The Mason: Health Starts Here Prospective Cohort Study

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Abstract

Background: Young adulthood is a period of increasing independence for the 40% of young adults enrolled in U.S. colleges. Previous research indicates differences in how students’ health behaviors develop and vary by gender, race, ethnicity, and socioeconomic status. George Mason University is a state institution that enrolls a highly diverse student population, making it an ideal setting to launch a longitudinal cohort study using multiple research methods to evaluate the effects of health behaviors on physical and psychological functioning, especially during the COVID-19 pandemic.

Methods: *Mason: Health Starts Here* was developed as a longitudinal cohort study of successive waves of first-time freshmen that aims to improve understanding of the natural history and determinants of young adults’ physical health, mental health, and their role in college completion. The study recruits first-time freshmen who are 18 to 24 years old and able to read and understand English. All incoming freshman are recruited through various methods to participate in a longitudinal cohort for four years. Data collection occurs in fall and spring semesters, with online surveys conducted in both semesters and in-person clinic visits conducted in the fall. Students receive physical examinations during clinic visits and provide biospecimens (blood and saliva).

Discussion: The study will produce new knowledge to help understand the development of health-related behaviors during young adulthood. A long-term goal of the cohort study is to support the design of effective, low-cost interventions to encourage young adults’ consistent performance of healthful behaviors, improve their mental health, and improve academic performance.

Background

The transition from adolescence to adulthood in postindustrial societies varies considerably in duration. It may be an extended and “emerging” period characterized by exploration of identity and human capital acquisition for professional and technological careers (1), or it may be a brief and “accelerated” period in assuming adult roles (e.g., completing school, working fulltime, creating an independent household, or parenting) due to marginalized identities, such as gender, ethnic/racial minority, immigration status, or poverty status (2). The pace and processes of young adult development and maturation, notably social-cognitive and motivational systems, lay the foundation for self-efficacy, decision-making, and behavioral self-regulation (3). Further, the transition to college is a critical time for establishing and reinforcing healthy or unhealthy behaviors including those related to nutrition, exercise, sleep, substance use, and mental health (4). Approximately 40% of young adults enroll in college (5), making this a social context of considerable influence during this period of development and maturation. Universities are uniquely positioned to study cohorts of young adults for the assessment and promotion of health. Such research has the potential to yield insights, and guide interventions and policies that improve students’ health and educational outcomes.
Mental and physical health issues are leading factors interfering with students’ academic performance (6,7). Approximately 32% of college students report significant mental health symptoms, including depression (17%), generalized anxiety (7%), and suicidal ideation (6%) (8). A recent study of 1,441 adults ages 18 to 39 found that the prevalence of depressive symptoms was more than 3-fold higher during the COVID-19 pandemic compared with before the pandemic (9). College students engage in heavier drinking than their non-college peers (10–12). Approximately 30% of college students ages 18 to 22 currently binge drink, and 20% used an illicit drug within the past month (13). Additionally, disordered eating behavior, such as binge eating, excessive exercise, and restriction is prevalent among college students (14,15) and linked to all of the mental health conditions described above (16).

By the time they enroll in college, most students have engaged in sexual behavior at some point in their lifetime (17,18). Rates of sexually transmitted infections (STIs) are highest among those in the traditional undergraduate college students age range (19). National samples of college students highlight inconsistent condom or other protective barrier use during sex (17), along with low rates of testing for STIs within this population (20). College students, particularly females, report very high rates of dating and intimate partner violence (21). Studies indicate that an average of 10% of college women experience at least one sexual assault during the academic year, and rates are especially high among first year college women (22,23). One recent study of 155,026 students across 196 campuses found that the percent of students with lifetime mental health diagnoses had increased from 22% to 36% (24). Of importance to academic outcomes, college students with mental health conditions are at higher risk of dropping out than other students (25). All these factors underscore the need for improved understanding of emotional and behavioral health during the college years.

Unfortunately, higher rates of college enrollment have not uniformly translated into increased rates of graduation. Many students drop out or do not complete their degrees in four years, which creates a large economic burden nationally (26,27).

Several factors that promote college students’ mental health and the likelihood of completing their degrees have previously been identified. For example, the presence of supportive social networks across multiple systems of relationships, including peers, friends, romantic partners and other adults can support personal and academic success (28). Recent research has linked supportive social networks to mental health (e.g., 29) as well as to educational perseverance and achievement (30). Other psychosocial factors, such as self-perceptions (self-esteem and self-efficacy), attributions (internal control and mastery), motivation (goals and values), and self-regulation (time management and study skills) predict persistence in staying in school and achievement (31). Further, a variety of young adults’ personality strengths such as meaning in life, hope, grit, gratitude, curiosity, and knowledge of one’s strengths have been correlated with reduced psychological symptoms and increased life satisfaction (32).

Other health behaviors known to shift substantially in young adulthood include diet and exercise, which can have considerable long-term implications. Excessive weight gain and higher rates of obesity are among the changes experienced by young adults. Obesity prevalence among young adults is 34 percent,
compared to 20 percent among adolescents (33). Obesity has been found to be a substantial risk factor for, among many other conditions, type-2 diabetes, heart disease, severe osteoarthritis, and mortality (33). Moreover, this risk is disproportionately experienced by select racial and ethnic groups (30). While under-researched, ethnic disparities in the prevalence of obesity and excessive weight gain may begin during young adulthood (34–36). Particularly relevant for college campuses is that obesity has been found to spread along social and family networks (37). Fortunately, the risk of developing obesity, associated co-morbidities, and their attendant costs may be substantially reduced through even modest (5-10%) weight loss. Modest weight loss can reduce diabetes risk up to 58% in individuals with pre-diabetes—a finding consistent for at least 15 years—as well as reduce diabetes-related medical complications (38–40).

Rates of physical activity fall sharply when young adults transition from high school to college (41). This decline is associated with a variety of factors, from psychosocial, to levels of self-efficacy, and to perceived health benefits. Despite the health benefits of physical activity, among them improved cognitive abilities and lower stress, college students face many demands on their time, including academics and work. Previous studies have found that students with higher fitness levels have lower credit loads and study less than students with lower fitness levels, underscoring the trade-offs that students may face (42). Students’ physical activity is related to better academic performance. Data from college students has found that adequate physical activity, sleep, and diet were positive predictors of grade point averages (43), which opens the doors to a variety of novel studies and interventions that can target not just health but also academic and employment outcomes. Numerous questions remain among young adults, including the role of social media exposure in physical activity, differences in physical activity levels by socioeconomic status, ethnicity, culture, gender and other health factors, and whether low-cost, effective interventions can be designed to encourage participation in exercise, improved eating habits, improved academic performance and improved mental health.

Overall, previous evidence points to the importance of capturing the college experience early on, because experiences in freshman year are predictive of continued enrollment in post-secondary education (44). For example, excess stress in the first semester has been found to be a predictor of poor academic performance, and further, poor academic performance in the first year predicts attrition (45). Further, it has been observed that many maladaptive health behavior patterns begin in the freshman year and remain stable throughout later undergraduate years (e.g., 46,47). In response to this need to understand the health trajectories of young adults during college, Mason: Health Starts Here was developed as a longitudinal cohort study of successive waves of first-time freshmen that aims to improve understanding of the natural history and determinants of young adult physical health, mental health, and college completion. The study will produce new knowledge to support the design of primarily low-cost, effective interventions to encourage participation in healthy behaviors, improve mental health, and improve academic performance among young adults.

**Methods**

*Objectives and Study Design*
The Mason: Health Starts Here is a longitudinal cohort study of first-time freshmen, and the objectives of the study are:

- to examine health, health behavior, and mental health as predictors of college completion;
- to examine the applicability of emerging adulthood or accelerated adulthood theories to college students who differ by socioeconomic status, sexual orientation, ethnicity, culture, gender, and other demographic factors;
- to examine nutrition and physical activity levels during the college years, a time of increasing adult independence;
- to examine differences in longitudinal associations among physical and psychological health factors by socioeconomic status, sexual orientation, ethnicity, culture, gender, and other demographic factors;
- to examine how social network influences and social media modulate healthful and unhealthful behaviors;
- to examine how social connectedness and trauma exposures may impact mental and physical health;
- to examine how current and past risky behaviors, sexual risk, gun ownership, and substance use modulate health, mental health, and successful college completion; and
- to identify modifiable risk and protective factors to inform new interventions to improve health and well-being.

Data collection occurs each fall and spring semester and each cohort is followed for four years. Each fall and spring semester, participants will be contacted to participate in online questionnaires. Each fall, they will also be asked to participate in an in-person physical exam in a research center which includes biospecimen collection. Saliva will be collected in all four years, and blood will only be collected during years 1 and 4. The longitudinal capture of data is illustrated in Figure 1, along with timing of incentives.

**Study Population**

The study includes first-time freshmen who are 18 to 24 years old who are able to read and understand English. First-time freshman is defined as students who are newly embarking on a four-year undergraduate degree at Mason. The goal is to recruit 300 participants each year.

**Recruitment and Retention**

In the pilot year (academic year 2019-2020), the study was advertised to students in selected courses with large numbers of freshmen enrollees through flyers outside of classrooms, brief in-class presentations and to select student organization, online video, postcards distributed in class, and email. Beginning in 2020, contact information of incoming freshman was obtained from University Life and recruitment was expanded to all incoming first-time freshmen reached through invitation letters and emails, along with video and information during freshmen orientation sessions, and messages to
followers on University social media. Additional recruitment occurs by asking faculty teaching courses with high proportions of freshman to share the recruitment video to their classes. Because of COVID-19, in 2020, all recruitment is virtual, but once a higher proportion of in-person classes and student organizations resume in future years, in-person presentations about the study will resume.

Once participants complete an online survey, they are invited to make an appointment for an in-person physical exam and biospecimen collection. Participants are offered $10 for completing each online survey and an additional $25 for completing each in-person visit. Participants receive personalized health feedback based on their survey responses and physical exam. To encourage study retention, participants receive survey reminder emails and birthday emails. Participants are asked to provide contact information of friends or family to facilitate follow-up. The study team also delivers health-related messages to the participant community, such as tips for stress management, and will share summary study findings.

Data Collection

The study includes online and in-person data collection. Table 1 lists all study measures and the timing of data collection.

Online questionnaire

The online data collection focuses on physical and emotional health, nutrition, sleep, civic engagement, and academic success.

Demographics and Social Determinants of Health

These items include age, race, ethnicity, mother’s and father’s education, current employment status and hours worked, whether the participant lives on campus, romantic relationship status, religious preference, country of birth for participant and parents, sexual identity, current gender, and gender at birth. Adult food security was assessed using two items adapted from the Hunger Vital Sign screener (48): “1) I worried about not having enough to eat and 2) I tried not to eat a lot so that the food would last.” The response options were: often true, sometimes true, never true. Housing insecurity was assessed using two items adapted from the Veterans Screener (49): “In the past 2 months, have you been living in stable housing that you own, rent, or stay in as part of a household?” and “Are you worried or concerned that in the next 2 months you may NOT have stable housing that you own, rent, or stay in as part of a household?” Both questions are answered with yes or no.

Health

Self-rated health (SRH) is measured with one item that asks, “Would you say your health is excellent, very good, good, fair, or poor?” Responses range from 1 (poor) to 5 (excellent). SRH is strongly correlated with objective health status (50).
**Migraine**

The presence of migraine and migraine severity is assessed using the American Migraine Prevalence and Prevention (AMPP) diagnostic module (7 items; 43) and the Migraine Disability Assessment (MIDAS) questionnaire (7 items; 44), respectively.

**Nutrition, Physical Activity, and Sleep**

Respondents are asked to self-report height and weight. Habitual dietary and supplement intake is assessed using the Diet History Questionnaire (DHQ)-III food frequency questionnaire, a 161-item tool which asks about food intake over the past month (53). *Physical activity* is measured with the International Physical Activity Questionnaire (IPAQ) - short version, a 7-item questionnaire (54). *Sedentary behavior* is assessed using the 18-item PACE questionnaire (55). *Sleep quality* is measured with 24 items from the Pittsburgh Sleep Quality Index or PSQI (56). The PSQI items form seven component scores that range from 0 to 3 points. Some items are fill-in-the blank and others have four choices to measure sleep quality, latency, duration, efficiency, disturbances, medication, and dysfunction during the past month.

**Technology Use and Social media**

Technology Use is measured with questions about 10 types of social media and amount of use with a 10-point response scale (57). Online Status Indicators (58) are measured with 4 questions with a 5-point response scale of how important number of followers and likes are on social media to them (58). The Social Media Integration Subscale (59) consists of 6 questions with a 5-point response scale. To assess emotional investment in social media, a modification of the Social Integration and Emotional Connection subscale of the Social Media Use Integration Scale (59) will be used. Nighttime-specific Social Media is measured with seven items rated from Never (1) to Daily (7).

**Perceived Risk of Sexually Transmitted Infection, Contraceptive Use and Sexual History**

Sexual behavior and attitudes are measured with a total of 51 modified items about sexual behaviors (42 items; 52), types of contraceptives (2 items; 53), perceived risk and susceptibility to sexually transmitted infections (3 items; 54), and PrEP knowledge (4 items; 55).

The Sexual Experiences Survey (SES; 57) asks participants whether or not they have experienced unwanted sexual contact via a number of different means. The questionnaire has been modified to ask participants if they have experienced each type of unwanted sexual assault since the age of 14 and in the past three months. Participants respond ‘yes’ or ‘no’ to a series of 10 questions describing sexual assault experiences (65).

**Firearms**

There are 30 questions assessing a variety of firearm related topics including: acquisition, ownership, access, proximity, safe storage, training, carrying behavior, reasons for carrying, and firearm type, as well
as whether they knew someone who was unintentional or intentional shot. These items were adapted from several national surveys including the National Firearm Survey, Pew Research Center, National Comorbidity Survey - Adolescent Supplement (NCS-AS), as well as from previously conducted research (66,67).

**Substance Use**

Alcohol use is measured with the Alcohol Use Disorders Identification Test (AUDIT), a 10-item scale assessing alcohol consumption, drinking behaviors, and alcohol-related problems, which is used to identify individuals at risk of an alcohol use disorder (68). Degree of Problems Related to Drug Abuse is measured using the 10-item Drug Abuse Screening Test (DAST-10; Skinner, 1982). Nicotine use and dependence are measured with the 6-item Fagerström Test for Nicotine Dependence (FTND; 60). Ever smoking cigarettes, past 30-day cigarette smoking, and 30-day menthol cigarette smoking items were used/adapted from the Monitoring the Future (MTF) study and National Survey on Drug Use and Health (NSDUH). Vaping/electronic cigarette (e-cigarette) use was measured using items from the MTF study, modified with nicotine clarification as part of the instructions per the Behavioral Risk Factor Surveillance System (BRFSS).

Past 30-day alcohol consumption items were measured using or adapting items from the NSDUH and BRFSS. Marijuana use was measured using three items from the BRFSS: ever use (yes/no), past 30-day use frequency, and manner of use (i.e., smoke, eat, drink, vaporize, dab, don’t know, unsure). Risky driving-related behaviors (i.e., driving under the influence of alcohol, riding in a vehicle driven by someone who had been drinking, driving under the influence of marijuana, and texting or e-mailing while driving) were assessed using items from the NSDUH and YRBSS or adapting them (i.e., past 30-day rather than 12 month).

**Access to Health Care**

Health psychiatric medication, history of mental health treatment, health insurance, regular source of care and barriers to access. Measured with if you have ever been prescribed or currently prescribed psychiatric medicine with 1 “Yes” or 2 “No.”

**Psychological Symptoms**

Eating Disorder risk and symptoms are measured with the Eating Pathology Symptoms Inventory (EPSI; 61). The EPSI is a 45-item multidimensional measure of eating pathology and includes items related to body dissatisfaction as well as restricted eating and binge eating.

Anger, Depression, and Anxiety symptoms are measured with the Patient Reported Outcomes Measurement Information System (PROMIS; 62). The PROMIS assesses individual functioning across various domains of well-being. Respondents report their feelings of these emotions over the past 7 days using a 5-point Likert scale (‘Never’ to ‘Always’).
Loneliness is measured with 4 items from the Short Scale for Measuring Loneliness measure (73). Items are scored on a 3-point scale from “hardly ever” to “often.”

Post-Traumatic Stress Disorder symptoms are measured with 20 items rated from 0 (not at all) to 4 (extremely) using the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5; 64).

Impulsivity/Impulse control is measured with the 56 item UPPS-P (75). The UPPS-P consists of five scales assessing conscientiousness, lack of planning, sensation seeking, and acting impulsivity during periods of positive and negative mood. Participants are asked to rate their typical behavior on a scale from 1-5.

**Psychological Well-Being**

Life Satisfaction is measured with 5 items from The Satisfaction with Life Scale (SWLS; 66). Items that are rated on 7-point scale from ‘strongly disagree’ to ‘strongly agree.’

- Happiness is measured with 4 items from The Subjective Happiness Scale (SHS; 67). The items are rated on 7-point scales with various response choices.
- Gratitude is measured with 6 items from The Gratitude Questionnaire (78). The items that are rated on 7-point scale from ‘strongly disagree’ to ‘strongly agree.’
- Hope is measured with the 8-item Adult Hope Scale (AHS; 69). The AHS measures two facets of hope: Agency, or goal-directed energy, and Pathways, or planning to meet goals. Items are rated on an 8-point scale from ‘definitely false’ to ‘definitely true.’
- Meaning in Life is measured with 5 items from the presence subscale of the Meaning in Life Questionnaire (80). Items are rated on a 7-point scale from ‘absolutely untrue’ to ‘absolutely true.’
- The Ethnic Identity Scale – Brief (EIS-B; 71) consists of 9 items that examine three different domains of ethnic identity formation: exploration (3 items), resolution (3 items), and affirmation (3 items). Responses are coded so that higher scores on each subscale indicate greater exploration, resolution, and affirmation.
- The Compassion Scale (82) and the short form of The Self-Compassion Scale (83) are measured with 16 items, and 12 items, respectively, of how you feel and behave on a scale from 1 ‘Almost Never’ to 5 ‘Almost Always.’

**Psychological Risk Variables**

The Life Events Checklist (84) is a 17-item measure asking participants to check experiences related to any of 17 potentially traumatic events (e.g. natural disaster, accident, combat exposure) listed. Participants are asked to check one or more of the following statements: ‘Happened to me’; ‘Witnessed it’; ‘Learned about it’; ‘Not sure’; and ‘Doesn’t apply’.

Adverse Childhood Experiences assesses all types of abuse, neglect, and other potentially traumatic experiences that may be experienced by people under the age of 18 by asking participants to respond
“yes” or “no” to the occurrence of 10 events in two categories: abuse (psychological, physical, and sexual) and household dysfunction (substance use, mental illness, physical violence, and criminal behavior). The prevalence of exposure is computed by summing across the number of abuse and household dysfunction categories (85).

Everyday Inequity Scale is a 5-item scale asking participants to report frequency, from ‘never’ to ‘at least once a week’, and reasons for experiencing racial and nonracial discrimination in their day-to-day life (86,87).

**Peers and Social Support**

Perceived Social Support is measured with 12 items from the Multidimensional Scale of Perceived Social Support (88). The items are rated on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree) for relationships with family, friends, and a significant other.

**Personal Network Composition and Structure.** Individuals reported on up to 5 members of their personal networks with whom they discuss important matters and for each of these members they provided information on individual characteristics (e.g., gender, race/ethnicity, education, nature of relationship, frequency and mode of communication), rated positive and negative quality of their relationship with each network member, and estimated likelihood that network members know one another. Similar assessments have been used in large-scale aging surveys, such as the National Social Life, Health, and Aging Project (NSHAP; 78) and Chicago Health, Aging, and Social Relations Study (CHASRS; 79).

**Personality Traits.** The Mini-IPIP (91) is a 20-item short form of the 50-item International Personality Item Pool-Five-Factor Model Measure (92). The scale measures extraversion, agreeableness, conscientiousness, neuroticism, and intellect/imagination with 4 items for each trait. The items are rated on a 5-point scale from 1 (very inaccurate) to 5 (very accurate).

**Environment and Sustainability**

Environmental orientation is assessed with the 4-item revised New Environmental Paradigm Scale (93) and sustainable consumption is measured with the 18-item Sustainable Consumption Behavior Scale (94). The NAPS is used to uncover attitudes and beliefs in relation to the environment, while the SCBS measures what, if any, sustainable practices individuals are currently utilizing.

**Environmental Exposures**

Exposures related to food, employment and personal care products (94) includes 12 items related to purchases of food and personal care items and their packaging, 2 items related to second-hand smoke, 3 questions related to type of work, and 3 items related to products used in the home.

**Assessment in the Research Center (In-Person Visit)**
During the in person visit to the public health clinic, study participants are asked additional questions about their medical history, given a history and physical exam by a clinician, and asked to donate a venous blood sample and a saliva sample. Participants are requested to fast prior to their appointment and to avoid taking medications and engaging in rigorous physical activity within an hour of their appointment.

At intake, participants are asked for medical history and family history using a checklist of conditions, including indicators of cardiovascular-related health issues, such as high blood pressure, heart disease, stroke, high cholesterol, chest pain, and irregular heartbeat. Participants also complete a past hospitalizations list, a weight history by age, a current medications list, two items on perceived problematic gambling and shopping; six questions on meal timing and meal frequency; and a source and frequency of purchased meals checklist; and two questions on wake-up time that day and participants’ usual wake-up time. Women are asked to report on a 15-item menstrual history. Participants are also asked to complete an interviewer-guided Self-Injurious Thoughts and Behaviors Interview (SITBI). This is a 25-item instrument that queries lifetime and past week self-injurious thoughts and behaviors (95). The physical exam includes body weight, height, waist circumference, blood pressure, pulse, respiratory rate, current oral temperature, heart and lung exam, abdominal exam, neck exam, and general physical appearance. Body composition is measured using a DXA scanner (DXA, Hologic Horizon densitometer Hologic, Boston MA). Resting metabolic rate is measured using indirect calorimeter (FitMatePro, Cosmed Inc, Rome, Italy).

**Biospecimens**

Participants are asked to fill two cryovials with approximately 1 mL of saliva using passive drool procedures. Blood samples include a venous blood draw of 36 mL. Samples are tested immediately for HbA1c, lipid panels, and blood chemistries. Abnormal results are communicated to participants by clinical staff. The remaining sample is processed, aliquoted, and frozen at -70 degrees C.

**Discussion**

The purpose of the Mason Cohort study is to assess and longitudinally follow, in a racially and ethnically diverse population of young adults, risk factors for the development of chronic disease conditions, as well as the presence and effect of health-promoting habits. Among the outcome measures of particular interest are those factors that predict failure to complete undergraduate degrees among participants.

While most longitudinal cohort studies are by design, purely observational, and thus, at best of indirect benefit to participants, even these may show expectancy effects. For example, participants may be triggered to answer survey questions “appropriately” (so-called “reactivity” effects, or to address unfavorable health-related behaviors through merely being asked about them (96). The Mason Cohort was envisioned as also being a tool to potentially benefit participants directly, in addition to benefitting our understanding as researchers in health fields. Thus, it is a hybrid design, part traditional cohort study and part intervention trial.
This has obvious benefits to participants, as information and advice concerning their own health and risk factors are returned to them, and interest in improving those risks is potentially fostered. The study design also encourages researchers, stimulated by data gathered and associations discerned to propose sub-studies, which, upon review and approval by the study steering committee are submitted for IRB review and offered to all or subsets of cohort participants based on the specific questions being asked in the sub-study. Preference will be given to proposed sub-studies which offer a direct potential benefit to study participants.

From an evaluation of theories on college student retention and success, interactionalist theory of social and academic integration suggests that college completion relies upon the extent to which students are committed to their institution, and this commitment level depends on the level of social and academic integration, determined by the quality of interactions (97). The student attrition model, focused more on cognitive and behavioral aspects of college completion, posits a significant role for perceptions of satisfaction and attitude impacting behavioral intentions to stay or leave (98). Besides, results from different interventions on college students suggest that low cost and brief interventions can have a meaningful impact on long-term student outcomes (99). Therefore, this study will follow a multi-stage developmental process for preventive interventions (following Institute of Medicine recommendations); the identification of a target problem, then the review and investigation of research that can identify protective factors and inform etiologic models, and finally, preventive interventions targeting these factors using experimental designs and intervention analyses (100).

*Self-selected population pros and cons...*

The self-selected population is a popular sampling technique in many health areas that require human subjects and is an effective sampling strategy, especially in experimental research settings (101). Since the potential research subjects contact study staff directly, this can reduce the amount of time necessary to search for appropriate participants. In addition, the potential participants are likely to be committed to taking part in the study, which can help improve attendance and a greater willingness to provide more insight into the phenomenon being studied. However, with self-selection potential research participants may exhibit an inherent bias in their characteristics and approach to the study (102).

To complete any study of living things, it is critical to retain study participants. Participants who complete their scheduled follow-up visits within predefined visit windows will be considered as retained. Although every effort is being taken to facilitate completing each participant's entry, mid, and exit visits, attrition can and does happen; and the retention rate can fluctuate over time and across visits (103). To ensure continued participation and minimize attrition, this study follows the key precepts of retention and practice: facilitating participation, communicating study progress, expressing appreciation, and informing participants of study results (104).

Assuming good rates of retention, we see the future of the study as promising- its breadth of coverage of health predictors and precursors, its diverse sample of young college students, and its flexible
implementation strategies enhance its capacity to inform emerging health problems and risk factors through examination of the wealth of data and specimens being gathered.

Also of note is the benefit of having baseline specimens and surveys in a diverse sample of young adults when new health problems like COVID-19 emerge.

More work needs to be done, though, including securing sources of ongoing funding, and developing collaborations with other studies of young adults/college students. Future enhancements being considered include following participants for a time frame well beyond the undergraduate years to track health trajectories across the lifespan, and gathering more family data, including adding parents and future offspring of current participants

**Declarations**

*Ethics approval and consent to participate*

Study approval was given by George Mason University’s Institutional Review Board. Informed consent was obtained. For the online survey portion of the study, potential participants were enrolled and consented online. A separate, written informed consent was obtained for the in-person physical examination. All methods were carried out in accordance with relevant guidelines and regulations, along with the IRB approval.

*Consent for publication:*

taken

*Availability of data and materials:*

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*Competing interests:*

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References

1. Arnett JJ. Emerging adulthood: A theory of development from the late teens through the twenties. Am Psychol. 2000;55(5):469–80.

2. Lee J, Waithaka E. The Intersections of Marginalized Social Identities in the Transition to Adulthood: A Demographic Profile. Emerg Adulthood. 2017;5(3):151–163.

3. Masten AS, Burt KB, Roisman GI, Obradovic J, Long JD, Tellegen A. Resources and resilience in the transition to adulthood: Continuity and change. Dev Psychopathol. 2004;16(04):1071–94.

4. Simons-Morton B, Haynie D, O’Brien F, Lipsky L, Bible J, Liu D. Variability in measures of health and health behavior among emerging adults 1 year after high school according to college status. J Am Coll Health. 2017;65(1):58–66.

5. National Center for Education Statistics. College enrollment rates. [Internet]. 2019. Available from: https://nces.ed.gov/programs/coe/indicator_cpb.asp.

6. Eisenberg D, Golberstein E, Hunt JB. Mental health and academic success in college. BE J Econ Anal Policy [Internet]. 2009 [cited 2020 Oct 27];9(1). Available from: http://www.degruyter.com/view/j/bejeap.2009.9.1/bejeap.2009.9.1.2191/bejeap.2009.9.1.2191.xml

7. Ruthig JC, Marrone S, Hladkyj S, Robinson-Epp N. Changes in college student health: Implications for academic performance. J Coll Stud Dev. 2011;52(3):307–20.

8. Eisenberg D, Hunt J, Speer N. Mental health in American colleges and universities: Variation across student subgroups and across campuses. J Nerv Ment Dis. 2013;201(1):60–67.

9. Ettman CK, Abdalla SM, Cohen GH, Sampson L, Vivier PM, Galea S. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. JAMA Netw Open. 2020;3(9):e2019686.

10. Blanco C, Okuda M, Wright C, Hasin DS, Grant BF, Liu S-M, et al. Mental health of college students and their non–college-attending peers: Results from the National Epidemiologic Study on Alcohol and Related Conditions. Arch Gen Psychiatry. 2008;65(12):1429–37.
11. Johnston L, O’Malley P, Bachman J, Schulenberg J. Monitoring the Future national survey results on drug use, 1975-2000. Volume II: College students and adults ages 19-40. 2010;(NIH Publication No. 10-7585):Bethesda, MD: National Institute on Drug Abuse.

12. Johnston LD, O’Malley PM, Bachman JG, Schulenberg JE. Monitoring the Future national survey results on drug use, 1975-2012: Volume I, Secondary school students. [Internet]. Ann Arbor: Institute for Social Research, The University of Michigan; 2013. Available from: https://deepblue.lib.umich.edu/bitstream/handle/2027.42/137921/mtf-vol1_2012.pdf?sequence=1

13. Lipari R, Jean-Francois B. Trends in perception of risk and availability of substance use among full-time college students. In: The CBHSQ Report [Internet]. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2013 [cited 2020 Oct 28]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK396151/

14. Goldschmidt AB, Wall MM, Zhang J, Loth KA, Neumark-Sztainer D. Overeating and binge eating in emerging adulthood: 10-year stability and risk factors. Dev Psychol. 2016;52(3):475–83.

15. Trojanowski PJ, Adams LM, Fischer S. Understanding profiles of student binge drinking and eating: The importance of motives. Addict Behav. 2019;96:148–55.

16. Eisenberg D, Nicklett EJ, Roeder K, Kirz NE. Eating disorder symptoms among college students: Prevalence, persistence, correlates, and treatment-seeking. J Am Coll Health. 2011;59:700–7.

17. American College Health Association. American College Health Association National College Health Assessment II: Reference Group Executive Summary Spring 2018 [Internet]. Silver Spring, MD: American College Health Association; 2018. Available from: https://www.acha.org/documents/ncha/NCHA-II_Spring_2018_Reference_Group_Executive_Summary.pdf

18. Cavazos-Rehg PA, Krauss MJ, Spitznagel EL, Schootman M, Bucholz KK, Peipert JF, et al. Age of sexual debut among US adolescents. Contraception. 2009 Aug 1;80(2):158–62.

19. Whiting W, Pharr JR, Buttner MP, Lough NL. Behavioral Interventions to Increase Condom Use Among College Students in the United States: A Systematic Review: Health Educ Behav [Internet]. 2019 Jun 5 [cited 2020 Nov 20]; Available from: https://journals.sagepub.com/doi/10.1177/1090198119853008

20. Lindley LL, Sharif AM, Chowdhury T. College students' comfort with and intention to use self-collection services for STI testing. J Am Coll Health. 2020 Oct 13;0(0):1–10.

21. Knowledge Networks, Inc. 2011 College Dating Violence and Abuse Poll. Liz Claiborne, Inc.; 2011.

22. Cantor D, Fisher B, Chibnall S, Harps S, Townsend R, Thomas G, et al. Report on the AAU Campus Climate Survey on Sexual Assault and Misconduct. 2020. 2020.

23. Krebs C, Lindquist C, Berzofsky M, Shook-Sa B, Peterson K. Campus Climate Survey Validation Study Final Technical Report. 2016 p. 218.

24. Lipson SK, Lattie EG, Eisenberg D. Increased Rates of Mental Health Service Utilization by U.S. College Students: 10-Year Population-Level Trends (2007–2017). Psychiatr Serv. 2019;70(1):60–3.

25. Kochhar-Bryant C, Bassett DS, Webb KW. Transition to Postsecondary Education for Students With Disabilities. Corwin Press; 2009. 249 p.
26. National Center for Education Statistics. The Condition of Education 2019 (NCES 2019-144), [Internet]. 2019. Available from: https://nces.ed.gov/fastfacts/display.asp?id=40.

27. Schneider M, Yin L (Michelle). The Hidden Costs of Community Colleges: (537212012-001) [Internet]. American Psychological Association; 2011 [cited 2020 Oct 28]. Available from: http://doi.apa.org/get-pe-doi.cfm?doi=10.1037/e537212012-001

28. Barry CM, Madsen SD, DeGrace A. Growing up with a little help from their friends in emerging adulthood. In: The Oxford handbook of emerging adulthood. New York, NY, US: Oxford University Press; 2016. p. 215–29. (Oxford library of psychology).

29. Mason MJ, Zaharakis N, Benotsch EG. Social Networks, Substance Use, and Mental Health in College Students. J Am Coll Health. 2014 Oct 3;62(7):470–7.

30. Stadtfeld C, Vörös A, Elmer T, Boda Z, Raabe IJ. Integration in emerging social networks explains academic failure and success. Proc Natl Acad Sci. 2019;116(3):792–7.

31. Fong CJ, Davis CW, Kim Y, Kim YW, Marriott L, Kim S. Psychosocial factors and community college student success: A meta-analytic investigation. Rev Educ Res. 2017;87(2):388–424.

32. Goodman FR, Disabato DJ, Kashdan TB, Machell KA. Personality strengths as resilience: A one-year multiwave study. J Pers. 2017;85(3):423–34.

33. Dietz WH. Obesity and excessive weight gain in young adults: New targets for prevention. JAMA. 2017 Jul 18;318(3):241–2.

34. Bruce MA, Beech BM, Thorpe RJ, Griffith DM. Racial disparities in sugar-sweetened beverage consumption change efficacy among male first-year college students. Am J Mens Health. 2016;10(6):NP168–75.

35. Sarathy H, Henriquez G, Abramowitz MK. Abdominal obesity, race and chronic kidney disease in young adults: Results from NHANES 1999-2010. PLoS ONE. 2016;11(5):e0153588.

36. VanKim NA, Laska MN. Socioeconomic Disparities in Emerging Adult Weight and Weight Behaviors. Am J Health Behav. 2012;36(4):433–45.

37. Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. N Engl J Med. 2007;357(4):370–9.

38. Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. The Lancet. 2009;374(9702):1677–86.

39. Diabetes Prevention Program Research Group. The 10-Year Cost-Effectiveness of Lifestyle Intervention or Metformin for Diabetes Prevention: An intent-to-treat analysis of the DPP/DPPOS. Diabetes Care. 2012 Apr 1;35(4):723–30.

40. Diabetes Prevention Program Research Group. Long-term effects of lifestyle intervention or metformin on diabetes development and microvascular complications over 15-year follow-up: the Diabetes Prevention Program Outcomes Study. Lancet Diabetes Endocrinol. 2015 Nov 1;3(11):866–75.
41. Calestine J, Bopp M, Bopp CM, Papalia Z. College Student Work Habits are Related to Physical Activity and Fitness. Int J Exerc Sci. 2017 Nov 1;10(7):1009–17.
42. Stults-Kolehmainen MA, Sinha R. The effects of stress on physical activity and exercise. Sports Med. 2014 Jan 1;44(1):81–121.
43. Wald A, Muennig PA, O’Connell KA, Garber CE. Associations between healthy lifestyle behaviors and academic performance in U.S. undergraduates: A secondary analysis of the American College Health Association's National College Health Assessment II. Am J Health Promot. 2014;28(5):298–305.
44. Turner P, Thompson E. College retention initiatives meeting the needs of millennial freshman students. Coll Stud J. 2014 Mar 1;48(1):94–104.
45. Amirkhan JH, Kofman YB. Stress overload as a red flag for freshman failure and attrition. Contemp Educ Psychol. 2018;54:297–308.
46. Lyzwinski LN, Caffery L, Bambling M, Edirippulige S. The relationship between stress and maladaptive weight-related behaviors in college students: A review of the literature. Am J Health Educ. 2018;49(3):166–78.
47. Wilson OWA, Bopp CM, Papalia Z, Duffey M, Bopp M. Freshman physical activity constraints are related to the current health behaviors and outcomes of college upperclassmen. J Am Coll Health. 2020 Jul 23;0(0):1–7.
48. Hager E, Quigg A, Black M, Coleman S, Heeren T, Rose-Jacobs R, et al. Development and validity of a 2-item screener to identify families at risk for food insecurity. Pediatrics. 2010;126(1):26–32.
49. Montgomery A, Fargo J, Kane V, Culhane D. Development and Validation of an instrument to assess imminent risk of homelessness among veterans. Public Health Rep. 2014;129:428–36.
50. Meng Q, Xie Z, Zhang T. A single-item self-rated health measure correlates with objective health status in the elderly: a survey in suburban beijing. Front Public Health. 2014;2(27).
51. Lipton R, Stewart W, Diamond S, Diamond M, Reed M. Prevalence and burden of migraine in the United States: data from the American Migraine Study II. Headache. 2001;41(7):646–57.
52. Stewart W, Lipton R, Kolodner K, Sawyer J, Lee C, Liberman J. Validity of the Migraine Disability Assessment (MIDAS) score in comparison to a diary-based measure in a population sample of migraine sufferers. Pain. 2000;88(1):41–52.
53. Kipnis V, Subar AF, Midthune D, Freedman LS, Ballard-Barbash R, Troiano RP, et al. Structure of Dietary Measurement Error: Results of the OPEN Biomarker Study. Am J Epidemiol. 2003 Jul 1;158(1):14–21.
54. Mäder URS, Martin BW, Schutz Y, Marti B. Validity of Four Short Physical Activity Questionnaires in Middle-Aged Persons. Med Sci Sports Exerc. 2006 Jul;38(7):1255–1266.
55. Rosenberg DE, Norman GJ, Wagner N, Patrick K, Calfas KJ, Sallis JF. Reliability and validity of the Sedentary Behavior Questionnaire (SBQ) for adults. J Phys Act Health. 2010 Nov;7(6):697–705.
56. Buysse D, Reynolds III C, Monk T, Berman S, Kupfer D. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193–213.
57. Ohannessian C. Does technology use moderate the relationship between parental alcoholism and adolescent alcohol and cigarette use? Addict Behav. 2009;34(6–7):606–9.

58. Nesi J, Choukas-Bradley S, Prinstein M. Transformation of Adolescent Peer Relations in the Social Media Context: Part 1-A Theoretical Framework and Application to Dyadic Peer Relationships. Clin Child Fam Psychol Rev. 2018;21(3):267–94.

59. Jenkins-Guarnieri M, Wright S, Johnson B. Development and validation of a social media use integration scale. Psychol Pop Media Cult. 2013;2(1):38.

60. Mustanski B, Starks T, Newcomb ME. Methods for the design and analysis of relationship and partner effects on sexual health. Arch Sex Behav. 2014 Jan;43(1):21–33.

61. Trussell J, Aiken A, Micks E, Guthrie K. Efficacy, safety, and personal considerations. In: Contraceptive Technology. 21st ed. New York, NY, US: Ayer Company Publishers, Inc.; 2018.

62. Pollack LM, Boyer CB, Weinstein ND. Perceived risk for sexually transmitted infections aligns with sexual risk behavior with the exception of condom nonuse: data from a nonclinical sample of sexually active young adult women. Sex Transm Dis. 2013 May 1;40(5):388–94.

63. Mosley T, Khaketla M, Armstrong HL, Cui Z, Sereda P, Lachowsky NJ, et al. Trends in awareness and use of HIV PrEP among gay, bisexual, and other men who have sex with men in Vancouver, Canada 2012 – 2016. AIDS Behav. 2018 Nov;22(11):3550–65.

64. Janulis P, Newcomb ME, Sullivan P, Mustanski B. Evaluating HIV knowledge questionnaires among men who have sex with men: a multi-study item response theory analysis. Arch Sex Behav. 2018;47(1):107–119.

65. Koss M, Gidycz C. Sexual experiences survey: reliability and validity. J Consult Clin Psychol. 1985;53(3):422–3.

66. Miller M, Hepburn L, Azrael D. Firearm Acquisition Without Background Checks. Ann Intern Med. 2017 Jan 3;166(4):233–9.

67. Rowhani-Rahbar A, Lyons VH, Simonetti JA, Azrael D, Miller M. Formal firearm training among adults in the USA: results of a national survey. Inj Prev J Int Soc Child Adolesc Inj Prev. 2018;24(2):161–5.

68. Saunders J, Aasland O, Babor T, de la Fuente J, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption–II. Addiction. 1993;88(6):791–804.

69. Skinner H. Drug Abuse Screening Test. Addict Behav. 1982;7:363–71.

70. Heatherton T, Kozlowski L, Frecker R, Fagerstrom K. The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. Br J Addict. 1991;86:1119–27.

71. Forbush K, Wildes J, Pollack L, Dunbar D, Luo J, Patterson K, et al. Development and validation of the Eating Pathology Symptoms Inventory (EPSI). Psychol Assess. 2013;25(3):859–78.

72. Cella D, Riley W, Stone A, Rothrock N, Reeve B, Yount S, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005e2008. J Clin Epidemiol. 2010;63:1179–94.
73. Hughes M, Waite L, Hawkley L, Cacioppo J. A short scale for measuring loneliness in large surveys: Results from two population-based studies. Res Aging. 2004;26(6):655–72.

74. Blevins C, Weathers F, Davis M. The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): Development and Initial Psychometric Evaluation. J Trauma Stress. 2015;28(6):489–98.

75. Lynam D, Smith G, Whiteside S, Cyders M. The UPPS-P: Assessing five personality pathways to impulsive behavior. West Lafayette Purdue Univ. 2006;Unpublished Report.

76. Diener E, Emmons R, Larsen R, Griffin S. The Satisfaction With Life Scale. J Assess. 1985;49(1):71–5.

77. Lyubomirsky S, Lepper H. A measure of subjective happiness: Preliminary reliability and construct validation. Soc Indic Res. 1999;46(2):137–55.

78. McCullough M, Emmons R, Tsang J. The grateful disposition: a conceptual and empirical topography. J Pers Soc Psychol. 2002;82:112–27.

79. Snyder C, Harris C, Anderson J, Holleran S, Irving L, Sigmon S. The will and the ways: Development and validation of an individual-differences measure of hope. J Pers Soc Psychol. 1991;60:570–85.

80. Steger M, Frazier P, Oishi S, Kaler M. The meaning in life questionnaire: Assessing the presence of and search for meaning in life. J Couns Psychol. 2006;53(1):80.

81. Douglass S, Umaña-Taylor A. A brief form of the Ethnic Identity Scale: Development and empirical validation. Identity. 2015;15(1):48–65.

82. Pommier E, Neff K, Tóth-Király I. The development and validation of the Compassion Scale. Assessment. 2020;27(1):21–39.

83. Raes F, Pommier E, Neff K, Van Gucht D. Construction and factorial validation of a short form of the Self-Compassion Scale. Clin Psychol Psychother. 2011;250–5.

84. Gray M, Litz B, Hsu J, Lombardo T. Psychometric properties of the life events checklist. Assessment. 2004;11(4):330–41.

85. Felitti V, Anda R, Nordenberg D, Williamson D, Spitz A, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med. 1998;14(4):245–58.

86. Sternthal M, Slopen N, Williams D. Racial disparities in health: how much does stress really matter? Bois Rev. 2011;8(1):95–113.

87. Williams DR, Yu Y, Jackson JS, Anderson NB. Racial Differences in Physical and Mental Health: Socio-economic Status, Stress and Discrimination. J Health Psychol. 1997 Jul 1;2(3):335–51.

88. Zimet G, Dahlem N, Zimet S, Farley G. The multidimensional scale of perceived social support. J Assess. 1988;52(1):30–41.

89. Cornwell B, Schumm L, Laumann E, Kim J, Kim Y. Assessment of social network change in a national longitudinal survey. J Gerontol Ser B Psychol Sci Soc Sci. 2014;69(Suppl 2):75–82.

90. Cacioppo J, Hawkley L, Thisted R. Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago Health, Aging, and Social
Relations Study. Psychol Aging. 2010;25(2):453.

91. Donnellan M, Oswald F, Baird B, Lucas R. The mini-IPIP scales: tiny-yet-effective measures of the Big Five factors of personality. Psychol Assess. 2006;18(2):192.

92. Goldberg L. A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In: Personality Psychology in Europe. Tilburg, The Netherlands: Tilburg University Press; 1999. p. 7–28.

93. Dunlap RE, Van Liere KD, Mertig AG, Jones. Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. J Soc Issues. 2000;56(3):425–42.

94. Dunlap R. The new environmental paradigm scale: From marginality to worldwide use. J Environ Educ. 2008;40(1):3–18.

95. Nock M, Holmberg E, Photos V, Michel B. Self-Injurious Thoughts and Behaviors Interview: development, reliability, and validity in an adolescent sample. Psychol Assess. 2007;19(3):309–17.

96. Mitchum AL, Kelley CM, Fox MC. When asking the question changes the ultimate answer: Metamemory judgments change memory. J Exp Psychol Gen. 2016;145(2):200–19.

97. Draper S. Tinto's model of student retention [Internet]. 2008. Available from: https://www.psy.gla.ac.uk/~steve/localed/tinto.html

98. Aljohani O. A comprehensive review of the major studies and theoretical models of student retention in Higher Education. High Educ Stud. 2016;6(2):1.

99. Harackiewicz JM, Priniski SJ. Improving student outcomes in Higher Education: The science of targeted intervention. Annu Rev Psychol. 2018;69(1):409–35.

100. American Psychological Association. Guidelines for prevention in psychology. Am Psychol. 2014 Apr;69(3):285–96.

101. Creighton N, Purdie S, Soeberg M, Walton R, Baker D, Young J. Self-selection in a population-based cohort study: impact on health service use and survival for bowel and lung cancer assessed using data linkage. BMC Med Res Methodol. 2018;18(1):84.

102. Khazaal Y, Van Singer M, Chatton A, Achab S, Zullino D, Rothen S, et al. Does self-selection affect samples' representativeness in online surveys? An investigation in online video game research. J Med Internet Res. 2014;16(7):164.

103. Abshire M, Dinglas V, Cajita M, Eakin M, Needham D, Himmelfarb C. Participant retention practices in longitudinal clinical research studies with high retention rates. BMC Med Res Methodol. 2017;17(1):1–10.

104. Gibaldi J, Siddiqi B. Retention Strategies for Keeping Participants Engaged. Appl Clin Trials. 2019;28(9):20–1.

105. Cinamon R. Integrating work and study among young adults: Testing an empirical model. J Career Assess. 2016;24(3):527–42.

106. Riley W, Rothrock N, Bruce B, Christodolou C, Cook K, Hahn E, et al. Patient-reported outcomes measurement information system (PROMIS) domain names and definitions revisions: further
evaluation of content validity in IRT-derived item banks. Qual Life Res. 2010;19(9):1311–21.

107. Substance Abuse and Mental Health Services Administration. Results from the 2011 National Survey on Drug Use and Health: Summary of National Findings [Internet]. NSDUH Series H-44, HHS Publication No. (SMA) 12-4713. Rockville, MD: Substance Abuse and Mental Health Services Administration. 2012. Available from: https://store.samhsa.gov/product/Results-from-the-2011-National-Survey-on-Drug-Use-and-Health-Summary-of-National-Findings/SMA12-4713

108. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data [Internet]. 2005. Available from: https://www.cdc.gov/brfss/about/index.htm

109. Centers for Disease Control and Prevention (CDC). 1991-2019 High School Youth Risk Behavior Survey Data [Internet]. 2019. Available from: http://nccd.cdc.gov/youthonline/

110. Garnefski N, Kraaij V. Cognitive emotion regulation questionnaire—development of a short 18-item version (CERQ-short). Individ Dif. 2006;41(6):1045–53.

111. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983;24(4):385–96.

112. Kernsmith P, Victor B, Smith-Darden J. Online, offline, and over the line: Coercive sexting among adolescent dating partners. Youth Soc. 2018;50(7):891–904.

113. Shen Y, Kim S, Wang Y, Chao R. Language brokering and adjustment among Chinese and Korean American adolescents: A moderated mediation model of perceived maternal sacrifice, respect for the mother, and mother–child open communication. Asian Am J Psychol. 2014;5(2):86.

114. Yoon E, Jung K, Lee R, Felix-Mora M. Validation of Social Connectedness in Mainstream Society and the Ethnic Community Scales. Cult Divers Ethn Minor Psychol. 2012;18(1):64–73.

115. IPAQ Research Committee. Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)-short and long forms [Internet]. 2005. Available from: http://www.ipaq.ki.se/scoring.pdf

116. Gerrior S, Juan W, Peter B. An easy approach to calculating estimated energy requirements. Prev Chronic Dis. 2006;3(4).

117. Sathyanarayana S, Barrett E, Nguyen R, Redmon B, Haaland W, Swan S. First Trimester Phthalate Exposure and Infant Birth Weight in the Infant Development and Environment Study. Int J Env Res Public Health. 2016;13(10):945.

118. Geiger S, Fischer D, Schrader U. Measuring what matters in sustainable consumption: an integrative framework for the selection of relevant behaviors. Sustain Dev. 2018;26(1):18–33.

119. Auxier B, Rainie L, Anderson M, Perrin A, Kumar M, Turner E. Americans and privacy: Concerned, confused and feeling lack of control over their personal information. Pew Research Center: Internet, Science & Tech. 2019.

120. Diet History Questionnaire, Version 3.0. National Institutes of Health, Epidemiology and Genomics Research Program, National Cancer Institute; 2018.
121. Neff K. The development and validation of a scale to measure self-compassion. Self Identity. 2003;2(3):223–50.

Table
Table 1

Descriptions, points of data collection, and references of the measures included in the study

| Measure                                      | Baseline Only | Fall | Spring | Citation     | # of items |
|----------------------------------------------|---------------|------|--------|--------------|------------|
| **Online Survey**                            |               |      |        |              |            |
| Demographics                                 | X             | X    |        |              |            |
| Financial Support                            | X             |      | (105)  | 1            |
| Disability/ability Status                    | X             |      |        |              | 1          |
| Anger, Depression, Anxiety                   | X             | X    | (106)  | 21           |
| Loneliness                                   | X             | X    | (73)   | 4            |
| PTSD                                         | X             | X    | (74)   | 20           |
| Alcohol Use Disorders                        | X             | X    | (68)   | 10           |
| 30 Day Alcohol Use NSDUH                     | X             | X    | (107)  | 1            |
| 30 Day Binge Drinking NSDUH/BRFSS            | X             | X    | (107,108) | 1        |
| 30 Day Drinking Max BRFSS                   | X             | X    | (108)  | 1            |
| 30 Day Drinking and Driving YRBS/NSDUH      | X             | X    | (107,109) | 1        |
| 30 Day Driving Under Influence YRBS/NSDUH   | X             | X    | (107,109) | 1        |
| Riding with Drinking Driver YRBS            | X             | X    | (109)  | 1            |
| **Drug Use**                                 |               |      |        |              |            |
| Vaping E-cigarette                          | X             | X    | (108)  | 2            |
| Cigarette Smoking                            | X             | X    | (11)   | 1            |
| Cigarette Smoking, 30 Days                  | X             | X    | (107)  | 1            |
| Cigarette Menthol, 30 Days                  | X             | X    | (107)  | 1            |
| Marijuana Use                                | X             | X    | (108)  | 3            |
| Eating Disorders                             | X             | X    | (71)   | 31           |
| Rumination                                   | X             |      | (110)  | 4            |
| Perceived Stress                             | X             | X    | (111)  | 4            |
| Migraine Severity                            | X             |      | (51,52) | 14           |
| Life Satisfaction                            | X             | X    | (76)   | 5            |
| Happiness                                    | X             | X    | (77)   | 4            |
| Item                                                                  | Include | Exclusion | References | Comments |
|----------------------------------------------------------------------|---------|-----------|------------|----------|
| Self-Rated Health                                                    | X       | X         | (50)       | 1        |
| Life Events Checklist, Baseline and Follow-up                       | X       | X         | (84)       | 17, 9    |
| Sexual History, Contraceptive Use, Perceived Risk, and PrEP Knowledge| X       | X         | (60–64)    | 42, 2, 3, 4 |
| Sexual Experiences, Baseline and Follow-up                          | X       | X         | (65)       | 10       |
| Adverse Childhood Experiences                                       | X       |           | (85)       | 10       |
| Dating Violence                                                      |         |           | (109)      | 9        |
| Online Dating Violence                                              | X       |           | (112)      | 2        |
| Everyday Inequity                                                    | X       | X         | (86)       | 6        |
| Ethnic Identity Scale, Baseline                                      |         |           | (81)       | 9        |
| Language Brokering Scale                                            |         |           | (113)      | 1        |
| Social Connectedness                                                |         |           | (114)      | 10       |
| Impulsivity/Impulse Control                                          |         |           | (75)       | 21       |
| Physical Activity                                                    | X       | X         | (115)      | 7        |
| Texting/e-mailing While Driving                                     |         |           | (109)      | 1        |
| Sleep Quality                                                        | X       | X         | (56)       | 24       |
| Gratitude                                                            | X       | X         | (78)       | 6        |
| Hope                                                                 |         |           | (79)       | 8        |
| Meaning in Life                                                      | X       | X         | (80)       | 5        |
| Perceived Social Support                                             | X       | X         | (88)       | 12       |
| Mini Personality Scale                                              |         |           | (91)       | 20       |
| Personal Network/Social Structure                                   | X       | X         | (89,90)    | 23       |
| USDA + Personalized Feedback                                        |         |           | (116)      | 4        |
| Food/Personal Care Products                                          |         |           | (117)      | 44       |
| Sustainable Consumption Behavior Nutrition                           | X       |           | (118)      | 18       |
| New Environmental Paradigm                                           |         |           | (93)       | 15       |
| Food Insecurity                                                      |         |           | (48)       | 2        |
| Housing Security                                                     |         |           | (49)       | 2        |
| Past and Anticipated Voting                                         |         |           | (49)       | 7        |
| Technology Use                                                       | X       | X         | (57)       | 11       |
| Online Status Indicators | X | (58) | 4 |
|--------------------------|---|------|---|
| Social Media Integration Scale | X | (59) | 6 |
| Night-Time Social Media Use | X | X | (119) | 7 |
| DHQ-III Food Frequency | X | (120) | 135 |
| Self-Compassion | X | (121) | 26 |
| Compassion | X | (82) | 16 |

**In-Person Clinic Visit**

| Health History Form | X |
|---------------------|---|
| Physical Exam (body weight, height, waist circumference, blood pressure, pulse, respiratory rate, current oral temperature, heart and lung exam, abdominal exam, neck exam, and general physical appearance) | X |
| Self-Injurious Thoughts and Behaviors (SITBI) | X | (95) | 25 |
| Saliva Collection | X |
| Blood Collection | X |
| Urine Collection | X |
| Body Composition via DXA Scan | X |
| Resting Metabolic Rate via Fitmate | X |
| Stool Kit Collection (Optional) | X |