

Long-Term Health Implications of Students' Friendship Formation during the Transition to University

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Background: The transition to university is a major life change wherein young adults' primary support system shifts from the family to peers. Can change in social integration (operationalised as number of friends) during the first term at university contribute to students' health *years* later, and if so, how? **Methods:** The friendship formation of 67 students at a large Canadian university was assessed during their first term. These data were used to predict self-reported health and health behaviors (physical exercise, diet, tobacco, alcohol and marijuana consumption) at a follow-up assessment that occurred near the end of their time at university (2 or 3 years later). **Results:** Linear regression models showed that students who made more friends in their first term reported better health and a healthier diet at the follow-up (2 or 3 years later). Perceived social support at the follow-up mediated the relationship between friendship formation and self-reported health but not diet. **Conclusions:** This study provides evidence for both (1) an indirect effect of friendship formation on self-reported health via perceived social support, and (2) a direct effect of friendship formation on a healthy diet. Broadly, these results highlight the importance of friendship formation and social integration for the long-term well-being of university students.

Keywords: college students, health behavior, self-reported health, social integration, social support, young adulthood

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INTRODUCTION

In the first few months at university, a typical student faces a challenging new social and academic environment. This life transition commonly involves separation from family and high-school friends along with the opportunity—and need—to build new friendships.

Research has shown that the quality and quantity of new friendships made by first-year students has a large effect on their emotional and academic adjustment to university life (Buote et al., 2007). In the current study, we examine whether students' friendship formation during their transition to university can also affect their physical health and well-being, even years later.

Social relationships and social integration play a critical role in an individual's health (Fiorillo & Sabatini, 2011; Holt-Lunstad, Smith, & Layton, 2010; House, Landis, & Umberson, 1988; Reblin & Uchino, 2008). Social integration indicates the embeddedness of an individual in a social network and is often measured as number of social ties an individual has (Berkman, Glass, Brissette, & Seeman, 2000). Past research has documented that social integration can influence health directly; it is a powerful predictor of mortality even after accounting for behavioral variables such as smoking or socioeconomic status (Barger & Uchino, 2017). In university students, higher social integration is associated with better student adjustment (Brooks & DuBois, 1995), multiple indicators of better physical health (heart rate variability, immune response; Gouin, Zhou, & Fitzpatrick, 2015; Pressman et al., 2005) and better self-reported health (Hale, Hanum, & Espelage, 2005).

Social integration can also influence health indirectly (e.g. through social norms; Cohen & Wills, 1985). For example, if a person observes others making healthy eating choices, he or she may be more likely to follow their example (Christie & Chen, 2017; Giese et al., 2015; Thomas et al., 2017). In support of this indirect pathway, health-related risk behaviors have been found to be inversely related to social integration (Berkman et al., 2000).

Social integration can also affect physical health through the availability of social support (Cohen & Wills, 1985). Here, we use “social support” to describe the perceived availability of social resources (Delistamati et al., 2006)—a perception that can protect individuals from a stress response (Lazarus & Folkman, 1987). In other words, perceived social support can function as a mediator between social integration (e.g. number of friends) and health. Indeed, research on first-year university students has shown that perceived social inclusion mediates the effect of actual social inclusion on self-reported health (Hartung, Sproesser, & Renner, 2015).

The Transition to University and Students' Health

Most existing studies that examine predictors of health behaviors in university students have been cross-sectional (Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004;

Cheng, Weiss, & Siegel, 2015; Visser & Hirsch, 2014); yet, this life stage presents unique opportunities for longitudinal research (Giese, Stok, & Renner, 2017).

First, the transition to university requires adjustment in various life domains, including significant changes in students' social networks (Arthur & Hiebert, 2011; Brooks & DuBois, 1995). For most students, the primary support system shifts away from the family and also away from high-school friends (Fralely & Davis, 1997; Oswald & Clark, 2003). However, making new friends at university can be challenging: over half of students recently surveyed in the US and Canada reported feeling "very lonely" in the last 12 months (American College Health Association, 2016).

Second, when students enter university, they gain more control over their lives and have new opportunities to adopt or abandon healthy habits such as eating a balanced diet and engaging in regular physical activity (Dinger & Waigandt, 1997), which over the long term have a large impact on health (Hu et al., 2004). However, a high number of students fail to engage in positive health behaviors such as exercising and eating a healthy diet (American College Health Association, 2016; Anderson, Shapiro, & Lundgren, 2003; Desai, Miller, Staples, & Bravender, 2008; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Thus, it is important to understand factors that predict these behaviors.

Third, the beginning of a student's first year at university—a time when sitting next to a stranger and striking up a conversation is socially acceptable and even expected—may represent a unique window of opportunity to make new friends. Indeed, one study showed that the chance that two students will become friends decreases as the first year proceeds (Van De Bunt, van Duijn, & Snijders, 1999). In addition, friendship quality is associated with friendship length (Mendelson & Aboud, 1999). Thus, students who are able to take advantage of this unique window of opportunity and make a greater number of friends within the first few months of university may experience longer term benefits including higher quality friendships and increased health and well-being.

The Present Study

The present study investigated whether friendship formation (change in number of friends, taken here to be a basic condition for social integration; Russell, Peplau, & Cutrona, 1980) following the transition to university predicted health and health behaviors two to three years later. Furthermore, we examined different pathways of social integration on health and tested which effects were mediated by perceived social support. On an exploratory basis, we differentiated between early and late friendship formation to examine whether friendship formation at the beginning of university is especially beneficial. This is the first study, to our knowledge, to track the influence of students' social integration on a variety of health-related measures during an extended time span encompassing most of their university career.

The following hypotheses were tested:

H1: Friendship formation (the increase in number of friends in the first term) predicts students' health behaviors (physical activity, alcohol, marijuana consumption, and healthy eating) 2–3 years later.

H2: Friendship formation is beneficial for self-reported physical health 2–3 years later.

Additional analyses:

- To test how social integration influences health, mediation analysis for the effects of friendship formation on health and health behaviors via perceived social support were conducted.
- We examined whether early friendship formation (increase in number of friends in the first term) would be especially beneficial for health and health behaviors compared to later friendship formation (increase in number of friends after the first term).

METHOD

Participants were recruited for a study about first-year experiences (see Study 2 of Whillans, Christie, Cheung, Jordan, & Chen, 2017, for details); all participants who completed the first wave of data collection and who agreed to be re-contacted in the future ($N = 289$) were invited to take part in the follow-up 2–3 years later. Consistent with prior literature (Hanna, Scott, & Schmidt, 2014), retention after such an extended period was a challenge; however, the final sample used in this manuscript consisted of 67 students in their third (38.8%) or fourth (61.2%) undergraduate year (see Table 1 for descriptives of the sample). Importantly, participants who returned for the follow-up did not differ significantly from participants who did not return, with respect to psychosocial and sociodemographic variables (T1 and T2; see online supplement 1 Table S3 for descriptive and inferential statistics). Participants received either payment (CAD 10) or course credit for participation. The protocol was approved by the university's research ethics board.

Procedure

Data were initially collected from a sample of two consecutive cohorts of first-year students in the beginning of their first term (September 2013 or September 2014, T1) and the beginning of their second term (January–February 2013 or January–February 2014, T2; Whillans et al., 2017). Students were eligible to

TABLE 1
 Descriptives of the Sample and List of Measures and When they were Included

Variable	T3		
	T1 First term of first year	T2 Second term of first year	Second term of third or fourth year
<i>Demographics</i>	x		x
% Female			74.6%
Age (SD)			20.63 (1.11)
% Caucasian			28.4%
% in a long-term relationship			32.8%
% with family at university			16.4%
% international student			4.5%
% with a paid job			64.2%
% live on campus			29.9%
% engaged in extracurriculars			59.7%
% moved from another city to attend university			34.3%
Social integration (# of close friends)	x	x	x
Life satisfaction (SWL)	x	x	x
Extraversion	x		
Depressive symptoms (CESD)	x		
Social anxiety (BFNE)	x		
Perceived social support (C-ISEL)			x
Health behaviors			x
Self-reported general health (SF-36)			x
Physical measures (height, weight, waist and hip circumference, blood pressure)		x	x

participate if they attended classes full-time, were between the ages of 17 and 24,¹ and were generally in good health (see online supplement 1 Table S2 for the full list of exclusion criteria). For the follow-up, the initial participants were invited for a lab visit 2 to 3 years later in January–March 2017 (T3). Since the original participants consisted of two cohorts (two consecutive academic years) of first-year students, and our follow-up study was conducted in a single semester, our final sample consisted of students in their third and fourth years at T3. At the beginning of each lab visit, informed consent was obtained by a research assistant conducting the study. A full list of the measures and procedure can be found in the online supplement 1 (Table S1).

¹ The initial study (Whillans et al., 2017) examined the influence of social comparisons with peers on first-year students' well-being. To ensure that the participants would see their fellow students as peers, the age range was restricted to a maximum of 24 years.

Measures

Table 1 lists all measures examined in this manuscript and the time point(s) at which they were included. Measures of extraversion (John, Donahue, & Kentle, 1991), social anxiety (Leary, 1983), life-satisfaction (Diener, Emmons, Larsen, & Griffin, 1985), and depressive symptoms (Andresen, Malmgren, Carter, & Patrick, 1994) were collected at T1 and were used as covariates in order to test whether the hypothesised effects were driven by other psychosocial variables (see Main Analysis for model testing details). We also measured body-mass-index, waist-to-hip-ratio and blood pressure, but did not find a link between friendship formation and indicators of physical health (BMI, WHR, blood pressure). This null finding may have been due in part to low variability in our sample (i.e. students in our sample were generally in good health, with only 18% falling in the category of overweight or obese of the BMI; Center for Disease Control and Prevention, 2015). Thus, for readability, we focus in this paper on health behavior and self-reported health as our main outcomes, but we report the additional analyses in the online supplement 1 (Table S14).

Number of Friends (T1/T2/T3). Participants were asked to report the number of close friends and acquaintances they have at university. A close friend was defined as “someone who you would be likely to confide in/talk to about yourself and your problems” (Sandstrom & Dunn, 2014). An acquaintance was defined as “someone you would consider a friend, but not be likely to confide in/talk to about your problems”. The change in number of friends in the first term (number of friends at T2, while controlling for number of friends at T1) was defined as *early friendship formation*, and the change in number of friends from T2 to T3 was defined as *late friendship formation*. For readability, we focus on analysis with number of close friends as the predictor variable. However, we obtain the same results using number of acquaintances as the predictor (see online supplement 1 Table S4 for details).

Perceived Social Support (T3). Participants completed the 48-item college version of the Interpersonal Support Evaluation List (C-ISEL; Delistamati et al., 2006) to measure perceived social support using the following scale-points: 1 = *true*, 2 = *probably true*, 3 = *probably false*, 4 = *false*. Average scores were computed; higher values indicate more support. Internal consistency for the overall scale was excellent (Cronbach’s $\alpha = .93$).

Health Behaviors (T3). Alcohol, tobacco and marijuana consumption, as well as diet and physical activity, were assessed using self-report measures described below. Participants were assured at each session that their responses would not be linked to any personally identifiable information.

Alcohol consumption: Three items of the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, La Fuente, & Grant, 1993) were used

to assess alcohol consumption. Participants reported how often they had a drink containing alcohol (1 = *never*, 2 = *monthly or less*, 3 = *2–4 times a month*, 4 = *2–3 times a week*, 5 = *4 or more times a week*), how many drinks containing alcohol they had on a typical day when they were drinking (1 = *1 or 2*, 2 = *3 or 4*, 3 = *4 or 6*, 4 = *7 to 9*, 5 = *10 or more*) and how often they had six or more drinks on one occasion (1 = *never*, 2 = *less than monthly*, 3 = *monthly*, 4 = *weekly*, 5 = *daily or almost daily*). Items were averaged to compute an alcohol consumption score (Cronbach's $\alpha = .80$).

Tobacco and marijuana consumption: Participants were asked how many cigarettes they smoked in the last week and how often they used marijuana in the last month.

Diet: A Healthy Eating Index (HEI) was computed using a short version of the Alternative Healthy Eating Index (Chiuve et al., 2012; McCullough et al., 2002). This index was chosen because scores predict chronic disease, particularly cardiovascular disease (Chiuve et al., 2012; McCullough et al., 2002). Participants were asked to rate how often they ate (1) fish, (2) beef or high-fat meat, (3) non-meat protein (e.g. nuts, tofu), (4) fruit and vegetables, and drank (5) sugar-sweetened beverages in the last week. An average score was computed; beef/high fat meat and sugar-sweetened beverages were reverse-coded.

Motivation for a healthy diet was assessed using the seven-item Healthy Eating Motivation Score (HEMS; Naughton, McCarthy, & McCarthy, 2015). Scores are related to a healthier diet, more exercise and less time spent watching TV (Naughton et al., 2015). Internal consistency was acceptable in our sample (Cronbach's $\alpha = .77$).

Physical activity: Participants were asked how many minutes they had engaged in at least moderate-intensity aerobic physical activity in the last week (World Health Organization, 2011).

Self-reported health (T3): The five-item general health subscale of the 36-Item Short Form Health Survey (SF-36; Stewart, Hays, & Ware, 1988) was used to assess self-reported health. Participants rated their general health (1 = *excellent*, 2 = *very good*, 3 = *good*, 4 = *fair*, 5 = *poor*) and answered four additional items (e.g. "I am somewhat ill") using a 5-point scale from definitely true to definitely false. The average score was computed; higher values indicate better self-reported health (Cronbach's $\alpha = .79$).

RESULTS

Descriptives and Preliminary Analyses

Social Integration (T1/T2/T3). On average, students reported having 2.51 ($SD = 2.06$) close friends at university at the beginning of their first term (T1), 3.83 ($SD = 3.37$) at the beginning of their second term (T2), and 4.80 ($SD =$

5.27) in their third or fourth year (T3 follow-up). These variables were moderately correlated across time (see Table 2). Number of friends at T1 was not correlated with social support at T3, but number of friends at T2 and at T3 were (see Table 2).

Perceived Social Support (T3). Participants scored 3.01 points on average ($SD = 0.43$) on the 4-point C-ISEL scale.

Health and Health Behaviors (T3). On average, participants scored 3.62 ($SD = 0.62$) on self-reported health and 3.37 points ($SD = 0.42$) on the healthy eating index (both 5-point Likert scales) and 5.47 points ($SD = 0.78$) on the healthy eating motivation score (7-point Likert scale). Participants reported on average spending 108.36 min ($SD = 142.66$) in the last week engaging in at least moderate-intensity aerobic physical activity. The WHO recommends at least 150 minutes of moderate-intensity physical activity per week for adults aged 18–64 years (World Health Organization, 2011). They reported drinking alcohol 2–4 times a month and 3–4 drinks on each occasion. They reported using marijuana 0.70 times ($SD = 2.20$) per month and smoking 0.17 ($SD = 0.76$) cigarettes a day. Given that the small proportion of students who reported any use of marijuana (20% in the last month) or cigarettes (6% in the last week) would have yielded underpowered tests, no further analyses were conducted for those outcome measures. Correlations between self-reported health, diet, and physical activity were substantial (Table 2).

Main Analysis

Relationships between friendship formation during the first term and the health and health behavior outcome measures were examined using linear regression analyses. To estimate robust confidence intervals for all (partial) regression coefficients, 5,000 bootstrap samples were used. Analyses were conducted using IBM SPSS 22.0 and the PROCESS macro for the mediation analysis (Hayes, 2012). Participants with missing data were pairwise excluded for each of the analyses.² We used G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to calculate our achieved power for a medium effect ($f^2 = 0.15$). Given an alpha of .05, two-tailed tests, $N = 66$ and two predictors (number of friends at T1 and T2), a power of .85 was achieved.

First, to examine the relationship between change in number of close friends in the first term and health outcomes, we entered the number of close friends at

² Due to one missing data point for T2 number of friends and one missing data point for the health behaviors at T3, $N = 66$ for all analyses examining self-reported health and $N = 65$ for all analyses examining health behaviors.

TABLE 2
Correlations between Health Behaviors and Self-Reported Health at T3

Correlations	# close friends T2	# of close friends T3 ³	Gender	Age	Self-reported health (T3 ³)	Diet (HEI, T3 ³)	Diet (HEMS, T3 ³)	Physical activity (T3 ³)	Alcohol (T3 ³)	Social support (T3 ³)
# of close friends T1 ¹	.37**	.22	-.09	-.19	-.14	-.001	.03	.01	.19	.11
# of close friends T2 ²	1	.55***	-.24	-.12	.28*	.28*	.26*	.18	.29*	.36**
# of close friends T3 ³		1	-.33*	-.09	.40**	.41***	.32*	.16	-.02	.34***
Gender			1	-.30*	-.17	-.02	-.05	-.25*	-.31*	-.19
Age				1	.08	-.01	-.04	.01	-.02	.16
Self-reported health (T3 ³)					1	.27*	.29*	.30*	-.06	.41***
Diet (HEI, T3 ³)						1	.31**	.22	-.06	.16
Diet (HEMS, T3 ³)							1	.28*	-.17	.27*
Physical activity (T3 ³)								1	.28*	.24*
Alcohol (T3 ³)									1	.16

Note: * $p < .05$; ** $p < .01$; *** $p < .001$. ¹first term of first year, ²second term of first year, ³second term of third or fourth year (~2.5 years after T2).

T2 controlling for number of friends at T1 (step 1):

$$\hat{Y} = b_0 + b_1 * \text{close friends (T1)} + b_2 * \text{close friends (T2)}.$$

The partial regression weight b_2 indicates the influence of the change in number of friends from T1 to T2. Second, psychosocial and demographic measures taken at T1 (extraversion, social anxiety, depressive symptoms, life satisfaction, gender, relocation in order to attend university) were added to confirm that the relationship between friendship formation and health outcomes held controlling for these covariates (step 2). The analyses in step 2 are reported in the online supplement 1.

H1: Health Behaviors. As predicted, change in number of friends during the first term (number of friends at T2 controlling for T1) was positively related to a healthier diet ($\beta = .33$) and motivation for a healthy diet ($\beta = .30$) at T3 (see Table 3). However, the estimated 95% CIs (based on 5,000 bootstrap samples) only revealed a significant influence on the healthy eating score, and not the healthy eating motivation score. Physical activity per week and alcohol usage at T3 were not significantly related to change in friends in the first term (step 1). Descriptively, however, the effect sizes for physical activity ($\beta = .21$) and alcohol usage ($\beta = .25$) were relatively large. All effects held after controlling for the covariates (step 2, see online supplement 1 Tables S5–S8).

H2: Self-Reported General Health. Consistent with our hypothesis, increases in the number of friends during the first term were related to self-reported health at T3. Number of friends at T2 ($\beta = .38$, $b = 0.07$, $SE = 0.02$, 95% $CI = [0.02, 0.11]$) predicted self-reported health at T3, controlling for number of friends at T1 ($\beta = -.28$, $b = -0.09$, $SE = 0.04$, 95% $CI = [-0.15, -0.00]$; overall model: $F(2, 63) = 5.29$, $p = .008$). These effects held after controlling for the covariates (step 2, see online supplement 1 Table S9).

Additional Analyses

Mediation Analyses. To examine whether the significant findings (on self-reported general health and diet) were due to social integration (direct effect) or mediated by perceived social support (indirect effect), mediation analyses were conducted. T2 number of friends was entered as a predictor, controlling for T1 number of friends. Social support (C-ISEL score) was entered as a potential mediator. A significant indirect effect was found for self-reported general health ($b = 0.03$, $SE = 0.01$, 95% $CI = [0.01, 0.06]$), suggesting that students who made more friends during their first term at university reported better general health in part due to perceiving more social support (see Figure 1 for a mediation model). The effect of friendship formation on self-reported health remained significant in

TABLE 3
Regression Analysis Examining the Influence of Change in Number of Friends in the First Term on Health Behaviors

Outcome variable	Predictor 1: T1 ¹ # of close friends			Predictor 2: T2 ² # of close friends			F- statistics	R ²
	β	b (SE)	95% CI for b	β	b (SE)	95% CI for b		
Diet (HEI, T3 ³)	-.12	-0.03 (0.02)	[-0.07, 0.02]	.33	0.04 (0.01)	[0.01, 0.07]	F(2, 62) = 3.15, p = .050	.092
Diet (HEMS, T3 ³)	-.09	-0.03 (0.05)	[-0.11, 0.08]	.30	0.06 (0.03)	[-0.01, 0.11]	F(2, 62) = 2.53, p = .088	.076
Physical activity (T3 ³)	-.07	-4.60 (9.35)	[-25.15, 11.83]	.21	8.82 (5.11)	[-1.33, 19.14]	F(2, 62) = 1.22, p = .303	.038
Alcohol (T3 ³)	.11	0.04 (0.05)	[-0.09, 0.12]	.25	0.05 (0.03)	[-0.01, 0.12]	F(2, 62) = 3.14, p = .050	.092

Note: CIs are based on 5,000 bootstrap samples, ¹first term of first year, ²second term of third or fourth year (-2.5 years after T2).

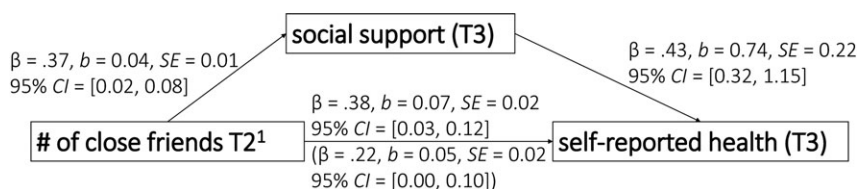


FIGURE 1. Regression coefficients for the relationship between friendship formation and self-reported general health (T3) mediated by social support (T3). The regression coefficients for friendship formation predicting self-reported general health controlling for social support are in parentheses.

¹controlling for number of friends at T1, *CIs* are based on 5,000 bootstrap samples, T1: first term of first year, T2: second term of first year, T3: second term of third or fourth year (~2.5 years after T2).

a model including social support ($\beta = .22, b = 0.05, SE = 0.02, 95\% CI = [0.00, 0.10]$), indicating only partial mediation. The indirect effect remains significant controlling for the covariates described above (step 2, see online supplement 1 Table S10). However, no evidence for mediation by social support was found for diet (HEI and HEMS; all $bs \leq 0.01, ps > .05$).

Early versus Late Friendship Formation. To compare whether early (T1 to T2) or later (T2 to T3) change in number of friends contributed more to students' self-reported health and healthy diet, regression analyses were conducted. First, we predicted T2 friends with T1 friends (early change) and T3 friends with T2 friends (late change) and saved the residuals as new variables. These two new variables indicating early change and late change were used to predict self-reported health, diet (HEI), and motivation for a healthy diet (HEMS). Only early ($\beta = .35, b = 0.07, SE = 0.02, 95\% CI = [0.03, 0.12]$), but not late change ($\beta = .30, b = 0.04, SE = 0.02, 95\% CI = [-0.00, 0.09]$) in number of friends predicted self-reported health at T3: $F(2, 61) = 8.15, p = .001, R^2 = .208$. Diet (HEI) was also predicted by early ($\beta = .30, b = 0.04, SE = 0.01, 95\% CI = [0.01, 0.07]$), but not late change ($\beta = .31, b = 0.03, SE = 0.02, 95\% CI = [-0.01, 0.04]$), overall model: $F(2, 61) = 6.79, p = .002, R^2 = .182$. Motivation for Healthy Eating (HEMS) was significantly predicted by early change ($\beta = .29, b = 0.07, SE = 0.03, 95\% CI = [0.01, 0.12]$), as well as late change ($\beta = .20, b = 0.03, SE = 0.02, 95\% CI = [0.00, 0.10]$), overall model: $F(2, 61) = 4.32, p = .018, R^2 = .124$. All effects hold after controlling for covariates (step 2, see online supplement 1 Tables S11–S13).

Overall, early friendship formation appeared to be an important predictor of self-reported health and a healthy diet. Notably, despite the fact that the late friendship formation measure (T2 to T3) covered a longer time period and was closer in time to the outcomes measured in our study, early friendship formation

(T1 to T2) appears to be at least equally powerful in predicting students' health outcomes towards the end of their time at university.

DISCUSSION

Our findings show that the number of friends that students make during the transition to university predicts their self-reported health and healthy eating several years later. We found evidence for both direct and indirect models (through perceived social support) for the influence of social integration on health.

Self-reported health—which was predicted by friendship formation in our study—is a unique metric of a person's integrated, holistic perception of his or her own health that is not fully accessible to external observers (Miilunpalo, Vuori, Oja, Pasanen, & Urponen, 1997). Importantly, self-reported health is strongly related to objective physical health parameters, ratings by healthcare professionals (Garratt, Ruta, Abdalla, Buckingham, & Russell, 1993), and is a powerful predictor of mortality (for a meta-analysis, see DeSalvo, Bloser, Reynolds, He, & Muntner, 2006). Furthermore, people with higher self-reported health use the health care system less frequently (Miilunpalo et al., 1997; Saxena, 2002). Thus, self-reported health represents a valid and easily accessible outcome measure for studies examining the health state of populations.

We found that social integration in students' first term directly predicted healthy eating behaviors after 2–3 years, with no evidence of mediation through perceived social support. These results are consistent with most evidence suggesting that higher social connectedness is correlated with fewer health-related risk behaviors (Berkman et al., 2000). Although prior research has documented an association between social connection and healthy eating in older adults (Conklin et al., 2014), our study is the first to our knowledge to document a similar pattern longitudinally for university students. These findings are notable given that university students tend to gain weight more rapidly (averaging 2.36 kg over 2.5 years in our study) than emerging adults of similar age in the general population (Orpana, Tremblay, & Finès, 2007; Vadeboncoeur, Townsend, & Foster, 2015). Understanding how social integration and friendship formation shape emerging adults' eating habits may inform programs intended to promote a healthy diet during this potentially influential life transition into young adulthood. As network analyses have revealed that health behaviors travel through social networks (Christakis & Fowler, 2007), it may be particularly important to examine how students can be supported in making friends who are likely to have a positive influence on their own health behaviors.

Descriptively, our findings suggest a possible positive influence of increase in number of friends in the first term on physical activity and increased alcohol consumption, although these results did not reach statistical significance. A recent social network study of university freshmen did not find a significant association between change in number of social ties (indegree and outdegree)

and alcohol consumption (Giese et al., 2017). Future longitudinal research with larger sample sizes will be necessary to confirm whether the effects of friendship formation and social integration are generally stronger for eating than for other health behaviors (as they were in our study), or whether the effects can also extend to physical activity and alcohol consumption.

As is common with studies on university students (wherein low retention rates for university programs and other rapidly changing life circumstances make it difficult to follow up with these individuals over time; Hanna et al., 2014), retention of participants in our study was a challenge. Our relatively small sample size at T3 is a limitation of this study, and further research with larger sample sizes will be critical to replicate and build upon the findings reported here.

We found that change in number of friends in the first term (from T1 to T2) was at least as powerful in predicting self-reported health and a healthy diet as change in number of friends over the next two to three years (T2 to T3). Interestingly, early and late change in number of friends were unrelated in our study ($r = -.001$), suggesting that individual students experience substantially different time courses for making friends at university.

This result may have implications for future research (which may productively examine what factors predict successful friendship formation early in students' time at university) and the design of interventions to support university students' social integration (which may be most impactful if administered soon after students arrive on campus). It is worth noting that existing interventions to improve students' health, which commonly focus on one specific health behavior, generally show small effect sizes (Conner & Norman, 2017). Our findings suggest that an intervention that targets students' social adjustment, rather than one specific health behavior, may have the potential to be more broadly impactful. Future research using interventions to support students' social adjustment could productively examine the extent of any downstream consequences on a number of health outcomes and health behaviors.

Change in number of friends from the beginning to the end of students' first term at university was used in this study as a proxy for successful friendship formation. Strengths of this analysis strategy are that it does not rely on retrospective self-report, nor is it a momentary snapshot of students' social integration. Furthermore, controlling for students' baseline number of friends should reduce the influence of individual response biases (e.g. optimism; Vollmann, Antoniw, Hartung, & Renner, 2011) on any analyses that are based on people's self-reported social network size. To the best of our ability, we ruled out the possibility that our results were driven purely by obvious demographic (gender, relocation to attend university) and psychosocial variables (extraversion, life satisfaction, social anxiety, depressive symptoms). However, it remains possible that people who tend to make more friends and succeed in dealing with major life transitions may differ in other ways from people who have more difficulty making friends and adjusting to a new environment. To establish a causal role of

students' friendship formation on their health, future research using an experimental design will be necessary (e.g. randomly assigning some students to an intervention designed to increase socialising during their first term).

These results highlight the importance of building a social network after transitioning into a new environment. Especially for adolescents progressing into young adulthood, successfully making friends seems to have many downstream health benefits. Universities and other institutions dedicated to supporting the well-being of young adults should be aware of the broad-ranging consequences of social relationships when designing programs for their constituents. Supporting young adults' efforts to make friends during major life transitions is likely to have long-term consequences for their health and well-being, through mechanisms ranging from shaping healthy habits to building support systems for dealing with problems and stress.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

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