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Kelly B. Filipkowski
Misericordia University

Kristin E. Heron
Old Dominion University, kheron@odu.edu

Joshua M. Smyth
The Pennsylvania State University

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Early Adverse Experiences and Health: The Transition to College

Kelly B. Filipkowski, PhD; Kristin E. Heron, PhD; Joshua M. Smyth, PhD

Objective: This study cross-sectionally and prospectively examined the impact of adversity experienced prior to college on the health and well-being of students adjusting to their first college semester. **Methods**: Two-hundred sixteen (216) first-year students completed measures of adverse life experiences, perceived stress, physical symptoms, and health-related behaviors during the first 2 weeks of college entry and again at the end of the first semester. **Results**: Reported adversity prior to college predicted greater perceived stress and physical symptoms at college entry and an increase in physical symptoms over the semester; perceived stress mediated the prospective changes. Early adversity predicted smoking, alcohol use problems, and risky sexual behavior at college entry, but was unrelated to the change in smoking, alcohol use problems, or risky sexual behavior. Adversity was not related to drug use at college entry but did predict change in drug use over the semester. **Conclusion**: Some risk factors associated with early adversity are present when students matriculate, but adversity also may impact mental and physical health prospectively during the transition to college. Interventions directed at reducing distress may prevent negative developmental consequences.

Key words: early adversity; physical health; health behaviors; prospective design; college transition

Research has established a strong connection between early traumatic and/or stressful experiences and subsequent health and well-being outcomes. For instance, higher exposure to abuse and household dysfunction as a child is associated with various negative outcomes such as poorer self-rated health, substance use and dependency,[1] smoking,[2] and risky sexual behaviors.[3] Greater exposure to dysfunction in the household also predicted higher instances of heart disease, cancer, chronic bronchitis, and hepatitis later in life.[1] Thus, there is substantial evidence that experiencing adversity across a range of different events of varying severity (eg, ranging from household dysfunction to physical/sexual abuse) as a child is associated with risky health behaviors and increased morbidity.[4]

Several potential pathways by which early adversity may be related to health outcomes have been proposed.[4] It has been suggested that early adverse experiences may lead to the development of subsequent health problems by influencing biological responses to stress, in the form of disruption and over-activation of the body's reactivity to stress,[5-8] as well as pro-inflammatory responses.[9,10] Survivors of adverse childhood experiences also may be more likely to adopt negative behaviors in order to deal with ongoing negative psychological effects of the events (eg, maladaptive coping strategies), which may then lead to poor health outcomes.[1,11] For example, victims of early adverse experiences are more likely to drink,[12-14] smoke,[2] and use drugs.[13]

Evidence suggests that continuing stress mediates the association between adversity and later health outcomes. For instance, psychological distress has been found to mediate the relationship between early adversity and alcohol consumption of adults.[14] Furthermore, a prospective investigation of early adversity and physical health found that social and nonsocial stress, as well as depressive affect, were the mechanisms by which early adversity impacted health in young adults.[8] As such, stress is likely an important mediator of the relationship between early adversity and subsequent health-related outcomes.

Extending previous research, the goal of the

Kelly B. Filipkowski, Associate Professor, Misericordia University, Department of Psychology, Dallas, PA. Kristin E. Heron, Assistant Professor, Old Dominion University, Department of Psychology, Norfolk, VA. Joshua M. Smyth, Professor, The Pennsylvania State University, Department of Biobehavioral Health and Medicine, University Park, PA.
Correspondence Dr Smyth; jms1187@psu.edu

present study is to examine how negative or stressful childhood experiences are linked to subsequent health and risky health behaviors (eg, substance use, sexual activity). The current study examines early adversity across a broader age range than many other studies that examine adverse childhood experiences (ie, exposure prior to college enrollment) and uses a prospective design to assess health and risky health behaviors during the transition from high school to college. For individuals who attend college following high school, the adjustment to college typically marks a potentially stressful transition into young adulthood, with students often living independently from their parents for the first time and adjusting to autonomy, experiencing changing social networks, and facing new academic challenges. Thus, they are in the unique position of struggling to create new identities for themselves,[15] while mastering learning strategies, content, and skills that will help shape their futures. Furthermore, nearly all students transitioning to college are presented with decisions to make about potentially risky behaviors such as alcohol consumption, sexual activity, and drug use.[16]

Childhood adversity has been shown to have a negative influence on the probability of college enrollment,[17] and those who have experienced prior adversity, yet still enroll in college, are likely more resilient than those individuals who were unable to attain college matriculation. Nonetheless, those who experience adversity early in life still may have more difficulty adjusting during life transitions and be more vulnerable to engaging in risky behavior. For instance, students who report at least one trauma prior to college also report lower personal-emotional and academic adjustment to college.[18] A prospective assessment of college students found that students who demonstrated either partial or full PTSD symptoms at college entry showed significantly higher risk for problem substance abuse at both the beginning of the first year of college as well as at the end of the school year.[13] However, it remains unclear how more common adverse childhood experiences (including those not associated with PTSD symptoms, such as divorce/separation of parents) are related to psychological and behavioral health-related outcomes, particularly during this important transition period in young adulthood. Additionally, although it has been well established that associations between childhood adversity and health outcomes may be due, in part, to how one responds and copes with stress, more work is needed to identify plausible psychosocial mechanisms linking childhood adversity to negative behaviors known to influence poor health outcomes in later life.

Current Study

The current study examines how early adversity predicts perceived stress, physical symptoms, and risky health behaviors, both cross-sectionally and prospectively. Taking a 2-phase approach, we examined whether college-aged students who experienced adversity prior to their college years face the continued effects of adversity. The first phase assessed if prior adversity relates to health and well-being outcomes at college entry. The second phase used prior adversity to make a prospective prediction of changes over the course of the first semester of college. Finally, in the present study we measure and test for the potential mediating effect of perceived stress on the relationship between early adverse life experiences and prospective changes in health behaviors and symptoms during the transition to college.

METHODS
Participants

Incoming freshmen at a midwestern public college were recruited for this study. To capture students undergoing a transitional period, only students who were entering their first semester as a college student directly from high school were enrolled. Overall, 249 participants completed written informed consent and questionnaires at the start of the fall semester (within 2 weeks of enrolling in college).

A total of 216 participants (87%) were retained over the semester and completed assessments at both the beginning of the fall semester (Time 1) and at the end of the fall semester (Time 2). The total sample that had usable data at both assessments (N = 216) was comprised of 18-19 year-old students, was primarily Caucasian (96%), and had a representative sex distribution (55% female). Those who did not complete a follow-up at Time 2 (N = 33; 13%) did not differ from those who did complete follow-up on sex (χ^2 = 0.65, p = .43), number of early adverse experiences (t = 0.03, p = .98), perceived stress (t = 1.15, p = .26), number of reported physical symptoms (t = -0.52, p = .61), number of partners outside of relationships (t = 1.83, p = .07), drug use (t = -1.16, p = .25), or cigarette use (t = 1.05, p = .30) as reported at Time 1. They did, however, differ in terms of alcohol use problems, as measured by the Michigan Alcohol Screening Test (see measurement information below; t = 2.36, p = .02). Specifically, those who did not complete the survey had a higher mean MAST score (M = 6.59, SD = 5.97) than those who completed both assessments (M = 4.45, SD = 4.24).

Measures

Adverse life experiences questionnaire. A measure was adapted for this study based on previously published surveys of adverse experiences in college students[19] to assess the number and severity of adverse life events experienced prior to college enrollment. Number of events was assessed by asking participants to indicate the total number of "extremely stressful or traumatic events" that they experienced during their lifetime. Response options ranged from 0 to 9 or more events. Event severity was measured by asking students to rate how stressful/traumatic 6 categories of events were on a 5-point scale (0 = *not at all stressful/*

traumatic, 4 = *extremely stressful/traumatic*). A score of 0 was used if the participant had not experienced this type of event. The categories of events were derived from previous work,[19] and included the death of a loved one, divorce/separation of parents, sexual event, violent event, non-personal event (eg, major illness), or other traumatic event. These severity ratings were combined to form a total severity rating for each participant. The total number of events and overall event severity were, as expected, correlated r = .65. Given the moderately strong correlation we converted each into z scores and summed them to create one composite score of adversity to be used in each of the models.

We also conducted all analyses with total number of events and overall event severity separately (ie, not using the composite score) to provide preliminary information regarding the relative contributions of exposure frequency, indexed by number of adverse events, and adversity 'burden', indexed by total adversity severity. The results were similar for both the analyses using composite scores and those using the separate predictors of number and severity of adversity. Given this, and the high correlation between number and severity of adverse events, we only present analyses using the composite score. [Details on all analyses are available from the corresponding author upon request.] Although we utilize the composite score for each of the models, we do, however, present the raw means (ie, prior to converting to z scores) for both number and severity of adversity in the results section for descriptive purposes. In addition, we display our outcome measures as a function of adversity exposure (ie, summed scores) in Tables 1 and 2, solely for the purpose of description.

Risky behaviors questionnaire. Participants were asked several questions regarding risky behaviors commonly seen among college students.

Sexual behavior – Potentially risky sexual behavior was indexed by asking students the total number of sexual intercourse partners they have had, and of these, how many were within a steady relationship. These values were used to calculate the total number of sexual partners *outside* of steady relationships, as these casual, non-committal encounters (often referred to as hook-ups) may be indicative of more general sexual risk, such as lower condom use.[20,21] This measure was positively skewed (ie, zero inflated), and thus, was re-coded into a dichotomous variable reflecting either a 0, no sexual partners outside a relationship, or a 1, at least one sexual partner outside of a relationship. At college entry approximately 79% (N = 168), were coded as "0" and approximately 21% (N = 46) were coded as "1." At the end of the semester, approximately 79% (N = 167) were coded as "0" and approximately 21% (N = 44) were coded as "1."

Drug use – Participants separately indicated the frequency of amphetamine, barbiturate, hallucinogen, marijuana, tranquilizer, and cocaine use each on the following scale: (0) *none/never*, (1) *daily*, (2)

weekly, (3) *monthly*, or (4) *less than monthly*. These items were summed to form a total drug use variable.

Cigarette use – This risk variable was assessed via the scale: (0) *none*, (1) *0-1/2 pack per day*, (2) *1 pack per day*, and (3) *more than 1 pack per day*. Similar to the risky sexual behavior, both drug and cigarette use were zero inflated, and thus, were dichotomized to reflect either a 0, no drug/cigarette use, or 1, drug/cigarette use at any level. In regards to drug use, approximately 78% of the participants (N = 169), were coded as "0" and approximately 22% (N = 47) were coded as "1" at college entry. At the end of the semester, approximately 79% (N = 165), were coded as "0" and approximately 21% (N = 44) were coded as "1." Regarding cigarette use at college entry, approximately 82% (N = 178), were coded as "0" and approximately 18% (N = 38) were coded as "1." At the end of the semester, approximately 86% (N = 179), were coded as "0" and approximately 14% (N = 30) were coded as "1."

Alcohol use – Risky behaviors associated with alcohol consumption were measured using the Michigan Alcohol Screening Test (MAST).[22] Participants responded to 25 items asking if they engaged in a specific behavior (eg, *Do you ever drink before noon?*) and about perceptions of their drinking behaviors (eg, *Do you feel you are a normal drinker?*). Standard scoring procedures were used in which point values for each question are assigned based on the *yes/no* responses, giving more serious/dangerous behaviors a higher weight. Items are summed to produce a total score ranging from 0-50 and scores indicate risk of alcoholism (ie, 0-3 = nonalcoholic; 4 = suggestive of alcoholism; 5-50 = alcoholism). This measure was similar to our other risky behavior measures in that it was positively skewed. Therefore, we created a dichotomous score, with a 1 indicative of alcoholism and 0 not reflective of this condition. That is, those receiving a MAST score of 0-4 were re-coded as "0" and those receiving a MAST score of 5 or greater were re-coded as "1" (a positive indicator for an alcohol use problem). At college entry approximately 57% (N = 123), were coded as "0" and approximately 43% (N = 93) were coded as "1." At the end of the semester, approximately 61% (N = 131), were coded as "0" and approximately 39% (N = 85) were coded as "1."

Perceived stress. We used the Perceived Stress Scale (PSS)[23] to assess the extent to which circumstances in one's life are interpreted as stressful over the last month. Participants reported on 14 items regarding perceptions of stress using a scale ranging from 0 (*never*) to 4 (*very often*). Seven items were reversed scored and then all items were summed such that higher scores indicated more perceived stress. Cronbach's alpha for the sample was 0.84.

Physical symptoms. We measured physical symptoms using the 53-itemed PILL[24] inquiring about the frequency of various symptoms (eg, itchy or burning eyes, insomnia, indigestion, swollen

Figure 1
Current Study Design
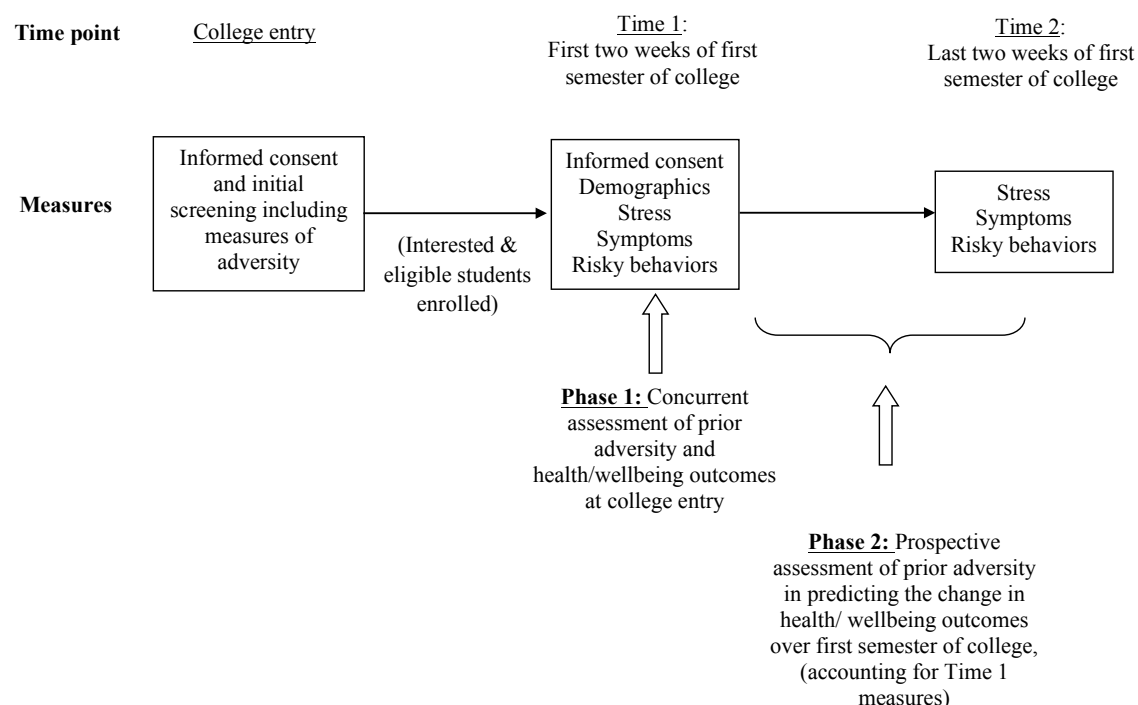
joints, headaches, nausea). Responses range on a 5-point scale: 0 = *Have never or almost never experienced the symptom*; 1 = *Less than 3 or 4 times per year;* 2 = *Every month or so; 3 = Every week or so;* and 4 = *More than once a week*. Items are summed to produce a total score, with higher scores indicating more reported physical health symptoms. Cronbach's alpha for the sample was 0.82.

Procedures

At the start of the academic year, first-year students enrolled in introductory psychology courses were contacted as part of a course-specific requirement to participate in any of a wide range of research experiences. Interested students completed an initial informed consent and a general screening questionnaire that included the adverse life experience questionnaire described above. Students who completed this initial measure were contacted by a research assistant and screened for eligibility (in first year of college, entering directly from high school). Eligible and interested students then attended a group session (Time 1; all sessions during the first 2 weeks of the fall semester) in which they completed a second consent form (including study specific details) and all baseline study measures. Participants were then scheduled to attend a final session, approximately 12 weeks later, during the last 2 weeks of the fall semester, (Time 2), at which point they completed the same measures for the

prospective component of the study (Figure 1).

Data Analytic Strategy

Our first aim was to examine the association between adverse life experiences and physical symptoms, as well as adverse life experiences and health-related behaviors at college entry. We conducted regression analyses to assess the relationship between adversity experienced prior to college (using the adversity z-score composite) and stress and health outcomes at the beginning of college. The second aim was to investigate the effect of childhood adversity on health and well-being over the first semester of college. Regression analyses were conducted, using the adversity z-score composite created from adversity reported at Time 1 (ie, events prior to college entry) to predict each of the dependent measures separately at Time 2 (end of the semester) while controlling for reports of the dependent measures at Time 1 (beginning of semester). This provided an index of the effect of adverse life events on the prospective change in the dependent measures over the course of the first semester of college. Logistic regressions were conducted for all dichotomous outcome measures (ie, sexual activity outside of a relationship, drug use, tobacco use, and the MAST). Additionally, analyses included sex as a covariate.

The third aim was to assess the potential mediating role of perceived stress in the relationship

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Table 1
Means and Standard Deviations as a Function of Number of Adverse Life Experiences

Number of adverse events	Frequency (%) N = 216	College entry (Time 1)					
		PSS	PILL	MAST	Drugs	Smoking	Sex
0	61 (28.2%)	21.85 (5.67)	50.17 (22.48)	3.78 (3.82)	0.23 (0.42)	0.15 (0.36)	0.20 (0.40)
1	52 (24.1%)	22.17 (5.71)	54.73 (24.17)	4.60 (4.68)	0.21 (0.41)	0.10 (0.30)	0.25 (0.44)
2	36 (16.7%)	25.97 (7.20)	59.86 (24.48)	3.50 (3.76)	0.08 (0.28)	0.22 (0.42)	0.09 (0.25)
3	35 (16.2%)	27.09 (7.90)	67.09 (19.78)	5.40 (4.83)	0.26 (0.44)	0.20 (0.41)	0.20 (0.41)
4	18 (8.3%)	29.44 (6.64)	66.61 (23.40)	4.28 (3.14)	0.28 (0.46)	0.22 (0.43)	0.33 (0.49)
5	7 (3.2%)	24.14 (7.97)	74.57 (15.93)	5.57 (2.76)	0.43 (0.53)	0.29 (0.49)	0.43 (0.53)
6	3 (1.4%)	22.67 (7.02)	98.67 (55.14)	1.67 (2.89)	0.00 (0.00)	0.67 (0.58)	0.00 (0.00)
7	1 (0.5%)	34.00 (N/A)	79.00 (N/A)	15.00 (N/A)	0.00 (N/A)	0.00 (N/A)	0.00 (N/A)
8	0	--	--	--	--	--	--
9+	3 (1.4%)	32.33 (1.53)	74.33 (12.50)	3.33 (2.31)	0.67 (0.58)	0.33 (0.58)	0.67 (0.58)
		Overall Means College entry (Time 1)					
		PSS	PILL	MAST	Drugs	Smoking	Sex
		24.38 (6.99)	58.97 (24.42)	4.31 (4.18)	0.22 (0.41)	0.18 (0.38)	0.21 (0.41)

Note.
Perceived stress (PSS), physical symptoms (PILL), alcohol use problems (MAST), drug use (Drugs), cigarette use (Smoking), and number of sexual partners outside of a steady relationship (Sex) at college entry (Time 1).

between adverse life experiences and prospective changes in health outcomes across the first semester of college. It has been suggested that more conventional approaches in testing indirect effects may not provide adequate power, and are limited by strict assumptions of the initial total effect of the independent variable on the dependent variable (X → Y) and the shape of the sampling distribution.[25-27] Therefore, to assess the indirect effects of stress, we used the recommended approach of nonparametric bootstrapping analysis which tests the effect of the independent variable on the de-

pendent variable via the mediator (the *ab* path), rather than solely relying on individual tests of the effect of the independent variable on the mediator, and the mediator on the dependent variable; the *a* and *b* pathways.[25,27,28] These analyses were conducted in SAS utilizing the PROCESS macro,[28] in which we specified 5000 bootstrapped samples using bias-corrected and accelerated 95% confidence intervals.[27,28] Additionally, researchers have argued that the requirement for a significant total effect (*c* path) is unnecessary for mediation to occur. Statistical methods have been developed to test the

Table 2
Means and Standard Deviations as a Function of Number of Adverse Life Experiences

Number of adverse events	Frequency (%) N = 216	At end of semester (Time 2)					
		PSS	PILL	MAST	Drugs	Smoking	Sex
0	61 (28.2%)	20.38 (6.06)	46.02 (26.40)	3.47 (3.57)	0.17 (0.38)	0.16 (0.37)	0.17 (0.38)
1	52 (24.1%)	21.25 (5.91)	48.39 (24.73)	5.35 (7.35)	0.16 (0.37)	0.06 (0.24)	0.22 (0.42)
2	36 (16.7%)	23.31 (7.29)	56.25 (27.52)	4.92 (6.94)	0.09 (0.28)	0.17 (0.38)	0.15 (0.36)
3	35 (16.2%)	25.06 (7.09)	69.47 (22.51)	4.94 (4.23)	0.32 (0.47)	0.18 (0.39)	0.23 (0.43)
4	18 (8.3%)	27.39 (7.13)	68.39 (23.65)	4.56 (3.40)	0.39 (0.50)	0.17 (0.38)	0.33 (0.49)
5	7 (3.2%)	29.43 (9.27)	74.86 (20.33)	5.29 (2.56)	0.29 (0.49)	0.29 (0.49)	0.29 (0.49)
6	3 (1.4%)	18.00 (1.73)	62.67 (6.11)	0.67 (1.15)	0.33 (0.58)	0.00 (0.00)	0.00 (0.00)
7	1 (0.5%)	28.00 (N/A)	105.00 (N/A)	15.00 (N/A)	0.00 (N/A)	0.00 (N/A)	0.00 (N/A)
8	0	--	--	--	--	--	--
9+	3 (1.4%)	24.00 (4.36)	67.67 (16.20)	3.67 (4.73)	0.67 (0.58)	0.33 (0.58)	0.67 (0.58)
		Overall Means At end of semester (Time 2)					
		PSS	PILL	MAST	Drugs	Smoking	Sex
		22.77 (6.97)	55.76 (26.66)	4.59 (5.47)	0.21 (0.41)	0.14 (0.35)	0.21 (0.41)

Note.
Perceived stress (PSS), physical symptoms (PILL), alcohol use problems (MAST), drug use (Drugs), cigarette use (Smoking), and number of sexual partners outside of a steady relationship (Sex) at college entry (Time 2).

indirect effect of X on Y, through M, even in the absence of a significant relationship between X and Y.[25-28] This allowed us to explore indirect effects of non-significant associations between adversity and risky health behaviors as described below.

RESULTS
Descriptive Statistics

The mean reported number of adverse life experiences at college entry was 1.80 (SD = 1.77; N = 216). The majority of our sample (~72%) reported experiencing adverse life events, with many experiencing multiple events (eg, 14.8% participants reporting at least 4 adverse life events; Table 1). At college entry, the mean for the severity of adverse life experiences was 5.05 (SD = 3.97; N = 216). Tables 1 and 2 also present the means and standard deviations for risky behaviors (ie, MAST scores, cigarette use, sexual partners outside of a steady relationship, drug use), stress (PSS), and physical symptoms at Times 1 and 2, respectively. Although we utilize a composite score (derived from number and severity of life events) for each of the models, we present our outcomes as a function of adverse
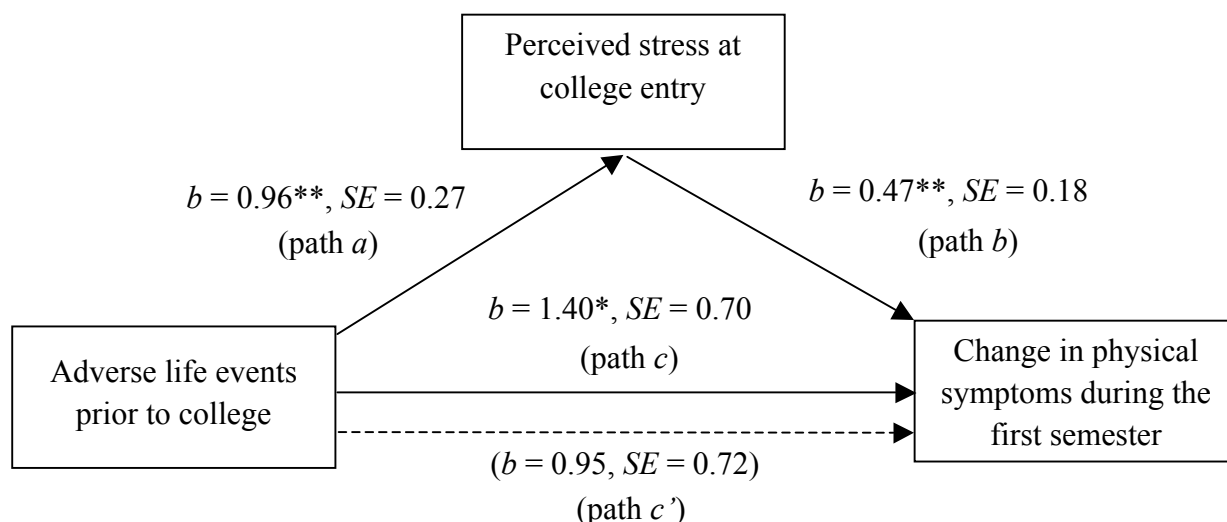
Table 3
Composite Score of Adverse Events Prior to College as a Predictor of Health and Health Behavior Outcomes at Both College Entry (Time 1) and the Change Over the First Semester (Time 2)

Adversity predicting each dependent variable:	College entry (Time 1)			Δ during first semester (Time 2)		
	b	SE	p	b	SE	p
Perceived stress	1.22	0.26	< .01	0.18	0.20	< .39
Physical symptoms	4.38	0.92	< .01	1.43	0.71	< .05
Alcohol use problems (MAST)	0.18	0.08	< .04	0.13	0.10	< .20
Sex outside of relationships	0.18	0.09	= .05	0.06	0.20	< .76
Cigarette use	0.25	0.10	< .02	-0.26	0.17	< .12
Drug use	0.06	0.10	< .51	0.35	0.15	< .02

Note.
All analyses included sex as a covariate. Time 2 analyses controlled for reports of the dependent measures at Time 1 (beginning of semester) in order to provide an index of the prospective change in the dependent measures over the course of the first semester of college.

Figure 2
Indirect Effects of Early Adverse Experiences (z-score composite) on Prospective Changes in Health at the End of the Semester, via the Stress Pathway

** = p < .01, * = p < .05

Note.
Path c refers to the total effect of IV on DV
Path c' refers to the direct effect of IV on DV

Table 4
Stress as a Mediator in the Relationships between Adverse Life Experiences
(z-score Composite) and Risky Behavior

Predictor	Dependent Variables			
	Alcohol use problems (MAST)			
	b	SE	p	95% CI
Perceived stress	-0.003	0.02	.90	[-0.04, 0.04]
Adverse life experiences	-0.004	0.03	.91	[-0.06, 0.06]
	Sex outside of relationships			
	b	SE	p	95% CI
Perceived stress	0.06	0.05	.26	[-0.04, 0.16]
Adverse life experiences	0.08	0.08	.28	[-0.06, 0.27]
	Cigarette use			
	b	SE	p	95% CI
Perceived stress	-0.02	0.04	.70	[-0.11, 0.07]
Adverse life experiences	-0.02	0.06	.71	[-0.14, 0.09]
	Drug use			
	b	SE	p	95% CI
Perceived stress	0.06	0.04	.10	[-0.01, 0.13]
Adverse life experiences	0.08	0.06	.13	[-0.03, 0.22]

life events in Tables 1 and 2 for illustrative purposes.

Aim 1: Health Outcomes at College Entry

Higher adversity was related to greater stress levels, increased physical symptoms, higher reports of cigarette smoking, sexual activity with individuals outside of a steady relationship, and scores on the MAST at college entry. Yet, adversity was not related to illicit drug use at college enrollment (Table 3).

Aim 2: Change in Health Outcomes over the Semester

Adverse life experiences prospectively predicted an increase in physical symptoms over the semester. Prior adversity also predicted increased drug use over the first semester of college. Adversity, however, was not a significant predictor of change in perceived stress, the MAST assessment, the number of sexual partners outside of a steady relationship, or cigarette smoking over the semester (Table 3).

Aim 3: Indirect Effects of Stress

Adverse experiences, stress, and physical symptoms. We tested the indirect effects of adverse life experiences (using the z-score composite) on physical symptoms at Time 2 (controlling for physical symptoms at college entry – Time 1) via a stress pathway (ie, stress measured at college entry) (Figure 2). Perceived stress was significantly related to physical symptoms at Time 2 ($p <$ .01). The total effect of adverse life experiences on physical symptoms at Time 2 (*c* path) was also significant (Figure 2; 95% CI: 0.01 to 2.79). The direct effect between adversity and physical symptoms (*c´* path), however, was not statistically significant (95% CI: -0.46 to 2.36). Stress exerted an indirect effect between adverse life experiences and the change in physical health outcomes across the first college semester (95% CI: 0.12 to 1.07). In these analyses, the indirect effect (*ab* path) of perceived stress is assumed to be statistically significant (ie, $p <$ .05) if the confidence interval for the indirect effect does not include zero.[27,28] Thus, experiencing more early adversity predicts a greater increase in physical symptoms over the first semester as a function of higher stress.

Adverse experiences, stress, and risky behaviors. Despite non-significant associations between

adverse life events and several of the risky behavior outcomes, we performed exploratory indirect analyses, utilizing the PROCESS macro,[28] for each of our risky behavior outcomes. No evidence of stress mediation was found for any risky behaviors (Table 4).

DISCUSSION

Prior research has demonstrated that traumatic and stressful events occurring early in life can have an important subsequent influence on health and well-being outcomes. Thus, the first objective of the study was to investigate if physical symptoms and health-related behaviors were associated with adverse events experienced prior to college. Our sample reported levels of early adversity broadly consistent with prior work using college samples and similar measures,[19] with most of our sample (almost 72%) reporting one or more adverse life events prior to college. In contrast, this is somewhat higher than other estimates.[1,18] The higher estimates in the current study may be due to using a more liberal approach to measuring early adversity by including potentially less serious/traumatic experiences, such as parental divorce/separation. Despite our liberal approach, it is evident that early adverse experiences of varying degree are related to important health outcomes.[4]

Adverse experiences were related to higher stress, more physical symptoms, higher MAST scores, sexual activity outside of relationships, and a greater likelihood of cigarette use at college entry; these findings were as predicted and are consistent with previous research.[1-3,11-14] Contrary to our predictions and previous research,[1,13] however, early adversity was unrelated to drug use at the beginning of college. This unexpected result bears greater research attention, although it should be noted that the rates of these behaviors in this sample were low and, thus, we may not have been able to detect effects.

There have been a number of prospective and longitudinal assessments of adversity and health risk, for example, investigating the influence of early adversity on disease in adults,[5] as well as mental health resiliency,[18] alcohol consumption,[13] and disordered eating behaviors among college students.[29] In the current study, we examined young adults via a prospective manner, similar to Raposa et al;[8] additionally, our study examined the influence of early adversity on the prospective change in physical symptoms and health behaviors during an important life transition of young adults (ie, start of college). Early adversity predicted the change in physical symptoms over the first semester. Interestingly, it has been demonstrated that there are more reported health problems by the end of college students' first year.[30] The current study seems to show a somewhat different, and more nuanced, trend. In examining the reported means as a function of summed adversity experiences (Tables 1 and 2), those with lower levels of adversity tend to

report an overall drop in physical symptoms at the end of the first semester as compared to at college entry; those with higher levels of adversity, however, seem to demonstrate either smaller decreases or increases in symptoms across the semester. Thus, the natural progression in this sample appears to be to experience a decrease in health issues over the semester as the students adjust to college. Those with higher levels of adversity may continue to struggle with more physical symptoms throughout the semester. This may be due to depression, as it has been linked as a mediator in the relationship between adversity and poorer health outcomes;[8] however, it also could be due to higher levels of perceived stress, as discussed below. This research contributes to our understanding of early adversity through its prospective examination of physical health as it 'unfolds' over the course of the first semester of college.

Prior research has suggested that behaviors such as frequent alcohol consumption, smoking, or drug use may be more prevalent for individuals who have experienced adversity,[2,13,14] as it can offer a way to cope (albeit maladaptively). It also is suggested that this may be a pathway by which adversity leads to poorer health later in life.[1] Our prospective investigation did not find that prior adversity predicted different rates of change in these types of activities (alcohol use problems, cigarette use, or sexual partners outside of a relationship) across the first semester of college. Our sample, however, consisted largely of 18-19 year-old students who are not of legal drinking age, and thus, may have somewhat limited access to alcohol in many contexts. We did, however, find an effect of adverse life experiences and the change in drug use. Specifically, those who were higher in adversity were more likely to report increased drug use across the semester. A notable limitation with regard to this result was that only a small proportion of individuals self-reported drug use at either time point. Moreover, we did not assess any history of risky health behaviors (ie, behaviors that may have occurred in younger grade levels, including middle school through high school). Adversity has been found to predict substance abuse problems in younger adolescents;[31] thus, it is plausible that some of these individuals may have engaged in riskier behaviors in earlier grade levels, but discontinued substance use prior to enrollment in college. In addition, although the Michigan Alcohol Screening Test (MAST) may identify those with indications of current alcohol problems, it may be less able to identify those who are at future risk. Future research could consider including other measures of alcohol use (eg, number of drinks consumed, binge drinking) or potential future alcohol use problems (eg, the Transmissible Liability Index-College Version [TLI-CV])[32] that would capture other aspects of alcohol use beyond current risky behavior measured in the present study.

Prior research has suggested that the distress as-

sociated with adversity may mediate the relationships between adverse life experiences and some risky health behaviors such as drug and alcohol consumption.[13,14] Thus, adverse events may exert an indirect effect on health and well-being via a stress pathway, such that more adversity is related to higher stress levels, and this stress predicts negative outcomes. Contrary to our expectations and this prior research, stress did not show much of a relationship to risky health behaviors. There was, however, evidence that stress had an influence on the relationship between adversity and change in physical symptoms across the semester, similar to previous research.[8] As physical symptoms are based on physiological activity,[33] these findings are broadly consistent with views suggesting that the influence of chronic stress often may be observed via effects on physiology, such as chronic sympathetic activation.[4,7] Our conclusion is speculative and warrants future investigation. Nevertheless, the current findings suggest that stress is a plausible mechanism linking early family adversity to heightened risk for illness during stressful transitional periods.

The transition to college may be challenging for most students, and colleges and universities are well aware of the need to help students transition smoothly during freshman year. Those who have a history of adverse experiences, however, may be at greater risk for poorer adjustment over the first semester of college; furthermore, some of these risks – notably physical symptoms/health complaints – may be driven by stress.[8] This may be a fruitful area for universities to have significant impact on its students' well-being via the promotion and development of appropriate coping and resiliency resources, and the results of the current study (and others) may provide information regarding how colleges can engage in risk stratification to identify and aid students most in need.

For instance, Taylor et al suggest,[4] individuals with adverse life experiences may benefit from interventions focused on cognitive development and coping skills. Indeed, problem solving ability has been demonstrated to reduce perceived stress and physical symptoms among college students.[34] Some research has indicated that factors related to self-perception (eg, self-esteem) and perceptions of one's relationships (eg, perceived social support) may link early adversity to perceived stress during college,[35] which suggests interventions to strengthen these factors may be beneficial for improving related health outcomes. Moreover, perceptions of control, specifically academic control, have been shown to moderate optimism and social support in reducing stress and depression during the freshman year.[36] Therefore, the provision of opportunities via first-year programs and seminars, interactions with retention liaisons, and programs to enhance positive self-perception and perceptions of control, relationships, and problem solving abilities may benefit students; additional counseling

may also be beneficial, as it has been shown to be effective in college retention outcomes.[37] Thus, the results of collective research may facilitate such efforts by helping to identify those students who may be at risk, as well as suggest potential areas to target in order to improve outcomes for students who may have a harder time transitioning.

Future Directions and Limitations

We examined relationships among supposedly high functioning individuals; it is unclear whether the same patterns would exist for those who did not attend college or, for example, whether the relationship between adversity and outcomes is intensified. A second question is whether the risk associated with early adversity only emerges during challenging transitions or if it reflects a broader and more enduring process. Some evidence suggests that it may be a reflection of a longer process; a study that followed freshmen across 4 years of schooling[38] found that individuals with a history of child abuse and more distress were less likely than non-abused students to remain enrolled in college at the end of each semester (ie, not merely after the first semester or year adjustment). As such, our restricted timeframe of only one semester is a limitation. In addition, we utilized a convenience sample of college students enrolled in Psychology courses, reducing our ability to make generalized statements about (1) the trajectory of these processes over the duration of the college experience, and (2) how these processes might unfold for young adults who did not attend college. Thus, future research should examine processes of stress and health during and outside of transitional periods, for longer durations of time (eg, over several college semesters), and for those who do not attain college matriculation.

Several broader limitations also warrant mention. This study's reliance on self-report to assess early adversity is a limitation, as evidence suggests that long-term retrospective estimates may be inaccurate or biased.[39,40] Previous research, however, has utilized similar approaches[1-3,18,19,29,41] and some have suggested that self-report may lead to an underestimation – rather than an overestimation – of early adversity.[1,12] Similarly, participants reported their physical symptoms. Although the self-report of physical symptoms is a commonly used and often valid approach to assessing physical health, future work would certainly benefit from the use of more objective measures of health. Additionally, given the overlap between stress and physical symptoms, it is plausible to suggest that we may be tapping into some broader psychosomatic dysfunction, neuroticism, or stress response more generally, rather than actual illness. This is also speculative and warrants future investigation.

We utilized stress assessed at college entry to predict health outcomes and risky behaviors at the end of the semester. Although this allowed for a prospective analysis, this approach fails to capture

stress dynamics, particularly throughout the semester. That is, stress reported at college entry may or may not persist throughout the semester and other stressors may develop during the semester. Future approaches could assess stress throughout these periods of transition and examine how the dynamics relate to the relationship between adversity and health processes and outcomes.

Another limitation already noted involved our measures of risky behaviors. We had limited response options for drug and tobacco use, and participants also reported low rates of drug use; as a result, we had limited power to detect any associations. More generally, these dichotomous variables may represent something different than other studies, which investigated more chronic engagement in risky behaviors. That is, our dichotomous variables assessed at the start of college may represent experimentation rather than more serious and problematic use. Additionally, we only had one item assessing sexual risk (number of sexual partners outside of a relationship). Although this is theoretically a viable proxy for sexual risk, a more comprehensive measure would be clearly preferable. Although this study focused on indicators of risk in this study, a more complete assessment of adjustment including positive indicators – eg, whether one has created new social networks, engaged in the college communities (clubs, volunteerism, etc), are achieving academically, and so on – would also be desirable.

Furthermore, our use of the MAST to measure problematic alcohol use comes with limitations; the MAST is primarily used as a diagnostic tool to identify individuals with indications of an alcohol use disorder. Notably, this measure does not assess alcohol consumption behaviors more generally (eg, number of days one drank in the past month/week, how many beverages were consumed on those days, etc). Yet, measuring more traditional frequency and amount-related questions also may have been useful, as well as measuring binge drinking, specifically, as that has been shown to be associated with a higher frequency of drinking (at college entry) and a faster rate of increase in alcohol frequency.[42] Moreover, we did not measure the reasons why students engage in various drinking behaviors, which may differentiate problem drinkers from normal drinkers.[43] Perhaps more traditional measures of alcohol consumption would have been more strongly related to adversity. Related to this, those who did not complete both assessments (ie, did not complete the study) were significantly higher on the MAST, raising some generalizability concerns to those with more serious problem alcohol use.

Lastly, we had limited information regarding other important variables in the relationship between adversity and health outcomes, such as socioeconomic status (SES) and race. Not only has it been demonstrated that minority and lower SES groups may be more likely to be exposed to early adversity,[44] but lower SES has been shown to be associated with adversity and health via its alteration of biological responses,[9] as well as being linked more directly to environmental factors that may precipitate poorer health.[45] Moreover, biological responses to SES may be differentiated by race.[9] Unfortunately, SES was not assessed in the current study, and our sample was racially limited giving us a narrow sample potentially lacking in generalizability to other more diverse populations.

Conclusion

Overall, our results suggest that persons who have endured adversity prior to college are at enhanced risk regarding psychological and physical health outcomes when arriving at college and prospectively over the first semester. Screening efforts and interventions aimed at students with adversity histories may facilitate adjustment and buffer stress-related risks, ultimately reducing negative physical and behavioral consequences resultant from early adversity.

Human Subjects Statement

This research was conducted at North Dakota State University. The Institutional Review Board at North Dakota State University provided approval for data collection.

Conflict of Interest Statement

This work was not supported by any funding agency. There is no conflict of interest, financial interest nor benefit from the direct application of this research.

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