Markov chain Monte Carlo samples within the valid probability space.

The second issue with log-binomial models was how to estimate within-group (level 1) variance, since it is not produced by the model output. In multilevel logistic models commonly used in intersectional MAIHDA, researchers typically use the latent variable method,[109] which estimates level 1 variance as the variance of the logistic distribution (i.e., $\frac{\pi^2}{3} \approx 3.29$). To address this issue, I adapted methods proposed by Yelland et al.[192] to approximate level 1 variance in log-binomial models as the theoretical binomial distribution. Since this produced level 1 variance on the probability scale, I then converted level 2 (between-group) variance estimates to the probability scale prior to calculating VPC estimates (described in greater detail in Appendix C).

Marginal standardization. Lastly, I developed a function to conduct marginal standardization in intersectional MAIHDA to ensure direct comparability of intersection- and exposure-specific risk estimates when confounder variables are included in models. Marginal standardization produces predicted risks "summed to a weighted average reflecting the confounder distribution in the target population."[199] This procedure is necessary given that the confounder distribution can vary across intersectional groups and exposure levels.

In the Add Health study, the target population was US middle and high school students in the 1994-95 school year. At Wave 5, this prospective cohort is now intended to be represent US residents in middle adulthood (i.e., ages 33-44) in 2016-2018. First, I calculated Add Health design-weighted proportions (weights) that reflected the marginal probabilities of the joint distribution of the three categorical confounding variables included in the models: neighborhood SES (3 levels), household SES (3 levels), and sexual orientation (2 levels). This resulted in 18 weights (18=3*3*2) intended to represent the proportion in the target population. Second, for

each intersectional group and exposure level pairing, I calculated the risk estimate for all 18 confounder variable combinations, multiplied each estimate by its associated weight, then summed across the 18 weighted sums to obtain confounder-adjusted risk summarized by means and 95% credible intervals. For the benefit of future researchers conducting intersectional MAIHDA estimating confounder-adjusted exposure-outcome associations, I plan to make this code publicly available via GitHub.

Implications for intersectionality-informed quantitative research

This dissertation used individual-level demographic variables to approximate each participant's position within interlocking systems of oppression. In Aim 3, I also used an individual-level exposure variable (i.e., whether or not specific individuals experienced disordered eating and/or depression). However, individual-level measures such as these may not fully capture the complexity of how systems of oppression are structured, operate, and influence health inequities. As such, future lines of research in the field of intersectionality-informed quantitative methods must make progress towards the inclusion of direct measures of systems of oppression.

A variety of measures of systems of oppression have been proposed in recent decades. For instance, Hatzenbuehler used principal component analysis to derive composite measures of US county-level[200] and state-level[201,202] sexual orientation-based structural stigma (i.e., structural heterosexism). These composites used a set of indicators (e.g., density of same-sex couples, presence/absence of sexual orientation-related state policies, public opinion towards sexual minority people) to derive continuous[200,201] and categorical[202] (i.e., high vs. low) structural heterosexism scores. More recently, Agénor et al. (2021) developed a database of 843 structural racism-related US state laws.[203] Specifically, they identified laws in place from 2010-2013 that

fell under 10 legal domains (stand your ground, mandatory minimum sentencing, racial profiling, minimum wage, undocumented immigrant protection, voting rights, stop and identify, predatory lending, corporal punishment in public schools, fair housing).[203] As such, this database has been used to study the legal drivers of racial inequities in premature mortality,[204] wherein researchers grouped states with similar patterns of structural racism-related laws using latent class analysis. For structural heterosexism and transphobia, Agénor et al. (2022) also set up a database of US state laws in place annually from 1999 to 2016.[205] Here, the authors grouped 30 sexual orientation- and gender identity-related laws into 9 legal domains (relationship recognition, sexual orientation-related antidiscrimination, gender identity-related antidiscrimination, school settings, hate crimes, sodomy, family formation and parenting, HIV/AIDS, denial of services).[205]

In future intersectional MAIHDA studies, these measures can be used as exposure variables to assess the degree to which certain structural mechanisms may uphold intersectional inequities in various health status measures. Analytically, this could take multiple forms. For instance, the disordered eating & depression exposure variable in Aim 3 could be replaced with an index of structural racism-related US state laws similar to that compiled by Agénor et al. (2021).[203] This model structure could open opportunities to answer research questions concerning whether (1) living in US states with higher structural racism is associated with poor cardiometabolic health at the sample-level, (2) living in US states with higher structural racism places certain intersectional groups at heightened (or reduced) risk of poor cardiometabolic health, and (3) between-group intersectional differences in cardiometabolic health outcomes can be explained by US state-level variation in structural racism.

A potential limitation of this approach is that most available measures of systems of oppression (such as those proposed and applied by Hatzenbuehler[200–202] and Agénor[203–205]) do

not explicitly consider the intersecting and interlocking nature of systems of oppression. In the context of intersectional MAIHDA, potential solutions include (1) specifying random slopes for the oppression measure(s) included in the model and/or (2) including oppression measures (and their interactions) that map onto the individual-level demographic variables used to construct intersectional groups. By including random slopes, solution 1 would allow the association between the oppression measure and the outcome to vary across intersections, which would capture some of the complexity of how the health outcomes of differently situated individuals are impacted by the oppression measure. For solution 2, including multiple oppression measures and their statistical interactions would allow researchers to estimate the combined effect of the measured systems of oppression explains health outcome variation. However, this may unintentionally introduce certain statistical issues, such as multicollinearity, that may bias regression parameters. For example, structural racism and structural heterosexism are not independent of one another, which can be visualized by comparing maps of the state-level distribution of structural racism-related laws (Figures 1-4 in Agénor et al. [2021])[203] and structural heterosexism-related laws (Figure 1 in Agénor et al. [2022])[205] across the United States. In other words, it is reasonable to assume that states with higher levels of structural racism may concurrently have higher levels of structural heterosexism. This may result from shared social, economic, and political factors within US states (e.g., political beliefs, political representation of marginalized/minoritized people). To address multicollinearity, future researchers could use latent class, factor, or principal component analysis to cluster US states according to the multivariate distribution of multiple systems of oppression; however, this may reduce meaningful complexity in the resulting analysis. Specifically, this approach may conceal the specific laws or policies that are particularly relevant to the health issue under study.

Conclusions

Results from this dissertation confirm that health inequities by race/ethnicity, sex and gender, sexual orientation, and weight status are particularly ingrained throughout US society. Using US nationally representative data, I uncovered substantial intersectional inequities in disordered eating, depression, and poor cardiometabolic health. Methodologically, this dissertation extended the intersectional MAIHDA framework through the use of longitudinal analysis, log-binomial modeling, and marginal standardization. Going forward, future intersectionality-informed quantitative research should utilize modeling techniques that shift focus from individual-level demographics/exposures towards direct measures of interlocking systems of oppression. To this end, I provided paths forward and notes worth considering as these measures are applied in future intersectional MAIHDA research studies.

Overall, I provide strong evidence that experiencing disordered eating, depression, and their comorbidity during adolescence/young adulthood is associated with increased risk of poor cardiometabolic health as individuals reach middle adulthood. In particular, I found that an individual's social position at the intersection of race/ethnicity, gender identity, and weight status moderated longitudinal association from disordered eating and depression to poor cardiometabolic health. Given the structural nature of these issues, structural solutions are necessary. In particular, using an intersectional lens when designing and implementing interventions is acutely needed to address inequities in disordered eating, depression, and cardiometabolic health.

References

1. Casiero D, Frishman WH. Cardiovascular complications of eating disorders. *Cardiol Rev*. 2006;14(5):227-231. doi:10.1097/01.crd.0000216745.96062.7c

2. Santonicola A, Gagliardi M, Guarino MPL, Siniscalchi M, Ciacci C, Iovino P. Eating Disorders and Gastrointestinal Diseases. *Nutrients*. 2019;11(12):3038. doi:10.3390/nu11123038

3. Li Cavoli G, Mulè G, Rotolo U. Renal involvement in psychological eating disorders. *Nephron Clin Pract*. 2011;119(4):c338-341; discussion c341. doi:10.1159/000333798

4. Chesney E, Goodwin GM, Fazel S. Risks of all-cause and suicide mortality in mental disorders: a meta-review. *World Psychiatry*. 2014;13(2):153-160. doi:10.1002/wps.20128

5. Streatfeild J, Hickson J, Austin SB, et al. Social and economic cost of eating disorders in the United States: Evidence to inform policy action. *Int J Eat Disord*. 2021;54(5):851-868. doi:10.1002/eat.23486

6. Gadalla T, Piran N. Psychiatric Comorbidity in Women with Disordered Eating Behavior: A National Study. *Women & Health*. 2008;48(4):467-484. doi:10.1080/03630240802575104

7. Calzo JP, Turner BC, Marro R, Phillips GL. Alcohol Use and Disordered Eating in a US Sample of Heterosexual and Sexual Minority Adolescents. *J Am Acad Child Adolesc Psychiatry*. 2019;58(2):200-210. doi:10.1016/j.jaac.2018.09.437

8. Johnson ER, Weiler RM, Barnett TE, Pealer LN. Extreme Weight-Control Behaviors and Suicide Risk Among High School Students. *J Sch Health*. 2016;86(4):281-287. doi:10.1111/josh.12380

9. Galmiche M, Déchelotte P, Lambert G, Tavolacci MP. Prevalence of eating disorders over the 2000-2018 period: a systematic literature review. *Am J Clin Nutr*. 2019;109(5):1402-1413. doi:10.1093/ajcn/nqy342

10. Beccia AL, Baek J, Jesdale WM, et al. Risk of disordered eating at the intersection of gender and racial/ethnic identity among U.S. high school students. *Eating Behaviors*. 2019;34:101299. doi:10.1016/j.eatbeh.2019.05.002

11. Demyttenaere K, Bruffaerts R, Posada-Villa J, et al. Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. *JAMA*. 2004;291(21):2581-2590. doi:10.1001/jama.291.21.2581

12. Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, Severity, and Comorbidity of 12-Month DSM-IV Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005;62(6):617-627. doi:10.1001/archpsyc.62.6.617

13. Kessler RC, Ormel J, Petukhova M, et al. Development of Lifetime Comorbidity in the World Health Organization World Mental Health Surveys. *Archives of General Psychiatry*. 2011;68(1):90-100. doi:10.1001/archgenpsychiatry.2010.180

14. Swanson SA, Crow SJ, Le Grange D, Swendsen J, Merikangas KR. Prevalence and correlates of eating disorders in adolescents. Results from the national comorbidity survey replication adolescent supplement. *Arch Gen Psychiatry*. 2011;68(7):714-723. doi:10.1001/archgenpsychiatry.2011.22

15. Bahji A, Mazhar MN, Hudson CC, Nadkarni P, MacNeil BA, Hawken E. Prevalence of substance use disorder comorbidity among individuals with eating disorders: A systematic review and meta-analysis. *Psychiatry Research*. 2019;273:58-66. doi:10.1016/j.psychres.2019.01.007

16. Ulfvebrand S, Birgegård A, Norring C, Högdahl L, von Hausswolff-Juhlin Y. Psychiatric comorbidity in women and men with eating disorders results from a large clinical database. *Psychiatry Research*. 2015;230(2):294-299. doi:10.1016/j.psychres.2015.09.008

17. Van Alsten SC, Duncan AE. Lifetime patterns of comorbidity in eating disorders: An approach using sequence analysis. *European Eating Disorders Review*. 2020;28(6):709-723. doi:10.1002/erv.2767

18. Grilo CM, White MA, Masheb RM. DSM-IV psychiatric disorder comorbidity and its correlates in binge eating disorder. *International Journal of Eating Disorders*. 2009;42(3):228-234. doi:10.1002/eat.20599

19. Keshishian AC, Tabri N, Becker KR, et al. Comorbid depression and substance use prospectively predict eating disorder persistence among women with anorexia nervosa and bulimia nervosa. *Journal of Behavioral and Cognitive Therapy*. 2021;31(4):309-315. doi:10.1016/j.jbct.2021.09.003

20. Jenkins PE, Hoste RR, Meyer C, Blissett JM. Eating disorders and quality of life: A review of the literature. *Clinical Psychology Review*. 2011;31(1):113-121. doi:10.1016/j.cpr.2010.08.003

21. Munn-Chernoff MA, Grant JD, Agrawal A, et al. Are there common familial influences for major depressive disorder and an overeating–binge eating dimension in both European American and African American Female twins? *International Journal of Eating Disorders*. 2015;48(4):375-382. doi:10.1002/eat.22280

22. Zhang Z, Robinson L, Jia T, et al. Development of Disordered Eating Behaviors and Comorbid Depressive Symptoms in Adolescence: Neural and Psychopathological Predictors. *Biological Psychiatry*. 2021;90(12):853-862. doi:10.1016/j.biopsych.2020.06.003

23. Molendijk ML, Hoek HW, Brewerton TD, Elzinga BM. Childhood maltreatment and eating disorder pathology: a systematic review and dose-response meta-analysis. *Psychological Medicine*. 2017;47(8):1402-1416. doi:10.1017/S0033291716003561

24. Gardner MJ, Thomas HJ, Erskine HE. The association between five forms of child maltreatment and depressive and anxiety disorders: A systematic review and meta-analysis. *Child Abuse & Neglect*. 2019;96:104082. doi:10.1016/j.chiabu.2019.104082

25. Mason TB, Mozdzierz P, Wang S, Smith KE. Discrimination and Eating Disorder Psychopathology: A Meta-Analysis. *Behavior Therapy*. 2021;52(2):406-417. doi:10.1016/j.beth.2020.05.003

26. Cave L, Cooper MN, Zubrick SR, Shepherd CCJ. Racial discrimination and child and adolescent health in longitudinal studies: A systematic review. *Social Science & Medicine*. 2020;250:112864. doi:10.1016/j.socscimed.2020.112864

27. Ridley M, Rao G, Schilbach F, Patel V. Poverty, depression, and anxiety: Causal evidence and mechanisms. *Science*. 2020;370(6522):eaay0214. doi:10.1126/science.aay0214

28. Burke NL, Hazzard VM, Schaefer LM, Simone M, O'Flynn JL, Rodgers RF. Socioeconomic status and eating disorder prevalence: at the intersections of gender identity, sexual orientation, and race/ethnicity. *Psychological Medicine*. 2023;53(9):4255-4265. doi:10.1017/S0033291722001015

29. Arenas DJ, Thomas A, Wang J, DeLisser HM. A Systematic Review and Meta-analysis of Depression, Anxiety, and Sleep Disorders in US Adults with Food Insecurity. *J GEN INTERN MED*. 2019;34(12):2874-2882. doi:10.1007/s11606-019-05202-4

30. Hazzard VM, Loth KA, Hooper L, Becker CB. Food Insecurity and Eating Disorders: a Review of Emerging Evidence. *Curr Psychiatry Rep*. 2020;22(12):74. doi:10.1007/s11920-020-01200-0

31. Beccia AL, Austin SB, Baek J, et al. Cumulative exposure to state-level structural sexism and risk of disordered eating: Results from a 20-year prospective cohort study. *Social Science & Medicine*. 2022;301:114956. doi:10.1016/j.socscimed.2022.114956

32. Pachankis JE, Hatzenbuehler ML, Bränström R, et al. Structural stigma and sexual minority men's depression and suicidality: A multilevel examination of mechanisms and mobility across 48 countries. *Journal of Abnormal Psychology*. 2021;130(7):713-726. doi:10.1037/abn0000693

33. Presnell K, Stice E, Seidel A, Madeley MC. Depression and eating pathology: Prospective reciprocal relations in adolescents. *Clinical Psychology & Psychotherapy*. 2009;16(4):357-365. doi:10.1002/cpp.630

34. Ferreiro F, Wichstrøm L, Seoane G, Senra C. Reciprocal Associations Between Depressive Symptoms and Disordered Eating Among Adolescent Girls and Boys: A Multiwave, Prospective Study. *J Abnorm Child Psychol*. 2014;42(5):803-812. doi:10.1007/s10802-013-9833-x

35. Measelle JR, Stice E, Hogansen JM. Developmental trajectories of co-occurring depressive, eating, antisocial, and substance abuse problems in female adolescents. *Journal of Abnormal Psychology*. 2006;115(3):524-538. doi:10.1037/0021-843X.115.3.524

36. Lee KS, Vaillancourt T. Longitudinal Associations Among Bullying by Peers, Disordered Eating Behavior, and Symptoms of Depression During Adolescence. *JAMA Psychiatry*. 2018;75(6):605-612. doi:10.1001/jamapsychiatry.2018.0284

37. Campbell PT, Newton CC, Patel AV, Jacobs EJ, Gapstur SM. Diabetes and Cause-Specific Mortality in a Prospective Cohort of One Million U.S. Adults. *Diabetes Care*. 2012;35(9):1835-1844. doi:10.2337/dc12-0002

38. Murakami Y, Hozawa A, Okamura T, Ueshima H. Relation of Blood Pressure and All-Cause Mortality in 180 000 Japanese Participants. *Hypertension*. 2008;51(6):1483-1491. doi:10.1161/HYPERTENSIONAHA.107.102459

39. Zhou H, Ding X, Yang Q, et al. Associations of Hypertriglyceridemia Onset Age With Cardiovascular Disease and All-Cause Mortality in Adults: A Cohort Study. *Journal of the American Heart Association*. 2022;11(20):e026632. doi:10.1161/JAHA.122.026632

40. American Diabetes Association. Economic Costs of Diabetes in the U.S. in 2017. *Diabetes Care*. 2018;41(5):917-928. doi:10.2337/dci18-0007

41. Solmi F, Moreno AB, Lewis G, Angélica Nunes M, de Jesus Mendes da Fonseca M, Harter Griep R. Longitudinal association between binge eating and metabolic syndrome in adults: Findings from the ELSA-Brasil cohort. *Acta Psychiatrica Scandinavica*. 2021;144(5):464-474. doi:10.1111/acps.13356

42. Yoon C, Jacobs Jr. DR, Duprez DA, Neumark-Sztainer D, Steffen LM, Mason SM. Problematic eating behaviors and attitudes predict long-term incident metabolic syndrome and diabetes: The Coronary Artery Risk Development in Young Adults Study. *International Journal of Eating Disorders*. 2019;52(3):304-308. doi:10.1002/eat.23020

43. Hudson JI, Lalonde JK, Coit CE, et al. Longitudinal study of the diagnosis of components of the metabolic syndrome in individuals with binge-eating disorder. *Am J Clin Nutr*. 2010;91(6):1568-1573. doi:10.3945/ajcn.2010.29203

44. Gagnon C, Aimé A, Bélanger C. Predictors of Comorbid Eating Disorders and Diabetes in People with Type 1 and Type 2 Diabetes. *Can J Diabetes*. 2017;41(1):52-57. doi:10.1016/j.jcjd.2016.06.005

45. Rotella F, Mannucci E. Depression as a Risk Factor for Diabetes: A Meta-Analysis of Longitudinal Studies. *J Clin Psychiatry*. 2013;74(1):4231. doi:10.4088/JCP.12r07922

46. Lindekilde N, Rutters F, Erik Henriksen J, et al. Psychiatric disorders as risk factors for type 2 diabetes: An umbrella review of systematic reviews with and without meta-analyses. *Diabetes Res Clin Pract*. 2021;176:108855. doi:10.1016/j.diabres.2021.108855

47. Crenshaw K. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *University of Chicago Legal Forum*. 1989;1989(1).

48. Crenshaw K. Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color. *Stanford Law Review*. 1991;43(6):1241-1299. doi:10.2307/1229039

49. Collins PH. *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*. 2nd ed. Routledge; 1990. doi:10.4324/9780203900055

50. Bowleg L. When Black + Lesbian + Woman ≠ Black Lesbian Woman: The Methodological Challenges of Qualitative and Quantitative Intersectionality Research. *Sex Roles*. 2008;59(5):312-325. doi:10.1007/s11199-008-9400-z

51. Bowleg L. The Problem With the Phrase Women and Minorities: Intersectionality—an Important Theoretical Framework for Public Health. *Am J Public Health*. 2012;102(7):1267-1273. doi:10.2105/AJPH.2012.300750

52. Homan P. Structural Sexism and Health in the United States: A New Perspective on Health Inequality and the Gender System. *Am Sociol Rev*. 2019;84(3):486-516. doi:10.1177/0003122419848723

53. Bailey ZD, Krieger N, Agénor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453-1463. doi:10.1016/S0140-6736(17)30569-X

54. Hatzenbuehler ML. Structural Stigma and Health Inequalities: Research Evidence and Implications for Psychological Science. *Am Psychol*. 2016;71(8):742-751. doi:10.1037/amp0000068

55. McCall L. The Complexity of Intersectionality. *Signs: Journal of Women in Culture and Society*. 2005;30(3):1771-1800. doi:10.1086/426800

56. Fordham University Internet History Sourcebooks Project. Modern History Sourcebook: Sojourner Truth: Ain't I a Woman? Published 2023. Accessed October 6, 2023. https://sourcebooks.fordham.edu/mod/sojtruth2.asp

57. Merlo J, Mulinari S, Wemrell M, Subramanian S, Hedblad B. The tyranny of the averages and the indiscriminate use of risk factors in public health: The case of coronary heart disease. *SSM - Population Health*. 2017;3:684-698. doi:10.1016/j.ssmph.2017.08.005

58. Collins PH, Bilge S. *Intersectionality*. Polity Press; 2016. Accessed October 6, 2023. http://swbplus.bsz-bw.de/bsz456909702cov.htm

59. Lee SM. Racial classifications in the US census: 1890–1990. *Ethnic and Racial Studies*. 1993;16(1):75-94. doi:10.1080/01419870.1993.9993773

60. Mahendran M, Lizotte D, Bauer GR. Quantitative methods for descriptive intersectional analysis with binary health outcomes. *SSM Popul Health*. 2022;17:101032. doi:10.1016/j.ssmph.2022.101032

61. Merlo J. Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) within an intersectional framework. *Soc Sci Med*. 2018;203:74-80. doi:10.1016/j.socscimed.2017.12.026

62. Evans CR. *Innovative Approaches to Investigating Social Determinants of Health - Social Networks, Environmental Effects and Intersectionality*. D.Sc. Harvard University; 2015. Accessed September 22, 2023. https://www.proquest.com/docview/2542256178/abstract/7A30D759BCC24EAEPQ/1

63. Evans CR, Williams DR, Onnela JP, Subramanian SV. A multilevel approach to modeling health inequalities at the intersection of multiple social identities. *Social Science & Medicine*. 2018;203:64-73. doi:10.1016/j.socscimed.2017.11.011

64. Evans CR, Nieves CI, Erickson N, Borrell LN. Intersectional inequities in the birthweight gap between twin and singleton births: A random effects MAIHDA analysis of 2012-2018 New York City birth data. *Soc Sci Med*. 2023;331:116063. doi:10.1016/j.socscimed.2023.116063

65. Neumark-Sztainer D, Sherwood NE, French SA, Jeffery RW. Weight control behaviors among adult men and women: cause for concern? *Obes Res*. 1999;7(2):179-188. doi:10.1002/j.1550-8528.1999.tb00700.x

66. Vrany EA, Hawkins MAW, Wu W, Stewart JC. Depressive symptoms and weight loss behaviors in U.S. adults. *Eating Behaviors*. 2018;29:107-113. doi:10.1016/j.eatbeh.2018.03.006

67. Kärkkäinen U, Mustelin L, Raevuori A, Kaprio J, Keski-Rahkonen A. Do Disordered Eating Behaviours Have Long-term Health-related Consequences? *European Eating Disorders Review*. 2018;26(1):22-28. doi:10.1002/erv.2568

68. Chaitoff A, Swetlik C, Ituarte C, et al. Associations Between Unhealthy Weight-Loss Strategies and Depressive Symptoms. *Am J Prev Med*. 2019;56(2):241-250. doi:10.1016/j.amepre.2018.09.017

69. Mitchison D, Hay PJ. The epidemiology of eating disorders: genetic, environmental, and societal factors. *Clin Epidemiol*. 2014;6:89-97. doi:10.2147/CLEP.S40841

70. Sonneville KR, Lipson SK. Disparities in eating disorder diagnosis and treatment according to weight status, race/ethnicity, socioeconomic background, and sex among college students. *Int J Eat Disord*. 2018;51(6):518-526. doi:10.1002/eat.22846

71. Pike KM, Dunne PE, Addai E. Expanding the Boundaries: Reconfiguring the Demographics of the "Typical" Eating Disordered Patient. *Curr Psychiatry Rep*. 2013;15(11):411. doi:10.1007/s11920-013-0411-2

72. Beccia AL, Baek J, Austin SB, Jesdale WM, Lapane KL. Eating-related pathology at the intersection of gender identity and expression, sexual orientation, and weight status: An intersectional Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) of the Growing Up Today Study cohorts. *Soc Sci Med*. 2021;281:114092. doi:10.1016/j.socscimed.2021.114092

73. Simone M, Telke S, Anderson LM, Eisenberg M, Neumark-Sztainer D. Ethnic/racial and gender differences in disordered eating behavior prevalence trajectories among women and men from adolescence into adulthood. *Soc Sci Med*. 2022;294:114720. doi:10.1016/j.socscimed.2022.114720

74. Duncan AE, Ziobrowski HN, Nicol G. The Prevalence of Past 12-Month and Lifetime DSM-IV Eating Disorders by BMI Category in US Men and Women. *Eur Eat Disord Rev*. 2017;25(3):165-171. doi:10.1002/erv.2503

75. Murray SB, Nagata JM, Griffiths S, et al. The enigma of male eating disorders: A critical review and synthesis. *Clinical Psychology Review*. 2017;57:1-11. doi:10.1016/j.cpr.2017.08.001

76. Nagata JM, Ganson KT, Austin SB. Emerging Trends in Eating Disorders among Sexual and Gender Minorities. *Curr Opin Psychiatry*. 2020;33(6):562-567. doi:10.1097/YCO.0000000000000645

77. Burke NL, Schaefer LM, Hazzard VM, Rodgers RF. Where identities converge: The importance of intersectionality in eating disorders research. *International Journal of Eating Disorders*. 2020;53(10):1605-1609. doi:10.1002/eat.23371

78. Goel NJ, Jennings Mathis K, Egbert AH, et al. Accountability in promoting representation of historically marginalized racial and ethnic populations in the eating disorders field: A call to action. *International Journal of Eating Disorders*. 2022;55(4):463-469. doi:10.1002/eat.23682

79. Austin SB, Nelson LA, Birkett MA, Calzo JP, Everett B. Eating Disorder Symptoms and Obesity at the Intersections of Gender, Ethnicity, and Sexual Orientation in US High School Students. *Am J Public Health*. 2013;103(2):e16-e22. doi:10.2105/AJPH.2012.301150

80. Nagata JM, Garber AK, Tabler JL, Murray SB, Bibbins-Domingo K. Prevalence and Correlates of Disordered Eating Behaviors Among Young Adults with Overweight or Obesity. *J GEN INTERN MED*. 2018;33(8):1337-1343. doi:10.1007/s11606-018-4465-z

81. Udo T, Grilo CM. Prevalence and Correlates of DSM-5–Defined Eating Disorders in a Nationally Representative Sample of U.S. Adults. *Biological Psychiatry*. 2018;84(5):345-354. doi:10.1016/j.biopsych.2018.03.014

82. Calzo JP, Blashill AJ, Brown TA, Argenal RL. Eating disorders and disordered weight and shape control behaviors in sexual minority populations. *Curr Psychiatry Rep*. 2017;19(8):49. doi:10.1007/s11920-017-0801-y

83. Parker LL, Harriger JA. Eating disorders and disordered eating behaviors in the LGBT population: a review of the literature. *J Eat Disord*. 2020;8. doi:10.1186/s40337-020-00327-y

84. Greenhalgh S. Disordered Eating/Eating Disorder: Hidden Perils of the Nation's Fight against Fat. *Medical Anthropology Quarterly*. 2016;30(4):545-562. doi:10.1111/maq.12257

85. MacLaughlin HL, Campbell KL. Obesity as a barrier to kidney transplantation: Time to eliminate the body weight bias? *Seminars in Dialysis*. 2019;32(3):219-222. doi:10.1111/sdi.12783

86. Brownstone LM, DeRieux J, Kelly DA, Sumlin LJ, Gaudiani JL. Body Mass Index Requirements for Gender-Affirming Surgeries Are Not Empirically Based. *Transgend Health*. 2021;6(3):121-124. doi:10.1089/trgh.2020.0068

87. Andreyeva T, Puhl RM, Brownell KD. Changes in Perceived Weight Discrimination Among Americans, 1995–1996 Through 2004–2006. *Obesity*. 2008;16(5):1129-1134. doi:10.1038/oby.2008.35

88. Crenshaw K. Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color. *Stanford Law Review*. 1991;43(6):1241-1299. doi:10.2307/1229039

89. Crenshaw K. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *University of Chicago Legal Forum*. 1989;1989(1).

90. Bowleg L. The Problem With the Phrase Women and Minorities: Intersectionality—an Important Theoretical Framework for Public Health. *Am J Public Health*. 2012;102(7):1267-1273. doi:10.2105/AJPH.2012.300750

91. Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *International Journal of Epidemiology*. 2001;30(4):668-677. doi:10.1093/ije/30.4.668

92. Collins PH. *Intersectionality as Critical Social Theory*. Duke University Press; 2019.

93. McCall L. The Complexity of Intersectionality. *Signs: Journal of Women in Culture and Society*. 2005;30(3):1771-1800. doi:10.1086/426800

94. Bauer GR, Scheim AI. Methods for analytic intercategorical intersectionality in quantitative research: Discrimination as a mediator of health inequalities. *Soc Sci Med*. 2019;226:236-245. doi:10.1016/j.socscimed.2018.12.015

95. Bauer GR, Churchill SM, Mahendran M, Walwyn C, Lizotte D, Villa-Rueda AA. Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. *SSM Popul Health*. 2021;14:100798. doi:10.1016/j.ssmph.2021.100798

96. Merlo J, Wagner P, Austin PC, Subramanian S, Leckie G. General and specific contextual effects in multilevel regression analyses and their paradoxical relationship: A conceptual tutorial. *SSM - Population Health*. 2018;5:33-37. doi:10.1016/j.ssmph.2018.05.006

97. McGuire FH, Beccia AL, Peoples J, Williams MR, Schuler MS, Duncan AE. Depression at the intersection of race/ethnicity, sex/gender, and sexual orientation in a nationally representative sample of US adults: A design-weighted MAIHDA. *American Journal of Epidemiology*. Published online March 28, 2024:2023.04.13.23288529.

98. Evans CR, Erickson N. Intersectionality and depression in adolescence and early adulthood: A MAIHDA analysis of the national longitudinal study of adolescent to adult health, 1995-2008. *Soc Sci Med*. 2019;220:1-11. doi:10.1016/j.socscimed.2018.10.019

99. Axelsson Fisk S, Mulinari S, Wemrell M, Leckie G, Perez Vicente R, Merlo J. Chronic Obstructive Pulmonary Disease in Sweden: An intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy. *SSM Popul Health*. 2018;4:334-346. doi:10.1016/j.ssmph.2018.03.005

100. Merlo J, Chaix B, Ohlsson H, et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *Journal of Epidemiology & Community Health*. 2006;60(4):290-297. doi:10.1136/jech.2004.029454

101. Udo T, Grilo CM. Epidemiology of eating disorders among US adults. *Current Opinion in Psychiatry*. 2022;35(6):372-378. doi:10.1097/YCO.0000000000000814

102. Johnson CL, Dohrmann SM, Burt VL, Mohadjer LK. National health and nutrition examination survey: sample design, 2011-2014. *Vital Health Stat 2*. 2014;(162):1-33.

103. National Center for Health Statistics. NHANES 2015-2016 Questionnaire Instruments. Published 2016. Accessed October 12, 2023. https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/questionnaires.aspx?BeginYear=2015

104. Bauer GR. Sex and Gender Multidimensionality in Epidemiologic Research. *American Journal of Epidemiology*. 2023;192(1):122-132. doi:10.1093/aje/kwac173

105. Dahlhamer JM, Galinsky AM, Joestl SS, Ward BW. Sexual orientation in the 2013 national health interview survey: a quality assessment. *Vital Health Stat 2*. 2014;(169):1-32.

106. CDC. NHANES Questionnaires, Datasets, and Related Documentation. Published 2020. Accessed December 13, 2020. https://wwwn.cdc.gov/nchs/nhanes/Default.aspx

107. Williams MR, Savitsky TD. Uncertainty Estimation for Pseudo-Bayesian Inference Under Complex Sampling. *International Statistical Review*. 2021;89(1):72-107. doi:10.1111/insr.12376

108. Hornby R, Williams MR, Savitsky TD, Elkasabi M. csSampling: An R Package for Bayesian Models for Complex Survey Data [Preprint]. *arXiv*. Published online 2023. https://arxiv.org/abs/2308.06845

109. Goldstein H, Browne W, Rasbash J. Partitioning Variation in Multilevel Models. *Understanding Statistics*. 2002;1(4):223-231. doi:10.1207/S15328031US0104_02

110. Merlo J, Wagner P, Leckie G. A simple multilevel approach for analysing geographical inequalities in public health reports: The case of municipality differences in obesity. *Health & Place*. 2019;58:102145. doi:10.1016/j.healthplace.2019.102145

111. Stan Development Team. RStan: the R interface to Stan (R package version 2.21.7). Published online 2022. https://mc-stan.org/

112. Williams MR. csSampling: Complex survey sampling. Published online 2022. Accessed January 6, 2023. https://rdrr.io/github/RyanHornby/csSampling/

113. McElreath R. *Statistical Rethinking: A Bayesian Course with Examples in R and Stan*. 2nd ed. CRC Press; 2020.

114. Diemer EW, Grant JD, Munn-Chernoff MA, Patterson DA, Duncan AE. Gender Identity, Sexual Orientation, and Eating-Related Pathology in a National Sample of College Students. *J Adolesc Health*. 2015;57(2):144-149. doi:10.1016/j.jadohealth.2015.03.003

115. Fredrickson BL, Roberts TA. Objectification Theory. *Psychology of Women Quarterly*. 1997;21(2):173-206. doi:10.1111/j.1471-6402.1997.tb00108.x

116. Schaefer LM, Thompson JK. Self-Objectification and Disordered Eating: A Meta-Analysis. *Int J Eat Disord*. 2018;51(6):483-502. doi:10.1002/eat.22854

117. Evans CR, Leckie G, Merlo J. Multilevel versus single-level regression for the analysis of multilevel information: The case of quantitative intersectional analysis. *Social Science & Medicine*. 2020;245:112499. doi:10.1016/j.socscimed.2019.112499

118. Rose G. Sick individuals and sick populations. *Int J Epidemiol*. 1985;14(1):32-38. doi:10.1093/ije/14.1.32

119. Marmot M, Allen J, Goldblatt P, et al. *Fair Society, Healthy Lives: The Marmot Review*. Institute of Health Equity; 2010. Accessed September 14, 2023. https://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review

120. McGuire FH, Wood J, Brown DS, Hudson D, Nagata JM, Duncan AE. Disordered eating at the intersection of race/ethnicity, sex/gender, sexual orientation, and weight status in a nationally representative sample of US adults. *[Unpublished manuscript]*. Published online 2024.

121. O'Hara SK, Smith KC. Presentation of eating disorders in the news media: What are the implications for patient diagnosis and treatment? *Patient Education and Counseling*. 2007;68(1):43-51. doi:10.1016/j.pec.2007.04.006

122. Caspi A, Houts RM, Ambler A, et al. Longitudinal Assessment of Mental Health Disorders and Comorbidities Across 4 Decades Among Participants in the Dunedin Birth Cohort Study. *JAMA Network Open*. 2020;3(4):e203221. doi:10.1001/jamanetworkopen.2020.3221

123. Greenberg P, Chitnis A, Louie D, et al. The Economic Burden of Adults with Major Depressive Disorder in the United States (2019). *Adv Ther*. 2023;40(10):4460-4479. doi:10.1007/s12325-023-02622-x

124. Puccio F, Fuller-Tyszkiewicz M, Ong D, Krug I. A systematic review and meta-analysis on the longitudinal relationship between eating pathology and depression. *International Journal of Eating Disorders*. 2016;49(5):439-454. doi:10.1002/eat.22506

125. Chao YM, Pisetsky EM, Dierker LC, et al. Ethnic differences in weight control practices among U.S. adolescents from 1995 to 2005. *International Journal of Eating Disorders*. 2008;41(2):124-133. doi:10.1002/eat.20479

126. Blashill AJ, Calzo JP, Griffiths S, Murray SB. Anabolic Steroid Misuse Among US Adolescent Boys: Disparities by Sexual Orientation and Race/Ethnicity. *Am J Public Health*. 2017;107(2):319-321. doi:10.2105/AJPH.2016.303566

127. Croll J, Neumark-Sztainer D, Story M, Ireland M. Prevalence and risk and protective factors related to disordered eating behaviors among adolescents: relationship to gender and ethnicity. *Journal of Adolescent Health*. 2002;31(2):166-175. doi:10.1016/S1054-139X(02)00368-3

128. Hasin DS, Sarvet AL, Meyers JL, et al. Epidemiology of Adult DSM-5 Major Depressive Disorder and Its Specifiers in the United States. *JAMA Psychiatry*. 2018;75(4):336-346. doi:10.1001/jamapsychiatry.2017.4602

129. Kessler RC, Berglund P, Demler O, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *JAMA*. 2003;289(23):3095-3105. doi:10.1001/jama.289.23.3095

130. Riolo SA, Nguyen TA, Greden JF, King CA. Prevalence of depression by race/ethnicity: findings from the National Health and Nutrition Examination Survey III. *Am J Public Health*. 2005;95(6):998-1000. doi:10.2105/AJPH.2004.047225

131. Hooker K, Phibbs S, Irvin VL, et al. Depression Among Older Adults in the United States by Disaggregated Race and Ethnicity. *Gerontologist*. 2019;59(5):886-891. doi:10.1093/geront/gny159

132. González HM, Tarraf W, Whitfield KE, Vega WA. The epidemiology of major depression and ethnicity in the United States. *Journal of Psychiatric Research*. 2010;44(15):1043-1051. doi:10.1016/j.jpsychires.2010.03.017

133. Blazer DG, Kessler RC, McGonagle KA, Swartz MS. The prevalence and distribution of major depression in a national community sample: the National Comorbidity Survey. *Am J Psychiatry*. 1994;151(7):979-986. doi:10.1176/ajp.151.7.979

134. Williams DR, González HM, Neighbors H, et al. Prevalence and distribution of major depressive disorder in African Americans, Caribbean blacks, and non-Hispanic whites: results from the National Survey of American Life. *Arch Gen Psychiatry*. 2007;64(3):305-315. doi:10.1001/archpsyc.64.3.305

135. Breslau J, Kendler KS, Su M, Gaxiola-Aguilar S, Kessler RC. Lifetime risk and persistence of psychiatric disorders across ethnic groups in the United States. *Psychol Med*. 2005;35(3):317-327. doi:10.1017/s0033291704003514

136. Kessler RC. Epidemiology of women and depression. *J Affect Disord*. 2003;74(1):5-13. doi:10.1016/s0165-0327(02)00426-3

137. Kessler RC, McGonagle KA, Swartz M, Blazer DG, Nelson CB. Sex and depression in the National Comorbidity Survey. I: Lifetime prevalence, chronicity and recurrence. *J Affect Disord*. 1993;29(2-3):85-96. doi:10.1016/0165-0327(93)90026-g

138. Inaba A, Thoits PA, Ueno K, Gove WR, Evenson RJ, Sloan M. Depression in the United States and Japan: gender, marital status, and SES patterns. *Soc Sci Med*. 2005;61(11):2280-2292. doi:10.1016/j.socscimed.2005.07.014

139. Salk RH, Hyde JS, Abramson LY. Gender differences in depression in representative national samples: Meta-analyses of diagnoses and symptoms. *Psychol Bull*. 2017;143(8):783-822. doi:10.1037/bul0000102

140. Li G, Pollitt AM, Russell ST. Depression and Sexual Orientation During Young Adulthood: Diversity Among Sexual Minority Subgroups and the Role of Gender Nonconformity. *Arch Sex Behav*. 2016;45(3):697-711. doi:10.1007/s10508-015-0515-3

141. Chaudhry AB, Reisner SL. Disparities by Sexual Orientation Persist for Major Depressive Episode and Substance Abuse or Dependence: Findings from a National Probability Study of Adults in the United States. *LGBT Health*. 2019;6(5):261-266. doi:10.1089/lgbt.2018.0207

142. Scott RL, Lasiuk G, Norris C. The relationship between sexual orientation and depression in a national population sample. *J Clin Nurs*. 2016;25(23-24):3522-3532. doi:10.1111/jocn.13286

143. Bostwick WB, Boyd CJ, Hughes TL, McCabe SE. Dimensions of sexual orientation and the prevalence of mood and anxiety disorders in the United States. *Am J Public Health*. 2010;100(3):468-475. doi:10.2105/AJPH.2008.152942

144. Murray SB, Blashill AJ, Calzo JP. Prevalence of Disordered Eating and Associations With Sex, Pubertal Maturation, and Weight in Children in the US. *JAMA Pediatrics*. 2022;176(10):1039-1040. doi:10.1001/jamapediatrics.2022.2490

145. Ma J, Xiao L. Obesity and Depression in US Women: Results From the 2005–2006 National Health and Nutritional Examination Survey. *Obesity*. 2010;18(2):347-353. doi:10.1038/oby.2009.213

146. Olvera RL, Williamson DE, Fisher-Hoch SP, Vatcheva KP, McCormick JB. Depression, Obesity, and Metabolic Syndrome: Prevalence and Risks of Comorbidity in a Population-Based Representative Sample of Mexican Americans. *J Clin Psychiatry*. 2015;76(10):4209. doi:10.4088/JCP.14m09118

147. Strine TW, Mokdad AH, Dube SR, et al. The association of depression and anxiety with obesity and unhealthy behaviors among community-dwelling US adults. *General Hospital Psychiatry*. 2008;30(2):127-137. doi:10.1016/j.genhosppsych.2007.12.008

148. Merlo J, Ohlsson H, Lynch KF, Chaix B, Subramanian SV. Individual and collective bodies: using measures of variance and association in contextual epidemiology. *Journal of Epidemiology & Community Health*. 2009;63(12):1043-1048. doi:10.1136/jech.2009.088310

149. Merlo J. Invited commentary: multilevel analysis of individual heterogeneity-a fundamental critique of the current probabilistic risk factor epidemiology. *Am J Epidemiol*. 2014;180(2):208-212; discussion 213-214. doi:10.1093/aje/kwu108

150. Merlo J. Multilevel analytical approaches in social epidemiology: measures of health variation compared with traditional measures of association. *J Epidemiol Community Health*. 2003;57(8):550-552. doi:10.1136/jech.57.8.550

151. Merlo J, Wagner P, Ghith N, Leckie G. An Original Stepwise Multilevel Logistic Regression Analysis of Discriminatory Accuracy: The Case of Neighbourhoods and Health. *PLOS ONE*. 2016;11(4):e0153778. doi:10.1371/journal.pone.0153778

152. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606-613. doi:10.1046/j.1525-1497.2001.016009606.x

153. Kroenke K, Spitzer RL. The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals*. 2002;32(9):509-515. doi:10.3928/0048-5713-20020901-06

154. R Core Team. R: A language and environment for statistical computing. Published online 2022. https://www.R-project.org/

155. Hedden S, Gfroerer J, Barker P, et al. Comparison of NSDUH Mental Health Data and Methods with Other Data Sources. In: *CBHSQ Data Review*. Substance Abuse and Mental Health Services Administration (US); 2012. Accessed January 31, 2024. http://www.ncbi.nlm.nih.gov/books/NBK390286/

156. Zhao G, Ford ES, Dhingra S, Li C, Strine TW, Mokdad AH. Depression and anxiety among US adults: associations with body mass index. *Int J Obes*. 2009;33(2):257-266. doi:10.1038/ijo.2008.268

157. Wang L, Li X, Wang Z, et al. Trends in Prevalence of Diabetes and Control of Risk Factors in Diabetes Among US Adults, 1999-2018. *JAMA*. 2021;326(8):704-716. doi:10.1001/jama.2021.9883

158. Zhang Y, Moran AE. Trends in the Prevalence, Awareness, Treatment, and Control of Hypertension Among Young Adults in the United States, 1999 to 2014. *Hypertension*. 2017;70(4):736-742. doi:10.1161/HYPERTENSIONAHA.117.09801

159. Shay CM, Ning H, Allen NB, et al. Status of Cardiovascular Health in US Adults: Prevalence Estimates from the National Health and Nutrition Examination Surveys (NHANES) 2003-2008. *Circulation*. 2012;125(1):45-56. doi:10.1161/CIRCULATIONAHA.111.035733

160. Wang C, Yuan Y, Zheng M, et al. Association of Age of Onset of Hypertension With Cardiovascular Diseases and Mortality. *Journal of the American College of Cardiology*. 2020;75(23):2921-2930. doi:10.1016/j.jacc.2020.04.038

161. Hudson JI, Hiripi E, Pope HG, Kessler RC. The Prevalence and Correlates of Eating Disorders in the National Comorbidity Survey Replication. *Biological Psychiatry*. 2007;61(3):348-358. doi:10.1016/j.biopsych.2006.03.040

162. Ward ZJ, Rodriguez P, Wright DR, Austin SB, Long MW. Estimation of Eating Disorders Prevalence by Age and Associations With Mortality in a Simulated Nationally Representative US Cohort. *JAMA Network Open*. 2019;2(10):e1912925. doi:10.1001/jamanetworkopen.2019.12925

163. Substance Abuse and Mental Health Services Administration. *Key Substance Use and Mental Health Indicators in the United States: Results from the 2022 National Survey on Drug Use and Health (HHS Publication No. PEP23-07-01-006, NSDUH Series H-58)*. Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration; 2023. Accessed March 19, 2024. https://www.samhsa.gov/data/report/2022-nsduh-annual-national-report

164. Greenberg PE, Fournier AA, Sisitsky T, et al. The Economic Burden of Adults with Major Depressive Disorder in the United States (2010 and 2018). *PharmacoEconomics*. 2021;39(6):653-665. doi:10.1007/s40273-021-01019-4

165. Nagata JM, Garber AK, Tabler J, Murray SB, Vittinghoff E, Bibbins-Domingo K. Disordered eating behaviors and cardiometabolic risk among young adults with overweight or obesity. *International Journal of Eating Disorders*. 2018;51(8):931-941. doi:10.1002/eat.22927

166. Nagata JM, Chaphekar AV, Vargas R, et al. Sex differences in cholesterol and triglyceride levels among hospitalized adolescents and young adults with eating disorders. *Int J Eat Disord*. 2024;57(1):184-194. doi:10.1002/eat.24072

167. Hussain AA, Hübel C, Hindborg M, et al. Increased lipid and lipoprotein concentrations in anorexia nervosa: A systematic review and meta-analysis. *Int J Eat Disord*. 2019;52(6):611-629. doi:10.1002/eat.23051

168. Nieto-Martínez R, González-Rivas JP, Medina-Inojosa JR, Florez H. Are Eating Disorders Risk Factors for Type 2 Diabetes? A Systematic Review and Meta-analysis. *Curr Diab Rep*. 2017;17(12):138. doi:10.1007/s11892-017-0949-1

169. Meng L, Chen D, Yang Y, Zheng Y, Hui R. Depression increases the risk of hypertension incidence: a meta-analysis of prospective cohort studies. *Journal of Hypertension*. 2012;30(5):842. doi:10.1097/HJH.0b013e32835080b7

170. Shin JY, Suls J, Martin R. Are cholesterol and depression inversely related? A meta-analysis of the association between two cardiac risk factors. *Ann Behav Med*. 2008;36(1):33-43. doi:10.1007/s12160-008-9045-8

171. Chaplin AB, Daniels NF, Ples D, et al. Longitudinal association between cardiovascular risk factors and depression in young people: a systematic review and meta-analysis of cohort studies. *Psychological Medicine*. 2023;53(3):1049-1059. doi:10.1017/S0033291721002488

172. van Reedt Dortland AKB, Giltay EJ, van Veen T, Zitman FG, Penninx BWJH. Longitudinal Relationship of Depressive and Anxiety Symptoms With Dyslipidemia and Abdominal Obesity. *Psychosomatic Medicine*. 2013;75(1):83. doi:10.1097/PSY.0b013e318274d30f

173. Persons JE, Robinson JG, Coryell WH, Payne ME, Fiedorowicz JG. Longitudinal Study of Low Serum LDL Cholesterol and Depressive Symptom Onset in Postmenopause. *J Clin Psychiatry*. 2016;77(2):10589. doi:10.4088/JCP.14m09505

174. Solmi M, Radua J, Olivola M, et al. Age at onset of mental disorders worldwide: large-scale meta-analysis of 192 epidemiological studies. *Mol Psychiatry*. 2022;27(1):281-295. doi:10.1038/s41380-021-01161-7

175. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime Prevalence and Age-of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):593-602. doi:10.1001/archpsyc.62.6.593

176. Guerrero Fernández de Alba I, Gimeno-Miguel A, Poblador-Plou B, et al. Association between mental health comorbidity and health outcomes in type 2 diabetes mellitus patients. *Sci Rep*. 2020;10(1):19583. doi:10.1038/s41598-020-76546-9

177. Das-Munshi J, Stewart R, Ismail K, Bebbington PE, Jenkins R, Prince MJ. Diabetes, Common Mental Disorders, and Disability: Findings From the UK National Psychiatric

Morbidity Survey. *Psychosomatic Medicine*. 2007;69(6):543. doi:10.1097/PSY.0b013e3180cc3062

178. Wang R, Zhao Y, He X, et al. Impact of hypertension on health-related quality of life in a population-based study in Shanghai, China. *Public Health*. 2009;123(8):534-539. doi:10.1016/j.puhe.2009.06.009

179. Färber F, Alonso-Perez E, Heidemann C, et al. Intersectional analysis of social disparities in type 2 diabetes risk among adults in Germany: results from a nationwide population-based survey. *BMC Public Health*. 2024;24(1):498. doi:10.1186/s12889-024-17903-5

180. Holman D, Salway S, Bell A. Mapping intersectional inequalities in biomarkers of healthy ageing and chronic disease in older English adults. *Sci Rep*. 2020;10(1):13522. doi:10.1038/s41598-020-69934-8

181. Wemrell M, Bennet L, Merlo J. Understanding the complexity of socioeconomic disparities in type 2 diabetes risk: a study of 4.3 million people in Sweden. *BMJ Open Diab Res Care*. 2019;7(1):e000749. doi:10.1136/bmjdrc-2019-000749

182. Holman D, Bell A, Green M, Salway S. Neighbourhood deprivation and intersectional inequalities in biomarkers of healthy ageing in England. *Health & Place*. 2022;77:102871. doi:10.1016/j.healthplace.2022.102871

183. Whitsel EA, Mullan Harris K, Killeya-Jones LA, et al. Add Health Wave IV Documentation: Measures of Glucose Homeostasis. Published online 2012. doi:10.17615/C64D4P

184. National Cholesterol Education Program. *Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III): Final Report*. National Cholesterol Education Program; 2002.

185. Gomez AM. Abortion and subsequent depressive symptoms: an analysis of the National Longitudinal Study of Adolescent Health. *Psychological Medicine*. 2018;48(2):294-304. doi:10.1017/S0033291717001684

186. Primack BA, Swanier B, Georgiopoulos AM, Land SR, Fine MJ. Association between media use in adolescence and depression in young adulthood: a longitudinal study. *Arch Gen Psychiatry*. 2009;66(2):181-188. doi:10.1001/archgenpsychiatry.2008.532

187. Freedman D. cdcanthro: CDC ANTHROpometry values. Published online 2023. Accessed March 20, 2024. https://github.com/CDC-DNPAO/CDCAnthro

188. Belsky DW, Domingue BW, Wedow R, et al. Genetic analysis of social-class mobility in five longitudinal studies. *Proc Natl Acad Sci U S A*. 2018;115(31):E7275-E7284. doi:10.1073/pnas.1801238115

189. Stacklies W, Redestig H, Scholz M, Walther D, Selbig J. pcaMethods—a bioconductor package providing PCA methods for incomplete data. *Bioinformatics*. 2007;23(9):1164-1167. doi:10.1093/bioinformatics/btm069

190. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the Relative Risk in Cohort Studies and Clinical Trials of Common Outcomes. *American Journal of Epidemiology*. 2003;157(10):940-943. doi:10.1093/aje/kwg074

191. Persmark A, Wemrell M, Evans CR, Subramanian SV, Leckie G, Merlo J. Intersectional inequalities and the U.S. opioid crisis: challenging dominant narratives and revealing heterogeneities. *Critical Public Health*. 2020;30(4):398-414. doi:10.1080/09581596.2019.1626002

192. Yelland LN, Salter AB, Ryan P, Laurence CO. Adjusted intraclass correlation coefficients for binary data: methods and estimates from a cluster-randomized trial in primary care. *Clin Trials*. 2011;8(1):48-58. doi:10.1177/1740774510392256

193. Raffoul A, Turner SL, Salvia MG, Austin SB. Population-level policy recommendations for the prevention of disordered weight control behaviors: A scoping review. *International Journal of Eating Disorders*. 2023;56(8):1463-1479. doi:10.1002/eat.23970

194. Lorant V, Deliège D, Eaton W, Robert A, Philippot P, Ansseau M. Socioeconomic Inequalities in Depression: A Meta-Analysis. *American Journal of Epidemiology*. 2003;157(2):98-112. doi:10.1093/aje/kwf182

195. Hatzenbuehler ML, McLaughlin KA, Slopen N. Sexual Orientation Disparities in Cardiovascular Biomarkers Among Young Adults. *American Journal of Preventive Medicine*. 2013;44(6):612-621. doi:10.1016/j.amepre.2013.01.027

196. Everett B, Mollborn S. Differences in Hypertension by Sexual Orientation Among U.S. Young Adults. *J Community Health*. 2013;38(3):588-596. doi:10.1007/s10900-013-9655-3

197. Merkin SS, Karlamangla A, Roux AD, Shrager S, Watson K, Seeman T. Race/ethnicity, neighborhood socioeconomic status and cardio-metabolic risk. *SSM - Population Health*. 2020;11:100634. doi:10.1016/j.ssmph.2020.100634

198. Chen W, Qian L, Shi J, Franklin M. Comparing performance between log-binomial and robust Poisson regression models for estimating risk ratios under model misspecification. *BMC Medical Research Methodology*. 2018;18(1):63. doi:10.1186/s12874-018-0519-5

199. Muller CJ, MacLehose RF. Estimating predicted probabilities from logistic regression: different methods correspond to different target populations. *Int J Epidemiol*. 2014;43(3):962-970. doi:10.1093/ije/dyu029

200. Hatzenbuehler ML. The Social Environment and Suicide Attempts in Lesbian, Gay, and Bisexual Youth. *Pediatrics*. 2011;127(5):896-903. doi:10.1542/peds.2010-3020

201. Hatzenbuehler ML, Jun HJ, Corliss HL, Austin SB. Structural Stigma and Cigarette Smoking in a Prospective Cohort Study of Sexual Minority and Heterosexual Youth. *Ann Behav Med*. 2014;47(1):48-56. doi:10.1007/s12160-013-9548-9

202. Hatzenbuehler ML, Jun HJ, Corliss HL, Bryn Austin S. Structural stigma and sexual orientation disparities in adolescent drug use. *Addictive Behaviors*. 2015;46:14-18. doi:10.1016/j.addbeh.2015.02.017

203. Agénor M, Perkins C, Stamoulis C, et al. Developing a Database of Structural Racism-Related State Laws for Health Equity Research and Practice in the United States. *Public Health Rep*. 2021;136(4):428-440. doi:10.1177/0033354920984168

204. Jahn JL, Zubizarreta D, Chen JT, et al. Legislating Inequity: Structural Racism In Groups Of State Laws And Associations With Premature Mortality Rates. *Health Affairs*. 2023;42(10):1325-1333. doi:10.1377/hlthaff.2023.00471

205. Agénor M, Pérez AE, Solazzo AL, et al. Assessing Variations in Sexual Orientation- and Gender Identity-Related U.S. State Laws for Sexual and Gender Minority Health Research and Action, 1996–2016. *LGBT Health*. 2022;9(3):207-216. doi:10.1089/lgbt.2021.0157

206. Merlo J, Wagner P, Leckie G. A simple multilevel approach for analysing geographical inequalities in public health reports: The case of municipality differences in obesity. *Health Place*. 2019;58:102145. doi:10.1016/j.healthplace.2019.102145

207. Robin X, Turck N, Hainard A, et al. pROC: an open-source package for R and S+ to analyze and compare ROC curves. *BMC Bioinformatics*. 2011;12(1):77. doi:10.1186/1471-2105-12-77

Appendix A: Chapter 2 (Aim 1) Supplementary Materials

Statistical information

Data

Data came from six repeated, cross-sectional waves of the National Health and Nutrition Examination Survey (NHANES) collected from 2005 to 2016. For analysis, the study data was organized as follows:

- **group**: intersectional group identifier (j)
- **seqn:** individual identifier (i)
- outcomes (y_{ij}):
    - **anyDEB:** dummy variable for any past-year disordered eating behaviors (DEB) to lose weight (1: yes; 0: no)
    - **skipMealsLW:** dummy variable for past-year skipped meals to lose weight (1: yes; 0: no)
    - **supplementsLW:** dummy variable for past-year non-prescription pills or supplements to lose weight (DEB) (1: yes; 0: no)
    - **purgingLW:** dummy variable for past-year purging behaviors (laxatives, self-induced vomiting) to lose weight (1: yes; 0: no)
    - **smokingLW:** dummy variable for past-year smoking to lose weight (1: yes; 0: no)
- **black:** dummy variable for Black/African-American race/ethnicity (1: Black/African-American; 0: otherwise) (x_{2j})
- **latine:** dummy variable for Hispanic/Latine race/ethnicity (1: Hispanic/Latine; 0: otherwise) (x_{3j})
- **woman:** dummy variable for Woman sex/gender (1: woman; 0: man) (x_{4j})
- **sexual_minority:** dummy variable for sexual minority sexual orientation (1: sexual minority; 0: heterosexual) (x_{5j})
- **larger_body:** dummy variable for larger-bodied weight status (1: larger-bodied; 0: smaller-bodied) (x_{6j})

Individuals were sorted into 24 intersectional groups through mutually-exclusive combinations of all race/ethnicity (White, Black/African American, Hispanic/Latine), sex/gender (man, woman), sexual orientation (heterosexual, sexual Minority), and weight status (smaller-bodied, larger-bodied) categories (24 = 3*2*2*2).

Multilevel variance estimation in logistic models

Given the multilevel structure of the current study's analytic approach, individual outcome variance can be partitioned into two components.[109] In this study, these are the differences found comparing intersectional groups to one another (Level 2 or between-group variance) vs. differences within intersectional groups (Level 1 or within-group variance).

Level 1 variance is not directly estimable in logistic models. Therefore, I used latent variable approach described by Goldstein et al. (2002),[109] which applies the variance of the logistic distribution as an approximation for level 1 variance in multilevel logistic models. This builds off the assumption that the binary outcome variable we observed is derived from an underlying, unobserved (i.e., latent) continuous variable. As such, Level 1 variance σ_w^2 was estimated as:

$$\sigma_w^2 = \frac{\pi^2}{3},$$

Where:

- $\frac{\pi^2}{3}$ is the variance of the logistic distribution, which approximates to 3.29.

In the simplest case of a random-intercepts model, Level 2 (between-group) variance is estimated directly from a multilevel logistic model as:

$$\sigma_b^2 = var(u_{0j}),$$

Where:

- u_{0j} are the Level 2 random intercepts for each intersectional group j.

When additional random effects (e.g., random slopes) are added to the model, this formula will need alterations (discussed below in the section titled "VPCs with random intercepts and random slopes").

Variance partition coefficient (VPC)

Now that σ_w^2 and σ_b^2 are estimated, the variance partition coefficient (VPC, also known as intraclass correlation [ICC]), can be calculated as:

$$VPC \equiv ICC = \frac{\sigma_b^2}{\sigma_w^2 + \sigma_b^2} * 100\%$$

Here, the VPC estimates the proportion of individual outcome variation that is found comparing intersectional group to one another. Thus, in cases where between-group differences (inequities) in the outcome are large, the VPC measure will large, which will indicate a higher degree of clustering of outcome cases within intersectional groups.

To interpret the relative size of VPC estimates, I used the following thresholds proposed by Merlo, Wagner, & Leckie (2019):[206]

Assessment of between-group differences	VPC (%)

Absent	0 to 1
Very small	1 to 5
Small	5 to 10
Moderate[1]	10 to 20
Fairly large	20 to 30
Very large	30 to 100

[1] Merlo, Wagner, & Leckie (2019) referred to this category as “less large”.

Proportional change in variance (PCV)

In this study, I fit a two models for each outcome. While Model 1 included no Level 1 covariates, Model 2 added the social position variable main effects to predict the prevalence of the outcome.

I calculated proportional change in (Level 2) variance (PCV) from the reference model (Model 1) to the adjusted model (Model 2), which can be expressed as:

$$\text{PCV} = \frac{\sigma^2_{u0(\text{Reference})} - \sigma^2_{u0(\text{Adjusted})}}{\sigma^2_{u0(\text{Reference})}} * 100\%$$

Area under the receiver operator characteristic curve (AUC-ROC)

As a complimentary measure of discriminatory accuracy, I used the AUC to assess the sensitivity and specificity of intersectional groups to classify cases (e.g., has DEBs) versus non-cases (e.g., no DEBs) of each outcome. For interpretation, an AUC value of 0.5 indicates that intersectional groups are random classifiers, which means that knowing an individual's intersectional group does not provide any meaningful information on their propensity to have the outcome. At the other end, an AUC value of 1.0 indicates that intersectional groups are perfect classifiers, which means that knowing an individual's intersectional group perfectly predicts if they will have the outcome. I used the "roc" function from the "pROC" R package to calculate AUC values for each outcome.[207] I extracted the model-predicted prevalence p_j for each intersectional group, which corresponds to the probability that an individual in the group is a "true positive." I then compared this probability against the observed data (controls [no DEBs] = 0; cases [DEBs] = 1) and calculated the true positive fraction (i.e., sensitivity), and the false positive fraction (i.e., 1 – specificity) for different thresholds of probabilities as:

$$True\ Positive\ Fraction = \frac{True\ Positives}{True\ Positives + False\ Negatives}$$

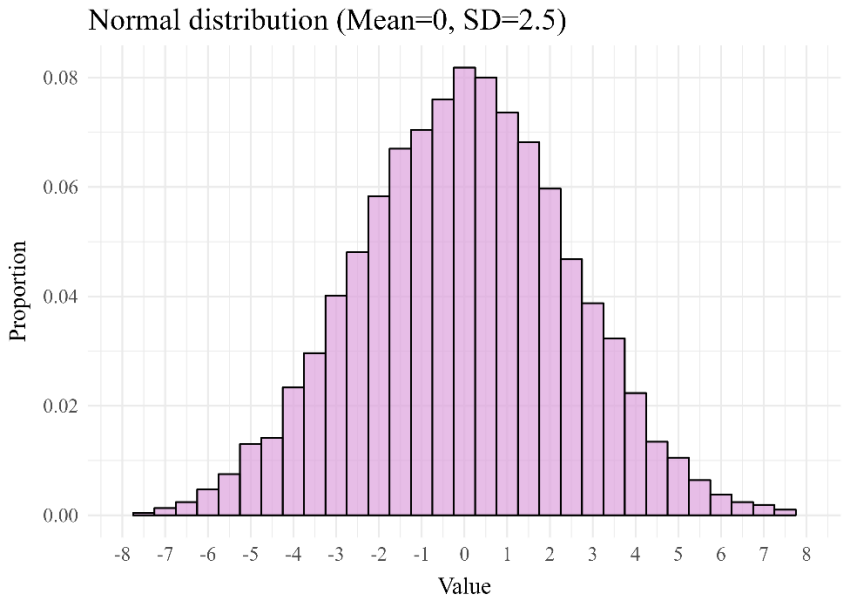
$$False\ Positive\ Fraction = \frac{False\ Positives}{False\ Positives + True\ Negatives}$$

To generate 95% confidence intervals around AUC estimates, I used bootstrap resampling with 2,000 replicates using the "ci.auc" function from the "pROC" R package.[207]

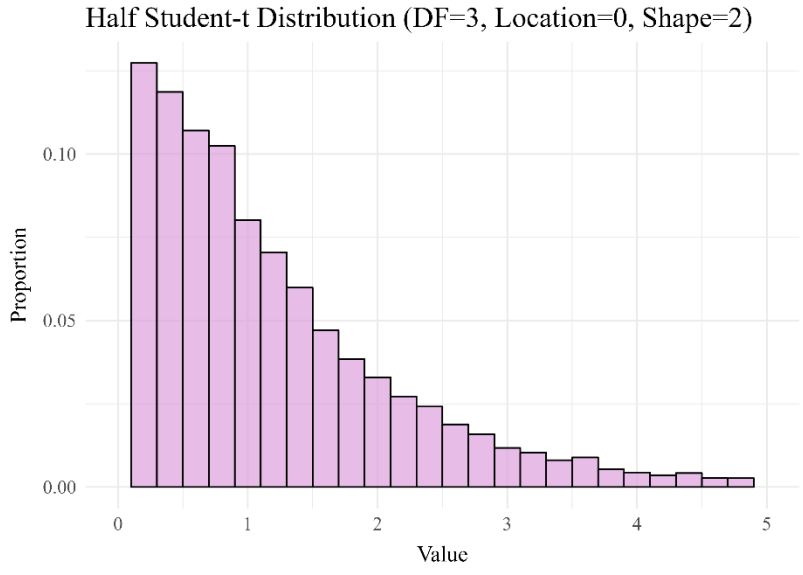
Prior distributions

To provide regularization to improve model convergence, I used weakly informative priors. The following prior distributions were used for model parameters:

- Normal distribution with mean = 0 and standard deviation = 2.5
    - Main effects parameters

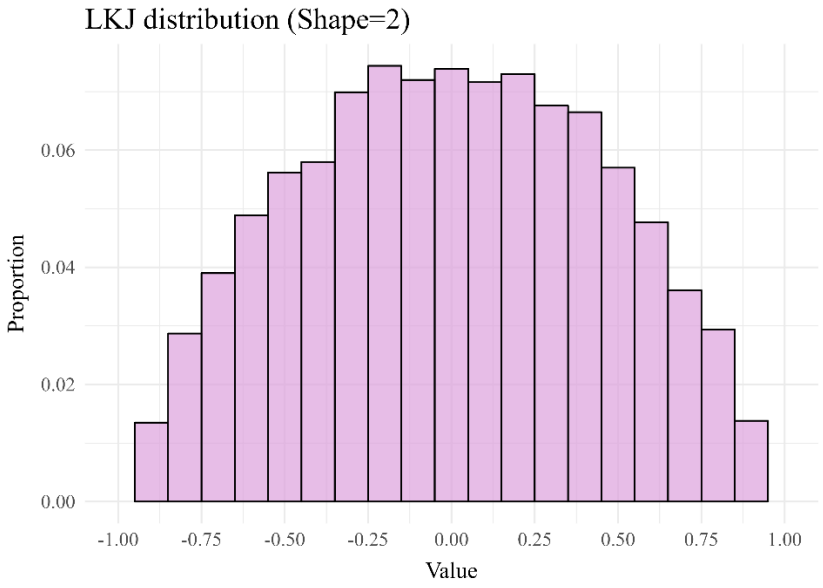


- Half student-t distribution (lower bound = 0) with degrees of freedom = 3, location = 0, and scale = 2.
    - Variance parameters



- Lewandowski-Kurowicka-Joe (LKJ) distribution with shape = 2.

- Random effects correlation (for Models 4 & 5) bounded between -1 and +1.



Null model

The null model (i.e., simple intersectional model) was a two-level logistic model with no level 1 covariates and random intercepts for each intersectional group, which can be written as:

Null model equation

$$\text{logit}(\pi_j) = \log\left(\frac{\pi_j}{1-\pi_j}\right) = \beta_0 + u_{0j}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_j)$$

$$u_{0j} \sim N(0, \sigma^2_{u0})$$

Where:

- y_{ij} follows a Bernoulli distribution with probability of success π_j.
- π_j is the probability of engagement in DEBs for individuals in intersectional group j.
- β_0 is the main (fixed) effects intercept.
- u_{0j} are intersectional group-specific (Level 2) random intercepts, which are assumed to be normally distributed with a mean of zero and a constant between-group variance σ^2_{u0}.

To obtain predicted prevalence estimates of depression for each intersectional group j, I calculated the inverse logit of the sum of the model main effects and group-specific random intercepts as:

Predicted prevalence estimates

$$\pi_j = logit^{-1}(\pi_j) = logit^{-1}(\beta_0 + u_{0j})$$

Full model

The full model (i.e., intersectional interaction model) which included the main effects for each social position variable. This model can be expressed as:

Full model equation

$$\text{logit}(\pi_j) = \log\left(\frac{\pi_j}{1-\pi_j}\right) = \beta_0 + \beta_1 x_{1j} + \beta_2 x_{2j} + \beta_3 x_{3j} + \beta_4 x_{4j} + \beta_5 x_{5j} + u_{0j}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_j)$$

$$u_{0j} \sim N(0, \sigma^2_{u0})$$

Where:

- β_0 is the main effects intercept. This now represents the sample-level average predicted prevalence for those in the reference category for all other predictors (i.e., White men who are heterosexual and smaller-bodied).
- β_1 is the main effects slope for "Black/African-American" race/ethnicity [ref=White].
- β_2 is the main effects slope for "Hispanic/Latine" race/ethnicity [ref=White].
- β_3 is the main effects slope for "Woman" sex/gender [ref=Man].
- β_4 is the main effects slope for "Sexual minority" sexual orientation [ref=Heterosexual].
- β_5 is the main effects slope for "Larger-bodied" weight status [ref=Smaller-bodied].
- σ^2_{u0} now represents the between-group variance that remains unexplained by the social position variable main effects.
- u_{0j} now represents the intersectional group-specific deviations from the model main effects intercept that remain unexplained by the social position variable main effects.

Model 2 was used to estimate sample-level and group-specific interaction effects (i.e., two-way or higher interactions between the social position variables). These refer to residual, group-specific deviations (i.e., the random intercepts) that are unexplained in the full model following adjustment for the social position variables. Relative to the prevalence of the outcome expected based on the social position main effects, random intercept values that are *positive* indicate *excess* (i.e., greater than expected) prevalence, while *negative* values indicate *reduced* (i.e., lower than expected) prevalence.

Sample-level interaction effects were calculated using the PCV relative to the null model.

To calculate group-specific interaction effects, I used methods outlined by Axelsson-Fisk.[99] From the full model and for each intersectional group, I first calculated the model-predicted prevalence based on the main effects $\pi_{j,main}$, defined as the inverse logit of the linear combination of the model main effects intercept (excluding the random intercepts) and the social position variable main effects as:

$$\pi_{j,main} = \text{logit}^{-1}(\beta_0 + \beta_1 x_{1j} + \beta_2 x_{2j} + \beta_3 x_{3j} + \beta_4 x_{4j} + \beta_5 x_{5j})$$

I then calculated the model-predicted prevalence based on the total effects p_j^t (i.e., main effects + interaction effects) as the inverse logit of the linear combination of the model main effects intercept, the social position variable main effects, and the random intercepts as:

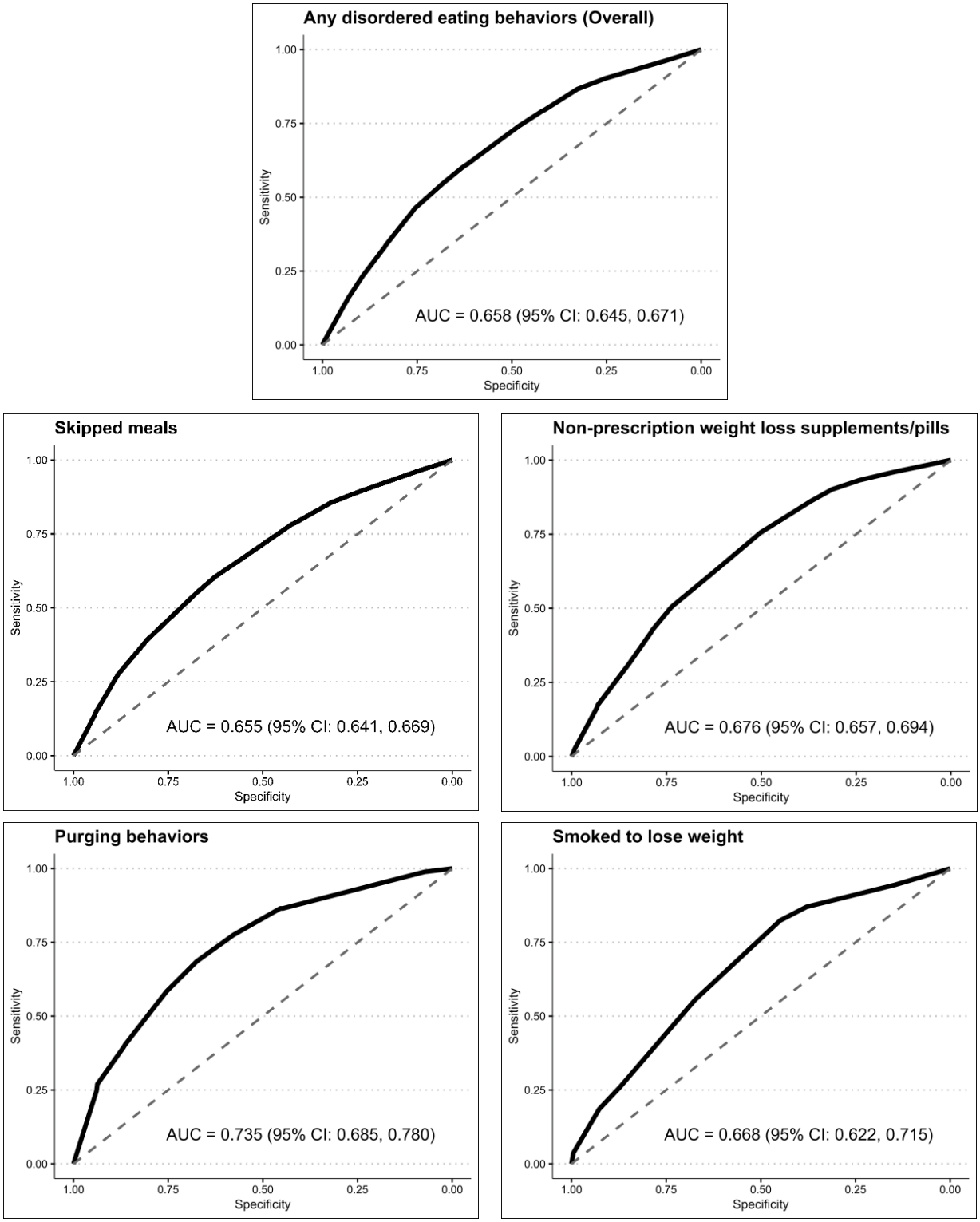
$$\pi_{j,total} = \text{logit}^{-1}(\beta_0 + \beta_1 x_{1j} + \beta_2 x_{2j} + \beta_3 x_{3j} + \beta_4 x_{4j} + \beta_5 x_{5j} + u_{0j})$$

To isolate interaction effects $\pi_{j,int}$, I subtracted the model-predicted prevalence based on the main effects from the model-predicted prevalence based on the total effects, which can be represented as:

$$\pi_{j,int} = \pi_{j,total} - \pi_{j,main}$$

Supplemental figures

Figure S1. Area under the receiver operator characteristic curve (AUC) for each outcome



Note: CI = confidence interval. "Any disordered eating behaviors (Overall)" were defined past-year engagement in any of the following methods to lose weight: skipped meals, non-prescription weight loss supplements/pills, purging behaviors, or smoked to lose weight. Purging behaviors were inclusive of self-induced vomiting or using laxatives to lose weight. 95% CIs were computed using 2000 bootstrap replicate samples.

Supplemental tables

Table S1. Intersectional group sample size overall and by data collection year, NHANES 2005-16

Intersectional groups					Data collection year					
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Overall (n=17,614)**	**2005-06 (n=2,741)**	**2007-08 (n=3,044)**	**2009-10 (n=3,418)**	**2011-12 (n=2,689)**	**2013-14 (n=3,062)**	**2015-16 (n=2,660)**
Men	White	Smaller-bodied	Heterosexual	2574	415	466	525	390	483	295
			Sexual Minority	121	22	16	14	24	21	24
		Larger-bodied	Heterosexual	1277	206	218	268	190	219	176
			Sexual Minority	57	10	7	11	9	10	10
	Hispanic/Latine	Smaller-bodied	Heterosexual	1568	237	299	362	203	236	231
			Sexual Minority	64	8	13	14	9	11	9
		Larger-bodied	Heterosexual	890	83	168	178	130	160	171
			Sexual Minority	18	4	2	5	2	1	4
	Black	Smaller-bodied	Heterosexual	1227	176	187	204	257	196	207
			Sexual Minority	62	9	13	13	7	15	5
		Larger-bodied	Heterosexual	753	115	114	129	139	130	126
			Sexual Minority	21	6	3	1	5	3	3
Women	White	Smaller-bodied	Heterosexual	2425	464	420	524	326	408	283
			Sexual Minority	160	17	20	42	17	35	29
		Larger-bodied	Heterosexual	1336	226	226	249	188	263	184
			Sexual Minority	119	20	18	23	15	26	17
	Hispanic/Latine	Smaller-bodied	Heterosexual	1497	228	289	317	183	251	229
			Sexual Minority	61	4	10	12	9	7	19
		Larger-bodied	Heterosexual	1092	145	200	203	121	202	221
			Sexual Minority	53	2	10	11	6	10	14
	Black	Smaller-bodied	Heterosexual	962	155	163	116	195	162	171
			Sexual Minority	93	15	12	11	21	20	14
		Larger-bodied	Heterosexual	1088	169	163	168	219	169	200
			Sexual Minority	96	5	7	18	24	24	18

Note: NHANES = National Health and Nutrition Examination Survey.

Table S2. Any DEBs: Predicted prevalence and interaction effects by intersectional group, NHANES 2005-2016

Intersectional group					
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Predicted Prevalence (95% CI)**	**Interaction Effects (95% CI)**
Men	White	Smaller-bodied	Heterosexual	5.5 (4.8, 6.2)	-0.8 (-2.8, 1.2)
			Sexual Minority	10.3 (6.8, 14.5)	0.5 (-3.1, 4.7)
		Larger-bodied	Heterosexual	13.1 (11.6, 14.6)	0.0 (-4.0, 3.7)
			Sexual Minority	20.0 (13.3, 28.0)	1.2 (-4.4, 7.9)
	Hispanic/Latine	Smaller-bodied	Heterosexual	5.2 (3.9, 6.7)	-0.8 (-3.3, 1.3)
			Sexual Minority	10.7 (4.7, 19.2)	0.0 (-3.9, 4.3)
		Larger-bodied	Heterosexual	12.4 (9.9, 15.1)	-0.3 (-4.9, 3.6)
			Sexual Minority	17.2 (6.9, 33.1)	0.4 (-5.7, 7.5)
	Black	Smaller-bodied	Heterosexual	6.6 (4.8, 8.7)	-1.3 (-5.3, 2.5)
			Sexual Minority	11.4 (5.1, 20.4)	-0.1 (-4.7, 4.8)
		Larger-bodied	Heterosexual	19.7 (15.9, 23.6)	3.1 (-1.6, 8.7)
			Sexual Minority	20.0 (8.6, 37.6)	0.7 (-5.8, 8.2)
Women	White	Smaller-bodied	Heterosexual	11.0 (10.0, 12.0)	2.7 (-0.2, 6.1)
			Sexual Minority	11.7 (8.1, 16.0)	-0.6 (-5.3, 3.8)
		Larger-bodied	Heterosexual	16.7 (15.1, 18.4)	-2.4 (-7.4, 2.0)
			Sexual Minority	21.7 (16.1, 27.9)	-1.3 (-8.1, 4.7)
	Hispanic/Latine	Smaller-bodied	Heterosexual	9.9 (7.9, 12.0)	0.9 (-2.2, 4.2)
			Sexual Minority	17.0 (8.9, 27.8)	1.0 (-3.8, 7.1)
		Larger-bodied	Heterosexual	17.9 (14.9, 21.2)	-0.1 (-5.3, 4.7)
			Sexual Minority	16.6 (7.8, 28.4)	-0.8 (-8.2, 6.0)
	Black	Smaller-bodied	Heterosexual	10.5 (8.1, 13.2)	-0.5 (-4.3, 3.2)
			Sexual Minority	14.5 (7.7, 23.2)	-0.0 (-5.8, 6.0)
		Larger-bodied	Heterosexual	22.2 (19.0, 25.5)	0.0 (-5.3, 5.3)
			Sexual Minority	22.3 (13.3, 33.2)	-0.9 (-8.3, 6.1)

Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval.

Table S3. Skipped meals: Predicted prevalence and interaction effects by intersectional group, NHANES 2005-2016

Intersectional group					
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Predicted Prevalence (95% CI)**	**Interaction Effects (95% CI)**
Men	White	Smaller-bodied	Heterosexual	4.6 (4.0, 5.3)	-0.1 (-1.9, 1.8)
			Sexual Minority	6.9 (4.1, 10.4)	-0.1 (-3.2, 3.2)
		Larger-bodied	Heterosexual	10.0 (8.8, 11.3)	-0.3 (-4.0, 3.2)
			Sexual Minority	16.9 (10.9, 24.2)	1.9 (-3.6, 9.1)
	Hispanic/Latine	Smaller-bodied	Heterosexual	3.9 (2.7, 5.1)	-0.5 (-2.6, 1.2)
			Sexual Minority	8.5 (3.4, 16.0)	0.2 (-3.0, 4.1)
		Larger-bodied	Heterosexual	9.1 (6.9, 11.5)	-0.2 (-4.5, 3.2)
			Sexual Minority	14.2 (5.3, 29.6)	0.8 (-5.1, 8.5)
	Black	Smaller-bodied	Heterosexual	4.8 (3.4, 6.6)	-1.8 (-5.3, 1.1)
			Sexual Minority	8.7 (3.5, 16.6)	-0.1 (-4.6, 4.7)
		Larger-bodied	Heterosexual	16.0 (12.6, 19.7)	2.1 (-2.8, 7.6)
			Sexual Minority	16.9 (6.6, 34.4)	1.1 (-6.2, 10.2)
Women	White	Smaller-bodied	Heterosexual	7.5 (6.7, 8.3)	2.1 (-0.2, 4.9)
			Sexual Minority	6.0 (3.5, 9.3)	-1.5 (-5.4, 1.7)
		Larger-bodied	Heterosexual	11.2 (9.9, 12.7)	-1.7 (-6.1, 2.2)
			Sexual Minority	14.5 (10.0, 20.0)	-1.0 (-7.4, 4.5)
	Hispanic/Latine	Smaller-bodied	Heterosexual	6.0 (4.5, 7.9)	0.5 (-1.9, 3.0)
			Sexual Minority	12.2 (5.6, 21.6)	1.0 (-2.6, 6.3)
		Larger-bodied	Heterosexual	10.0 (7.7, 12.5)	-1.2 (-6.1, 2.6)
			Sexual Minority	10.9 (4.6, 20.3)	-0.6 (-7.7, 6.2)
	Black	Smaller-bodied	Heterosexual	7.9 (5.8, 10.3)	-0.1 (-3.5, 3.2)
			Sexual Minority	13.0 (6.6, 21.6)	1.0 (-3.8, 7.2)
		Larger-bodied	Heterosexual	17.4 (14.6, 20.6)	0.9 (-4.5, 6.3)
			Sexual Minority	14.6 (7.6, 23.7)	-1.6 (-10.0, 5.7)

Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval.

Table S4. Non-prescription weight loss supplements/pills: Predicted prevalence and interaction effects by intersectional group, NHANES 2005-2016

Intersectional group					
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Predicted Prevalence (95% CI)**	**Interaction Effects (95% CI)**
Men	White	Smaller-bodied	Heterosexual	1.5 (1.1, 1.9)	-0.7 (-2.0, 0.4)
			Sexual Minority	4.8 (2.6, 7.8)	1.0 (-1.8, 4.9)
		Larger-bodied	Heterosexual	3.6 (2.8, 4.4)	-1.2 (-4.5, 1.5)
			Sexual Minority	11.8 (6.6, 18.4)	3.8 (-2.2, 12.5)
	Hispanic/Latine	Smaller-bodied	Heterosexual	1.7 (1.0, 2.6)	-0.7 (-2.6, 0.8)
			Sexual Minority	5.1 (1.6, 11.1)	0.3 (-3.1, 4.9)
		Larger-bodied	Heterosexual	4.1 (2.6, 5.8)	-0.9 (-5.2, 2.3)
			Sexual Minority	6.8 (1.8, 17.4)	0.5 (-6.5, 9.5)
	Black	Smaller-bodied	Heterosexual	2.3 (1.3, 3.6)	0.2 (-2.5, 3.4)
			Sexual Minority	4.1 (1.1, 9.6)	-0.1 (-3.2, 3.8)
		Larger-bodied	Heterosexual	6.2 (4.1, 8.7)	1.9 (-1.7, 6.3)
			Sexual Minority	6.9 (1.9, 17.4)	0.7 (-5.8, 10.0)
Women	White	Smaller-bodied	Heterosexual	4.5 (3.9, 5.2)	1.7 (-0.9, 4.4)
			Sexual Minority	6.5 (3.9, 9.8)	0.7 (-3.9, 5.9)
		Larger-bodied	Heterosexual	7.1 (6.1, 8.3)	-0.9 (-6.2, 3.3)
			Sexual Minority	7.3 (4.2, 11.3)	-4.6 (-13.7, 2.4)
	Hispanic/Latine	Smaller-bodied	Heterosexual	4.7 (3.3, 6.3)	1.1 (-2.0, 4.3)
			Sexual Minority	5.7 (1.9, 12.6)	-0.0 (-5.5, 6.5)
		Larger-bodied	Heterosexual	9.5 (7.2, 11.9)	1.7 (-3.9, 6.8)
			Sexual Minority	8.7 (2.9, 18.3)	-0.3 (-10.0, 9.8)
	Black	Smaller-bodied	Heterosexual	3.3 (2.0, 4.9)	-0.3 (-3.1, 2.4)
			Sexual Minority	3.6 (1.0, 7.9)	-1.2 (-6.6, 4.1)
		Larger-bodied	Heterosexual	7.0 (5.2, 9.0)	-0.7 (-6.3, 3.7)
			Sexual Minority	9.7 (4.4, 17.9)	-0.2 (-9.0, 8.8)

Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval.

Table S5. Purging behaviors: Predicted prevalence and interaction effects by intersectional group, NHANES 2005-2016

Intersectional group					
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Predicted Prevalence (95% CI)**	**Interaction Effects (95% CI)**
Men	White	Smaller-bodied	Heterosexual	0.2 (0.1, 0.4)	0.1 (-0.1, 0.5)
			Sexual Minority	0.3 (0.0, 1.0)	0.0 (-0.4, 0.4)
		Larger-bodied	Heterosexual	0.1 (0.0, 0.3)	-0.1 (-0.7, 0.2)
			Sexual Minority	0.4 (0.0, 1.4)	-0.0 (-0.8, 1.0)
	Hispanic/Latine	Smaller-bodied	Heterosexual	0.2 (0.0, 0.5)	-0.0 (-0.5, 0.3)
			Sexual Minority	0.5 (0.0, 2.0)	0.0 (-0.6, 1.0)
		Larger-bodied	Heterosexual	0.4 (0.1, 0.9)	0.0 (-0.9, 0.9)
			Sexual Minority	1.0 (0.1, 4.6)	0.3 (-1.1, 3.5)
	Black	Smaller-bodied	Heterosexual	0.4 (0.1, 0.8)	0.1 (-1.9, 2.9)
			Sexual Minority	0.5 (0.0, 2.0)	0.0 (-1.1, 1.6)
		Larger-bodied	Heterosexual	0.7 (0.2, 1.6)	0.1 (-1.3, 2.0)
			Sexual Minority	1.1 (0.1, 4.6)	0.4 (-1.8, 5.1)
Women	White	Smaller-bodied	Heterosexual	0.2 (0.1, 0.4)	-0.1 (-0.8, 0.4)
			Sexual Minority	0.7 (0.1, 1.8)	0.2 (-0.8, 1.8)
		Larger-bodied	Heterosexual	0.6 (0.3, 0.9)	-0.0 (-1.5, 1.2)
			Sexual Minority	0.9 (0.2, 2.4)	0.2 (-1.9, 2.9)
	Hispanic/Latine	Smaller-bodied	Heterosexual	0.5 (0.2, 1.1)	0.0 (-1.2, 1.2)
			Sexual Minority	0.6 (0.1, 2.4)	0.1 (-1.9, 2.6)
		Larger-bodied	Heterosexual	0.9 (0.3, 1.7)	-0.1 (-2.8, 2.0)
			Sexual Minority	0.7 (0.1, 2.7)	0.0 (-4.0, 4.5)
	Black	Smaller-bodied	Heterosexual	0.7 (0.2, 1.5)	-0.1 (-2.2, 1.7)
			Sexual Minority	0.5 (0.0, 1.8)	-0.2 (-3.7, 2.8)
		Larger-bodied	Heterosexual	1.6 (0.8, 2.7)	0.0 (-4.4, 3.4)
			Sexual Minority	0.8 (0.1, 2.5)	-0.6 (-7.7, 4.6)

Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval.

Table S6. Smoking to lose weight: Predicted prevalence and interaction effects by intersectional group, NHANES 2005-2016

Intersectional group					
Sex/gender	**Race/ethnicity**	**Weight status**	**Sexual orientation**	**Predicted Prevalence (95% CI)**	**Interaction Effects (95% CI)**
Men	White	Smaller-bodied	Heterosexual	0.4 (0.2, 0.6)	-0.0 (-0.2, 0.2)
			Sexual Minority	0.5 (0.2, 1.2)	-0.0 (-0.4, 0.4)
		Larger-bodied	Heterosexual	0.7 (0.4, 1.1)	0.1 (-0.3, 0.7)
			Sexual Minority	0.8 (0.3, 1.8)	0.0 (-0.5, 0.9)
	Hispanic/Latine	Smaller-bodied	Heterosexual	0.5 (0.2, 0.8)	0.0 (-0.2, 0.2)
			Sexual Minority	0.8 (0.2, 2.1)	0.0 (-0.2, 0.4)
		Larger-bodied	Heterosexual	0.5 (0.2, 0.9)	-0.0 (-0.4, 0.3)
			Sexual Minority	0.7 (0.2, 1.9)	0.0 (-0.5, 0.7)
	Black	Smaller-bodied	Heterosexual	0.6 (0.2, 1.1)	-0.0 (-0.8, 1.0)
			Sexual Minority	0.8 (0.2, 2.1)	0.1 (-0.5, 0.9)
		Larger-bodied	Heterosexual	0.8 (0.3, 1.6)	0.0 (-0.7, 0.8)
			Sexual Minority	0.7 (0.2, 1.9)	0.0 (-1.0, 1.4)
Women	White	Smaller-bodied	Heterosexual	0.7 (0.5, 1.0)	0.1 (-0.4, 0.6)
			Sexual Minority	0.7 (0.2, 1.3)	-0.0 (-0.8, 0.6)
		Larger-bodied	Heterosexual	0.8 (0.5, 1.2)	-0.1 (-1.2, 0.5)
			Sexual Minority	1.0 (0.4, 2.3)	0.1 (-1.1, 1.5)
	Hispanic/Latine	Smaller-bodied	Heterosexual	0.5 (0.2, 0.9)	-0.0 (-0.4, 0.3)
			Sexual Minority	0.7 (0.2, 1.7)	0.0 (-0.6, 0.7)
		Larger-bodied	Heterosexual	0.8 (0.4, 1.5)	0.1 (-0.6, 0.8)
			Sexual Minority	0.8 (0.2, 2.1)	0.1 (-0.8, 1.4)
	Black	Smaller-bodied	Heterosexual	0.9 (0.4, 1.6)	0.0 (-0.8, 0.8)
			Sexual Minority	1.1 (0.4, 2.9)	0.2 (-0.9, 2.3)
		Larger-bodied	Heterosexual	1.0 (0.5, 1.8)	-0.2 (-1.9, 0.9)
			Sexual Minority	0.8 (0.2, 1.9)	-0.1 (-2.3, 1.9)

Note: NHANES = National Health and Nutrition Examination Survey. CI = credible interval.

Table S7. Any DEBs: Null model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-1.89 (-2.15, -1.63)	1396.06	1.00
White heterosexual smaller-bodied men	-0.96 (-1.26, -0.66)	1644.61	1.00
White heterosexual larger-bodied men	-0.01 (-0.3, 0.28)	1578.81	1.00
White sexual minority smaller-bodied men	-0.3 (-0.78, 0.15)	3878.24	1.00
White sexual minority larger-bodied men	0.48 (-0.03, 0.98)	4470.64	1.00
White heterosexual smaller-bodied women	-0.2 (-0.48, 0.08)	1520.7	1.00
White heterosexual larger-bodied women	0.28 (0, 0.56)	1614.27	1.00
White sexual minority smaller-bodied women	-0.15 (-0.6, 0.29)	3501.61	1.00
White sexual minority larger-bodied women	0.6 (0.18, 1.03)	3272.12	1.00
Black heterosexual smaller-bodied men	-0.77 (-1.17, -0.39)	2992.16	1.00
Black heterosexual larger-bodied men	0.47 (0.12, 0.82)	2390.26	1.00
Black sexual minority smaller-bodied men	-0.23 (-1.08, 0.53)	7265.47	1.00
Black sexual minority larger-bodied men	0.43 (-0.49, 1.38)	6955.58	1.00
Black heterosexual smaller-bodied women	-0.26 (-0.63, 0.1)	2590.91	1.00
Black heterosexual larger-bodied women	0.63 (0.32, 0.95)	1994.51	1.00
Black sexual minority smaller-bodied women	0.07 (-0.63, 0.72)	6215.53	1.00
Black sexual minority larger-bodied women	0.61 (-0.02, 1.21)	6221.8	1.00
Hispanic/Latine heterosexual smaller-bodied men	-1.02 (-1.4, -0.64)	2541.92	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.08 (-0.43, 0.28)	2273.79	1.00
Hispanic/Latine sexual minority smaller-bodied men	-0.29 (-1.13, 0.45)	6842.67	1.00
Hispanic/Latine sexual minority larger-bodied men	0.24 (-0.69, 1.18)	7727.24	1.00
Hispanic/Latine heterosexual smaller-bodied women	-0.33 (-0.67, 0.01)	2206.9	1.00
Hispanic/Latine heterosexual larger-bodied women	0.36 (0.03, 0.69)	2032.14	1.00
Hispanic/Latine sexual minority smaller-bodied women	0.26 (-0.46, 0.94)	6880.22	1.00
Hispanic/Latine sexual minority larger-bodied women	0.22 (-0.58, 0.98)	7254.97	1.00
Log prior density	-3.18 (-3.28, -3.1)	1457	1.00
Log posterior density	-5996.42 (-6006.57, -5987.88)	1746.49	1.00
Level 2 (group) standard deviation	0.57 (0.4, 0.81)	1787.94	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S8. Any DEBs: Full model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-2.14 (-2.25, -2.02)	3840.87	1.00
Black	0.23 (-0.02, 0.47)	4263.49	1.00
Hispanic/Latine	-0.04 (-0.28, 0.2)	4317.9	1.00
Woman	0.43 (0.22, 0.62)	4722	1.00
Sexual minority	0.39 (0.14, 0.64)	5149.85	1.00
Larger-bodied	0.85 (0.65, 1.06)	4838.61	1.00
White heterosexual smaller-bodied men	-0.09 (-0.32, 0.13)	4070.99	1.00
White heterosexual larger-bodied men	0 (-0.23, 0.22)	4610.54	1.00
White sexual minority smaller-bodied men	0.03 (-0.25, 0.34)	8045.98	1.00
White sexual minority larger-bodied men	0.06 (-0.22, 0.36)	10511.47	1.00
White heterosexual smaller-bodied women	0.2 (-0.01, 0.44)	3422.02	1.00
White heterosexual larger-bodied women	-0.11 (-0.35, 0.1)	4205.57	1.00
White sexual minority smaller-bodied women	-0.04 (-0.33, 0.23)	7630.03	1.00
White sexual minority larger-bodied women	-0.06 (-0.34, 0.2)	8183.4	1.00
Black heterosexual smaller-bodied men	-0.09 (-0.38, 0.17)	7055.61	1.00
Black heterosexual larger-bodied men	0.16 (-0.08, 0.44)	6260.57	1.00
Black sexual minority smaller-bodied men	-0.01 (-0.34, 0.3)	9133.14	1.00
Black sexual minority larger-bodied men	0.03 (-0.28, 0.35)	10496.97	1.00
Black heterosexual smaller-bodied women	-0.03 (-0.29, 0.22)	6435.46	1.00
Black heterosexual larger-bodied women	0 (-0.23, 0.25)	5939.03	1.00
Black sexual minority smaller-bodied women	0 (-0.32, 0.31)	9060.32	1.00
Black sexual minority larger-bodied women	-0.04 (-0.34, 0.25)	8528.95	1.00
Hispanic/Latine heterosexual smaller-bodied men	-0.09 (-0.38, 0.14)	5381.07	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.02 (-0.28, 0.23)	6278.81	1.00
Hispanic/Latine sexual minority smaller-bodied men	0 (-0.33, 0.32)	9343.59	1.00
Hispanic/Latine sexual minority larger-bodied men	0.02 (-0.3, 0.35)	10636.33	1.00
Hispanic/Latine heterosexual smaller-bodied women	0.07 (-0.16, 0.34)	5870.16	1.00
Hispanic/Latine heterosexual larger-bodied women	0 (-0.24, 0.24)	5654.04	1.00
Hispanic/Latine sexual minority smaller-bodied women	0.06 (-0.24, 0.41)	8327.43	1.00
Hispanic/Latine sexual minority larger-bodied women	-0.04 (-0.37, 0.25)	7997.69	1.00
Log prior density	-12.48 (-12.55, -12.42)	3465.87	1.00
Log posterior density	-6005.17 (-6014.88, -5997.03)	2513.77	1.00
Level 2 (group) standard deviation	0.16 (0.07, 0.28)	2600.15	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S9. Skipped meals: Null model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-2.25 (-2.52, -1.98)	1457.49	1.00
White heterosexual smaller-bodied men	-0.78 (-1.1, -0.48)	1790.78	1.00
White heterosexual larger-bodied men	0.05 (-0.25, 0.35)	1794.54	1.00
White sexual minority smaller-bodied men	-0.39 (-0.96, 0.15)	4549.78	1.00
White sexual minority larger-bodied men	0.64 (0.09, 1.16)	4459.87	1.00
White heterosexual smaller-bodied women	-0.27 (-0.56, 0.01)	1664.23	1.00
White heterosexual larger-bodied women	0.18 (-0.13, 0.47)	1708.91	1.00
White sexual minority smaller-bodied women	-0.53 (-1.12, 0.02)	5021.25	1.00
White sexual minority larger-bodied women	0.47 (0, 0.93)	3856.53	1.00
Black heterosexual smaller-bodied men	-0.74 (-1.2, -0.32)	3400.86	1.00
Black heterosexual larger-bodied men	0.58 (0.22, 0.95)	2539.83	1.00
Black sexual minority smaller-bodied men	-0.18 (-1.07, 0.63)	6719.64	1.00
Black sexual minority larger-bodied men	0.58 (-0.38, 1.58)	6384.27	1.00
Black heterosexual smaller-bodied women	-0.22 (-0.63, 0.18)	3004.06	1.00
Black heterosexual larger-bodied women	0.69 (0.36, 1.03)	2283.12	1.00
Black sexual minority smaller-bodied women	0.31 (-0.4, 0.98)	6827.66	1.00
Black sexual minority larger-bodied women	0.44 (-0.24, 1.09)	5673.27	1.00
Hispanic/Latine heterosexual smaller-bodied men	-0.97 (-1.41, -0.58)	3264.49	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.06 (-0.44, 0.32)	2759.68	1.00
Hispanic/Latine sexual minority smaller-bodied men	-0.2 (-1.09, 0.59)	7278.55	1.00
Hispanic/Latine sexual minority larger-bodied men	0.36 (-0.63, 1.37)	7556.59	1.00
Hispanic/Latine heterosexual smaller-bodied women	-0.5 (-0.9, -0.12)	2970.84	1.00
Hispanic/Latine heterosexual larger-bodied women	0.05 (-0.33, 0.41)	2372.56	1.00
Hispanic/Latine sexual minority smaller-bodied women	0.22 (-0.57, 0.97)	7281.62	1.00
Hispanic/Latine sexual minority larger-bodied women	0.08 (-0.78, 0.87)	7591.15	1.00
Log prior density	-3.3 (-3.41, -3.21)	1477.41	1.00
Log posterior density	-4816.74 (-4826.72, -4808.34)	1422.38	1.00
Level 2 (group) standard deviation	0.58 (0.4, 0.84)	1609.3	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S10. Skipped meals: Full model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-2.51 (-2.65, -2.38)	3960.42	1.00
Black	0.33 (0.05, 0.61)	3904.38	1.00
Hispanic/Latine	-0.13 (-0.42, 0.18)	3938.26	1.00
Woman	0.24 (-0.02, 0.47)	4963.24	1.00
Sexual minority	0.36 (0.07, 0.66)	5504.09	1.00
Larger-bodied	0.85 (0.62, 1.11)	4265.63	1.00
White heterosexual smaller-bodied men	-0.02 (-0.28, 0.25)	4002.45	1.00
White heterosexual larger-bodied men	-0.02 (-0.3, 0.24)	4456.29	1.00
White sexual minority smaller-bodied men	-0.02 (-0.38, 0.32)	8990.96	1.00
White sexual minority larger-bodied men	0.11 (-0.22, 0.48)	7106.98	1.00
White heterosexual smaller-bodied women	0.23 (-0.02, 0.55)	3201.57	1.00
White heterosexual larger-bodied women	-0.11 (-0.38, 0.16)	3915.55	1.00
White sexual minority smaller-bodied women	-0.14 (-0.53, 0.15)	6282.75	1.00
White sexual minority larger-bodied women	-0.06 (-0.39, 0.24)	6922.53	1.00
Black heterosexual smaller-bodied men	-0.18 (-0.54, 0.1)	5178.7	1.00
Black heterosexual larger-bodied men	0.12 (-0.16, 0.45)	5607.68	1.00
Black sexual minority smaller-bodied men	-0.02 (-0.43, 0.35)	9022.1	1.00
Black sexual minority larger-bodied men	0.05 (-0.32, 0.47)	8722.16	1.00
Black heterosexual smaller-bodied women	-0.01 (-0.31, 0.3)	6462.15	1.00
Black heterosexual larger-bodied women	0.05 (-0.22, 0.36)	5014.33	1.00
Black sexual minority smaller-bodied women	0.06 (-0.28, 0.46)	8042.25	1.00
Black sexual minority larger-bodied women	-0.08 (-0.48, 0.26)	7826.75	1.00
Hispanic/Latine heterosexual smaller-bodied men	-0.09 (-0.43, 0.2)	6028.67	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.01 (-0.34, 0.27)	5982.9	1.00
Hispanic/Latine sexual minority smaller-bodied men	0.01 (-0.37, 0.41)	9446.71	1.00
Hispanic/Latine sexual minority larger-bodied men	0.04 (-0.35, 0.47)	8311.47	1.00
Hispanic/Latine heterosexual smaller-bodied women	0.07 (-0.22, 0.39)	5765.06	1.00
Hispanic/Latine heterosexual larger-bodied women	-0.08 (-0.39, 0.2)	5829.08	1.00
Hispanic/Latine sexual minority smaller-bodied women	0.08 (-0.27, 0.51)	7488.24	1.00
Hispanic/Latine sexual minority larger-bodied women	-0.04 (-0.45, 0.31)	7949.36	1.00
Log prior density	-12.61 (-12.71, -12.54)	3125.54	1.00
Log posterior density	-4826.83 (-4837.12, -4818.66)	2118.61	1.00
Level 2 (group) standard deviation	0.19 (0.07, 0.35)	2358.53	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S11. Non-prescription weight loss supplements/pills: Null model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-2.97 (-3.29, -2.64)	1251.81	1.00
White heterosexual smaller-bodied men	-1.25 (-1.66, -0.86)	1925.67	1.00
White heterosexual larger-bodied men	-0.34 (-0.72, 0.05)	1755.48	1.00
White sexual minority smaller-bodied men	-0.05 (-0.7, 0.59)	4006.75	1.00
White sexual minority larger-bodied men	0.92 (0.27, 1.57)	4159.52	1.00
White heterosexual smaller-bodied women	-0.09 (-0.45, 0.25)	1487.81	1.00
White heterosexual larger-bodied women	0.4 (0.03, 0.76)	1555.14	1.00
White sexual minority smaller-bodied women	0.28 (-0.3, 0.83)	3678.86	1.00
White sexual minority larger-bodied women	0.4 (-0.21, 0.98)	3538.71	1.00
Black heterosexual smaller-bodied men	-0.81 (-1.41, -0.26)	3453.77	1.00
Black heterosexual larger-bodied men	0.22 (-0.29, 0.71)	2777.31	1.00
Black sexual minority smaller-bodied men	-0.32 (-1.49, 0.72)	7137.85	1.00
Black sexual minority larger-bodied men	0.21 (-0.96, 1.39)	8060	1.00
Black heterosexual smaller-bodied women	-0.43 (-1, 0.11)	3116.47	1.00
Black heterosexual larger-bodied women	0.37 (-0.07, 0.79)	2133	1.00
Black sexual minority smaller-bodied women	-0.46 (-1.66, 0.51)	5645.37	1.00
Black sexual minority larger-bodied women	0.68 (-0.11, 1.47)	5353.99	1.00
Hispanic/Latine heterosexual smaller-bodied men	-1.13 (-1.72, -0.6)	3400.45	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.22 (-0.73, 0.28)	2584.3	1.00
Hispanic/Latine sexual minority smaller-bodied men	-0.08 (-1.15, 0.88)	8363.9	1.00
Hispanic/Latine sexual minority larger-bodied men	0.19 (-1.03, 1.39)	8507.31	1.00
Hispanic/Latine heterosexual smaller-bodied women	-0.06 (-0.52, 0.38)	2333.79	1.00
Hispanic/Latine heterosexual larger-bodied women	0.7 (0.28, 1.12)	1987.68	1.00
Hispanic/Latine sexual minority smaller-bodied women	0.06 (-0.97, 1.03)	7532.06	1.00
Hispanic/Latine sexual minority larger-bodied women	0.51 (-0.52, 1.49)	6789.43	1.00
Log prior density	-3.62 (-3.81, -3.48)	1342.66	1.00
Log posterior density	-2950.93 (-2961.25, -2942.37)	1560.76	1.00
Level 2 (group) standard deviation	0.68 (0.46, 1)	1646.74	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S12. Non-prescription weight loss supplements/pills: Full model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-3.26 (-3.47, -3.07)	4423.79	1.00
Black	-0.01 (-0.46, 0.38)	4624.5	1.00
Hispanic/Latine	0.08 (-0.36, 0.49)	4679.54	1.00
Woman	0.62 (0.24, 0.95)	4306.33	1.00
Sexual minority	0.6 (0.19, 0.99)	5363.93	1.00
Larger-bodied	0.84 (0.51, 1.21)	4635.71	1.00
White heterosexual smaller-bodied men	-0.24 (-0.68, 0.13)	4312.99	1.00
White heterosexual larger-bodied men	-0.16 (-0.61, 0.21)	4353.17	1.00
White sexual minority smaller-bodied men	0.13 (-0.31, 0.67)	7565.45	1.00
White sexual minority larger-bodied men	0.28 (-0.17, 0.85)	5957.93	1.00
White heterosexual smaller-bodied women	0.25 (-0.12, 0.67)	3771.03	1.00
White heterosexual larger-bodied women	-0.06 (-0.46, 0.31)	4133.54	1.00
White sexual minority smaller-bodied women	0.06 (-0.39, 0.54)	7435.93	1.00
White sexual minority larger-bodied women	-0.28 (-0.82, 0.15)	5516.2	1.00
Black heterosexual smaller-bodied men	0.02 (-0.44, 0.49)	7825.87	1.00
Black heterosexual larger-bodied men	0.23 (-0.19, 0.73)	5939.03	1.00
Black sexual minority smaller-bodied men	-0.04 (-0.64, 0.51)	8675.77	1.00
Black sexual minority larger-bodied men	0.03 (-0.54, 0.66)	9564.23	1.00
Black heterosexual smaller-bodied women	-0.04 (-0.48, 0.41)	6888.46	1.00
Black heterosexual larger-bodied women	-0.04 (-0.46, 0.37)	5960.59	1.00
Black sexual minority smaller-bodied women	-0.15 (-0.81, 0.37)	7588.28	1.00
Black sexual minority larger-bodied women	-0.01 (-0.52, 0.5)	9335.04	1.00
Hispanic/Latine heterosexual smaller-bodied men	-0.2 (-0.73, 0.22)	6608.65	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.11 (-0.59, 0.32)	6360.49	1.00
Hispanic/Latine sexual minority smaller-bodied men	0.03 (-0.55, 0.61)	9600.5	1.00
Hispanic/Latine sexual minority larger-bodied men	0.02 (-0.6, 0.62)	10695.35	1.00
Hispanic/Latine heterosexual smaller-bodied women	0.16 (-0.24, 0.66)	4737.46	1.00
Hispanic/Latine heterosexual larger-bodied women	0.14 (-0.25, 0.59)	5087.87	1.00
Hispanic/Latine sexual minority smaller-bodied women	-0.02 (-0.6, 0.55)	10045.24	1.00
Hispanic/Latine sexual minority larger-bodied women	-0.02 (-0.57, 0.51)	10141.41	1.00
Log prior density	-13.01 (-13.19, -12.88)	4296.33	1.00
Log posterior density	-2961.13 (-2972.23, -2952.14)	1611.26	1.00
Level 2 (group) standard deviation	0.28 (0.1, 0.53)	2148.8	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S13. Purging behaviors: Null model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-5.46 (-6, -4.92)	4376.11	1.00
White heterosexual smaller-bodied men	-0.81 (-1.68, -0.05)	6727.25	1.00
White heterosexual larger-bodied men	-1.47 (-2.94, -0.37)	8052.18	1.00
White sexual minority smaller-bodied men	-0.58 (-2.43, 0.84)	10392.98	1.00
White sexual minority larger-bodied men	-0.36 (-2.17, 1.17)	11691.74	1.00
White heterosexual smaller-bodied women	-0.66 (-1.49, 0.1)	6494.49	1.00
White heterosexual larger-bodied women	0.27 (-0.48, 1.01)	6110.73	1.00
White sexual minority smaller-bodied women	0.26 (-1.08, 1.49)	11192.78	1.00
White sexual minority larger-bodied women	0.57 (-0.69, 1.83)	11004.65	1.00
Black heterosexual smaller-bodied men	-0.29 (-1.56, 0.76)	10173.81	1.00
Black heterosexual larger-bodied men	0.36 (-0.83, 1.44)	9682.99	1.00
Black sexual minority smaller-bodied men	-0.17 (-2.09, 1.51)	11767.91	1.00
Black sexual minority larger-bodied men	0.52 (-1.22, 2.41)	11305.19	1.00
Black heterosexual smaller-bodied women	0.38 (-0.68, 1.34)	8951	1.00
Black heterosexual larger-bodied women	1.3 (0.53, 2.11)	5928.73	1.00
Black sexual minority smaller-bodied women	-0.22 (-2.12, 1.39)	11624.36	1.00
Black sexual minority larger-bodied women	0.25 (-1.44, 1.81)	13729.19	1.00
Hispanic/Latine heterosexual smaller-bodied men	-1.03 (-2.58, 0.15)	7586.84	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.21 (-1.4, 0.85)	10391.74	1.00
Hispanic/Latine sexual minority smaller-bodied men	-0.19 (-2.13, 1.5)	12331.52	1.00
Hispanic/Latine sexual minority larger-bodied men	0.43 (-1.35, 2.37)	12468.27	1.00
Hispanic/Latine heterosexual smaller-bodied women	0.11 (-0.87, 1.03)	9872.8	1.00
Hispanic/Latine heterosexual larger-bodied women	0.62 (-0.31, 1.54)	7149.16	1.00
Hispanic/Latine sexual minority smaller-bodied women	0.02 (-1.76, 1.71)	13787.06	1.00
Hispanic/Latine sexual minority larger-bodied women	0.1 (-1.72, 1.86)	15044.03	1.00
Log prior density	-5.37 (-5.94, -4.92)	4409.86	1.00
Log posterior density	-451.33 (-461.17, -443.15)	2023.27	1.00
Level 2 (group) standard deviation	0.94 (0.53, 1.54)	3400	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S14. Purging behaviors: Full model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-5.73 (-6.12, -5.39)	4048.08	1.00
Black	1.13 (0.37, 1.83)	4166.61	1.00
Hispanic/Latine	0.52 (-0.35, 1.29)	3588.24	1.00
Woman	1.08 (0.4, 1.81)	4781.58	1.00
Sexual minority	0.41 (-0.59, 1.27)	5650.54	1.00
Larger-bodied	0.74 (0.11, 1.41)	4506.6	1.00
White heterosexual smaller-bodied men	0.18 (-0.31, 1)	3338.23	1.00
White heterosexual larger-bodied men	-0.25 (-1.35, 0.23)	2914.03	1.00
White sexual minority smaller-bodied men	-0.04 (-0.86, 0.67)	6374.42	1.00
White sexual minority larger-bodied men	-0.05 (-0.92, 0.64)	5691.71	1.00
White heterosexual smaller-bodied women	-0.1 (-0.8, 0.44)	3622.24	1.00
White heterosexual larger-bodied women	0.01 (-0.6, 0.61)	3934.64	1.00
White sexual minority smaller-bodied women	0.07 (-0.57, 0.89)	5489.21	1.00
White sexual minority larger-bodied women	0.06 (-0.56, 0.8)	6474.02	1.00
Black heterosexual smaller-bodied men	0 (-0.67, 0.67)	5194.56	1.00
Black heterosexual larger-bodied men	0.05 (-0.56, 0.78)	5044.16	1.00
Black sexual minority smaller-bodied men	-0.03 (-0.83, 0.7)	6156.42	1.00
Black sexual minority larger-bodied men	0.07 (-0.61, 0.98)	4657.37	1.00
Black heterosexual smaller-bodied women	-0.02 (-0.67, 0.58)	4684.94	1.00
Black heterosexual larger-bodied women	0.04 (-0.53, 0.68)	4551.95	1.00
Black sexual minority smaller-bodied women	-0.09 (-0.96, 0.54)	4481.89	1.00
Black sexual minority larger-bodied women	-0.08 (-0.92, 0.53)	5750.98	1.00
Hispanic/Latine heterosexual smaller-bodied men	-0.1 (-0.93, 0.47)	5242.87	1.00
Hispanic/Latine heterosexual larger-bodied men	0.01 (-0.67, 0.71)	5481.62	1.00
Hispanic/Latine sexual minority smaller-bodied men	-0.01 (-0.78, 0.76)	6373.57	1.00
Hispanic/Latine sexual minority larger-bodied men	0.08 (-0.59, 1.05)	5262.18	1.00
Hispanic/Latine heterosexual smaller-bodied women	0.03 (-0.57, 0.72)	4587.79	1.00
Hispanic/Latine heterosexual larger-bodied women	0.01 (-0.61, 0.65)	5541.99	1.00
Hispanic/Latine sexual minority smaller-bodied women	0 (-0.78, 0.76)	6248.72	1.00
Hispanic/Latine sexual minority larger-bodied women	-0.02 (-0.79, 0.69)	7774.52	1.00
Log prior density	-15 (-15.56, -14.59)	3623.6	1.00
Log posterior density	-461.59 (-470.98, -453.83)	2544.77	1.00
Level 2 (group) standard deviation	0.29 (0.01, 0.85)	1967.27	1.00

Table S15. Smoking to lose weight: Null model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-5.03 (-5.38, -4.69)	4136.07	1.00
White heterosexual smaller-bodied men	-0.64 (-1.29, -0.09)	4288.64	1.00
White heterosexual larger-bodied men	0.07 (-0.46, 0.59)	6792.63	1.00
White sexual minority smaller-bodied men	-0.29 (-1.44, 0.55)	8904.64	1.00
White sexual minority larger-bodied men	0.06 (-0.86, 0.99)	11475.36	1.00
White heterosexual smaller-bodied women	0.1 (-0.35, 0.55)	5480.04	1.00
White heterosexual larger-bodied women	0.22 (-0.28, 0.74)	6271.85	1.00
White sexual minority smaller-bodied women	-0.1 (-1.05, 0.71)	10383.8	1.00
White sexual minority larger-bodied women	0.34 (-0.47, 1.27)	7195.97	1.00
Black heterosexual smaller-bodied men	-0.2 (-1.01, 0.48)	9117.67	1.00
Black heterosexual larger-bodied men	0.13 (-0.64, 0.9)	9828.24	1.00
Black sexual minority smaller-bodied men	0.07 (-0.94, 1.16)	9943.95	1.00
Black sexual minority larger-bodied men	-0.02 (-1.1, 1.04)	10078.23	1.00
Black heterosexual smaller-bodied women	0.21 (-0.49, 0.94)	8631.45	1.00
Black heterosexual larger-bodied women	0.39 (-0.23, 1.1)	6370.22	1.00
Black sexual minority smaller-bodied women	0.34 (-0.53, 1.5)	6964.13	1.00
Black sexual minority larger-bodied women	0.05 (-0.99, 1.07)	9543.02	1.00
Hispanic/Latine heterosexual smaller-bodied men	-0.44 (-1.34, 0.24)	6372.01	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.42 (-1.44, 0.31)	5932.8	1.00
Hispanic/Latine sexual minority smaller-bodied men	0.06 (-0.97, 1.17)	10524.8	1.00
Hispanic/Latine sexual minority larger-bodied men	-0.03 (-1.09, 1.02)	8998.71	1.00
Hispanic/Latine heterosexual smaller-bodied women	-0.32 (-1.21, 0.35)	6787.1	1.00
Hispanic/Latine heterosexual larger-bodied women	0.19 (-0.49, 0.89)	9543.63	1.00
Hispanic/Latine sexual minority smaller-bodied women	-0.07 (-1.22, 0.95)	9016.35	1.00
Hispanic/Latine sexual minority larger-bodied women	0.07 (-0.94, 1.14)	9537.52	1.00
Log prior density	-4.91 (-5.23, -4.65)	4094.87	1.00
Log posterior density	-707.12 (-717.65, -698.86)	2059.12	1.00
Level 2 (group) standard deviation	0.5 (0.17, 0.93)	2694.07	1.00

Note: CI = credible interval. SE = standard error. SD = standard deviation. ESS = effective sample size.

Table S16. Smoking to lose weight: Full model estimates and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Model intercept	-5.2 (-5.49, -4.93)	6224.41	1.00
Black	0.4 (-0.16, 0.97)	6924.66	1.00
Hispanic/Latine	-0.43 (-1.14, 0.23)	6761.16	1.00
Woman	0.68 (0.2, 1.17)	6272.55	1.00
Sexual minority	0.29 (-0.47, 0.98)	8371.86	1.00
Larger-bodied	0.52 (0.04, 1.01)	5239.73	1.00
White heterosexual smaller-bodied men	-0.06 (-0.53, 0.31)	5295.93	1.00
White heterosexual larger-bodied men	0.1 (-0.26, 0.62)	4498.12	1.00
White sexual minority smaller-bodied men	-0.05 (-0.65, 0.38)	6437.55	1.00
White sexual minority larger-bodied men	0.01 (-0.45, 0.54)	6539.09	1.00
White heterosexual smaller-bodied women	0.07 (-0.29, 0.54)	4179.36	1.00
White heterosexual larger-bodied women	-0.07 (-0.55, 0.29)	5560.21	1.00
White sexual minority smaller-bodied women	-0.04 (-0.58, 0.41)	6748.98	1.00
White sexual minority larger-bodied women	0.02 (-0.42, 0.53)	8285.78	1.00
Black heterosexual smaller-bodied men	-0.02 (-0.53, 0.44)	6129.36	1.00
Black heterosexual larger-bodied men	0.01 (-0.48, 0.52)	6893.23	1.00
Black sexual minority smaller-bodied men	0.02 (-0.48, 0.58)	6743.96	1.00
Black sexual minority larger-bodied men	0 (-0.51, 0.53)	7486.37	1.00
Black heterosexual smaller-bodied women	0.01 (-0.43, 0.45)	6690.99	1.00
Black heterosexual larger-bodied women	-0.05 (-0.57, 0.33)	6699.18	1.00
Black sexual minority smaller-bodied women	0.06 (-0.38, 0.68)	5869.49	1.00
Black sexual minority larger-bodied women	-0.03 (-0.57, 0.43)	7431.64	1.00
Hispanic/Latine heterosexual smaller-bodied men	0.01 (-0.45, 0.52)	7639.68	1.00
Hispanic/Latine heterosexual larger-bodied men	-0.06 (-0.67, 0.38)	5686.26	1.00
Hispanic/Latine sexual minority smaller-bodied men	0.02 (-0.48, 0.55)	6172.49	1.00
Hispanic/Latine sexual minority larger-bodied men	0 (-0.56, 0.52)	5870.46	1.00
Hispanic/Latine heterosexual smaller-bodied women	-0.03 (-0.56, 0.41)	7371.14	1.00
Hispanic/Latine heterosexual larger-bodied women	0.05 (-0.36, 0.58)	6728.86	1.00
Hispanic/Latine sexual minority smaller-bodied women	-0.01 (-0.58, 0.49)	7022.73	1.00
Hispanic/Latine sexual minority larger-bodied women	0.01 (-0.51, 0.56)	6489.41	1.00
Log prior density	-14.32 (-14.65, -14.06)	4968.78	1.00
Log posterior density	-715.07 (-724.13, -707.6)	2685.63	1.00
Level 2 (group) standard deviation	0.2 (0.01, 0.57)	2381.51	1.00

Appendix B: Chapter 3 (Aim 2) Supplementary Materials

Statistical information

Data

Data came from six repeated, cross-sectional waves of the National Health and Nutrition Examination Survey (NHANES) collected from 2005 to 2016. For analysis, the study data was organized as follows:

- **group**: intersectional group identifier (j)
- **seqn:** individual identifier (i)
- **depression_binary**: dummy variable for moderate-to-severe depression symptoms (1: yes; 0: no) (y_{ij})
- **anyDEB:** dummy variable for any past-year disordered eating behaviors (DEB) (1: yes; 0: no) (x_{1ij})
- **black:** dummy variable for Black/African-American race/ethnicity (1: Black/African-American; 0: otherwise) (x_{2j})
- **latine:** dummy variable for Hispanic/Latine race/ethnicity (1: Hispanic/Latine; 0: otherwise) (x_{3j})
- **woman:** dummy variable for Woman sex/gender (1: woman; 0: man) (x_{4j})
- **sexual_minority:** dummy variable for sexual minority sexual orientation (1: sexual minority; 0: heterosexual) (x_{5j})
- **larger_body:** dummy variable for larger-bodied weight status (1: larger-bodied; 0: smaller-bodied) (x_{6j})

Individuals were sorted into 24 intersectional groups through mutually-exclusive combinations of all race/ethnicity (White, Black/African American, Hispanic/Latine), sex/gender (man, woman), sexual orientation (heterosexual, sexual Minority), and weight status (smaller-bodied, larger-bodied) categories (24 = 3*2*2*2).

Multilevel variance estimation in logistic models

Given the multilevel structure of the current study's analytic approach, individual outcome variance can be partitioned into two components.[109] In this study, these are the differences found comparing intersectional groups to one another (Level 2 or between-group variance) vs. differences within intersectional groups (Level 1 or within-group variance).

Level 1 variance is not directly estimable in logistic models. Therefore, I used latent variable approach described by Goldstein et al. (2002),[109] which applies the variance of the logistic distribution as an approximation for level 1 variance in multilevel logistic models. This builds off the assumption that the binary outcome variable we observed is derived from an underlying, unobserved (i.e., latent) continuous variable. As such, Level 1 variance σ_w^2 was estimated as:

$$\sigma_w^2 = \frac{\pi^2}{3},$$

Where:

- $\frac{\pi^2}{3}$ is the variance of the logistic distribution, which approximates to 3.29.

In the simplest case of a random-intercepts model, Level 2 (between-group) variance is estimated directly from a multilevel logistic model as:

$$\sigma_b^2 = var(u_{0j}),$$

Where:

- u_{0j} are the Level 2 random intercepts for each intersectional group j.

When additional random effects (e.g., random slopes) are added to the model, this formula will need alterations (discussed below in the section titled "VPCs with random intercepts and random slopes").

Variance partition coefficient (VPC) with random intercepts

Now that σ_w^2 and σ_b^2 are estimated, the variance partition coefficient (VPC, also known as intraclass correlation [ICC]), can be calculated as:

$$VPC \equiv ICC = \frac{\sigma_b^2}{\sigma_w^2 + \sigma_b^2} * 100\%$$

Here, the VPC estimates the proportion of individual outcome variation that is found comparing intersectional group to one another. Thus, in cases where between-group differences (inequities) in the outcome are large, the VPC measure will large, which will indicate a higher degree of clustering of outcome cases within intersectional groups.

To interpret the relative size of VPC estimates, I used the following thresholds proposed by Merlo, Wagner, & Leckie (2019):[206]

Assessment of between-group differences	VPC (%)
Absent	0 to 1
Very small	1 to 5
Small	5 to 10
Moderate[1]	10 to 20
Fairly large	20 to 30
Very large	30 to 100

[1] Merlo, Wagner, & Leckie (2019) referred to this category as "less large".

VPCs with random intercepts and random slopes

In Models with random slopes for the DEBs variable (Models 4-5), VPCs are separately calculated for each level of the predictor variable. This is because Level 2 variance can now come from multiple sources, namely, the random intercepts and the random slopes. Using methods outlined in prior application of intersectional MAIHDA with random slopes,[64] DEB-specific Level 2 variance estimates are summarized below:

Description	Total Level 2 variance calculation
Level 2 variance for those without DEBs	$\mathrm{Var}(u_{0j}) = \sigma^2_{u0}$
Level 2 variance for those with DEBs	$\mathrm{Var}(u_{0j} + u_{1j}) = \sigma^2_{u0} + 2\sigma_{u0u1} + \sigma^2_{u1}$

For those without DEBs, the same VPC formula that is used in Models 1-3 can be used in Model 4-5. Since it serves as the categorical reference level, the "No DEBs" category does not have an associated random slopes variance parameter.

However, for the "DEBs" category, the VPC must consider, the random intercepts variance (σ^2_{u0}) the random slopes variance (σ^2_{u1}) and two times the random intercepts-slopes covariance (σ_{u0u1}). Using methods outlined by Evans et al.,[64] the VPC for the "DEBs" category can be calculated as:

$$\text{VPC (with DEBs)} = \frac{\sigma^2_{u0} + 2\sigma_{u0u1} + \sigma^2_{u1}}{\sigma^2_w + \sigma^2_{u0} + 2\sigma_{u0u1} + \sigma^2_{u1}} * 100\%$$

Proportional change in variance (PCV) with random intercepts

In this study, I fit a series of models for each outcome. For instance, while Model 1 included no Level 1 covariates, Model 2 added the DEBs variable to predict the outcome.

This opens the opportunity to assess whether the DEBs variable explained (reduced) any of the Level 2 variance in the outcome. In other words, does including the DEBs variable in the model account for between-group inequities observed in Model 1?

To evaluate this research question, I calculated proportional change in (Level 2) variance (PCV) from the reference model (in this case, Model 1) to the adjusted model (Model 2), which can be expressed as:

$$\text{PCV} = \frac{\sigma^2_{u0(\text{Reference})} - \sigma^2_{u0(\text{Adjusted})}}{\sigma^2_{u0(\text{Reference})}} * 100\%$$

PCVs with random slopes

Similar to separate VPC calculations in the presence of random slopes, the PCVs for models must calculated for each predictor variable level. The PCV for those without DEBs can be calculated using the same equation as above, since this category does not have any associated random slopes.

For those with DEBs, the PCVs was estimated as:

PCV with DEBs:

$$PCV = \frac{(\sigma^2_{u0(\text{Reference})} + 2\sigma_{u0u1(\text{Reference})} + \sigma^2_{u1(\text{Reference})}) - (\sigma^2_{u0(\text{Adjusted})} + 2\sigma_{u0u1(\text{Adjusted})} + \sigma^2_{u1(\text{Adjusted})})}{\sigma^2_{u0(\text{Refernece})} + 2\sigma_{u0u1(\text{Reference})} + \sigma^2_{u1(\text{Reference})}} * 100\%$$

Model 1

Model 1 (null intersectional model) was a two-level logistic model with no level 1 covariates and random intercepts for each intersectional group, which can be written as:

Model 1 equation
$$\text{logit}(\pi_j) = \log\left(\frac{\pi_j}{1-\pi_j}\right) = \beta_0 + u_{0j}$$ $$y_{ij} \sim \text{Bernoulli}(\pi_j)$$ $$u_{0j} \sim N(0, \sigma^2_{u0})$$ Where: • y_{ij} follows a Bernoulli distribution with probability of success π_j. • π_j is the probability of moderate-to-severe depression symptoms for individuals in intersectional group j. • β_0 is the main (fixed) effects intercept. • u_{0j} are intersectional group-specific (Level 2) random intercepts, which are assumed to be normally distributed with a mean of zero and a constant between-group variance σ^2_{u0}.

To obtain predicted prevalence estimates of depression for each intersectional group j, irrespective of DEB status (presented in **Table S3**), I calculated the inverse logit of the sum of the model main effects and group-specific random intercepts as:

Predicted prevalence estimates from Model 1
$$\pi_j = logit^{-1}(\pi_j) = logit^{-1}(\beta_0 + u_{0j})$$

Model 2

Building off the specification for Model 1, Model 2 included the main (fixed) effect of DEBs variable β_1, which can be written as:

Model 2 equation

$$\text{logit}(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 x_{1ij} + u_{0j}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$u_{0j} \sim N(0, \sigma^2_{u0})$$

Where:

- β_0 is the main effects intercept.
  - With the DEBs variable included in the model, this now represents the sample-level average predicted value of the outcome for those without DEBs.
- β_1 is the main effects slope for the DEBs variable.
- σ^2_{u0} now represents the between-group variance that remains unexplained by the DEBs variable main effects.

For Model 2, the PCV is calculated in reference to Model 1 as:

$$\text{PCV} = \frac{\sigma^2_{u0(\text{Model 1})} - \sigma^2_{u0(\text{Model 2})}}{\sigma^2_{u0(\text{Model 1})}} * 100\%$$

Model 3

Model 3 updates the Model 2 specification by adding the main (fixed) effects of the social position variables used to construct intersectional groups: race/ethnicity, sex/gender, sexual orientation, and weight status, which can be written as:

Model 3 equation

$$\text{logit}(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2j} + \beta_3 x_{3j} + \beta_4 x_{4j} + \beta_5 x_{5j} + \beta_6 x_{6j} + u_{0j}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$u_{0j} \sim N(0, \sigma^2_{u0})$$

Where:

- β_0 is the main effects intercept.
    - With the social position variables included in the model, this now represents the sample-level average predicted risk of the outcome for those without DEBs and those in the reference category for all social position variables (i.e., White men who are heterosexual and smaller-bodied).
- β_2 is the main effects slope for "Black/African-American" race/ethnicity [ref=White].
- β_3 is the main effects slope for "Hispanic/Latine" race/ethnicity [ref=White].
- β_4 is the main effects slope for "Woman" sex/gender [ref=Man].
- β_5 is the main effects slope for "Sexual minority" sexual orientation [ref=Heterosexual].
- β_6 is the main effects slope for "Larger-bodied" weight status [ref=Smaller-bodied].
- σ^2_{u0} now represents the between-group variance that remains unexplained by the DEBs variable main effects and the social position variable main effects.

For Model 3, the PCV is calculated in reference to Model 1 as:

$$\text{PCV} = \frac{\sigma^2_{u0(\text{Model 1})} - \sigma^2_{u0(\text{Model 3})}}{\sigma^2_{u0(\text{Model 1})}} * 100\%$$

Model 4

Models 4 and 5 build on the prior set of models by adding random slopes u_{1j} for the DEBs variable, which allows for the association between DEBs and the outcome to vary across intersectional groups.

Specifically, Model 4 is a direct descendant of the Model 2 specification since it does not include the main (fixed) effects of the social position variables, which can be written as:

Model 4 equation
$$\text{logit}(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 x_{1ij} + u_{0j} + u_{1j}x_{1ij}$$ $$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$ $$\begin{bmatrix} u_{0j} \\ u_{1j} \end{bmatrix} \sim N\left(0, \begin{bmatrix} \sigma^2_{u0} & \sigma_{u0u1} \\ \sigma_{u0u1} & \sigma^2_{u1} \end{bmatrix}\right)$$ Where: • u_{1j} are intersectional group-specific (Level 2) random slopes for the DEBs variable, and they are assumed to be normally distributed with a mean of zero and a constant between-group variance σ^2_{u1}. • σ_{u0u1} is the covariance between the random effects (i.e., random intercepts u_{0j} and random slopes u_{1j}).

From Model 4, the main effects slope β_1 and the random effects slopes u_{1j} can be used to calculate the predicted prevalence (probabilities) of the outcome for each intersectional group stratified by DEB status $(x_{1ij} = 1 \text{ or } x_{1ij} = 0)$, which can be estimated as:

Predicted prevalence of the outcome without DEBs $(x_{1ij} = 0)$
$$\pi_{j,NoDEB} = \text{logit}^{-1}(\beta_0 + u_{0j})$$
Predicted prevalence of the outcome with DEBs $(x_{1ij} = 1)$
$$\pi_{j,DEB} = \text{logit}^{-1}(\beta_0 + \beta_1 x_{1ij} + u_{0j} + u_{1j}x_{1ij})$$

Among those with DEBs, we can then estimate the degree to which intersectional groups deviate from the main effects association between DEBs and the outcome by excluding the random slope term from the above equation. We then subtract the main effects predicted prevalence $\pi_{j,main}$ from the total (i.e., main + random) effects predicted prevalence $\pi_{j,DEB}$ calculated above. This difference measure is presented in Figure 3.2 and Table 3.3 and is calculated as:

Predicted prevalence of the outcome with DEBs based on main effects
$\pi_{j,main} = \text{logit}^{-1}(\beta_0 + \beta_1 x_{1ij} + u_{0j})$
Difference between predicted prevalence of the outcome with DEBs based on total effects vs. main effects
$\text{Difference} = \pi_{j,DEB} - \pi_{j,main}$

Model 5

Finally, Model 5 builds on the Model 4 specification by adding the main effects of the social position variables: race/ethnicity, sex/gender, sexual orientation, and weight status, which can be written as:

Model 5 equation

$$\text{logit}(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) =$$

$$\beta_0 + \beta_1 x_{1ij} \beta_2 x_{2j} + \beta_3 x_{3j} + \beta_4 x_{4j} + \beta_5 x_{5j} + \beta_6 x_{6j} + u_{0j} + u_{1j} x_{1ij}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \end{bmatrix} \sim N\left(0, \begin{bmatrix} \sigma^2_{u0} & \sigma_{u0u1} \\ \sigma_{u0u1} & \sigma^2_{u1} \end{bmatrix}\right)$$

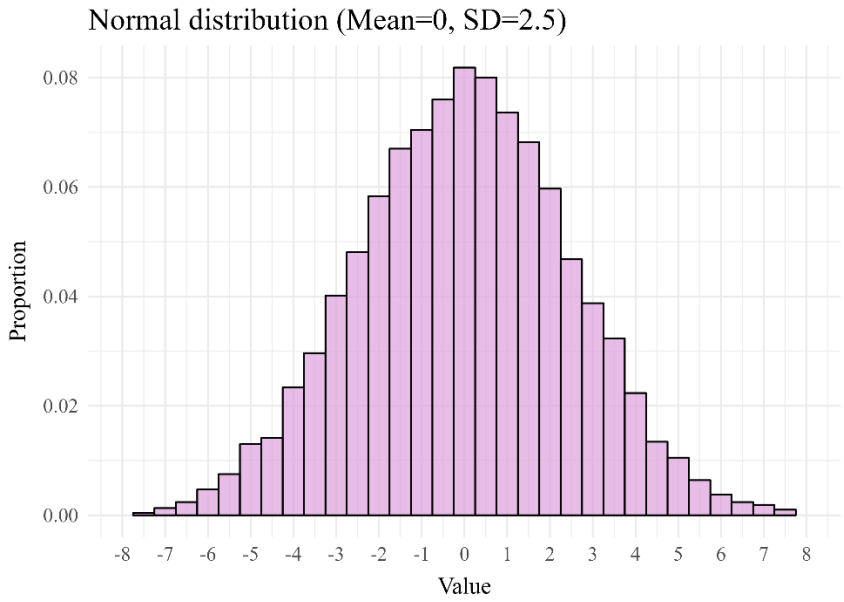
Where:

- u_{0j} represents residual deviations from the intercept main effects that are unexplained by the social position variables.
- u_{1j} represents residual deviations from the DEBs variable main effects slope that are unexplained by the social position variables.
- $\text{Var}(u_{0j})$ now represents the between-group variance among those without DEBs that remains unexplained by the social position variable main effects.
- $\text{Var}(u_{0j} + u_{1j})$ now represents the between-group variance among those with DEBs that remains unexplained by the DEBs variable main effects and the social position variable main effects

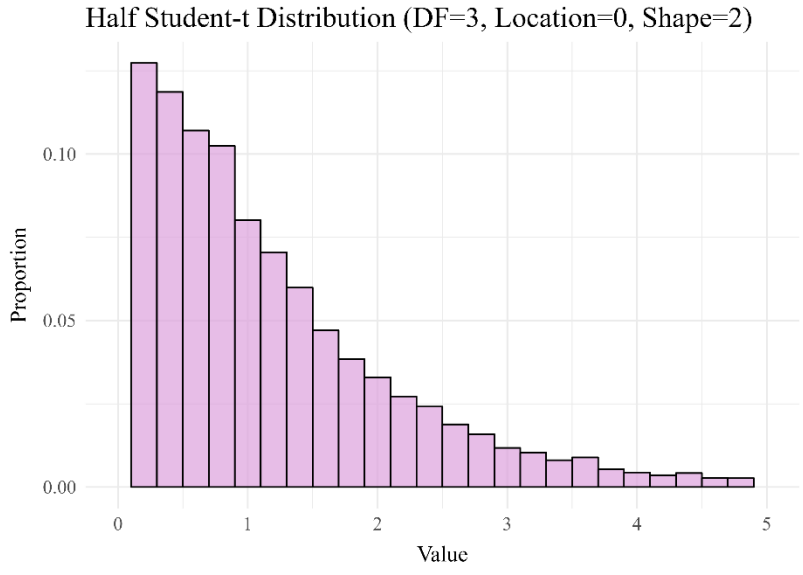
Prior distributions

To provide regularization to improve model convergence, I used weakly informative priors. The following prior distributions were used for model parameters:

- Normal distribution with mean = 0 and standard deviation = 2.5
    - Main effects parameters

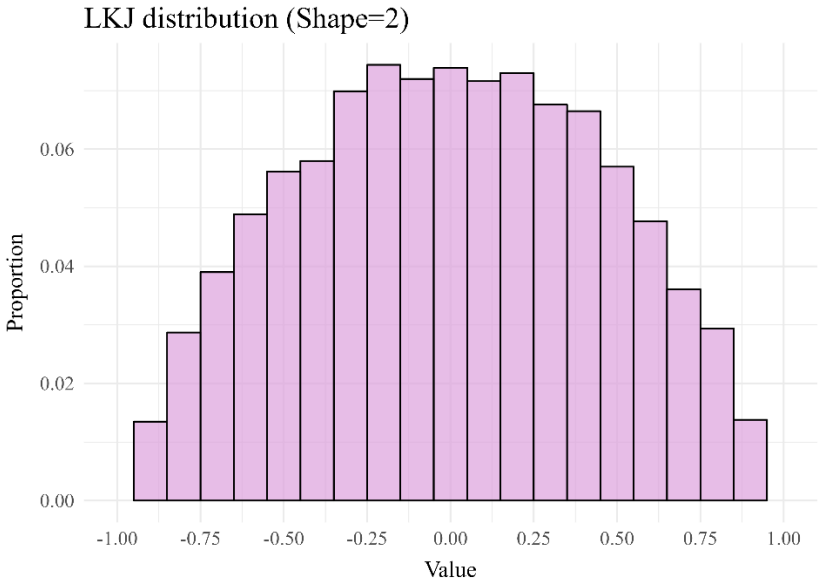


- Half student-t distribution (lower bound = 0) with degrees of freedom = 3, location = 0, and scale = 2.
    - Variance parameters



- Lewandowski-Kurowicka-Joe (LKJ) distribution with shape = 2.

- Random effects correlation (for Models 4 & 5) bounded between -1 and +1.



Supplemental tables

Table S1: Intersectional group sample sizes in the overall sample and by NHANES data collection year

Intersectional Group	Overall (n=17,578)	2005-06 (n=2,732)	2007-08 (n=3,039)	2009-10 (n=3,416)	2011-12 (n=2,682)	2013-14 (n=3,056)	2015-16 (n=2,653)
White heterosexual smaller-bodied men	2570	413	464	525	390	483	295
White heterosexual larger-bodied men	1276	206	218	268	190	219	175
White sexual minority smaller-bodied men	121	22	16	14	24	21	24
White sexual minority larger-bodied men	57	10	7	11	9	10	10
White heterosexual smaller-bodied women	2422	463	420	524	325	407	283
White heterosexual larger-bodied women	1334	225	226	249	188	262	184
White sexual minority smaller-bodied women	159	16	20	42	17	35	29
White sexual minority larger-bodied women	119	20	18	23	15	26	17
Black heterosexual smaller-bodied men	1224	176	187	204	255	195	207
Black heterosexual larger-bodied men	752	115	114	129	138	130	126
Black sexual minority smaller-bodied men	61	9	13	12	7	15	5
Black sexual minority larger-bodied men	21	6	3	1	5	3	3
Black heterosexual smaller-bodied women	960	155	163	116	195	162	169
Black heterosexual larger-bodied women	1083	168	163	168	218	168	198
Black sexual minority smaller-bodied women	93	15	12	11	21	20	14
Black sexual minority larger-bodied women	96	5	7	18	24	24	18
Hispanic/Latine heterosexual smaller-bodied men	1564	237	298	362	201	235	231
Hispanic/Latine heterosexual larger-bodied men	888	83	167	178	130	159	171
Hispanic/Latine sexual minority smaller-bodied men	64	8	13	14	9	11	9
Hispanic/Latine sexual minority larger-bodied men	18	4	2	5	2	1	4
Hispanic/Latine heterosexual smaller-bodied women	1495	227	289	316	183	251	229
Hispanic/Latine heterosexual larger-bodied women	1089	144	199	203	121	202	220
Hispanic/Latine sexual minority smaller-bodied women	59	3	10	12	9	7	18
Hispanic/Latine sexual minority larger-bodied women	53	2	10	11	6	10	14

Note: NHANES = National Health and Nutrition Examination Survey.

Table S2-A: Model 1 summary and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.13 (-2.42, -1.84)	1357.85	1.00
Intercept: White heterosexual smaller-bodied men	-0.74 (-1.06, -0.43)	1617.41	1.00
Intercept: White heterosexual larger-bodied men	-0.78 (-1.13, -0.45)	1848.82	1.00
Intercept: White sexual minority smaller-bodied men	-0.07 (-0.58, 0.41)	3714.54	1.00
Intercept: White sexual minority larger-bodied men	-0.05 (-0.70, 0.54)	4942.97	1.00
Intercept: White heterosexual smaller-bodied women	-0.48 (-0.80, -0.18)	1507.32	1.00
Intercept: White heterosexual larger-bodied women	0.20 (-0.13, 0.50)	1536.5	1.00
Intercept: White sexual minority smaller-bodied women	0.53 (0.10, 0.96)	2598.13	1.00
Intercept: White sexual minority larger-bodied women	0.83 (0.39, 1.26)	2789.76	1.00
Intercept: Black heterosexual smaller-bodied men	-0.58 (-1.00, -0.18)	2680.64	1.00
Intercept: Black heterosexual larger-bodied men	-0.36 (-0.83, 0.07)	2981.21	1.00
Intercept: Black sexual minority smaller-bodied men	0.07 (-0.76, 0.86)	6744.38	1.00
Intercept: Black sexual minority larger-bodied men	-0.05 (-1.14, 0.97)	8012.43	1.00
Intercept: Black heterosexual smaller-bodied women	0.02 (-0.38, 0.39)	2442.16	1.00
Intercept: Black heterosexual larger-bodied women	0.10 (-0.28, 0.47)	2131.37	1.00
Intercept: Black sexual minority smaller-bodied women	0.92 (0.28, 1.57)	5075.13	1.00
Intercept: Black sexual minority larger-bodied women	0.52 (-0.15, 1.17)	4959.22	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied men	-0.82 (-1.23, -0.43)	2501.34	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied men	-0.64 (-1.08, -0.23)	2883.02	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied men	-0.13 (-1.01, 0.67)	7570.59	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied men	0.68 (-0.31, 1.68)	5554.07	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied women	-0.30 (-0.68, 0.08)	2179.47	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied women	0.29 (-0.08, 0.65)	2083.2	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied women	0.15 (-0.68, 0.95)	6719.43	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied women	0.71 (-0.10, 1.49)	6232.81	1.00
Log prior density	-3.27 (-3.39, -3.17)	1265.14	1.00
Log posterior density	-4736.96 (-4747.34, -4728.02)	1414.7	1.00
Random intercepts standard deviation	0.62 (0.43, 0.89)	1521.21	1.00

Note: CI = credible interval. ESS = effective sample size.

Table S2-B: Model 2 summary and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.15 (-2.42, -1.86)	1278.28	1.00
DEBs (main effect)	0.36 (0.21, 0.52)	7433.35	1.00
Intercept: White heterosexual smaller-bodied men	-0.71 (-1.03, -0.40)	1480.17	1.00
Intercept: White heterosexual larger-bodied men	-0.78 (-1.13, -0.46)	1715.16	1.00
Intercept: White sexual minority smaller-bodied men	-0.06 (-0.57, 0.41)	3059.82	1.00
Intercept: White sexual minority larger-bodied men	-0.07 (-0.73, 0.53)	4522.78	1.00
Intercept: White heterosexual smaller-bodied women	-0.47 (-0.79, -0.18)	1468.14	1.00
Intercept: White heterosexual larger-bodied women	0.18 (-0.13, 0.49)	1479.46	1.00
Intercept: White sexual minority smaller-bodied women	0.54 (0.11, 0.95)	2505.01	1.00
Intercept: White sexual minority larger-bodied women	0.79 (0.35, 1.22)	2669.79	1.00
Intercept: Black heterosexual smaller-bodied men	-0.55 (-0.97, -0.15)	2464.56	1.00
Intercept: Black heterosexual larger-bodied men	-0.39 (-0.86, 0.06)	2760.94	1.00
Intercept: Black sexual minority smaller-bodied men	0.08 (-0.80, 0.86)	5778.48	1.00
Intercept: Black sexual minority larger-bodied men	-0.07 (-1.12, 0.92)	7283.27	1.00
Intercept: Black heterosexual smaller-bodied women	0.03 (-0.36, 0.41)	2225.24	1.00
Intercept: Black heterosexual larger-bodied women	0.07 (-0.30, 0.43)	1945.16	1.00
Intercept: Black sexual minority smaller-bodied women	0.90 (0.27, 1.54)	4094.5	1.00
Intercept: Black sexual minority larger-bodied women	0.48 (-0.14, 1.12)	5085.8	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied men	-0.79 (-1.21, -0.40)	2349.82	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied men	-0.63 (-1.09, -0.21)	2600.77	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied men	-0.12 (-1.01, 0.69)	6651.94	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied men	0.65 (-0.33, 1.68)	5161.78	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied women	-0.28 (-0.67, 0.08)	1989.04	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied women	0.27 (-0.10, 0.62)	1940.39	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied women	0.13 (-0.68, 0.89)	6552.22	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied women	0.69 (-0.08, 1.46)	6314.82	1.00
Log prior density	-5.11 (-5.23, -5.02)	1166.03	1.00
Log posterior density	-4729.51 (-4740.27, -4720.65)	1572.15	1.00
Random intercepts standard deviation	0.61 (0.42, 0.87)	1436.48	1.00

Note: CI = credible interval. ESS = effective sample size.

Table S2-C: Model 3 summary and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.50 (-2.62, -2.38)	4396.36	1.00
DEBs (main effect)	0.35 (0.20, 0.50)	14369.31	1.00
Black/African-American	0.22 (-0.05, 0.49)	4415.9	1.00
Hispanic/Latine	0.09 (-0.17, 0.36)	4547.14	1.00
Woman	0.64 (0.42, 0.87)	5030.2	1.00
Sexual minority	0.84 (0.58, 1.09)	6088.43	1.00
Larger-bodied	0.26 (0.04, 0.47)	4497.62	1.00
Intercept: White heterosexual smaller-bodied men	0.15 (-0.09, 0.40)	3939.8	1.00
Intercept: White heterosexual larger-bodied men	-0.11 (-0.38, 0.13)	5412.66	1.00
Intercept: White sexual minority smaller-bodied men	0.01 (-0.29, 0.31)	10226.73	1.00
Intercept: White sexual minority larger-bodied men	-0.06 (-0.40, 0.25)	10178.95	1.00
Intercept: White heterosexual smaller-bodied women	-0.19 (-0.44, 0.05)	4279.67	1.00
Intercept: White heterosexual larger-bodied women	0.16 (-0.07, 0.41)	4356.01	1.00
Intercept: White sexual minority smaller-bodied women	0.01 (-0.28, 0.29)	8430.35	1.00
Intercept: White sexual minority larger-bodied women	0.02 (-0.26, 0.32)	8257.71	1.00
Intercept: Black heterosexual smaller-bodied men	0.05 (-0.23, 0.34)	6933.05	1.00
Intercept: Black heterosexual larger-bodied men	0.00 (-0.28, 0.30)	8609.71	1.00
Intercept: Black sexual minority smaller-bodied men	0.00 (-0.34, 0.34)	10962.76	1.00
Intercept: Black sexual minority larger-bodied men	-0.02 (-0.39, 0.34)	11259.68	1.00
Intercept: Black heterosexual smaller-bodied women	0.04 (-0.22, 0.33)	6754.9	1.00
Intercept: Black heterosexual larger-bodied women	-0.08 (-0.37, 0.18)	6406.09	1.00
Intercept: Black sexual minority smaller-bodied women	0.10 (-0.21, 0.46)	8704.25	1.00
Intercept: Black sexual minority larger-bodied women	-0.08 (-0.43, 0.22)	8788.76	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied men	-0.02 (-0.30, 0.26)	7037.65	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied men	-0.06 (-0.36, 0.22)	8469.68	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied men	-0.02 (-0.38, 0.32)	11078.77	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied men	0.08 (-0.25, 0.49)	8443.6	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied women	-0.08 (-0.37, 0.18)	6071.79	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied women	0.12 (-0.14, 0.41)	6401.44	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied women	-0.05 (-0.42, 0.27)	11027.17	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied women	0.03 (-0.30, 0.38)	11374.42	1.00

Log prior density	-14.47 (-14.55, -14.40)	3902.95	1.00
Log posterior density	-4738.50 (-4748.53, -4730.64)	2380.03	1.00
Random intercepts standard deviation	0.17 (0.09, 0.31)	3389.65	1.00

Note: CI = credible interval. ESS = effective sample size.

Table S2-D: Model 4 summary and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.14 (-2.42, -1.85)	2216.11	1.00
DEBs (main effect)	0.27 (-0.00, 0.51)	4633.39	1.00
Intercept: White heterosexual smaller-bodied men	-0.73 (-1.05, -0.42)	2417.8	1.00
Intercept: White heterosexual larger-bodied men	-0.82 (-1.18, -0.48)	2920.82	1.00
Intercept: White sexual minority smaller-bodied men	-0.07 (-0.60, 0.43)	5854.39	1.00
Intercept: White sexual minority larger-bodied men	-0.09 (-0.77, 0.54)	8275.74	1.00
Intercept: White heterosexual smaller-bodied women	-0.47 (-0.78, -0.17)	2491.87	1.00
Intercept: White heterosexual larger-bodied women	0.11 (-0.21, 0.43)	2560.02	1.00
Intercept: White sexual minority smaller-bodied women	0.52 (0.07, 0.95)	4303.2	1.00
Intercept: White sexual minority larger-bodied women	0.89 (0.42, 1.36)	4391.9	1.00
Intercept: Black heterosexual smaller-bodied men	-0.57 (-1.01, -0.16)	4089.87	1.00
Intercept: Black heterosexual larger-bodied men	-0.38 (-0.85, 0.06)	4654.36	1.00
Intercept: Black sexual minority smaller-bodied men	0.09 (-0.76, 0.88)	12512.76	1.00
Intercept: Black sexual minority larger-bodied men	-0.08 (-1.21, 0.95)	13128.44	1.00
Intercept: Black heterosexual smaller-bodied women	0.06 (-0.34, 0.45)	3755.63	1.00
Intercept: Black heterosexual larger-bodied women	0.04 (-0.35, 0.43)	3551.47	1.00
Intercept: Black sexual minority smaller-bodied women	0.95 (0.29, 1.62)	6542.94	1.00
Intercept: Black sexual minority larger-bodied women	0.50 (-0.20, 1.19)	9252.28	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied men	-0.83 (-1.24, -0.42)	3715.03	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied men	-0.68 (-1.14, -0.25)	4429.68	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied men	-0.13 (-1.03, 0.68)	12423.19	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied men	0.66 (-0.33, 1.70)	9595.66	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied women	-0.27 (-0.65, 0.10)	3425.8	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied women	0.29 (-0.10, 0.67)	3571.04	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied women	0.14 (-0.71, 0.95)	11511.69	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied women	0.72 (-0.08, 1.53)	8714.16	1.00
Slope: White heterosexual smaller-bodied men	0.18 (-0.22, 0.63)	6684.53	1.00
Slope: White heterosexual larger-bodied men	0.18 (-0.21, 0.66)	7489.62	1.00
Slope: White sexual minority smaller-bodied men	0.02 (-0.53, 0.58)	11055.23	1.00
Slope: White sexual minority larger-bodied men	0.04 (-0.54, 0.64)	11914.96	1.00
Slope: White heterosexual smaller-bodied women	-0.04 (-0.41, 0.31)	8019.94	1.00

Slope: White heterosexual larger-bodied women	0.30 (-0.03, 0.72)	4091.5	1.00
Slope: White sexual minority smaller-bodied women	0.03 (-0.45, 0.59)	10189.56	1.00
Slope: White sexual minority larger-bodied women	-0.35 (-1.08, 0.13)	5415.31	1.00
Slope: Black heterosexual smaller-bodied men	0.09 (-0.44, 0.67)	11809.25	1.00
Slope: Black heterosexual larger-bodied men	0.01 (-0.52, 0.51)	11622.93	1.00
Slope: Black sexual minority smaller-bodied men	-0.05 (-0.75, 0.56)	11727.19	1.00
Slope: Black sexual minority larger-bodied men	0.03 (-0.64, 0.72)	10424.95	1.00
Slope: Black heterosexual smaller-bodied women	-0.25 (-0.95, 0.19)	6187.63	1.00
Slope: Black heterosexual larger-bodied women	0.09 (-0.30, 0.55)	7676.33	1.00
Slope: Black sexual minority smaller-bodied women	-0.21 (-0.97, 0.35)	8032.21	1.00
Slope: Black sexual minority larger-bodied women	-0.09 (-0.72, 0.49)	10719.46	1.00
Slope: Hispanic/Latine heterosexual smaller-bodied men	0.27 (-0.22, 0.96)	6361.36	1.00
Slope: Hispanic/Latine heterosexual larger-bodied men	0.22 (-0.26, 0.84)	6877.95	1.00
Slope: Hispanic/Latine sexual minority smaller-bodied men	-0.01 (-0.67, 0.62)	10064.61	1.00
Slope: Hispanic/Latine sexual minority larger-bodied men	-0.08 (-0.81, 0.57)	10445.32	1.00
Slope: Hispanic/Latine heterosexual smaller-bodied women	-0.09 (-0.66, 0.37)	8529.82	1.00
Slope: Hispanic/Latine heterosexual larger-bodied women	-0.09 (-0.55, 0.32)	8563.52	1.00
Slope: Hispanic/Latine sexual minority smaller-bodied women	-0.04 (-0.67, 0.57)	11638.61	1.00
Slope: Hispanic/Latine sexual minority larger-bodied women	-0.13 (-0.85, 0.45)	9287.93	1.00
Log prior density	-6.74 (-7.67, -6.37)	5893.77	1.00
Log posterior density	-4761.67 (-4776.39, -4749.07)	1786.07	1.00
Random intercepts standard deviation	0.63 (0.43, 0.91)	2683.45	1.00
Random slopes standard deviation	0.30 (0.03, 0.64)	2706.33	1.00

Note: CI = credible interval. ESS = effective sample size.

Table S2-E: Model 5 summary and convergence diagnostics

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.50 (-2.63, -2.38)	4237.81	1.00
DEBs (main effect)	0.28 (0.02, 0.50)	4731.67	1.00
Black/African-American	0.24 (-0.04, 0.51)	4546.97	1.00
Hispanic/Latine	0.11 (-0.15, 0.37)	4799.54	1.00
Woman	0.65 (0.44, 0.87)	4816.89	1.00
Sexual minority	0.86 (0.60, 1.12)	5272.26	1.00
Larger-bodied	0.25 (0.03, 0.47)	5051.67	1.00
Intercept: White heterosexual smaller-bodied men	0.15 (-0.08, 0.41)	4447.68	1.00
Intercept: White heterosexual larger-bodied men	-0.10 (-0.38, 0.15)	4894.69	1.00
Intercept: White sexual minority smaller-bodied men	0.00 (-0.30, 0.30)	7617.6	1.00
Intercept: White sexual minority larger-bodied men	-0.05 (-0.38, 0.25)	8046.5	1.00
Intercept: White heterosexual smaller-bodied women	-0.16 (-0.42, 0.07)	3888.6	1.00
Intercept: White heterosexual larger-bodied women	0.12 (-0.11, 0.38)	4160.56	1.00
Intercept: White sexual minority smaller-bodied women	-0.00 (-0.28, 0.27)	7289.6	1.00
Intercept: White sexual minority larger-bodied women	0.04 (-0.23, 0.35)	6642.64	1.00
Intercept: Black heterosexual smaller-bodied men	0.04 (-0.22, 0.34)	7175.88	1.00
Intercept: Black heterosexual larger-bodied men	0.01 (-0.27, 0.29)	6855.56	1.00
Intercept: Black sexual minority smaller-bodied men	0.00 (-0.34, 0.34)	9031.1	1.00
Intercept: Black sexual minority larger-bodied men	-0.02 (-0.37, 0.32)	8499.93	1.00
Intercept: Black heterosexual smaller-bodied women	0.05 (-0.23, 0.35)	5381.26	1.00
Intercept: Black heterosexual larger-bodied women	-0.08 (-0.36, 0.16)	6028.56	1.00
Intercept: Black sexual minority smaller-bodied women	0.08 (-0.21, 0.44)	7000.2	1.00
Intercept: Black sexual minority larger-bodied women	-0.07 (-0.43, 0.22)	7875.86	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied men	-0.02 (-0.31, 0.23)	6539.37	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied men	-0.06 (-0.37, 0.21)	6077.7	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied men	-0.02 (-0.37, 0.30)	9135.51	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied men	0.07 (-0.26, 0.48)	7920.74	1.00
Intercept: Hispanic/Latine heterosexual smaller-bodied women	-0.07 (-0.36, 0.19)	5748.27	1.00
Intercept: Hispanic/Latine heterosexual larger-bodied women	0.12 (-0.13, 0.41)	5823.63	1.00
Intercept: Hispanic/Latine sexual minority smaller-bodied women	-0.05 (-0.40, 0.27)	8777.32	1.00
Intercept: Hispanic/Latine sexual minority larger-bodied women	0.02 (-0.30, 0.36)	8547.1	1.00

Slope: White heterosexual smaller-bodied men	0.13 (-0.24, 0.58)	6278.77	1.00
Slope: White heterosexual larger-bodied men	0.09 (-0.28, 0.52)	6123.24	1.00
Slope: White sexual minority smaller-bodied men	0.01 (-0.51, 0.55)	7988.24	1.00
Slope: White sexual minority larger-bodied men	-0.01 (-0.55, 0.53)	8386.22	1.00
Slope: White heterosexual smaller-bodied women	-0.09 (-0.45, 0.25)	6598.96	1.00
Slope: White heterosexual larger-bodied women	0.31 (-0.01, 0.74)	4248.27	1.00
Slope: White sexual minority smaller-bodied women	0.08 (-0.38, 0.63)	7741.58	1.00
Slope: White sexual minority larger-bodied women	-0.22 (-0.85, 0.19)	5368.91	1.00
Slope: Black heterosexual smaller-bodied men	0.01 (-0.54, 0.53)	7679.39	1.00
Slope: Black heterosexual larger-bodied men	-0.02 (-0.51, 0.43)	7779.51	1.00
Slope: Black sexual minority smaller-bodied men	-0.05 (-0.69, 0.52)	7569.25	1.00
Slope: Black sexual minority larger-bodied men	-0.02 (-0.63, 0.58)	8131.04	1.00
Slope: Black heterosexual smaller-bodied women	-0.23 (-0.93, 0.20)	6022.57	1.00
Slope: Black heterosexual larger-bodied women	0.04 (-0.35, 0.49)	6690.88	1.00
Slope: Black sexual minority smaller-bodied women	-0.05 (-0.66, 0.49)	7452.98	1.00
Slope: Black sexual minority larger-bodied women	-0.08 (-0.67, 0.43)	7920.43	1.00
Slope: Hispanic/Latine heterosexual smaller-bodied men	0.15 (-0.29, 0.77)	6375.81	1.00
Slope: Hispanic/Latine heterosexual larger-bodied men	0.11 (-0.32, 0.67)	7049.71	1.00
Slope: Hispanic/Latine sexual minority smaller-bodied men	-0.03 (-0.67, 0.55)	7590.99	1.00
Slope: Hispanic/Latine sexual minority larger-bodied men	0.06 (-0.53, 0.72)	6139.43	1.00
Slope: Hispanic/Latine heterosexual smaller-bodied women	-0.14 (-0.68, 0.28)	8201.24	1.00
Slope: Hispanic/Latine heterosexual larger-bodied women	-0.02 (-0.45, 0.40)	8095.81	1.00
Slope: Hispanic/Latine sexual minority smaller-bodied women	-0.05 (-0.66, 0.53)	8137.2	1.00
Slope: Hispanic/Latine sexual minority larger-bodied women	-0.02 (-0.62, 0.54)	8477.62	1.00
Log prior density	-15.99 (-16.85, -15.73)	4221.61	1.00
Log posterior density	-4771.39 (-4784.57, -4759.83)	2383.53	1.00
Random intercepts standard deviation	0.17 (0.07, 0.31)	3128.8	1.00
Random slopes standard deviation	0.27 (0.03, 0.57)	3273.61	1.00

Note: CI = credible interval. ESS = effective sample size.

Table S3: Predicted prevalence of moderate-to-severe depression symptoms by intersectional group, NHANES 2005-16 (n=17,578).

Rank[1]	Intersectional Group	PP (95% CI)
1	Hispanic/Latine heterosexual smaller-bodied men	5.02 (3.73, 6.48)
2	White heterosexual larger-bodied men	5.16 (4.25, 6.16)
3	White heterosexual smaller-bodied men	5.37 (4.69, 6.10)
4	Hispanic/Latine heterosexual larger-bodied men	5.97 (4.26, 8.01)
5	Black heterosexual smaller-bodied men	6.31 (4.58, 8.33)
6	White heterosexual smaller-bodied women	6.83 (6.06, 7.64)
7	Black heterosexual larger-bodied men	7.71 (5.31, 10.49)
8	Hispanic/Latine heterosexual smaller-bodied women	8.16 (6.33, 10.16)
9	Hispanic/Latine sexual minority smaller-bodied men	10.03 (4.11, 18.68)
10	White sexual minority larger-bodied men	10.45 (5.64, 16.33)
11	White sexual minority smaller-bodied men	10.17 (6.61, 14.46)
12	Black sexual minority larger-bodied men	11.14 (3.61, 23.98)
13	Black heterosexual larger-bodied women	11.68 (9.24, 14.39)
14	Black heterosexual smaller-bodied women	10.84 (8.31, 13.54)
15	White heterosexual larger-bodied women	12.63 (11.20, 14.10)
16	Black sexual minority smaller-bodied men	11.89 (5.30, 21.71)
17	Hispanic/Latine sexual minority smaller-bodied women	12.79 (5.65, 23.19)
18	Hispanic/Latine heterosexual larger-bodied women	13.69 (11.04, 16.57)
19	White sexual minority smaller-bodied women	16.94 (12.39, 21.86)
20	Black sexual minority larger-bodied women	17.10 (9.49, 26.95)
21	Hispanic/Latine sexual minority larger-bodied men	20.20 (7.96, 39.53)
22	Hispanic/Latine sexual minority larger-bodied women	20.10 (9.76, 33.88)
23	White sexual minority larger-bodied women	21.50 (15.85, 27.77)
24	Black sexual minority smaller-bodied women	23.46 (13.84, 35.43)

[1] To aid comparison, rank order is the same as presented in the main manuscript tables/figures. Groups are sorted in ascending order by the predicted prevalence of moderate-to-severe depression symptoms among those without DEBs.

Note: NHANES = National Health and Nutrition Examination Survey. PP = predicted prevalence. CI = credible interval. Estimates are obtained from the null model (Model 1). As noted in prior intersectional MAIHDA obtaining and comparing PP estimates from differently-specified multilevel logistic models,[99] PP estimates may vary slightly due to differences in how main (fixed) effects are defined across models.

Appendix C: Chapter 4 (Aim 3) Supplementary Materials

Statistical information

Data

Data came from the National Longitudinal Survey of Adolescent to Adult Health (Add Health). For analysis, the study data was organized as follows:

- **group**: intersectional group identifier (j)
- **aid**: individual identifier (i)
- Outcomes (y_{ij})**:**
    - **diabetes_outcome**: dummy variable for diabetes cases (1: yes; 0: no)
    - **hypertension_outcome**: dummy variable for hyperlipidemia cases (1: yes; 0: no)
    - **cholesterol_outcome**: dummy variable for hyperlipidemia cases (1: yes; 0: no)
- **comorbidity**: 4-level categorical variable for the comorbidity between disordered eating and depression during the exposure period (Waves 1-3). The categorical levels are:
    - 0: Neither [reference]
    - 1: Disordered Eating only (x_{1ij})
    - 2: Depression only (x_{2ij})
    - 3: Disordered Eating & Depression (x_{3ij})
- **neighborhood_SES**: 3-level categorical variable for Wave 1 neighborhood (census-tract) socioeconomic status (SES) derived via principal component analysis of 6 indicators. The categorical levels are:
    - 0: Higher SES [reference]
    - 1: Average SES (x_{4ij})
    - 2: Lower SES (x_{5ij})
- **household_SES**: 3-level categorical variable for Wave 1 household (parent-reported) SES derived via principal component analysis of 4 indicators. The categorical levels are:
    - 0: Higher SES [reference]
    - 1: Average SES (x_{6ij})
    - 2: Lower SES (x_{7ij})
- **sexual_minority**: dummy variable for sexual minority status (1: Sexual minority; 0: Heterosexual) (x_{8ij})
- **black**: dummy variable for Black/African-American race/ethnicity (1: Black/African-American; 0: otherwise) (x_{9j})
- **latine**: dummy variable for Hispanic/Latine race/ethnicity (1: Hispanic/Latine; 0: otherwise) (x_{10j})
- **multiracial_other**: dummy variable for Hispanic/Latine race/ethnicity (1: Hispanic/Latine; 0: otherwise) (x_{11j})

- **cisgender_woman**: dummy variable for cisgender woman gender identity (1: cisgender woman; 0: cisgender man) (x_{12j})
- **larger_body**: dummy variable for larger-bodied weight status at Wave 1 (1: larger-bodied; 0: smaller-bodied) (x_{13j})

Individuals were sorted into 16 intersectional groups through mutually-exclusive combinations of all four race/ethnicity (White, Black/African American, Hispanic/Latine, Multiracial/Other Race), two gender identity (cisgender man, cisgender woman), and two weight status (smaller-bodied, larger-bodied) categories (16 = 4*2*2).

Multilevel variance estimation in log-binomial models

Given the multilevel structure of the current study's analytic approach, individual outcome variance can be partitioned into two components.[109] In this study, these are the differences found comparing intersectional groups to one another (Level 2 or between-group variance) vs. differences within intersectional groups (Level 1 or within-group variance).

Level 1 variance is not directly estimable in log-binomial models. Therefore, I used methods outlined by Yelland et al. (2011),[192] who stated that the Level 1 variance is "determined from the theoretical binomial variance which is calculated on the probability scale, independent of the link function." As such, Level 1 variance σ_w^2 was estimated as:

$$\sigma_w^2 = n * p(1-p),$$

Where:

- n is the number of trials
- p is the probability of success

I used the special case of n=1 trials (i.e., Bernoulli), which permitted the Level 1 variance to be estimated as:

$$\sigma_w^2 = p(1-p)$$

I approximated p as $\bar{p}$, which is the outcome-specific probability of success in the Add Health sample (e.g., design-weighted proportion with incident hypertension). The Level 1 variance equation can then be rewritten as:

$$\sigma_w^2 = \bar{p}(1-\bar{p})$$

The above calculations produce Level 1 variance estimate that is on the probability scale; however, the Level 2 (between-group) variance estimate obtained from log-binomial models is on the log scale. Therefore, guided again by Yelland et al.,[192] I transformed the Level 2 variance from the original log scale (σ_a^2) to the probability scale (σ_b^2), using the following method:

$$\sigma_b^2 \approx (e^{\sigma_a^2} - 1)\bar{p}^2$$

Variance partition coefficient (VPC) with random intercepts

Now that Level 1 variance σ_w^2 and Level 2 variance σ_b^2 are both on the probability scale, the variance partition coefficient (VPC, also known as intraclass correlation [ICC]), can be calculated as:

$$VPC \equiv ICC = \frac{\sigma_b^2}{\sigma_w^2 + \sigma_b^2} * 100\%$$

Here, the VPC estimates the proportion of individual outcome variation that is found comparing intersectional group to one another. Thus, in cases where between-group differences (inequities) in the outcome are large, the VPC measure will large, which will indicate a higher degree of clustering of outcome cases within intersectional groups.

To interpret the relative size of VPC estimates, I used the following thresholds proposed by Merlo, Wagner, & Leckie (2019):[206]

Assessment of between-group differences	VPC (%)
Absent	0 to 1
Very small	1 to 5
Small	5 to 10
Moderate[1]	10 to 20
Fairly large	20 to 30
Very large	30 to 100

[1] Merlo, Wagner, & Leckie (2019) referred to this category as "less large".

VPCs with random intercepts and random slopes

In Models with random slopes for the exposure variable (Models 4-5), VPCs are separately calculated for each exposure level. This is because Level 2 variance can now come from multiple sources, namely, the random intercepts and the random slopes. Using methods outlined in prior application of intersectional MAIHDA with random slopes,[64] exposure-specific Level 2 variance estimates are summarized below:

Description	Total Level 2 variance calculation
Level 2 variance for the unexposed	$\mathrm{Var}(u_{0j}) = \sigma^2_{u0}$
Level 2 variance for those with "Disordered Eating only"	$\mathrm{Var}(u_{0j} + u_{1j}) = \sigma^2_{u0} + 2\sigma_{u0u1} + \sigma^2_{u1}$
Level 2 variance for those with "Depression only"	$\mathrm{Var}(u_{0j} + u_{2j}) = \sigma^2_{u0} + 2\sigma_{u0u2} + \sigma^2_{u2}$
Level 2 variance for those with "Disordered Eating & Depression"	$\mathrm{Var}(u_{0j} + u_{3j}) = \sigma^2_{u0} + 2\sigma_{u0u3} + \sigma^2_{u3}$

For the unexposed, the same VPC formula that is used in Models 1-3 can be used in Model 4-5. Since it serves as the categorical reference level, the unexposed group does not have an associated random slopes variance parameter.

However, for the three non-referent exposed levels, the VPC must consider, the random intercepts variance (σ^2_{u0}) the random slopes variance (one of: σ^2_{u1}, σ^2_{u2}, σ^2_{u3}), and two times the random intercepts-slopes covariance (one of: σ_{u0u1}, σ_{u0u2}, σ_{u0u3}). Using methods outlined by Evans et al.,[64] the VPC for each exposure level can be calculated as:

$$\text{"Disordered Eating only" VPC} = \frac{\sigma^2_{u0} + 2\sigma_{u0u1} + \sigma^2_{u1}}{\sigma^2_{w} + \sigma^2_{u0} + 2\sigma_{u0u1} + \sigma^2_{u1}} * 100\%$$

$$\text{"Depression only" VPC} = \frac{\sigma^2_{u0} + 2\sigma_{u0u2} + \sigma^2_{u2}}{\sigma^2_{w} + \sigma^2_{u0} + 2\sigma_{u0u2} + \sigma^2_{u2}} * 100\%$$

$$\text{"Disordered Eating \& Depression" VPC} = \frac{\sigma_{u0}^2 + 2\sigma_{u0u3} + \sigma_{u3}^2}{\sigma_w^2 + \sigma_{u0}^2 + 2\sigma_{u0u3} + \sigma_{u3}^2} * 100\%$$

Proportional change in variance (PCV) with random intercepts

In this study, I fit a series of models for each outcome. For instance, while Model 1 included no Level 1 covariates, Model 2 added the exposure variable to predict risk of the outcome.

This opens the opportunity to assess whether the exposure variable explained (reduced) any of the Level 2 variance in the outcome. In other words, does including the exposure variable in the model account for between-group inequities observed in Model 1?

To evaluate this research question, I calculated proportional change in (Level 2) variance (PCV) from the reference model (in this case, Model 1) to the adjusted model (Model 2), which can be expressed as:

$$\text{PCV} = \frac{\sigma_{u0(\text{Reference})}^2 - \sigma_{u0(\text{Adjusted})}^2}{\sigma_{u0(\text{Reference})}^2} * 100\%$$

PCVs with random intercepts and random slopes

Similar to separate VPC calculations in the presence of random slopes, the PCVs for models must calculated for each exposure level. The PCV for the unexposed group can be calculated using the same equation as above, since the unexposed group does not have any associated random slopes.

For all non-referent exposure levels, PCVs were estimated as:

Disordered Eating only:

$$PCV = \frac{(\sigma_{u0(\text{Reference})}^2 + 2\sigma_{u0u1(\text{Reference})} + \sigma_{u1(\text{Reference})}^2) - (\sigma_{u0(\text{Adjusted})}^2 + 2\sigma_{u0u1(\text{Adjusted})} + \sigma_{u1(\text{Adjusted})}^2)}{\sigma_{u0(\text{Refernece})}^2 + 2\sigma_{u0u1(\text{Reference})} + \sigma_{u1(\text{Reference})}^2} * 100\%$$

Depression only:

$$PCV = \frac{(\sigma_{u0(\text{Reference})}^2 + 2\sigma_{u0u2(\text{Reference})} + \sigma_{u2(\text{Reference})}^2) - (\sigma_{u0(\text{Adjusted})}^2 + 2\sigma_{u0u2(\text{Adjusted})} + \sigma_{u2(\text{Adjusted})}^2)}{\sigma_{u0(\text{Refernece})}^2 + 2\sigma_{u0u2(\text{Reference})} + \sigma_{u2(\text{Reference})}^2} * 100\%$$

Disordered Eating & Depression:

$$PCV = \frac{(\sigma_{u0(\text{Reference})}^2 + 2\sigma_{u0u3(\text{Reference})} + \sigma_{u3(\text{Reference})}^2) - (\sigma_{u0(\text{Adjusted})}^2 + 2\sigma_{u0u3(\text{Adjusted})} + \sigma_{u3(\text{Adjusted})}^2)}{\sigma_{u0(\text{Refernece})}^2 + 2\sigma_{u0u3(\text{Reference})} + \sigma_{u3(\text{Reference})}^2} * 100\%$$

Updated Stan code to truncate linear predictor term

To ensure that the linear predictor term (mu) falls within valid probability scale bounds (i.e., 0 to 1), I truncated mu so that, on the log scale, it was no greater than -0.015, where exp(-0.015) = 0.9851119. While exp(0) = 1, setting the upper bound led to 0 led to sampling convergence issues. Therefore, I selected a value that was lower than but very close to 0 (i.e., -0.015) to avoid these issues.

The updated Stan code is printed below. This example is specific to Model 1, which was specified with random intercepts for the level 2 units and no level 1 covariates (i.e., a null model). The same code edits were made to Models 2-5.

Stan code for Model 1 (edits in red):

```
data {
  int<lower=1> N;  // total number of observations
  int Y[N];  // response variable
  vector<lower=0>[N] weights;  // model weights
  // data for group-level effects of ID 1
  int<lower=1> N_1;  // number of grouping levels
  int<lower=1> M_1;  // number of coefficients per level
  int<lower=1> J_1[N];  // grouping indicator per observation
  // group-level predictor values
  vector[N] Z_1_1;
  int prior_only;  // should the likelihood be ignored?
}

parameters {
  real Intercept;  // temporary intercept for centered predictors
  vector<lower=0>[M_1] sd_1;  // group-level standard deviations
  vector[N_1] z_1[M_1];  // standardized group-level effects
}

transformed parameters {
  vector[N_1] r_1_1;  // actual group-level effects
  real lprior = 0;  // prior contributions to the log posterior
  r_1_1 = (sd_1[1] * (z_1[1]));
  lprior += normal_lpdf(Intercept | 0, 2.5);
  lprior += student_t_lpdf(sd_1 | 3, 0, 2)
    - 1 * student_t_lccdf(0 | 3, 0, 2);
}

model {

  // likelihood including constants
  if (!prior_only) {
```

```
    // initialize linear predictor term
    vector[N] mu = rep_vector(0.0, N);
    mu += Intercept;

    for (n in 1:N) {
      // add more terms to the linear predictor
      mu[n] += r_1_1[J_1[n]] * Z_1_1[n];
    }

    // set upper bound of -0.015 on log scale
    // if mu<-0.015, return mu; if mu>=-0.015, return -0.015
    // Note: when exponentiated, max value is exp(-0.015) = 0.9851119
    mu = fmin(mu, -0.015);
    // exponentiate the truncated mu from log to probability scale
    mu = exp(mu);

    for (n in 1:N) {
      target += weights[n] * (bernoulli_lpmf(Y[n] | mu[n]));
    }

  }

  // priors including constants
  target += lprior;
  target += std_normal_lpdf(z_1[1]);

}

generated quantities {
  // actual population-level intercept
  real b_Intercept = Intercept;
}
```

Model 1

Model 1 (null intersectional model) was a two-level log-binomial model with no level 1 covariates and random intercepts for each intersectional group, which can be written as:

Model 1 equation
$$\log(\pi_j) = \beta_0 + u_{0j}$$ $$y_{ij} \sim \text{Bernoulli}(\pi_j)$$ $$u_{0j} \sim N(0, \sigma^2_{u0})$$ Where: • y_{ij} follows a Bernoulli distribution (Binomial distribution with n=1 trials) with probability of success π_j. • π_j is the incident risk of the outcome for individuals in intersectional group j. • β_0 is the main effects intercept. • u_{0j} are intersectional group-specific (Level 2) random intercepts, which are assumed to be normally distributed with a mean of zero and a constant between-group variance σ^2_{u0}.

To obtain predicted risk estimates for each outcome and each intersectional group j, irrespective of exposure level (which is estimated from Model 4), I exponentiated the sum of the model main effects and group-specific random intercepts as:

Predicted risk estimates from Model 1
$$\pi_j = \exp\left(log(\pi_j)\right) = \exp(\beta_0 + u_{0j})$$

Model 2

Building off the specification for Model 1, Model 2 included the main effects slopes for the exposure variable, which can be written as:

Model 2 equation

$$\log(\pi_{ij}) = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \beta_3 x_{3ij} + u_{0j}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$u_{0j} \sim N(0, \sigma^2_{u0})$$

Where:

- β_0 is the main effects intercept.
  - With the exposure variable included in the model, this now represents the sample-level average predicted risk of the outcome for those who were unexposed (i.e., neither disordered eating nor depression).
- β_1 is the main effects slope for the "Disordered Eating only" exposure level.
- β_2 is the main effects slope for the "Depression only" exposure level.
- β_3 is the main effects slope for the "Disordered Eating & Depression" exposure level.
- σ^2_{u0} now represents the between-group variance that remains unexplained by the exposure variable main effects.

For Model 2, the PCV is calculated in reference to Model 1 as:

$$\text{PCV} = \frac{\sigma^2_{u0(\text{Model 1})} - \sigma^2_{u0(\text{Model 2})}}{\sigma^2_{u0(\text{Model 1})}} * 100\%$$

Model 3

Model 3 updates the Model 2 specification by adding the confounder variables (i.e., neighborhood SES, household SES, sexual orientation), which can be written as:

Model 3 equation

$$\log(\pi_{ij}) = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \beta_3 x_{3ij} + \beta_4 x_{4ij} + \beta_5 x_{5ij} + \beta_6 x_{6ij} + \beta_7 x_{7ij} + \beta_8 x_{8ij} + u_{0j}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$u_{0j} \sim N(0, \sigma^2_{u0})$$

Where:

- β_0 is the main effects intercept.
    - With the exposure variable and confounder variables included in the model, this now represents the sample-level average predicted risk of the outcome for those who were unexposed (i.e., neither disordered eating nor depression) and in the reference groups for each confounder variable (i.e., Higher neighborhood SES, Higher household SES, heterosexual).
- β_4 is the main effects slope for "Average SES" neighborhood SES [ref=Higher SES].
- β_5 is the main effects slope for "Lower SES" neighborhood SES [ref=Higher SES].
- β_6 is the main effects slope for "Average SES" household SES [ref=Higher SES].
- β_7 is the main effects slope for "Lower SES" household SES [ref=Higher SES].
- β_8 is the main effects slope for "sexual minority" sexual orientation [ref=heterosexual].
- σ^2_{u0} now represents the between-group variance that remains unexplained by the exposure variable main effects and the confounder variable main effects.

For Model 3, the PCV is calculated in reference to Model 1 as:

$$\text{PCV} = \frac{\sigma^2_{u0(\text{Model 1})} - \sigma^2_{u0(\text{Model 3})}}{\sigma^2_{u0(\text{Model 1})}} * 100\%$$

Model 4

Models 4 builds on Model 3's specification by adding the random slopes (u_{1j}, u_{2j}, u_{3j}) for each level of the exposure variable. This allows the exposure-outcome associations to vary across the level 2 units (intersectional groups). Model 4 can be written as:

Model 4 equation

$$\log(\pi_{ij}) = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \beta_3 x_{3ij} + \beta_4 x_{4ij} + \beta_5 x_{5ij} + \beta_6 x_{6ij} + \beta_7 x_{7ij} + \beta_8 x_{8ij} + u_{0j} + u_{1j} x_{1ij} + u_{2j} x_{2ij} + u_{3j} x_{3ij}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \\ u_{2j} \\ u_{3j} \end{bmatrix} \sim N\left(0, \begin{bmatrix} \sigma^2_{u0} & & & \\ \sigma_{u0u1} & \sigma^2_{u1} & & \\ \sigma_{u0u2} & \sigma_{u1u2} & \sigma^2_{u2} & \\ \sigma_{u0u3} & \sigma_{u1u3} & \sigma_{u2u3} & \sigma^2_{u3} \end{bmatrix}\right)$$

Where:

- The random effects (u_{0j}, u_{1j}, u_{2j}, u_{3j}) are assumed to be normally distributed with a mean of zero with a random effects-specific between-group variances (σ^2_{u0}, σ^2_{u1}, σ^2_{u2}, σ^2_{u3}), and covariances (σ_{u0u1}, σ_{u0u2}, σ_{u0u3}, σ_{u1u2}, σ_{u1u3}, σ_{u2u3}).

Predicted risk estimates via marginal standardization

From Model 4, I calculated the predicted risk of the outcome for each intersectional group and exposure level. Since confounder variables were included in the model, I used marginal standardization. Marginal standardization is a regression-based method to obtain a weighted average of the predicted risk estimates that are standardized to the design-weighted sample confounder distribution.[199]

First, I derived a 18-level categorical variable which represented all possible combinations of the three categorical confounder variables (3 neighborhood SES levels * 3 household SES levels * 2 sexual orientation levels). Since sample sizes differed across outcome models, I used the survey package to calculate a vector of design-weighted proportions for each outcome, which are summarized below:

Confounder distribution: Z				**Design-weighted proportions: Pr(Z = z)**		
Level (z)	**Neighborhood SES**	**Household SES**	**Sexual orientation**	**Diabetes (n=8,878)**	**Hypertension (n=8,393)**	**Hyperlipidemia (n=8,462)**
1	Higher	Higher	Heterosexual	0.1653	0.1699	0.1649
2			Sexual minority	0.0519	0.0521	0.0507
3		Average	Heterosexual	0.0875	0.0897	0.0862
4			Sexual minority	0.0240	0.0236	0.0229
5		Lower	Heterosexual	0.0352	0.0350	0.0346
6			Sexual minority	0.0123	0.0129	0.0128
7	Average	Higher	Heterosexual	0.0900	0.0914	0.0891
8			Sexual minority	0.0213	0.0204	0.0212
9		Average	Heterosexual	0.1019	0.1031	0.1027
10			Sexual minority	0.0234	0.0225	0.0241
11		Lower	Heterosexual	0.0764	0.0753	0.0780
12			Sexual minority	0.0228	0.0223	0.0225
13	Lower	Higher	Heterosexual	0.0391	0.0386	0.0394
14			Sexual minority	0.0081	0.0085	0.0083
15		Average	Heterosexual	0.0692	0.0707	0.0698
16			Sexual minority	0.0184	0.0171	0.0188
17		Lower	Heterosexual	0.1272	0.1235	0.1284
18			Sexual minority	0.0259	0.0233	0.0256

Let $\pi_{j,e,z}$ be the predicted outcome risk for intersectional group j at exposure level E = e and confounder distribution level Z = z. Let exposure level 0 = "Neither", 1 = "Disordered Eating only", 2 = "Depression only", and 3 = "Disordered Eating & Depression."

Using this notation, the predicted outcome risk for each combination of intersectional group, exposure level, and confounder distribution level can be obtained. For example, to calculate the predicted outcome risk for intersectional group j = 5 (i.e., Black smaller-bodied men), exposure level E = 2 (i.e., "Depression only") and confounder distribution level Z = 18 (i.e., Neighborhood SES = Lower, Household SES = Lower, Sexual orientation = Sexual minority):

$$\pi_{5,2,18} = \exp\left(\beta_0 + u_{0,5} + \beta_2 + u_{2,5} + \beta_5 + \beta_7 + \beta_8\right),$$

Where:

- β_0 is the main effects intercept.
- $u_{0,5}$ is the random intercept for intersectional group j = 5.
- β_2 is the main effects slope for "Depression only".
- $u_{2,5}$ is the random slope for "Depression only" for intersectional group j = 5.

- β_5 is the main effects slope for "Lower SES" neighborhood SES [ref=Higher SES].
- β_7 is the main effects slope for "Lower SES" household SES [ref=Higher SES].
- β_8 is the main effects slope for "sexual minority" sexual orientation [ref=heterosexual].

Using this approach, I calculated the standardized predicted outcome risk for intersectional group j at exposure level E = e ($\pi_{j,e}$) as a weighted sum of the predicted risk estimates across all 18 confounder distribution levels Z = z:

$$\pi_{j,e} = \sum_{z} \pi_{j,e,z} * \Pr(Z = z)$$

For each intersectional group, I then calculated the risk difference (RD) and risk ratio (RR) relative to the unexposed group (E = 0):

Risk difference (RD) relative to the unexposed group (E = 0)
Disordered Eating only: $\pi_j^{e=1} - \pi_j^{e=0}$
Depression only: $\pi_j^{e=2} - \pi_j^{e=0}$
Disordered Eating & Depression: $\pi_j^{e=3} - \pi_j^{e=0}$
Risk ratio (RR) relative to the unexposed group (E = 0)
Disordered Eating only: $\pi_j^{e=1} / \pi_j^{e=0}$
Depression only: $\pi_j^{e=2} / \pi_j^{e=0}$
Disordered Eating & Depression: $\pi_j^{e=3} / \pi_j^{e=0}$

Model 5

Finally, Model 5 builds on the Model 4 specification by adding the main effects of the social position variables: race/ethnicity, gender identity, and weight status, which can be written as:

Model 5 equation

$$\begin{aligned}\log(\pi_{ij}) = {} & \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \beta_3 x_{3ij} + \beta_4 x_{4ij} + \\ & \beta_5 x_{5ij} + \beta_6 x_{6ij} + \beta_7 x_{7ij} + \beta_8 x_{8ij} + \\ & \beta_9 x_{9j} + \beta_{10} x_{10j} + \beta_{11} x_{11j} + \beta_{12} x_{12j} + \beta_{13} x_{13j} + \\ & u_{0j} + u_{1j} x_{1ij} + u_{2j} x_{2ij} + u_{3j} x_{3ij}\end{aligned}$$

$$y_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \\ u_{2j} \\ u_{3j} \end{bmatrix} \sim N\left(0, \begin{bmatrix} \sigma^2_{u0} & & & \\ \sigma_{u0u1} & \sigma^2_{u1} & & \\ \sigma_{u0u2} & \sigma_{u1u2} & \sigma^2_{u2} & \\ \sigma_{u0u3} & \sigma_{u1u3} & \sigma_{u2u3} & \sigma^2_{u3} \end{bmatrix}\right)$$

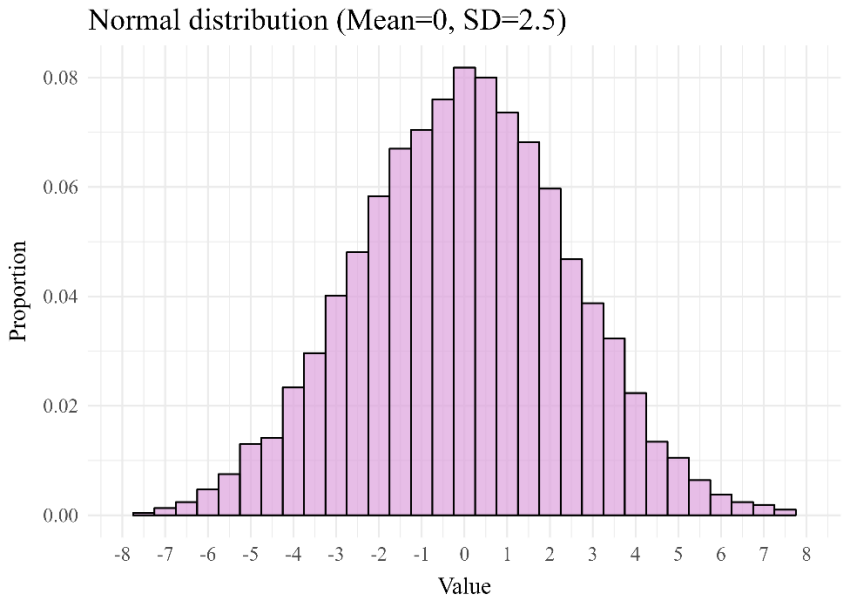
Where:

- β_9 is the main effects slope for “Black/African-American” race/ethnicity [ref=White].
- β_{10} is the main effects slope for “Hispanic/Latine” race/ethnicity [ref=White].
- β_{11} is the main effects slope for “Multiracial/Other Race” race/ethnicity [ref=White].
- β_{12} is the main effects slope for “Cisgender woman” gender identity [ref=Cisgender man].
- β_{13} is the main effects slope for “larger-bodied” weight status [ref=smaller-bodied].

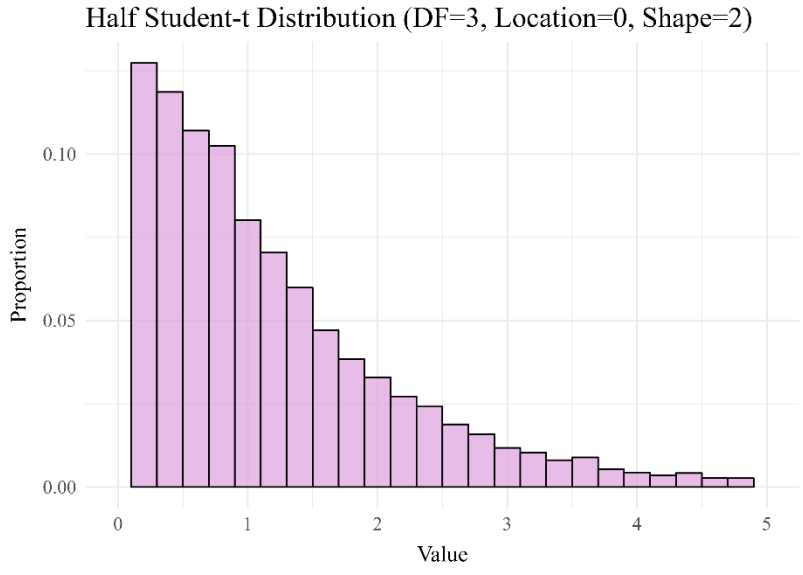
Prior distributions

To provide regularization to improve model convergence, I used weakly informative priors. The following prior distributions were used for model parameters:

- Normal distribution with mean = 0 and standard deviation = 2.5
    - Main effects parameters

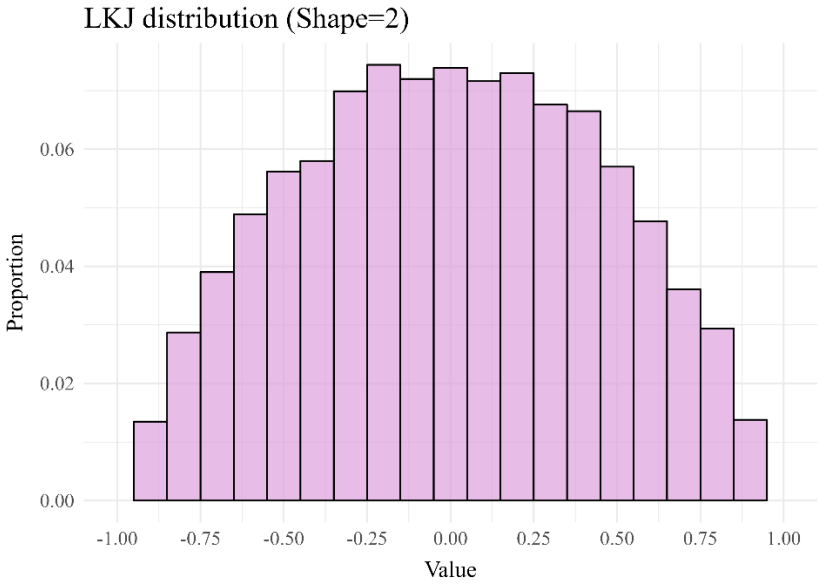


- Half student-t distribution (lower bound = 0) with degrees of freedom = 3, location = 0, and scale = 2.
    - Variance parameters



- Lewandowski-Kurowicka-Joe (LKJ) distribution with shape = 2.

- Random effects correlation (for Models 4 & 5) bounded between -1 and +1.



Supplemental tables

Table S1-A. Incident diabetes: Intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA), Add Health (n=8,878).

	Model 1	Model 2	Model 3	Model 4	Model 5
Main effects, RR (95% CI)					
Intercept	0.13 (0.09, 0.19)	0.13 (0.09, 0.18)	0.12 (0.08, 0.17)	0.11 (0.08, 0.16)	0.08 (0.06, 0.10)
Exposure [Ref: Neither]					
DE only	--	1.20 (0.99, 1.43)	**1.20 (1.01, 1.44)**	1.15 (0.89, 1.43)	1.15 (0.89, 1.42)
Depression only	--	0.96 (0.82, 1.13)	0.93 (0.80, 1.09)	0.87 (0.58, 1.27)	0.87 (0.59, 1.27)
DE & Depression	--	1.00 (0.80, 1.24)	0.96 (0.77, 1.20)	1.04 (0.75, 1.45)	1.03 (0.73, 1.44)
Covariates					
Neighborhood SES [Ref: Higher SES]					
Average SES	--	--	**1.20 (1.01, 1.42)**	**1.20 (1.00, 1.43)**	**1.20 (1.00, 1.44)**
Lower SES	--	--	**1.39 (1.15, 1.67)**	**1.40 (1.16, 1.68)**	**1.39 (1.15, 1.68)**
Household SES [Ref: Higher SES]					
Average SES	--	--	1.01 (0.85, 1.20)	1.00 (0.84, 1.19)	1.00 (0.85, 1.19)
Lower SES	--	--	**1.20 (1.02, 1.43)**	**1.21 (1.01, 1.43)**	**1.20 (1.01, 1.43)**
Sexual orientation [Ref: Heterosexual]					
Sexual minority	--	--	**1.18 (1.00, 1.38)**	**1.19 (1.01, 1.39)**	**1.19 (1.01, 1.38)**
Intersectional social position variables					
Race/ethnicity [Ref: White]					
Black/African-American	--	--	--	--	**2.04 (1.34, 3.09)**
Hispanic/Latine	--	--	--	--	1.34 (0.80, 2.19)
Multiracial or Other Race	--	--	--	--	**1.64 (1.01, 2.57)**
Sex/gender [Ref: Man]					
Woman	--	--	--	--	0.94 (0.70, 1.28)
Weight status [Ref: Smaller bodied]					
Larger bodied	--	--	--	--	**2.64 (1.90, 3.69)**
Random effects (log scale)					
Random intercepts var.	0.7082	0.6986	0.6558	0.7442	0.2913
Random slopes var. (cor.) – *DE only*	--	--	--	0.2053 (-0.21)	0.1967 (-0.11)
Random slopes var. (cor.) – *Depression only*	--	--	--	0.6428 (-0.50)	0.6175 (-0.36)
Random slopes var. (cor.) – *DE & Depression*	--	--	--	0.4236 (-0.21)	0.4115 (-0.15)
VPC and PCV summaries					
Overall					
VPC (%, 95% CI)	9.65 (6.02, 15.94)	9.49 (5.81, 15.94)	8.77 (5.28, 14.82)		

PCV (%)	--	-1.79	-10.04		
Neither					
VPC (%, 95% CI)	--	--	--	10.28 (6.39, 17.10)	3.41 (0.90, 7.14)
PCV (%)	--	--	--	--	-69.22
DE only					
VPC (%, 95% CI)	--	--	--	12.62 (7.48, 22.75)	5.95 (1.97, 12.96)
PCV (%)	--	--	--	--	-56.29
Depression only					
VPC (%, 95% CI)	--	--	--	13.19 (6.91, 25.61)	10.67 (5.78, 19.62)
PCV (%)	--	--	--	--	-22.21
DE & Depression					
VPC (%, 95% CI)	--	--	--	15.73 (8.36, 31.55)	8.93 (3.11, 19.17)
PCV (%)	--	--	--	--	-48.25

Note: Add Health = National Longitudinal Study of Adolescent to Adult Health. RR = risk ratio. CI = credible interval. DE = disordered eating. SES = socioeconomic status. Var. = variance. Cor. = correlation. VPC = variance partition coefficient. PCV = proportional change in variance. For main effects, bold font indicates a statistically significant result at a 95% CI level. For each set of random slopes, correlation values are calculated in reference to the random intercepts.

Table S1-B. Incident hypertension: Intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA), Add Health (n=8,393).

	Model 1	Model 2	Model 3	Model 4	Model 5
Main effects, RR (95% CI)					
Intercept	0.28 (0.22, 0.34)	0.28 (0.23, 0.34)	0.26 (0.22, 0.32)	0.26 (0.21, 0.32)	0.23 (0.20, 0.25)
Exposure [Ref: Neither]					
DE only	--	1.03 (0.92, 1.16)	1.04 (0.92, 1.16)	1.02 (0.84, 1.20)	1.01 (0.83, 1.21)
Depression only	--	**1.19 (1.09, 1.30)**	**1.18 (1.08, 1.29)**	**1.23 (1.02, 1.50)**	**1.22 (1.04, 1.44)**
DE & Depression	--	**1.39 (1.23, 1.57)**	**1.39 (1.24, 1.56)**	**1.41 (1.16, 1.71)**	**1.41 (1.17, 1.69)**
Covariates					
Neighborhood SES [Ref: Higher SES]					
Average SES	--	--	**1.10 (1.00, 1.21)**	**1.10 (1.00, 1.21)**	**1.10 (1.00, 1.21)**
Lower SES	--	--	**1.29 (1.17, 1.43)**	**1.30 (1.17, 1.43)**	**1.29 (1.17, 1.43)**
Household SES [Ref: Higher SES]					
Average SES	--	--	1.07 (0.98, 1.17)	1.07 (0.98, 1.17)	1.07 (0.97, 1.17)
Lower SES	--	--	1.06 (0.97, 1.17)	1.06 (0.97, 1.18)	1.07 (0.97, 1.18)
Sexual orientation [Ref: Heterosexual]					
Sexual minority	--	--	0.97 (0.88, 1.07)	0.97 (0.88, 1.07)	0.98 (0.88, 1.08)
Intersectional social position variables					
Race/ethnicity [Ref: White]					
Black/African-American	--	--	--	--	1.18 (0.95, 1.47)
Hispanic/Latine	--	--	--	--	0.83 (0.65, 1.04)
Multiracial or Other Race	--	--	--	--	1.11 (0.88, 1.39)
Gender identity [Ref: Cisgender man]					
Cisgender woman	--	--	--	--	**0.68 (0.57, 0.79)**
Weight status [Ref: Smaller bodied]					
Larger bodied	--	--	--	--	**1.56 (1.32, 1.84)**
Random effects (log scale)					
Random intercepts var.	0.3771	0.3754	0.3660	0.3991	0.1455
Random slopes var. (cor.) – *DE only*	--	--	--	0.1941 (0.07)	0.2141 (0.11)
Random slopes var. (cor.) – *Depression only*	--	--	--	0.2866 (-0.16)	0.2367 (-0.47)
Random slopes var. (cor.) – *DE & Depression*	--	--	--	0.2281 (-0.16)	0.2322 (0.10)
VPC and PCV summaries					
Overall					
VPC (%, 95% CI)	13.20 (8.62, 20.32)	13.14 (8.77, 20.39)	12.80 (8.54, 19.60)	--	--

PCV (%)	--	-0.62	-3.56	--	--
Neither					
VPC (%, 95% CI)	--	--	--	14.01 (8.76, 22.03)	4.95 (1.71, 9.61)
PCV (%)	--	--	--	--	-68.12
DE only					
VPC (%, 95% CI)	--	--	--	21.44 (12.06, 35.52)	12.79 (4.82, 23.57)
PCV (%)	--	--	--	--	-46.53
Depression only					
VPC (%, 95% CI)	--	--	--	23.08 (15.11, 34.66)	12.03 (5.29, 19.59)
PCV (%)	--	--	--	--	-54.66
DE & Depression					
VPC (%, 95% CI)	--	--	--	21.10 (12.15, 33.40)	13.40 (5.18, 23.82)
PCV (%)	--	--	--	--	-42.18

Note: Add Health = National Longitudinal Study of Adolescent to Adult Health. RR = risk ratio. CI = credible interval. DE = disordered eating. SES = socioeconomic status. Var. = variance. Cor. = correlation. VPC = variance partition coefficient. PCV = proportional change in variance. For main effects, bold font indicates a statistically significant result at a 95% CI level. For each set of random slopes, correlation values are calculated in reference to the random intercepts.

Table S1-C. Incident hyperlipidemia: Intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA), Add Health (n=8,462).

	Model 1	Model 2	Model 3	Model 4	Model 5
Main effects, RR (95% CI)					
Intercept	0.26 (0.24, 0.30)	0.26 (0.24, 0.29)	0.26 (0.23, 0.29)	0.26 (0.23, 0.29)	0.24 (0.22, 0.26)
Exposure [Ref: Neither]					
DE only	--	0.92 (0.82, 1.04)	0.92 (0.81, 1.04)	0.92 (0.76, 1.12)	0.92 (0.75, 1.12)
Depression only	--	**1.20 (1.10, 1.30)**	**1.18 (1.08, 1.29)**	**1.15 (1.01, 1.29)**	1.14 (0.98, 1.29)
DE & Depression	--	**1.29 (1.14, 1.45)**	**1.28 (1.13, 1.44)**	1.30 (0.99, 1.67)	**1.31 (1.04, 1.64)**
Covariates					
Neighborhood SES [Ref: Higher SES]					
Average SES	--	--	1.00 (0.92, 1.10)	1.00 (0.91, 1.09)	1.00 (0.91, 1.09)
Lower SES	--	--	1.08 (0.98, 1.20)	1.09 (0.98, 1.20)	1.09 (0.99, 1.21)
Household SES [Ref: Higher SES]					
Average SES	--	--	1.03 (0.94, 1.13)	1.04 (0.95, 1.14)	1.04 (0.95, 1.14)
Lower SES	--	--	1.06 (0.96, 1.17)	1.07 (0.97, 1.18)	1.07 (0.97, 1.18)
Sexual orientation [Ref: Heterosexual]					
Sexual minority	--	--	1.04 (0.95, 1.14)	1.04 (0.95, 1.14)	1.05 (0.95, 1.15)
Intersectional social position variables					
Race/ethnicity [Ref: White]					
Black/African-American	--	--	--	--	0.88 (0.73, 1.08)
Hispanic/Latine	--	--	--	--	0.96 (0.80, 1.15)
Multiracial or Other Race	--	--	--	--	1.17 (0.97, 1.44)
Gender identity [Ref: Cisgender man]					
Cisgender woman	--	--	--	--	**0.80 (0.69, 0.92)**
Weight status [Ref: Smaller bodied]					
Larger bodied	--	--	--	--	**1.22 (1.06, 1.41)**
Random effects (log scale)					
Random intercepts var.	0.1865	0.1864	0.1963	0.2357	0.0898
Random slopes var. (cor.) – *DE only*	--	--	--	0.2197 (-0.22)	0.2226 (-0.09)
Random slopes var. (cor.) – *Depression only*	--	--	--	0.1037 (-0.09)	0.1171 (-0.01)
Random slopes var. (cor.) – *DE & Depression*	--	--	--	0.3755 (-0.38)	0.3212 (-0.35)
VPC and PCV summaries					
Overall					
VPC (%, 95% CI)	6.47 (3.58, 10.68)	6.47 (3.58, 10.72)	6.82 (3.76, 11.36)	--	--
PCV (%)	--	-0.06	5.84	--	--

Neither					
VPC (%, 95% CI)	--	--	--	8.23 (4.61, 13.62)	3.08 (0.18, 7.79)
PCV (%)	--	--	--	--	-64.32
DE only					
VPC (%, 95% CI)	--	--	--	15.19 (6.65, 26.96)	10.83 (2.10, 23.11)
PCV (%)	--	--	--	--	-31.58
Depression only					
VPC (%, 95% CI)	--	--	--	11.73 (6.20, 19.71)	7.18 (1.74, 15.04)
PCV (%)	--	--	--	--	-41.50
DE & Depression					
VPC (%, 95% CI)	--	--	--	19.24 (10.86, 30.29)	13.69 (4.48, 24.85)
PCV (%)	--	--	--	--	-33.01

Note: Add Health = National Longitudinal Study of Adolescent to Adult Health. RR = risk ratio. CI = credible interval. DE = disordered eating. SES = socioeconomic status. Var. = variance. Cor. = correlation. VPC = variance partition coefficient. PCV = proportional change in variance. For main effects, bold font indicates a statistically significant result at a 95% CI level. For each set of random slopes, correlation values are calculated in reference to the random intercepts.

Table S2-A: Diabetes outcome models: Full summaries and convergence diagnostics

Model 1

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.06 (-2.43, -1.66)	442.3	1.00
Intercept: White smaller-bodied men	-1.02 (-1.47, -0.62)	538.1	1.00
Intercept: White larger-bodied men	0.04 (-0.40, 0.44)	508.8	1.00
Intercept: White smaller-bodied women	-0.92 (-1.35, -0.52)	524.6	1.00
Intercept: White larger-bodied women	0.12 (-0.32, 0.54)	506.5	1.00
Intercept: Black/African-American smaller-bodied men	0.19 (-0.26, 0.61)	552	1.00
Intercept: Black/African-American larger-bodied men	0.69 (0.22, 1.15)	639.5	1.00
Intercept: Black/African-American smaller-bodied women	-0.01 (-0.49, 0.44)	590.5	1.00
Intercept: Black/African-American larger-bodied women	0.67 (0.23, 1.09)	569.1	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.50 (-1.05, -0.00)	722.1	1.00
Intercept: Hispanic/Latine larger-bodied men	0.45 (-0.04, 0.91)	613.4	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.34 (-0.83, 0.14)	716.4	1.00
Intercept: Hispanic/Latine larger-bodied women	0.37 (-0.15, 0.87)	739.4	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.61 (-1.15, -0.10)	944.1	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.70 (0.19, 1.18)	707.5	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.87 (-1.50, -0.33)	970.7	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.95 (0.45, 1.43)	768.2	1.00
Random intercepts standard deviation	0.71 (0.49, 1.05)	684.6	1.00
Log prior density	-3.27 (-3.43, -3.15)	450.1	1.00
Log posterior density	-2589.48 (-2598.17, -2582.53)	760.6	1.00

Model 2

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.07 (-2.44, -1.71)	629.07	1.00
DE only (main effect)	0.18 (-0.01, 0.36)	2455.1	1.00
Depression only (main effect)	-0.04 (-0.20, 0.13)	2624.9	1.00
DE & Depression (main effect)	0.00 (-0.23, 0.22)	2720.8	1.00
Intercept: White smaller-bodied men	-1.00 (-1.41, -0.59)	754.23	1.00
Intercept: White larger-bodied men	0.05 (-0.36, 0.43)	719.86	1.00

Intercept: White smaller-bodied women	-0.91 (-1.31, -0.51)	719.26	1.00
Intercept: White larger-bodied women	0.12 (-0.29, 0.52)	747.45	1.00
Intercept: Black/African-American smaller-bodied men	0.20 (-0.23, 0.61)	776.64	1.00
Intercept: Black/African-American larger-bodied men	0.70 (0.25, 1.14)	956.66	1.00
Intercept: Black/African-American smaller-bodied women	-0.01 (-0.46, 0.43)	883.73	1.00
Intercept: Black/African-American larger-bodied women	0.66 (0.25, 1.08)	850.36	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.48 (-1.00, 0.01)	1084.5	1.00
Intercept: Hispanic/Latine larger-bodied men	0.44 (-0.03, 0.91)	968.04	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.34 (-0.83, 0.12)	1063.1	1.00
Intercept: Hispanic/Latine larger-bodied women	0.35 (-0.14, 0.85)	1022.8	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.60 (-1.13, -0.10)	1127.4	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.71 (0.23, 1.18)	1016.5	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.85 (-1.45, -0.30)	1466.2	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.94 (0.44, 1.41)	1070.5	1.00
Random intercepts standard deviation	0.70 (0.47, 1.05)	761.31	1.00
Log prior density	-8.78 (-8.94, -8.66)	654.94	1.00
Log posterior density	-2594.23 (-2603.75, -2586.72)	780.74	1.00

Model 3

Parameter	**Mean (95% CI)**	**ESS**	**R-hat**
Intercept (main effect)	-2.14 (-2.49, -1.77)	660.72	1.00
DE only (main effect)	0.18 (0.01, 0.36)	3328.4	1.00
Depression only (main effect)	-0.07 (-0.23, 0.09)	3022.3	1.00
DE & Depression (main effect)	-0.04 (-0.26, 0.19)	3393.5	1.00
Neighborhood SES: Average (main effect)	0.18 (0.01, 0.35)	2756.9	1.00
Neighborhood SES: Lower (main effect)	0.33 (0.14, 0.51)	2523.6	1.00
Household SES: Average (main effect)	0.01 (-0.17, 0.18)	2803.4	1.00
Household SES: Lower (main effect)	0.18 (0.02, 0.36)	2619.4	1.00
Sexual minority (main effect)	0.16 (-0.00, 0.32)	3019.4	1.00
Intercept: White smaller-bodied men	-0.89 (-1.30, -0.50)	823.57	1.00
Intercept: White larger-bodied men	0.10 (-0.30, 0.48)	722.59	1.00
Intercept: White smaller-bodied women	-0.83 (-1.22, -0.44)	810.57	1.00
Intercept: White larger-bodied women	0.13 (-0.28, 0.52)	811.41	1.00
Intercept: Black/African-American smaller-bodied men	0.15 (-0.27, 0.56)	841.3	1.00

Intercept: Black/African-American larger-bodied men	0.61 (0.14, 1.03)	959.73	1.00
Intercept: Black/African-American smaller-bodied women	-0.09 (-0.53, 0.35)	811.41	1.00
Intercept: Black/African-American larger-bodied women	0.55 (0.15, 0.96)	805.99	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.50 (-1.00, -0.02)	1209.4	1.00
Intercept: Hispanic/Latine larger-bodied men	0.40 (-0.04, 0.86)	1070.4	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.37 (-0.82, 0.09)	976.27	1.00
Intercept: Hispanic/Latine larger-bodied women	0.24 (-0.25, 0.71)	1133.4	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.52 (-1.06, -0.02)	1257.6	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.75 (0.31, 1.19)	1018.4	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.80 (-1.38, -0.27)	1468.9	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.87 (0.39, 1.33)	1054.3	1.00
Random intercepts standard deviation	0.66 (0.43, 0.99)	872.12	1.00
Log prior density	-17.98 (-18.15, -17.87)	781.7	1.00
Log posterior density	-2591.88 (-2601.92, -2584.08)	852.07	1.00

Model 4

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.17 (-2.54, -1.82)	1244.36	1.00
DE only (main effect)	0.14 (-0.12, 0.36)	3792.32	1.00
Depression only (main effect)	-0.14 (-0.54, 0.24)	2487.4	1.00
DE & Depression (main effect)	0.04 (-0.29, 0.37)	4314.2	1.00
Neighborhood SES: Average (main effect)	0.18 (0.00, 0.36)	5833.37	1.00
Neighborhood SES: Lower (main effect)	0.34 (0.15, 0.52)	5690.9	1.00
Household SES: Average (main effect)	0.00 (-0.17, 0.17)	6976.62	1.00
Household SES: Lower (main effect)	0.19 (0.01, 0.36)	6214.76	1.00
Sexual minority (main effect)	0.17 (0.01, 0.33)	11562.7	1.00
Intercept: White smaller-bodied men	-0.89 (-1.34, -0.45)	1538.09	1.00
Intercept: White larger-bodied men	0.22 (-0.21, 0.66)	1381.62	1.00
Intercept: White smaller-bodied women	-1.01 (-1.47, -0.56)	1635.89	1.00
Intercept: White larger-bodied women	0.11 (-0.35, 0.58)	1546.72	1.00
Intercept: Black/African-American smaller-bodied men	0.19 (-0.26, 0.65)	1508.12	1.00
Intercept: Black/African-American larger-bodied men	0.72 (0.23, 1.21)	1945.75	1.00
Intercept: Black/African-American smaller-bodied women	-0.13 (-0.63, 0.37)	1976.79	1.00
Intercept: Black/African-American larger-bodied women	0.68 (0.20, 1.16)	1720.63	1.00

Intercept: Hispanic/Latine smaller-bodied men	-0.60 (-1.22, -0.04)	2636.71	1.00
Intercept: Hispanic/Latine larger-bodied men	0.48 (-0.03, 0.98)	1897.29	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.36 (-0.91, 0.18)	2004.21	1.00
Intercept: Hispanic/Latine larger-bodied women	0.02 (-0.63, 0.62)	2375.35	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.84 (-1.52, -0.22)	3107	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.89 (0.37, 1.41)	2108.19	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.75 (-1.43, -0.14)	2674.21	1.00
Intercept: Multiracial/Other Race larger-bodied women	1.13 (0.58, 1.67)	2118.85	1.00
Slope (DE only): White smaller-bodied men	0.13 (-0.19, 0.62)	3663.22	1.00
Slope (DE only): White larger-bodied men	0.07 (-0.23, 0.47)	3752.56	1.00
Slope (DE only): White smaller-bodied women	0.15 (-0.13, 0.64)	3605.65	1.00
Slope (DE only): White larger-bodied women	-0.01 (-0.37, 0.37)	4635.12	1.00
Slope (DE only): Black/African-American smaller-bodied men	-0.12 (-0.66, 0.19)	4785.92	1.00
Slope (DE only): Black/African-American larger-bodied men	0.04 (-0.32, 0.51)	5457.51	1.00
Slope (DE only): Black/African-American smaller-bodied women	0.12 (-0.19, 0.67)	3623.82	1.00
Slope (DE only): Black/African-American larger-bodied women	-0.00 (-0.35, 0.39)	5183.09	1.00
Slope (DE only): Hispanic/Latine smaller-bodied men	0.04 (-0.42, 0.56)	6282.87	1.00
Slope (DE only): Hispanic/Latine larger-bodied men	-0.10 (-0.59, 0.21)	6481.23	1.00
Slope (DE only): Hispanic/Latine smaller-bodied women	-0.01 (-0.42, 0.39)	7373.7	1.00
Slope (DE only): Hispanic/Latine larger-bodied women	-0.14 (-0.81, 0.23)	3629.87	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied men	0.01 (-0.48, 0.52)	5884.39	1.00
Slope (DE only): Multiracial/Other Race larger-bodied men	-0.05 (-0.52, 0.35)	7935.85	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied women	-0.01 (-0.54, 0.44)	6156.2	1.00
Slope (DE only): Multiracial/Other Race larger-bodied women	-0.12 (-0.63, 0.25)	6308.22	1.00
Slope (Depression only): White smaller-bodied men	0.10 (-0.46, 0.65)	4383.07	1.00
Slope (Depression only): White larger-bodied men	-0.55 (-1.18, 0.01)	4867.92	1.00
Slope (Depression only): White smaller-bodied women	0.66 (0.16, 1.20)	3942.15	1.00
Slope (Depression only): White larger-bodied women	0.40 (-0.15, 0.99)	3871.05	1.00
Slope (Depression only): Black/African-American smaller-bodied men	-0.01 (-0.64, 0.62)	4921.36	1.00
Slope (Depression only): Black/African-American larger-bodied men	-0.50 (-1.26, 0.19)	6111.97	1.00
Slope (Depression only): Black/African-American smaller-bodied women	0.10 (-0.54, 0.74)	5117.26	1.00
Slope (Depression only): Black/African-American larger-bodied women	-0.29 (-0.95, 0.34)	4660.81	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied men	0.20 (-0.57, 0.95)	6391.52	1.00
Slope (Depression only): Hispanic/Latine larger-bodied men	-0.18 (-0.94, 0.55)	6489.35	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied women	-0.08 (-0.90, 0.63)	6368.55	1.00
Slope (Depression only): Hispanic/Latine larger-bodied women	0.64 (-0.14, 1.51)	4747.53	1.00

Slope (Depression only): Multiracial/Other Race smaller-bodied men	1.09 (0.26, 2.02)	5308.2	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied men	-0.41 (-1.15, 0.29)	6464.54	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied women	-0.14 (-1.16, 0.72)	7332	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied women	-0.93 (-1.97, -0.12)	6044.23	1.00
Slope (DE & Depression): White smaller-bodied men	0.05 (-0.68, 0.69)	8868.77	1.00
Slope (DE & Depression): White larger-bodied men	-0.30 (-1.07, 0.22)	4214.43	1.00
Slope (DE & Depression): White smaller-bodied women	-0.00 (-0.54, 0.49)	7419.61	1.00
Slope (DE & Depression): White larger-bodied women	-0.25 (-0.82, 0.19)	3835.07	1.00
Slope (DE & Depression): Black/African-American smaller-bodied men	-0.23 (-1.19, 0.41)	4761.32	1.00
Slope (DE & Depression): Black/African-American larger-bodied men	0.16 (-0.47, 0.87)	5792.74	1.00
Slope (DE & Depression): Black/African-American smaller-bodied women	0.03 (-0.57, 0.63)	8384.8	1.00
Slope (DE & Depression): Black/African-American larger-bodied women	-0.37 (-1.10, 0.12)	3589.49	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied men	0.58 (-0.09, 1.59)	2901.22	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied men	-0.11 (-0.86, 0.52)	7947.7	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied women	0.10 (-0.50, 0.72)	7756.2	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied women	0.34 (-0.24, 1.15)	3835.19	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied men	0.05 (-1.01, 1.01)	7829.94	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied men	-0.02 (-0.74, 0.66)	8649.98	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied women	0.10 (-0.68, 0.88)	7629.74	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied women	-0.16 (-0.88, 0.43)	5851.72	1.00
Random intercepts standard deviation	0.74 (0.51, 1.10)	1879.05	1.00
Random slopes (DE only) standard deviation	0.21 (0.01, 0.55)	2465.58	1.00
Random slopes (Depression only) standard deviation	0.64 (0.34, 1.05)	2952.29	1.00
Random slopes (DE & Depression) standard deviation	0.42 (0.03, 0.89)	1722.55	1.00
Intercepts-slopes (DE only) correlation	-0.21 (-0.77, 0.50)	6577.87	1.00
Intercepts-slopes (Depression only) correlation	-0.50 (-0.83, -0.02)	4533.93	1.00
Intercepts-slopes (DE & Depression) correlation	-0.21 (-0.72, 0.43)	6205.33	1.00
Log prior density	-23.82 (-26.20, -22.39)	3880.85	1.00
Log posterior density	-2642.27 (-2660.69, -2626.33)	1545.68	1.00

Model 5

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-2.58 (-2.80, -2.35)	2073.24	1.00
DE only (main effect)	0.14 (-0.12, 0.35)	4407.55	1.00

Depression only (main effect)	-0.14 (-0.53, 0.24)	4172.08	1.00
DE & Depression (main effect)	0.03 (-0.32, 0.36)	3240.01	1.00
Neighborhood SES: Average (main effect)	0.18 (0.00, 0.36)	7686.35	1.00
Neighborhood SES: Lower (main effect)	0.33 (0.14, 0.52)	6719.81	1.00
Household SES: Average (main effect)	0.00 (-0.16, 0.17)	7286.37	1.00
Household SES: Lower (main effect)	0.19 (0.01, 0.36)	7237.68	1.00
Sexual minority (main effect)	0.17 (0.01, 0.32)	13019.1	1.00
Black/African-American (main effect)	0.71 (0.29, 1.13)	2438.8	1.00
Hispanic/Latine (main effect)	0.29 (-0.22, 0.78)	2163.07	1.00
Multiracial/Other Race (main effect)	0.50 (0.01, 0.94)	2466.97	1.00
Cisgender woman (main effect)	-0.06 (-0.36, 0.25)	3189.21	1.00
Larger-bodied (main effect)	0.97 (0.64, 1.30)	3101.21	1.00
Intercept: White smaller-bodied men	-0.06 (-0.50, 0.33)	2555.06	1.00
Intercept: White larger-bodied men	0.07 (-0.33, 0.49)	2357.69	1.00
Intercept: White smaller-bodied women	-0.12 (-0.57, 0.30)	2252.08	1.00
Intercept: White larger-bodied women	0.01 (-0.41, 0.43)	2559.99	1.00
Intercept: Black/African-American smaller-bodied men	0.24 (-0.13, 0.69)	3820.7	1.00
Intercept: Black/African-American larger-bodied men	-0.06 (-0.50, 0.35)	3414.63	1.00
Intercept: Black/African-American smaller-bodied women	0.02 (-0.39, 0.45)	4224.78	1.00
Intercept: Black/African-American larger-bodied women	-0.06 (-0.48, 0.35)	3466.54	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.07 (-0.61, 0.41)	4065.25	1.00
Intercept: Hispanic/Latine larger-bodied men	0.05 (-0.37, 0.50)	4535.94	1.00
Intercept: Hispanic/Latine smaller-bodied women	0.13 (-0.29, 0.60)	4421.87	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.22 (-0.76, 0.22)	4193.79	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.33 (-0.92, 0.12)	4243.95	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.19 (-0.23, 0.70)	3652.29	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.19 (-0.73, 0.26)	6375.17	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.40 (-0.04, 0.97)	3519.3	1.00
Slope (DE only): White smaller-bodied men	0.09 (-0.21, 0.57)	4748.93	1.00
Slope (DE only): White larger-bodied men	0.07 (-0.21, 0.46)	4288.37	1.00
Slope (DE only): White smaller-bodied women	0.13 (-0.16, 0.58)	3668.9	1.00
Slope (DE only): White larger-bodied women	0.02 (-0.32, 0.39)	6116.75	1.00
Slope (DE only): Black/African-American smaller-bodied men	-0.10 (-0.63, 0.23)	5529.29	1.00
Slope (DE only): Black/African-American larger-bodied men	0.07 (-0.26, 0.54)	4291.67	1.00
Slope (DE only): Black/African-American smaller-bodied women	0.12 (-0.17, 0.66)	4130.91	1.00
Slope (DE only): Black/African-American larger-bodied women	0.01 (-0.33, 0.37)	5497.09	1.00

Slope (DE only): Hispanic/Latine smaller-bodied men	0.01 (-0.48, 0.52)	5061.88	1.00
Slope (DE only): Hispanic/Latine larger-bodied men	-0.09 (-0.58, 0.23)	7128.01	1.00
Slope (DE only): Hispanic/Latine smaller-bodied women	-0.03 (-0.49, 0.39)	8286.78	1.00
Slope (DE only): Hispanic/Latine larger-bodied women	-0.13 (-0.78, 0.22)	5022.03	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied men	-0.01 (-0.55, 0.48)	6763.58	1.00
Slope (DE only): Multiracial/Other Race larger-bodied men	-0.01 (-0.43, 0.41)	7703.59	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied women	-0.07 (-0.68, 0.34)	6264.07	1.00
Slope (DE only): Multiracial/Other Race larger-bodied women	-0.06 (-0.59, 0.34)	7064.42	1.00
Slope (Depression only): White smaller-bodied men	0.04 (-0.50, 0.60)	6118.46	1.00
Slope (Depression only): White larger-bodied men	-0.56 (-1.18, 0.02)	6483.91	1.00
Slope (Depression only): White smaller-bodied women	0.62 (0.13, 1.16)	4908.03	1.00
Slope (Depression only): White larger-bodied women	0.41 (-0.12, 0.97)	5265.06	1.00
Slope (Depression only): Black/African-American smaller-bodied men	0.00 (-0.64, 0.63)	6636.48	1.00
Slope (Depression only): Black/African-American larger-bodied men	-0.44 (-1.15, 0.18)	6911.06	1.00
Slope (Depression only): Black/African-American smaller-bodied women	0.10 (-0.57, 0.74)	7122.81	1.00
Slope (Depression only): Black/African-American larger-bodied women	-0.25 (-0.89, 0.34)	6139.83	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied men	0.12 (-0.67, 0.88)	7738.27	1.00
Slope (Depression only): Hispanic/Latine larger-bodied men	-0.13 (-0.90, 0.57)	8744.28	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied women	-0.14 (-0.98, 0.60)	9301.9	1.00
Slope (Depression only): Hispanic/Latine larger-bodied women	0.60 (-0.10, 1.36)	5614.55	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied men	0.95 (0.14, 1.83)	4716.66	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied men	-0.31 (-1.04, 0.36)	7009.42	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied women	-0.35 (-1.35, 0.50)	8418.45	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied women	-0.81 (-1.92, 0.03)	4723.37	1.00
Slope (DE & Depression): White smaller-bodied men	0.00 (-0.64, 0.63)	7946.56	1.00
Slope (DE & Depression): White larger-bodied men	-0.29 (-1.06, 0.24)	4634.7	1.00
Slope (DE & Depression): White smaller-bodied women	-0.02 (-0.56, 0.49)	5487.54	1.00
Slope (DE & Depression): White larger-bodied women	-0.23 (-0.79, 0.21)	4373	1.00
Slope (DE & Depression): Black/African-American smaller-bodied men	-0.23 (-1.23, 0.46)	5468.69	1.00
Slope (DE & Depression): Black/African-American larger-bodied men	0.18 (-0.42, 0.84)	4656.03	1.00
Slope (DE & Depression): Black/African-American smaller-bodied women	0.04 (-0.55, 0.67)	6205.35	1.00
Slope (DE & Depression): Black/African-American larger-bodied women	-0.35 (-1.03, 0.12)	4148.62	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied men	0.56 (-0.10, 1.59)	2960.82	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied men	-0.07 (-0.80, 0.54)	7666.49	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied women	0.12 (-0.49, 0.81)	6452.92	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied women	0.29 (-0.25, 1.01)	4080.52	1.00

Slope (DE & Depression): Multiracial/Other Race smaller-bodied men	0.02 (-0.93, 0.95)	8339.39	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied men	0.04 (-0.65, 0.72)	7008.54	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied women	0.02 (-0.74, 0.76)	6133.69	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied women	-0.07 (-0.79, 0.56)	5644.36	1.00
Random intercepts standard deviation	0.29 (0.09, 0.56)	2212.35	1.00
Random slopes (DE only) standard deviation	0.20 (0.01, 0.54)	2670.42	1.00
Random slopes (Depression only) standard deviation	0.62 (0.32, 1.04)	3089.63	1.00
Random slopes (DE & Depression) standard deviation	0.41 (0.04, 0.89)	2256.33	1.00
Intercepts-slopes (DE only) correlation	-0.11 (-0.76, 0.62)	5133.8	1.00
Intercepts-slopes (Depression only) correlation	-0.36 (-0.82, 0.30)	2363.4	1.00
Intercepts-slopes (DE & Depression) correlation	-0.15 (-0.77, 0.57)	3799.55	1.00
Log prior density	-33.07 (-35.50, -31.70)	3488.95	1.00
Log posterior density	-2653.84 (-2672.50, -2636.27)	1584.47	1.00

Note: CI = credible interval. ESS = effective sample size. DE = Disordered Eating.

Table S2-B: Hypertension outcome models: Full summaries and convergence diagnostics

Model 1

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.28 (-1.50, -1.09)	626.78	1.01
Intercept: White smaller-bodied men	-0.06 (-0.27, 0.16)	690.34	1.00
Intercept: White larger-bodied men	0.33 (0.12, 0.56)	721.69	1.00
Intercept: White smaller-bodied women	-0.62 (-0.84, -0.39)	725.26	1.00
Intercept: White larger-bodied women	0.10 (-0.13, 0.34)	825.18	1.00
Intercept: Black/African-American smaller-bodied men	0.05 (-0.19, 0.31)	867.82	1.00
Intercept: Black/African-American larger-bodied men	0.50 (0.23, 0.78)	1054.1	1.00
Intercept: Black/African-American smaller-bodied women	-0.10 (-0.35, 0.17)	987.22	1.00
Intercept: Black/African-American larger-bodied women	0.36 (0.11, 0.62)	935.92	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.01 (-0.27, 0.25)	972.62	1.00
Intercept: Hispanic/Latine larger-bodied men	0.18 (-0.10, 0.47)	1269.8	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.64 (-0.95, -0.35)	1346.3	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.18 (-0.53, 0.14)	1430.6	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.00 (-0.27, 0.26)	1007.3	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.42 (0.13, 0.72)	1187	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.30 (-0.60, -0.02)	1097.5	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.13 (-0.26, 0.49)	1496.5	1.00
Random intercepts standard deviation	0.38 (0.25, 0.57)	568.02	1.01
Log prior density	-2.99 (-3.05, -2.95)	592.85	1.01
Log posterior density	-4572.35 (-4581.08, -4565.37)	629.77	1.00

Model 2

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.28 (-1.48, -1.08)	641.38	1.00
DE only (main effect)	0.03 (-0.09, 0.15)	2786.6	1.00
Depression only (main effect)	0.17 (0.09, 0.26)	3082.7	1.00
DE & Depression (main effect)	0.33 (0.21, 0.45)	2927.3	1.00
Intercept: White smaller-bodied men	-0.04 (-0.26, 0.17)	694.47	1.00
Intercept: White larger-bodied men	0.34 (0.11, 0.55)	742.48	1.00

Intercept: White smaller-bodied women	-0.64 (-0.86, -0.42)	735.37	1.00
Intercept: White larger-bodied women	0.04 (-0.20, 0.26)	824	1.00
Intercept: Black/African-American smaller-bodied men	0.09 (-0.17, 0.32)	916.32	1.00
Intercept: Black/African-American larger-bodied men	0.48 (0.21, 0.75)	1088.7	1.00
Intercept: Black/African-American smaller-bodied women	-0.12 (-0.37, 0.14)	996.45	1.00
Intercept: Black/African-American larger-bodied women	0.31 (0.06, 0.56)	968.88	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.01 (-0.28, 0.25)	952.46	1.00
Intercept: Hispanic/Latine larger-bodied men	0.18 (-0.12, 0.46)	1250.4	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.65 (-0.98, -0.36)	1515.3	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.22 (-0.56, 0.10)	1489.8	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.01 (-0.25, 0.27)	1021.2	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.42 (0.12, 0.71)	1341.8	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.33 (-0.64, -0.06)	1126.1	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.14 (-0.25, 0.50)	1671.8	1.00
Random intercepts standard deviation	0.38 (0.25, 0.57)	817.19	1.00
Log prior density	-8.51 (-8.57, -8.47)	659.43	1.00
Log posterior density	-4561.00 (-4569.61, -4553.75)	735.17	1.00

Model 3

Parameter	**Mean (95% CI)**	**ESS**	**R-hat**
Intercept (main effect)	-1.33 (-1.53, -1.14)	750.99	1.01
DE only (main effect)	0.03 (-0.08, 0.15)	3952.7	1.00
Depression only (main effect)	0.17 (0.08, 0.26)	3731.1	1.00
DE & Depression (main effect)	0.33 (0.21, 0.45)	3653.4	1.00
Neighborhood SES: Average (main effect)	0.10 (0.00, 0.19)	3964.6	1.00
Neighborhood SES: Lower (main effect)	0.26 (0.16, 0.36)	3584.5	1.00
Household SES: Average (main effect)	0.07 (-0.02, 0.16)	3397.1	1.00
Household SES: Lower (main effect)	0.06 (-0.03, 0.16)	3242.5	1.00
Sexual minority (main effect)	-0.03 (-0.13, 0.06)	4543.5	1.00
Intercept: White smaller-bodied men	0.03 (-0.18, 0.23)	838.68	1.00
Intercept: White larger-bodied men	0.38 (0.18, 0.60)	897.06	1.00
Intercept: White smaller-bodied women	-0.56 (-0.78, -0.35)	900.93	1.01
Intercept: White larger-bodied women	0.07 (-0.17, 0.30)	956.71	1.00
Intercept: Black/African-American smaller-bodied men	0.04 (-0.20, 0.28)	1079.4	1.00

Intercept: Black/African-American larger-bodied men	0.40 (0.15, 0.66)	1199.3	1.00
Intercept: Black/African-American smaller-bodied women	-0.17 (-0.43, 0.09)	1195.7	1.00
Intercept: Black/African-American larger-bodied women	0.25 (-0.00, 0.50)	1172.5	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.03 (-0.29, 0.22)	1166.6	1.00
Intercept: Hispanic/Latine larger-bodied men	0.16 (-0.12, 0.43)	1409.5	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.66 (-0.97, -0.37)	1685.1	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.26 (-0.58, 0.04)	2038.4	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.07 (-0.21, 0.33)	1335.1	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.45 (0.16, 0.72)	1340.7	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.28 (-0.56, -0.00)	1502.6	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.14 (-0.22, 0.49)	2266.4	1.00
Random intercepts standard deviation	0.37 (0.25, 0.55)	1170.6	1.00
Log prior density	-17.70 (-17.76, -17.66)	898.34	1.00
Log posterior density	-4554.82 (-4564.19, -4546.84)	1149.4	1.00

Model 4

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.34 (-1.54, -1.14)	1267.57	1.00
DE only (main effect)	0.02 (-0.17, 0.18)	4417.1	1.00
Depression only (main effect)	0.21 (0.02, 0.40)	3311.78	1.00
DE & Depression (main effect)	0.34 (0.15, 0.53)	4492.71	1.00
Neighborhood SES: Average (main effect)	0.10 (0.00, 0.19)	7932.65	1.00
Neighborhood SES: Lower (main effect)	0.26 (0.16, 0.36)	7274.18	1.00
Household SES: Average (main effect)	0.07 (-0.02, 0.16)	7341.89	1.00
Household SES: Lower (main effect)	0.06 (-0.04, 0.16)	6993.1	1.00
Sexual minority (main effect)	-0.03 (-0.13, 0.07)	12354.9	1.00
Intercept: White smaller-bodied men	0.07 (-0.15, 0.29)	1370.57	1.00
Intercept: White larger-bodied men	0.39 (0.16, 0.63)	1478.55	1.00
Intercept: White smaller-bodied women	-0.57 (-0.80, -0.34)	1639.66	1.00
Intercept: White larger-bodied women	0.17 (-0.09, 0.45)	1741.38	1.00
Intercept: Black/African-American smaller-bodied men	-0.01 (-0.27, 0.25)	1917.22	1.00
Intercept: Black/African-American larger-bodied men	0.45 (0.16, 0.75)	2358.5	1.00
Intercept: Black/African-American smaller-bodied women	-0.18 (-0.47, 0.11)	2174.33	1.00
Intercept: Black/African-American larger-bodied women	0.27 (-0.01, 0.56)	2020.88	1.00

Intercept: Hispanic/Latine smaller-bodied men	0.03 (-0.27, 0.31)	1830.06	1.00
Intercept: Hispanic/Latine larger-bodied men	0.14 (-0.17, 0.45)	2432.76	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.68 (-1.04, -0.37)	3067.29	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.34 (-0.76, 0.05)	3591.59	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.12 (-0.16, 0.41)	2189.27	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.35 (0.01, 0.68)	2757.92	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.25 (-0.58, 0.06)	2683.75	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.07 (-0.36, 0.47)	3704.88	1.00
Slope (DE only): White smaller-bodied men	0.03 (-0.21, 0.30)	5742.93	1.00
Slope (DE only): White larger-bodied men	0.11 (-0.10, 0.39)	3564.93	1.00
Slope (DE only): White smaller-bodied women	-0.06 (-0.34, 0.20)	6495.19	1.00
Slope (DE only): White larger-bodied women	-0.09 (-0.45, 0.17)	4382.36	1.00
Slope (DE only): Black/African-American smaller-bodied men	-0.11 (-0.52, 0.18)	3836.62	1.00
Slope (DE only): Black/African-American larger-bodied men	0.10 (-0.22, 0.49)	5586.06	1.00
Slope (DE only): Black/African-American smaller-bodied women	0.03 (-0.27, 0.40)	6591.31	1.00
Slope (DE only): Black/African-American larger-bodied women	-0.04 (-0.38, 0.24)	6793.29	1.00
Slope (DE only): Hispanic/Latine smaller-bodied men	0.23 (-0.09, 0.73)	1927.71	1.00
Slope (DE only): Hispanic/Latine larger-bodied men	-0.13 (-0.58, 0.17)	3548.95	1.00
Slope (DE only): Hispanic/Latine smaller-bodied women	-0.07 (-0.52, 0.31)	8258.8	1.00
Slope (DE only): Hispanic/Latine larger-bodied women	-0.13 (-0.63, 0.20)	4763.19	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied men	-0.08 (-0.51, 0.21)	5344.69	1.00
Slope (DE only): Multiracial/Other Race larger-bodied men	-0.02 (-0.44, 0.35)	5995.27	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied women	0.15 (-0.15, 0.65)	3273.32	1.00
Slope (DE only): Multiracial/Other Race larger-bodied women	0.07 (-0.28, 0.53)	5861.4	1.00
Slope (Depression only): White smaller-bodied men	-0.17 (-0.42, 0.06)	3901.88	1.00
Slope (Depression only): White larger-bodied men	-0.05 (-0.31, 0.20)	4355.87	1.00
Slope (Depression only): White smaller-bodied women	0.10 (-0.15, 0.35)	5637.6	1.00
Slope (Depression only): White larger-bodied women	-0.19 (-0.56, 0.12)	4314.51	1.00
Slope (Depression only): Black/African-American smaller-bodied men	0.26 (-0.05, 0.59)	5533.66	1.00
Slope (Depression only): Black/African-American larger-bodied men	-0.15 (-0.53, 0.18)	7003.93	1.00
Slope (Depression only): Black/African-American smaller-bodied women	0.06 (-0.28, 0.41)	7252.73	1.00
Slope (Depression only): Black/African-American larger-bodied women	0.02 (-0.32, 0.36)	6583.02	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied men	-0.39 (-0.83, -0.01)	4288.16	1.00
Slope (Depression only): Hispanic/Latine larger-bodied men	0.25 (-0.12, 0.66)	5924.59	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied women	0.04 (-0.39, 0.48)	9962.01	1.00
Slope (Depression only): Hispanic/Latine larger-bodied women	0.28 (-0.15, 0.81)	4760.7	1.00

Slope (Depression only): Multiracial/Other Race smaller-bodied men	-0.17 (-0.59, 0.17)	6066.94	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied men	0.23 (-0.12, 0.64)	5507.41	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied women	-0.18 (-0.64, 0.19)	6220.04	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied women	0.06 (-0.39, 0.57)	7029.06	1.00
Slope (DE & Depression): White smaller-bodied men	0.13 (-0.10, 0.44)	4727.31	1.00
Slope (DE & Depression): White larger-bodied men	-0.05 (-0.37, 0.23)	6391.79	1.00
Slope (DE & Depression): White smaller-bodied women	-0.04 (-0.34, 0.21)	6168.73	1.00
Slope (DE & Depression): White larger-bodied women	-0.15 (-0.49, 0.10)	3209.84	1.00
Slope (DE & Depression): Black/African-American smaller-bodied men	-0.07 (-0.56, 0.30)	7700.68	1.00
Slope (DE & Depression): Black/African-American larger-bodied men	-0.10 (-0.57, 0.23)	5737.75	1.00
Slope (DE & Depression): Black/African-American smaller-bodied women	-0.08 (-0.49, 0.25)	5899.25	1.00
Slope (DE & Depression): Black/African-American larger-bodied women	-0.11 (-0.50, 0.17)	5139.88	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied men	0.30 (-0.07, 0.79)	2505.86	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied men	-0.16 (-0.71, 0.20)	4141.26	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied women	0.09 (-0.30, 0.54)	7751.61	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied women	0.05 (-0.33, 0.51)	5885.6	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied men	-0.04 (-0.51, 0.37)	7192.21	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied men	0.01 (-0.42, 0.46)	7397.12	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied women	0.02 (-0.38, 0.40)	6631.56	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied women	0.20 (-0.19, 0.80)	3459.09	1.00
Random intercepts standard deviation	0.40 (0.25, 0.62)	2237.49	1.00
Random slopes (DE only) standard deviation	0.19 (0.01, 0.46)	1773.17	1.00
Random slopes (Depression only) standard deviation	0.29 (0.11, 0.52)	2549.45	1.00
Random slopes (DE & Depression) standard deviation	0.23 (0.02, 0.49)	1982.44	1.00
Intercepts-slopes (DE only) correlation	0.07 (-0.58, 0.68)	6613.05	1.00
Intercepts-slopes (Depression only) correlation	-0.16 (-0.64, 0.39)	5004.78	1.00
Intercepts-slopes (DE & Depression) correlation	-0.16 (-0.69, 0.48)	6389.08	1.00
Log prior density	-23.00 (-24.98, -21.88)	4266.61	1.00
Log posterior density	-4612.69 (-4630.97, -4595.87)	1424.8	1.00

Model 5

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.49 (-1.59, -1.38)	2828.56	1.00
DE only (main effect)	0.01 (-0.19, 0.19)	4101.33	1.00

Depression only (main effect)	0.20 (0.04, 0.36)	4325.93	1.00
DE & Depression (main effect)	0.34 (0.15, 0.53)	5045	1.00
Neighborhood SES: Average (main effect)	0.09 (0.00, 0.19)	7831.26	1.00
Neighborhood SES: Lower (main effect)	0.26 (0.15, 0.36)	6805.29	1.00
Household SES: Average (main effect)	0.07 (-0.03, 0.16)	7982.25	1.00
Household SES: Lower (main effect)	0.06 (-0.03, 0.16)	6830.71	1.00
Sexual minority (main effect)	-0.02 (-0.12, 0.07)	10914	1.00
Black/African-American (main effect)	0.17 (-0.05, 0.38)	2815.78	1.00
Hispanic/Latine (main effect)	-0.19 (-0.43, 0.04)	3582.56	1.00
Multiracial/Other Race (main effect)	0.10 (-0.13, 0.33)	2987.14	1.00
Cisgender woman (main effect)	-0.39 (-0.55, -0.23)	4125.49	1.00
Larger-bodied (main effect)	0.45 (0.28, 0.61)	3627.36	1.00
Intercept: White smaller-bodied men	0.10 (-0.09, 0.29)	2530.36	1.00
Intercept: White larger-bodied men	-0.01 (-0.20, 0.19)	3101.1	1.00
Intercept: White smaller-bodied women	-0.12 (-0.34, 0.07)	3027.76	1.00
Intercept: White larger-bodied women	0.11 (-0.09, 0.36)	2907.24	1.00
Intercept: Black/African-American smaller-bodied men	-0.10 (-0.33, 0.09)	4571.1	1.00
Intercept: Black/African-American larger-bodied men	-0.04 (-0.29, 0.17)	5251.15	1.00
Intercept: Black/African-American smaller-bodied women	0.03 (-0.19, 0.26)	5419.04	1.00
Intercept: Black/African-American larger-bodied women	0.05 (-0.16, 0.30)	4364.69	1.00
Intercept: Hispanic/Latine smaller-bodied men	0.18 (-0.05, 0.46)	3397.71	1.00
Intercept: Hispanic/Latine larger-bodied men	-0.05 (-0.30, 0.18)	5703.65	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.07 (-0.33, 0.15)	6640.59	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.11 (-0.41, 0.14)	4974.28	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.05 (-0.16, 0.29)	4922.99	1.00
Intercept: Multiracial/Other Race larger-bodied men	-0.07 (-0.32, 0.15)	6036.42	1.00
Intercept: Multiracial/Other Race smaller-bodied women	0.04 (-0.20, 0.28)	5701.81	1.00
Intercept: Multiracial/Other Race larger-bodied women	-0.01 (-0.28, 0.26)	6789.86	1.00
Slope (DE only): White smaller-bodied men	0.04 (-0.21, 0.32)	5514.08	1.00
Slope (DE only): White larger-bodied men	0.11 (-0.11, 0.39)	3884.06	1.00
Slope (DE only): White smaller-bodied women	-0.07 (-0.36, 0.19)	5155.4	1.00
Slope (DE only): White larger-bodied women	-0.08 (-0.44, 0.20)	5154.43	1.00
Slope (DE only): Black/African-American smaller-bodied men	-0.14 (-0.58, 0.17)	5600.53	1.00
Slope (DE only): Black/African-American larger-bodied men	0.08 (-0.24, 0.45)	5131.2	1.00
Slope (DE only): Black/African-American smaller-bodied women	0.06 (-0.26, 0.45)	6089.84	1.00
Slope (DE only): Black/African-American larger-bodied women	-0.03 (-0.37, 0.28)	7007.22	1.00

Slope (DE only): Hispanic/Latine smaller-bodied men	0.29 (-0.07, 0.82)	2844.14	1.00
Slope (DE only): Hispanic/Latine larger-bodied men	-0.16 (-0.64, 0.17)	4683.73	1.00
Slope (DE only): Hispanic/Latine smaller-bodied women	-0.06 (-0.49, 0.29)	8555.86	1.00
Slope (DE only): Hispanic/Latine larger-bodied women	-0.16 (-0.69, 0.19)	4887.62	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied men	-0.09 (-0.52, 0.23)	6034.59	1.00
Slope (DE only): Multiracial/Other Race larger-bodied men	-0.06 (-0.48, 0.29)	8013.56	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied women	0.19 (-0.12, 0.69)	3477.86	1.00
Slope (DE only): Multiracial/Other Race larger-bodied women	0.06 (-0.32, 0.52)	7281.92	1.00
Slope (Depression only): White smaller-bodied men	-0.15 (-0.38, 0.05)	4836.23	1.00
Slope (Depression only): White larger-bodied men	-0.05 (-0.28, 0.17)	5725.78	1.00
Slope (Depression only): White smaller-bodied women	0.09 (-0.14, 0.33)	5544.2	1.00
Slope (Depression only): White larger-bodied women	-0.16 (-0.49, 0.12)	4739.16	1.00
Slope (Depression only): Black/African-American smaller-bodied men	0.23 (-0.04, 0.55)	5016.02	1.00
Slope (Depression only): Black/African-American larger-bodied men	-0.13 (-0.46, 0.16)	6208.02	1.00
Slope (Depression only): Black/African-American smaller-bodied women	0.06 (-0.24, 0.38)	8665.51	1.00
Slope (Depression only): Black/African-American larger-bodied women	0.03 (-0.30, 0.33)	7804.59	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied men	-0.35 (-0.78, 0.00)	4418.99	1.00
Slope (Depression only): Hispanic/Latine larger-bodied men	0.21 (-0.11, 0.61)	6038.55	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied women	0.05 (-0.32, 0.43)	9491.36	1.00
Slope (Depression only): Hispanic/Latine larger-bodied women	0.24 (-0.14, 0.73)	5181.25	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied men	-0.13 (-0.51, 0.18)	6214.94	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied men	0.18 (-0.12, 0.52)	5032.75	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied women	-0.15 (-0.56, 0.18)	6832.45	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied women	0.05 (-0.34, 0.49)	7799.21	1.00
Slope (DE & Depression): White smaller-bodied men	0.15 (-0.10, 0.44)	4886.54	1.00
Slope (DE & Depression): White larger-bodied men	-0.04 (-0.34, 0.22)	6880.13	1.00
Slope (DE & Depression): White smaller-bodied women	-0.08 (-0.36, 0.18)	5760.68	1.00
Slope (DE & Depression): White larger-bodied women	-0.12 (-0.44, 0.13)	4003.91	1.00
Slope (DE & Depression): Black/African-American smaller-bodied men	-0.09 (-0.59, 0.31)	6875.83	1.00
Slope (DE & Depression): Black/African-American larger-bodied men	-0.12 (-0.56, 0.19)	5910.85	1.00
Slope (DE & Depression): Black/African-American smaller-bodied women	-0.07 (-0.47, 0.24)	6950.66	1.00
Slope (DE & Depression): Black/African-American larger-bodied women	-0.09 (-0.45, 0.20)	6255.3	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied men	0.36 (-0.04, 0.85)	3265.89	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied men	-0.16 (-0.69, 0.21)	6088.52	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied women	0.05 (-0.31, 0.47)	7424.52	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied women	0.00 (-0.38, 0.41)	6499.31	1.00

Slope (DE & Depression): Multiracial/Other Race smaller-bodied men	-0.02 (-0.48, 0.37)	6748.1	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied men	0.02 (-0.37, 0.42)	7455.21	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied women	0.03 (-0.35, 0.40)	7866.34	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied women	0.20 (-0.17, 0.75)	4299.3	1.00
Random intercepts standard deviation	0.15 (0.05, 0.28)	2235	1.00
Random slopes (DE only) standard deviation	0.21 (0.02, 0.47)	2268.6	1.00
Random slopes (Depression only) standard deviation	0.24 (0.07, 0.43)	2190.71	1.00
Random slopes (DE & Depression) standard deviation	0.23 (0.03, 0.48)	2531.17	1.00
Intercepts-slopes (DE only) correlation	0.11 (-0.55, 0.71)	4734.65	1.00
Intercepts-slopes (Depression only) correlation	-0.47 (-0.89, 0.19)	3047.35	1.00
Intercepts-slopes (DE & Depression) correlation	0.10 (-0.57, 0.72)	4472.94	1.00
Log prior density	-32.85 (-35.43, -31.26)	3565.96	1.00
Log posterior density	-4623.55 (-4642.14, -4606.83)	1371.99	1.01

Note: CI = credible interval. ESS = effective sample size. DE = Disordered Eating.

Table S2-C: Hyperlipidemia outcome models: Full summaries and convergence diagnostics

Model 1

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.33 (-1.44, -1.22)	1126.2	1.00
Intercept: White smaller-bodied men	0.01 (-0.12, 0.13)	1411.7	1.00
Intercept: White larger-bodied men	0.12 (-0.03, 0.27)	1818.6	1.00
Intercept: White smaller-bodied women	-0.20 (-0.34, -0.07)	1437.9	1.00
Intercept: White larger-bodied women	0.02 (-0.15, 0.17)	2239.3	1.00
Intercept: Black/African-American smaller-bodied men	-0.09 (-0.27, 0.08)	2537	1.00
Intercept: Black/African-American larger-bodied men	-0.03 (-0.27, 0.19)	4220.3	1.00
Intercept: Black/African-American smaller-bodied women	-0.10 (-0.29, 0.08)	2915.2	1.00
Intercept: Black/African-American larger-bodied women	-0.09 (-0.31, 0.11)	3408.6	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.08 (-0.28, 0.11)	2968.9	1.00
Intercept: Hispanic/Latine larger-bodied men	0.22 (0.01, 0.44)	3100.5	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.09 (-0.29, 0.09)	2598.2	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.10 (-0.36, 0.12)	4197.4	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.01 (-0.19, 0.21)	2970.3	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.38 (0.12, 0.64)	2542.9	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.09 (-0.31, 0.10)	2900	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.12 (-0.16, 0.39)	4186.4	1.00
Random intercepts standard deviation	0.19 (0.10, 0.30)	1231.7	1.00
Log prior density	-2.98 (-3.01, -2.96)	1144.7	1.00
Log posterior density	-4771.60 (-4780.57, -4764.23)	888.62	1.00

Model 2

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.34 (-1.45, -1.23)	1154	1.00
DE only (main effect)	-0.08 (-0.20, 0.04)	6753.6	1.00
Depression only (main effect)	0.18 (0.09, 0.26)	5576.3	1.00
DE & Depression (main effect)	0.25 (0.13, 0.37)	5303.4	1.00
Intercept: White smaller-bodied men	0.02 (-0.10, 0.15)	1550.8	1.00
Intercept: White larger-bodied men	0.15 (0.00, 0.30)	1794.8	1.00

Intercept: White smaller-bodied women	-0.21 (-0.34, -0.09)	1538.3	1.00
Intercept: White larger-bodied women	-0.02 (-0.17, 0.13)	2518.9	1.00
Intercept: Black/African-American smaller-bodied men	-0.07 (-0.25, 0.11)	2767.8	1.00
Intercept: Black/African-American larger-bodied men	-0.03 (-0.27, 0.19)	3583.8	1.00
Intercept: Black/African-American smaller-bodied women	-0.11 (-0.31, 0.08)	2933.2	1.00
Intercept: Black/African-American larger-bodied women	-0.11 (-0.33, 0.09)	3561.4	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.07 (-0.28, 0.11)	3224.6	1.00
Intercept: Hispanic/Latine larger-bodied men	0.22 (0.01, 0.45)	3255.2	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.09 (-0.29, 0.10)	2906.1	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.12 (-0.39, 0.11)	4162.7	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.03 (-0.17, 0.22)	3242.2	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.36 (0.12, 0.61)	2867.9	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.10 (-0.31, 0.09)	3287.3	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.11 (-0.17, 0.40)	4624.3	1.00
Random intercepts standard deviation	0.19 (0.10, 0.30)	1398.3	1.00
Log prior density	-8.50 (-8.53, -8.48)	1355	1.00
Log posterior density	-4762.07 (-4771.61, -4754.24)	909.34	1.00

Model 3

Parameter	**Mean (95% CI)**	**ESS**	**R-hat**
Intercept (main effect)	-1.36 (-1.48, -1.25)	1343.9	1.00
DE only (main effect)	-0.09 (-0.21, 0.04)	6616.3	1.00
Depression only (main effect)	0.17 (0.08, 0.25)	5583.5	1.00
DE & Depression (main effect)	0.24 (0.12, 0.36)	5913.7	1.00
Neighborhood SES: Average (main effect)	0.00 (-0.09, 0.09)	4790.4	1.00
Neighborhood SES: Lower (main effect)	0.08 (-0.02, 0.18)	3994.7	1.00
Household SES: Average (main effect)	0.03 (-0.06, 0.12)	4393.2	1.00
Household SES: Lower (main effect)	0.06 (-0.04, 0.16)	3984	1.00
Sexual minority (main effect)	0.04 (-0.05, 0.13)	5392.6	1.00
Intercept: White smaller-bodied men	0.06 (-0.07, 0.19)	1606.9	1.00
Intercept: White larger-bodied men	0.17 (0.02, 0.32)	2016.5	1.00
Intercept: White smaller-bodied women	-0.19 (-0.32, -0.05)	1656.5	1.00
Intercept: White larger-bodied women	-0.01 (-0.18, 0.15)	2239.9	1.00
Intercept: Black/African-American smaller-bodied men	-0.08 (-0.27, 0.11)	2971.1	1.00

Intercept: Black/African-American larger-bodied men	-0.05 (-0.29, 0.18)	4520.5	1.00
Intercept: Black/African-American smaller-bodied women	-0.13 (-0.33, 0.06)	2776.4	1.00
Intercept: Black/African-American larger-bodied women	-0.13 (-0.36, 0.07)	3321.7	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.07 (-0.28, 0.11)	3086.1	1.00
Intercept: Hispanic/Latine larger-bodied men	0.22 (0.01, 0.45)	3276.8	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.10 (-0.31, 0.09)	3226.1	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.14 (-0.43, 0.10)	3755.5	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.05 (-0.15, 0.26)	3046.9	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.39 (0.13, 0.64)	2790.8	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.09 (-0.29, 0.11)	3178.7	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.10 (-0.18, 0.39)	4500.2	1.00
Random intercepts standard deviation	0.20 (0.11, 0.32)	1199.1	1.00
Log prior density	-17.68 (-17.71, -17.66)	1406.2	1.00
Log posterior density	-4769.50 (-4779.84, -4761.14)	920.45	1.00

Model 4

Parameter	**Mean (95% CI)**	**ESS**	**R-hat**
Intercept (main effect)	-1.37 (-1.49, -1.24)	2231.86	1.00
DE only (main effect)	-0.08 (-0.28, 0.12)	4015.42	1.00
Depression only (main effect)	0.14 (0.01, 0.25)	5171.91	1.00
DE & Depression (main effect)	0.26 (-0.01, 0.52)	3874.18	1.00
Neighborhood SES: Average (main effect)	-0.00 (-0.09, 0.09)	8860.94	1.00
Neighborhood SES: Lower (main effect)	0.08 (-0.02, 0.19)	8293.76	1.00
Household SES: Average (main effect)	0.04 (-0.05, 0.13)	8796.02	1.00
Household SES: Lower (main effect)	0.06 (-0.03, 0.16)	8523.49	1.00
Sexual minority (main effect)	0.04 (-0.05, 0.13)	12471.5	1.00
Intercept: White smaller-bodied men	0.06 (-0.10, 0.22)	2332.97	1.00
Intercept: White larger-bodied men	0.16 (-0.02, 0.34)	3197.83	1.00
Intercept: White smaller-bodied women	-0.16 (-0.33, 0.00)	2628.45	1.00
Intercept: White larger-bodied women	-0.00 (-0.21, 0.20)	3930.76	1.00
Intercept: Black/African-American smaller-bodied men	-0.10 (-0.32, 0.10)	4347.82	1.00
Intercept: Black/African-American larger-bodied men	-0.08 (-0.38, 0.20)	6742.81	1.00
Intercept: Black/African-American smaller-bodied women	-0.15 (-0.40, 0.07)	4832.84	1.00
Intercept: Black/African-American larger-bodied women	-0.12 (-0.40, 0.13)	5922.84	1.00

Intercept: Hispanic/Latine smaller-bodied men	-0.13 (-0.38, 0.09)	4115.43	1.00
Intercept: Hispanic/Latine larger-bodied men	0.36 (0.09, 0.64)	3736.13	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.19 (-0.46, 0.04)	4839.99	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.16 (-0.50, 0.14)	8249.92	1.00
Intercept: Multiracial/Other Race smaller-bodied men	0.07 (-0.16, 0.31)	5022.56	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.42 (0.12, 0.72)	4672.47	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.12 (-0.39, 0.11)	5887.58	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.14 (-0.19, 0.49)	7688.84	1.00
Slope (DE only): White smaller-bodied men	-0.01 (-0.30, 0.26)	5328.9	1.00
Slope (DE only): White larger-bodied men	-0.09 (-0.43, 0.16)	4961.23	1.00
Slope (DE only): White smaller-bodied women	-0.02 (-0.30, 0.24)	4703.76	1.00
Slope (DE only): White larger-bodied women	-0.01 (-0.35, 0.31)	6555.22	1.00
Slope (DE only): Black/African-American smaller-bodied men	0.03 (-0.34, 0.40)	6201.41	1.00
Slope (DE only): Black/African-American larger-bodied men	0.10 (-0.27, 0.60)	4692.19	1.00
Slope (DE only): Black/African-American smaller-bodied women	0.13 (-0.17, 0.62)	3925.39	1.00
Slope (DE only): Black/African-American larger-bodied women	-0.00 (-0.40, 0.39)	8001.66	1.00
Slope (DE only): Hispanic/Latine smaller-bodied men	0.10 (-0.25, 0.56)	5057.1	1.00
Slope (DE only): Hispanic/Latine larger-bodied men	-0.34 (-1.14, 0.07)	2481.8	1.00
Slope (DE only): Hispanic/Latine smaller-bodied women	0.15 (-0.17, 0.61)	3669	1.00
Slope (DE only): Hispanic/Latine larger-bodied women	-0.01 (-0.46, 0.41)	8600.62	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied men	-0.01 (-0.42, 0.39)	9605.81	1.00
Slope (DE only): Multiracial/Other Race larger-bodied men	0.15 (-0.25, 0.77)	3571.23	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied women	0.04 (-0.32, 0.45)	7118.05	1.00
Slope (DE only): Multiracial/Other Race larger-bodied women	-0.18 (-0.90, 0.20)	4007.31	1.00
Slope (Depression only): White smaller-bodied men	0.07 (-0.06, 0.27)	3530.85	1.00
Slope (Depression only): White larger-bodied men	0.04 (-0.11, 0.26)	4640.59	1.00
Slope (Depression only): White smaller-bodied women	0.03 (-0.11, 0.20)	5506.46	1.00
Slope (Depression only): White larger-bodied women	-0.05 (-0.28, 0.10)	5932.17	1.00
Slope (Depression only): Black/African-American smaller-bodied men	0.04 (-0.14, 0.30)	5721.6	1.00
Slope (Depression only): Black/African-American larger-bodied men	-0.07 (-0.42, 0.12)	4922.8	1.00
Slope (Depression only): Black/African-American smaller-bodied women	-0.01 (-0.23, 0.19)	7545.87	1.00
Slope (Depression only): Black/African-American larger-bodied women	0.00 (-0.22, 0.22)	8155.7	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied men	0.06 (-0.11, 0.36)	4156.56	1.00
Slope (Depression only): Hispanic/Latine larger-bodied men	-0.01 (-0.29, 0.24)	7495.95	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied women	0.01 (-0.20, 0.23)	7189.81	1.00
Slope (Depression only): Hispanic/Latine larger-bodied women	-0.01 (-0.27, 0.22)	8350.94	1.00

Slope (Depression only): Multiracial/Other Race smaller-bodied men	-0.06 (-0.35, 0.11)	5650.04	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied men	-0.02 (-0.30, 0.23)	6490	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied women	-0.01 (-0.22, 0.20)	8994.77	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied women	-0.01 (-0.26, 0.23)	8168.12	1.00
Slope (DE & Depression): White smaller-bodied men	-0.28 (-0.72, 0.09)	4675.91	1.00
Slope (DE & Depression): White larger-bodied men	0.23 (-0.16, 0.64)	5103.23	1.00
Slope (DE & Depression): White smaller-bodied women	-0.14 (-0.46, 0.18)	4677.87	1.00
Slope (DE & Depression): White larger-bodied women	0.00 (-0.35, 0.36)	5956.78	1.00
Slope (DE & Depression): Black/African-American smaller-bodied men	0.23 (-0.29, 0.83)	6753.52	1.00
Slope (DE & Depression): Black/African-American larger-bodied men	0.25 (-0.29, 0.87)	7487.47	1.00
Slope (DE & Depression): Black/African-American smaller-bodied women	0.04 (-0.43, 0.49)	6238.55	1.00
Slope (DE & Depression): Black/African-American larger-bodied women	-0.09 (-0.60, 0.36)	7221.49	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied men	0.34 (-0.15, 0.90)	4966.53	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied men	-0.70 (-1.66, -0.02)	4002.96	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied women	0.30 (-0.11, 0.77)	5699.21	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied women	0.02 (-0.51, 0.52)	7961.81	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied men	-0.01 (-0.62, 0.56)	9345.15	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied men	-0.25 (-1.02, 0.34)	6473.93	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied women	0.16 (-0.28, 0.64)	7298.08	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied women	-0.10 (-0.79, 0.51)	8319.63	1.00
Random intercepts standard deviation	0.24 (0.13, 0.38)	2706.51	1.00
Random slopes (DE only) standard deviation	0.22 (0.01, 0.55)	1846.47	1.00
Random slopes (Depression only) standard deviation	0.10 (0.00, 0.28)	2689.31	1.00
Random slopes (DE & Depression) standard deviation	0.38 (0.13, 0.72)	2913.72	1.00
Intercepts-slopes (DE only) correlation	-0.22 (-0.78, 0.51)	6503.11	1.00
Intercepts-slopes (Depression only) correlation	-0.09 (-0.71, 0.61)	6987.47	1.00
Intercepts-slopes (DE & Depression) correlation	-0.38 (-0.81, 0.21)	5020.14	1.00
Log prior density	-23.28 (-25.61, -21.92)	4269.33	1.00
Log posterior density	-4833.95 (-4852.35, -4816.66)	1645.68	1.00

Model 5

Parameter	Mean (95% CI)	ESS	R-hat
Intercept (main effect)	-1.43 (-1.52, -1.35)	2397.3	1.00
DE only (main effect)	-0.08 (-0.29, 0.11)	4225.1	1.00

Depression only (main effect)	0.13 (-0.02, 0.25)	4138.9	1.00
DE & Depression (main effect)	0.27 (0.03, 0.49)	4126.2	1.00
Neighborhood SES: Average (main effect)	-0.00 (-0.09, 0.09)	7421.2	1.00
Neighborhood SES: Lower (main effect)	0.09 (-0.01, 0.19)	6814.5	1.00
Household SES: Average (main effect)	0.04 (-0.05, 0.13)	7556.9	1.00
Household SES: Lower (main effect)	0.07 (-0.03, 0.16)	7081.9	1.00
Sexual minority (main effect)	0.04 (-0.05, 0.14)	9874.5	1.00
Black/African-American (main effect)	-0.13 (-0.32, 0.07)	3208.9	1.00
Hispanic/Latine (main effect)	-0.04 (-0.23, 0.14)	3808.2	1.00
Multiracial/Other Race (main effect)	0.16 (-0.03, 0.37)	3131.6	1.00
Cisgender woman (main effect)	-0.22 (-0.36, -0.08)	3761.7	1.00
Larger-bodied (main effect)	0.20 (0.06, 0.34)	3871.9	1.00
Intercept: White smaller-bodied men	0.03 (-0.11, 0.19)	2340.7	1.00
Intercept: White larger-bodied men	-0.03 (-0.20, 0.11)	3242.3	1.00
Intercept: White smaller-bodied women	0.02 (-0.12, 0.18)	2196.4	1.00
Intercept: White larger-bodied women	0.00 (-0.15, 0.17)	3676.2	1.00
Intercept: Black/African-American smaller-bodied men	-0.01 (-0.19, 0.15)	5420.7	1.00
Intercept: Black/African-American larger-bodied men	-0.06 (-0.28, 0.09)	4133.7	1.00
Intercept: Black/African-American smaller-bodied women	0.04 (-0.11, 0.25)	4052.7	1.00
Intercept: Black/African-American larger-bodied women	-0.01 (-0.20, 0.17)	5834.3	1.00
Intercept: Hispanic/Latine smaller-bodied men	-0.06 (-0.29, 0.09)	3650.5	1.00
Intercept: Hispanic/Latine larger-bodied men	0.11 (-0.05, 0.39)	2726	1.00
Intercept: Hispanic/Latine smaller-bodied women	-0.01 (-0.20, 0.17)	4639.3	1.00
Intercept: Hispanic/Latine larger-bodied women	-0.04 (-0.26, 0.12)	5904.7	1.00
Intercept: Multiracial/Other Race smaller-bodied men	-0.03 (-0.23, 0.12)	5420.7	1.00
Intercept: Multiracial/Other Race larger-bodied men	0.06 (-0.10, 0.29)	4490	1.00
Intercept: Multiracial/Other Race smaller-bodied women	-0.04 (-0.25, 0.10)	5078.2	1.00
Intercept: Multiracial/Other Race larger-bodied women	0.02 (-0.17, 0.24)	6582.2	1.00
Slope (DE only): White smaller-bodied men	-0.01 (-0.30, 0.28)	4877.4	1.00
Slope (DE only): White larger-bodied men	-0.10 (-0.45, 0.16)	4731.9	1.00
Slope (DE only): White smaller-bodied women	-0.02 (-0.30, 0.24)	5109.5	1.00
Slope (DE only): White larger-bodied women	-0.02 (-0.37, 0.29)	5717.2	1.00
Slope (DE only): Black/African-American smaller-bodied men	0.02 (-0.35, 0.41)	7549.6	1.00
Slope (DE only): Black/African-American larger-bodied men	0.07 (-0.34, 0.53)	6536.2	1.00
Slope (DE only): Black/African-American smaller-bodied women	0.17 (-0.16, 0.69)	3509.3	1.00
Slope (DE only): Black/African-American larger-bodied women	-0.02 (-0.42, 0.37)	7963.2	1.00

Slope (DE only): Hispanic/Latine smaller-bodied men	0.07 (-0.32, 0.52)	6042	1.00
Slope (DE only): Hispanic/Latine larger-bodied men	-0.30 (-1.05, 0.10)	2764.8	1.00
Slope (DE only): Hispanic/Latine smaller-bodied women	0.15 (-0.17, 0.63)	3469.9	1.00
Slope (DE only): Hispanic/Latine larger-bodied women	-0.06 (-0.53, 0.32)	7905.2	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied men	-0.02 (-0.44, 0.36)	8530	1.00
Slope (DE only): Multiracial/Other Race larger-bodied men	0.22 (-0.13, 0.78)	3207.9	1.00
Slope (DE only): Multiracial/Other Race smaller-bodied women	0.02 (-0.35, 0.41)	7452.9	1.00
Slope (DE only): Multiracial/Other Race larger-bodied women	-0.17 (-0.86, 0.20)	4858	1.00
Slope (Depression only): White smaller-bodied men	0.09 (-0.05, 0.31)	2940.1	1.00
Slope (Depression only): White larger-bodied men	0.04 (-0.13, 0.26)	4872.5	1.00
Slope (Depression only): White smaller-bodied women	0.04 (-0.10, 0.23)	4584.9	1.00
Slope (Depression only): White larger-bodied women	-0.06 (-0.31, 0.11)	5929	1.00
Slope (Depression only): Black/African-American smaller-bodied men	0.05 (-0.15, 0.32)	5727.6	1.00
Slope (Depression only): Black/African-American larger-bodied men	-0.11 (-0.48, 0.09)	3924.9	1.00
Slope (Depression only): Black/African-American smaller-bodied women	0.02 (-0.21, 0.27)	7849.2	1.00
Slope (Depression only): Black/African-American larger-bodied women	-0.00 (-0.23, 0.23)	8315.3	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied men	0.05 (-0.14, 0.33)	4244.9	1.00
Slope (Depression only): Hispanic/Latine larger-bodied men	0.02 (-0.25, 0.32)	6193.2	1.00
Slope (Depression only): Hispanic/Latine smaller-bodied women	0.01 (-0.21, 0.28)	6942.3	1.00
Slope (Depression only): Hispanic/Latine larger-bodied women	-0.04 (-0.34, 0.19)	7198.1	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied men	-0.08 (-0.41, 0.10)	4780.8	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied men	-0.01 (-0.26, 0.21)	7180.4	1.00
Slope (Depression only): Multiracial/Other Race smaller-bodied women	-0.02 (-0.28, 0.19)	7119.6	1.00
Slope (Depression only): Multiracial/Other Race larger-bodied women	-0.01 (-0.30, 0.24)	7640.9	1.00
Slope (DE & Depression): White smaller-bodied men	-0.27 (-0.68, 0.08)	4636.8	1.00
Slope (DE & Depression): White larger-bodied men	0.21 (-0.13, 0.59)	4532.1	1.00
Slope (DE & Depression): White smaller-bodied women	-0.14 (-0.44, 0.14)	4612.6	1.00
Slope (DE & Depression): White larger-bodied women	-0.01 (-0.33, 0.30)	5786.2	1.00
Slope (DE & Depression): Black/African-American smaller-bodied men	0.18 (-0.33, 0.75)	7020.2	1.00
Slope (DE & Depression): Black/African-American larger-bodied men	0.20 (-0.29, 0.73)	6211.4	1.00
Slope (DE & Depression): Black/African-American smaller-bodied women	0.05 (-0.39, 0.48)	7705.7	1.00
Slope (DE & Depression): Black/African-American larger-bodied women	-0.11 (-0.58, 0.30)	8495	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied men	0.27 (-0.18, 0.80)	4701.2	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied men	-0.55 (-1.46, 0.03)	3008.2	1.00
Slope (DE & Depression): Hispanic/Latine smaller-bodied women	0.27 (-0.10, 0.72)	4094.5	1.00
Slope (DE & Depression): Hispanic/Latine larger-bodied women	-0.05 (-0.52, 0.40)	8164.7	1.00

Slope (DE & Depression): Multiracial/Other Race smaller-bodied men	0.02 (-0.54, 0.54)	9130.8	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied men	-0.12 (-0.73, 0.36)	6212.2	1.00
Slope (DE & Depression): Multiracial/Other Race smaller-bodied women	0.11 (-0.29, 0.56)	6383.1	1.00
Slope (DE & Depression): Multiracial/Other Race larger-bodied women	-0.06 (-0.67, 0.45)	8309.1	1.00
Random intercepts standard deviation	0.09 (0.01, 0.22)	1813.1	1.00
Random slopes (DE only) standard deviation	0.22 (0.01, 0.54)	2000.5	1.00
Random slopes (Depression only) standard deviation	0.12 (0.01, 0.30)	2196.6	1.00
Random slopes (DE & Depression) standard deviation	0.32 (0.08, 0.63)	2336.7	1.00
Intercepts-slopes (DE only) correlation	-0.09 (-0.74, 0.64)	4580.9	1.00
Intercepts-slopes (Depression only) correlation	-0.01 (-0.70, 0.70)	5887.1	1.00
Intercepts-slopes (DE & Depression) correlation	-0.35 (-0.85, 0.40)	2476.5	1.00
Log prior density	-32.50 (-34.88, -31.11)	4268.1	1.00
Log posterior density	-4844.90 (-4863.20, -4827.51)	1549.3	1.00

Note: CI = credible interval. ESS = effective sample size. DE = Disordered Eating.