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Healthy Behavior Trajectories between Adolescence and Young Adulthood

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Abstract

Healthy behaviors including adequate exercise and sleep, eating breakfast, maintaining a healthy weight, and not smoking or binge drinking inhibit chronic disease. However, little is known about how these behaviors change across life course stages, or the social factors that shape healthy behaviors over time. I use multilevel growth models and waves I-III of the National Longitudinal Study of Adolescent Health (N=10,775) to evaluate relationships between adolescents' psychosocial resources, social support, and family of origin characteristics during adolescence and healthy behavior trajectories through young adulthood (ages 13-24). I find that healthy behaviors decline dramatically during the transition to young adulthood. Social support resources, such as school connectedness and support from parents, as well as living with non-smoking parents, are associated with higher levels of healthy behaviors across adolescence and adulthood. Social support from friends is associated with lower engagement in these behaviors, as is living in a single parent family or with a smoking parent during adolescence. Findings indicate that psychosocial, social support, and family of origin resources during adolescence exert a persistent, though generally not cumulative, influence on healthy behavior trajectories through young adulthood.

Keywords

health behaviors; medical sociology; adolescence; transition to adulthood

1. INTRODUCTION

Health-promoting behaviors such as adequate exercise and sleep, eating breakfast, maintaining a healthy weight, and refraining from smoking and binge drinking promote health and well-being during adolescence and are associated with higher levels of healthy behaviors during adulthood (e.g. Lau, Quadrel, & Hartman 1990). These behaviors prevent or delay the onset of many life-threatening illnesses and chronic conditions during middle age, including cardiovascular disease, onset of disability, Type-II diabetes, and obesity (DHHS 2000). Although researchers know a great deal about psychosocial, social support, and family-related factors associated with high engagement in healthy behaviors early in the life course, during adolescence (e.g. Resnick et al. 1997), far less is known about how and

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[3]Although family composition is conceptualized as a component of SES, supplemental analyses indicate that family composition is not a mediator of parental healthy behaviors.

why healthy behaviors change across life course stages, or whether these early resources exert a long-term impact on healthy behaviors. I advance this line of research in two ways. First, I use a nationally representative, three-wave panel study of US adolescents to examine within-individual trajectories of change in an index of six healthy behaviors between adolescence and young adulthood. Second, I draw from a life course perspective to argue that psychosocial resources, social support, and family of origin characteristics during adolescence structure healthy behavior trajectories across these life course stages, creating both initial (during adolescence) and widening (measured over time) inequalities in healthy behavior trajectories. Multilevel growth models, which distinguish between initial (intercept-related) and cumulative (slope-related) differences over time are used to compare the relative contributions of social environmental variables to "cumulating advantages and disadvantages" in healthy behavior engagement across life course stages (Elder, Johnson, & Crosnoe 2003: 12).

1.2 The importance of a longitudinal study of healthy behaviors

Although previous research makes clear the benefits of long-term, high levels of engagement in health-promoting behaviors (e.g. Mokdad et al. 2004), existing research on predictors of these behaviors generally focuses on individuals' incentives to adopt positive health practices at a single point in time. The Health Belief Model (Becker 1974), for example, posits that healthy behaviors are a product of individuals' health knowledge, the perceived benefits of healthy behavior adoption, and the perceived risks of not taking action. Although this approach is successful in predicting behaviors such as exercise and diet in relatively homogenous samples (see Campbell et al. 2010), it falls short in that it does not provide a framework for how healthy behaviors may change over time.

There are several reasons to investigate how and why healthy behavior engagement changes across pivotal life course stages. First, because healthy behaviors learned early in life are more likely to be maintained during adulthood (Telama et al. 1997; Lau et al. 1990), and because health-promoting behaviors aid in preventing or delaying chronic or life-threatening disease, understanding the ways that healthy behaviors learned early in life are maintained or lost over time may aid researchers in understanding the life course progression of chronic disease onset. Second, such a study is able to evaluate whether personal and social resources at one life course stage – here, during adolescence – exert an enduring or cumulative impact on healthy behaviors at later life course stages. In this study, I examine the whether adolescents' psychosocial resources, social support, and family of origin characteristics exert an enduring or cumulative influence on healthy behavior trajectories through young adulthood.

I draw from a life course perspective to argue that the transition from adolescence to young adulthood is associated with a decline in healthy behaviors, and that adolescents' psychosocial, social support, and family of origin resources continue to influence healthy behaviors as adolescents progress into adulthood. Although infrequently applied to the study of healthy behaviors, the life course perspective moves beyond existing theories of healthy behavior engagement by contending that proximate predictors of healthy behavior adoption, such as health-related knowledge, psychological well-being, and self-efficacy, are embedded in a broader social environment, which constrains individuals' choices through socioeconomic resources, social networks, and unique social environments associated with each life course stage (Elder, Johnson, & Crosnoe 2003; Crosnoe 2004). Thus, understanding individuals' engagement in healthy behaviors requires an understanding of the broader social environment in which an individual is embedded and the ways that social environments change over time.

The life course perspective is a critical component for a longitudinal study of healthy behaviors because it orients a researcher to not only examine cross-sectional differences between individuals at a single point in time – for example, those that exist as individuals enter adolescence, at age thirteen – but also differences that emerge over time and across life course stages, during the transition from adolescence into young adulthood. For example, socioeconomic resources or relationships with parents may be associated with baseline differences in healthy behaviors during adolescence, but how do these resources shape healthy behavior trajectories across life course stages, particularly life course stages associated with a great deal of social and environmental change? Through a longitudinal, life-course approach, I am able to evaluate whether social support, psychosocial, and family of origin resources create both initial and widening or narrowing gaps across groups in healthy behaviors. Because individuals draw from resources in earlier life course stages to navigate changing social environments as they age (Crosnoe & Elder 2002), psychosocial, social support, and family of origin resources during adolescence likely continue to influence healthy behavior trajectories long after individuals have moved away from home and completed schooling. However, the degree to which these factors influence long-term trajectories of healthy behaviors is unclear.

2. BACKGROUND

2.1 The significance of adolescence and young adulthood

Adolescents (ages 13-17) experience a great deal of change in their social environment and social roles during the transition to adulthood, and these changes are likely to negatively influence healthy behavior trajectories. While living with parents, adolescents face relatively few threats to healthy behaviors: typically, adolescents living with a parent or guardian are subject to school and home sanctions if they smoke or binge drink (Johnston et al. 2008a), are monitored by parents to eat healthfully and sleep adequately (White et al. 2006; Beasley et al. 2004), and live in an environment where norms among peers and parents support avoidance of drinking and smoking (Johnston et al. 2008a).

During the transition to adulthood, which occurs between ages 18-25, studies of individual healthy behaviors indicate an overall decline from levels during adolescence (Park et al. 2008; Harris et al. 2006). These declines are thought to be associated with young adults' increased independence and decreased monitoring by parents. Although increasing independence leads young adults to report that they accept responsibility for their actions (Arnett 2000), young adults remain far more willing to engage in risky behaviors than adolescents, and often struggle to establish consistent eating and sleeping patterns, resulting in lower levels of exercise, weight gain, irregular eating schedules, and inadequate sleep (Johnston et al. 2008b; Nelson & Barry 2005; Hicks et al. 2001). In addition, some young adults tend not to identify as adults (Nelson & Barry 2005; Arnett 2000), and peers rather than parents act as primary socializing agents (McDermott et al. 2006). In this setting, engagement in risky behaviors and experimentation with drugs and alcohol is more common (Johnston et al. 2008a, 2008b; McDermott et al. 2006), and parental or other supervisory oversight declines (White et al. 2006). Thus, during the transition to young adulthood, declines in health-promoting behaviors occur, as do increases in risk-taking behaviors. In order to assess overall losses to healthy behaviors between adolescence and young adulthood, the first goal of this study is to document the rate of within-individual declines in healthy behaviors between the beginning of adolescence (age 13) and the end of young adulthood (age 24).

Previous research examining single healthy behaviors supports the assertion that young adults engage in fewer positive health practices than they did as adolescents. Harris et al. (2006) find that young adults ages 18-25 are more likely to experiment with smoking and

drinking, and are less likely to exercise or maintain a healthy diet than they were as adolescents. Moreover, these declines were consistent across race-ethnicity and gender, supporting the assertion that it is the life course stage itself, and not an isolated subgroup of adolescents that are experiencing these declines. I move beyond this study by drawing from a life course perspective to evaluate the long-term consequences of adolescents' social environments to healthy behavior trajectories, and by examining overall change in healthy behaviors across life course stages.

2.2 The social environment and healthy behavior trajectories

The life course perspective also asserts that characteristics of the social environment early in the life course continue to influence health and well-being over time (Elder et al. 2003; Elder 1998). Following a life course perspective, healthy behavior trajectories may diverge across life course stages as social conditions early in life set in motion "cumulative advantages and disadvantages" across life course stages (Elder et al. 2003: 12), meaning that social resources during adolescence influence health outcomes during young adulthood by protecting the health of the more advantaged and contributing to greater health risks for the disadvantaged (e.g. Hayward & Gorman 2004). In this section, I describe how psychosocial resources, social support, and family of origin characteristics not only structure the resources that adolescents draw from to maintain healthy behaviors while living with parents, but also continue to influence healthy behavior trajectories during the transition to adulthood. This is important, because if resources during adolescence influence long-term trajectories of healthy behaviors, then adolescents with few health-promoting resources may face long-term entrenchment in unhealthy behaviors across life course stages, with deleterious consequences throughout adulthood for both healthy behaviors and chronic disease risk. In sum, the second central goal of this study is to evaluate the roles of psychosocial characteristics, social support, and family of origin characteristics during adolescence in structuring healthy behavior trajectories between adolescence and young adulthood (ages 13-24).

2.3 Psychosocial resources, social support, family of origin, and healthy behaviors

Adolescents' healthy behaviors are proximally shaped by psychosocial resources and physical health: psychological distress, low self-efficacy, and poor health or functional limitations limit individuals' abilities to engage in positive health practices (see Bandura 2004; Resnick et al. 1997). These personal resources are influenced by the broader social environment: peers and parents act as primary socializing agent for adolescents, and schools and homes are the primary settings for social exchange (Crosnoe 2004; Barber & Olsen 1997). As such, relationships with peers and parents, along with school and family of origin characteristics have been shown to influence a range of adolescents' outcomes, including academic achievement, emotional well-being, and likelihood to engage in risky behaviors (e.g. Cleveland et al. 2008; Bond et al. 2007; Crosnoe & Elder 2004; Barber & Olsen 1997). School connectedness, that is, feeling a sense of belonging to a school, feeling safe at school, and feeling that one is treated fairly at school, influence adolescents' likelihood to drink alcohol, smoke, engage in delinquency, and initiate drug use (Henry & Slater 2007; McNeely & Falci 2004; Resnick et al. 1997). Peer and parent support exert simultaneous and often opposing influences on adolescents (Crosnoe 2004): peers and peer support can either inhibit or encourage risky behaviors such as smoking and alcohol use and impact psychological well-being (Johnston et al. 2008a; Bond et al. 2007; McNeely & Falci 2004; Barber & Olsen 1997; Resnick et al. 1997). It is not clear, however, whether these influences persist or change over time, as social environments change. Moreover, because many previous studies focus specifically on risky behaviors such as drinking and drug or tobacco use, researchers do not fully understand the relationships between peer and parent support

and a range of health-promoting behaviors over time, such as adequate sleep, eating healthfully, or exercising regularly.

Structural characteristics also shape healthy behaviors. Between adolescence and adulthood, socioeconomic resources such as parent education and income, living with two married parents, or having parents who engage in high levels of healthy behaviors improve adolescents' healthy behaviors by providing stable monetary resources, modeling of positive health behaviors, disproval of unhealthy behaviors, and health-promoting social networks (Amato 2005; Wickrama et al. 2005; Ellickson et al. 2004; Blum et al. 2000; Link and Phelan 1995 McLanahan & Sandefur 1994). Living with two married parents is associated not only with greater financial resources (Amato 2005), but also with avoidance of drug and alcohol use, regular seatbelt use, a healthy diet, exercise, and adequate sleep among adolescents (Blum et al. 2000; Jessor, Turbin, & Costa 1998). These effects may persist during the transition to adulthood, as living with two married parents is associated with spending more time with a parent (Hofferth 2001), and increases in parental monitoring positively influence some healthy behaviors (Beasley et al. 2004; Li, Stanton, & Feigelman 2000). Additionally, adolescents not living with two married parents experience greater psychological distress, which reduces self-efficacy and subsequently, overall engagement in healthy behaviors over time (Cavanagh 2008; Bandura 2004; Blum et al. 2000). As a result, I expect that schools connectedness, relationships with parents and peers, and family of origin characteristics associated with SES and family composition will influence healthy behaviors during adolescence and healthy behavior trajectories between adolescence and young adulthood.

3. METHOD

3.1 Data

Hypotheses are tested using waves 1, 2 and 3 of the National Longitudinal Study of Adolescent Health (Add Health), in-home interviews and parent interviews (Harris 2008). Add Health is a nationally representative study of the health and well-being of US adolescents in grades 7-12 who were enrolled in school during 1994-1995. Respondents were selected from a school-based stratified random sample of 80 high schools and 52 feeder middle schools across the United States sampled with unequal probability of selection (Harris 2008). In-home interviews for the core sample of respondents (n=12,105) occurred during years 1994-1995 for adolescents and a fulltime residential parent or guardian for wave I, 1995-1996 for wave II (retention rate 71% of wave I adolescents), and 2001-2002 for wave III (retention rate 73% of wave I adolescents).

3.2 Sample

I first limit analyses to respondents in the core sample of adolescents who report a valid school code at wave I (n=12,105), in order to control for the clustering of individuals in schools. Second, I include only those adolescents between ages 13-18 who live with a parent or guardian at wave I (n=11,470). This is to ensure that measures of early disadvantage (taken from the parent interview) are assessed while the respondent attends middle or high school and lives at home. Next, I limit the sample to respondents who report that they are Hispanic, non-Hispanic black, Asian, or non-Hispanic white (n=10,861), as the samples sizes of adolescents of other backgrounds are not adequate to conduct supplemental subgroup analyses. Finally, I exclude adolescents who do not report healthy behaviors at any interview (i.e. are missing due to item nonresponse for all healthy behaviors at all waves). The final sample size includes 10,775 respondents who each provide between one and three waves of data.[1]

3.3 Analytic Approach

I use multilevel growth models (*xtmixed* in Stata 10) to estimate healthy behavior trajectories between ages 13 through 24. This approach is consistent with the life course perspective, which emphasizes the importance of modeling intra-individual and cohort trajectories over time (Elder 1998). Multilevel models adjust for the clustering of individuals in schools (at level 3), across-person differences attributable to time-invariant traits such as race-ethnicity and gender (at level 2), and individual attributes that vary across repeated observations (at level 1) (Singer & Willett 2003). The unconditional three-level model is as follows:

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\begin{aligned}
\text{Level 1:} \quad & Y_{tij}=\pi_{0ij}+\pi_{1ij}(AGE)_{tij}+\varepsilon_{tij} \\
\text{Level 2:} \quad & \pi_{0ij}=\beta_{00j}+r_{0ij} \\
& \pi_{1ij}=\beta_{10j}+r_{1ij} \\
\text{Level 3:} \quad & \beta_{00j}=\gamma_{000}+\mu_{ooj} \\
& \beta_{10j}=\gamma_{100}+\mu_{1oj}
\end{aligned}
$$

Y_{tij}, or healthy behavior engagement for individual i at age t in school j is a function of an individual-specific baseline level of healthy behaviors at age 13, π_{0ij}, plus the mean growth rate π_{1ij} for child i in school j. ε_{tij} represents random error variance at age t for individual i in school j. The individual-specific age-13 level of health behavior engagement, π_{0ij}, is a function of school j mean age-13 level of health behavior engagement. This school mean is a function of the grand mean level of healthy behaviors for all individuals across all schools, γ_{000}. The rate of healthy behavior change π_{1ij} for individual i at school j is a function of the average growth rate of school j for individual i (β_{10j}), and the average school growth rate is a function of the grand mean growth rate γ_{100}, or the average growth rate for all individuals at all ages across all schools. Variance components at each level estimate model variance at age 13 remaining at the within-individual (ε_{tij}), within school (r_{0ij} and between school (μ_{ooj}) levels and also at the slope (r_{0ij} and μ_{ooj}).

Thus, multilevel growth models disaggregate variance in healthy behaviors into individuals' attributes that are stable over time and individuals' attributes that change over time, while controlling for the clustering of Add Health respondents in schools at wave I. The benefit of this approach is that I am able to evaluate the relationships between psychosocial, social support, and family of origin resources and adolescent healthy behaviors at age 13 – while adolescents are living at home with parents – as well as the relationships between these variables and adolescents' rate of change in healthy behaviors over time, between ages 13 and 24. I restructure the three waves of Add Health data so that the time metric is years of age, rather than waves of survey data (see Costello et al. 2008 for a similar approach). As a result, I estimate the average rate of healthy behavior change *per year* from age 13 (the youngest age in the sample at wave I) to age 24 (the oldest age for which there is an adequate sample size at wave III).

3.4 Measures

3.4.1. Dependent variable: healthy behaviors—The dependent variable is a time-varying index of healthy behaviors similar to the index created by Breslow and colleagues through the Alameda County Survey (e.g. Wiley & Camacho 1983; Breslow & Enstrom

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[1]The ICE command in Stata is used to impute missing values on model variables based on item non-response at a given wave, but not for cases that attrit over time (i.e., if a respondent is present at wave I but attrits by wave II, I impute item non-response at wave I). I use the dependent variable in imputation regressions, but drop cases with an imputed dependent variable from all analyses (see von Hippel 2007). Supplemental sensitivity analyses indicate that men, foreign-born respondents, respondents whose parents did not attend college, and respondents not living with two married parents are more likely to attrit by wave III.

1980, Bellow & Breslow 1972). This index predicts incidence of chronic disease, disability, and mortality in populations of adults over and above predictions provided by individual health behaviors (Breslow & Enstrom 1980; Wiley & Camacho 1980; Belloc & Breslow 1972). Add Health respondents self-report healthy behaviors at each wave and I include all three waves of healthy behaviors in the analyses that follow. I assign each of six healthy behaviors a value of 1 or 0, where 1 signifies that the individual engages in the behavior and 0 signifies that the individual does not report the behavior. An index of the six healthy behaviors is constructed by summing the scores for individual healthy behaviors, resulting in a score of 0-6 for each individual at each interview.[2]

Each variable is described in detail below:

1. *Adequate Sleep* – Respondents report how many hours of sleep they usually get, or what time they usually wake up and go to sleep. The National Sleep Foundation (2000) recommends eight and a half to ten hours of sleep per night for adolescents ages 12-19. Following these recommendations, person-year observations under age 20 are assigned a value of 1 if they report adequate (8-11 hours) sleep, and a value of 0 otherwise. For those aged 20 or older, a value of 1 is assigned if adequate sleep (6-9 hours) is reported and 0 otherwise (National Sleep Foundation 2000).

2. *Non-smoking* -Respondents are assigned a value of 1 at each interview if they report not using tobacco products at all in the last thirty days (Fiore et al. 2004).

3. *Eating breakfast* -The Add Health data do not provide consistent measures of breakfast eating habits across all waves; however, I link two measures of eating breakfast together by assigning a value of 1 if respondents eat breakfast at all, and a value of 0 otherwise. At wave I, respondents were asked, "What do you usually have for breakfast on a weekday morning?" Individuals who reported having something for breakfast other than coffee, tea, or 'nothing' received a score of 1. At waves II and III, respondents were asked how many days in the last week they ate breakfast. Those who reported eating breakfast at least one day of the week received a score of 1.

4. *Adequate Exercise* – Add Health includes measures of frequency and type of exercise at all waves of data. Types of exercise include school gym class, biking or rollerblading, organized team sports, strength training, walking or running, and aerobics. All respondents at all waves are assigned a value of 1 if they report any of the above activities three or more times in the last week. This is the minimum recommended amount of exercise for preventing cardiovascular disease among individuals of all ages (DHHS 2000; NHLBI 1998).

5. *Maintaining a Healthy Weight* – I identify individuals maintaining a healthy weight through body mass index (BMI) calculations. A score of more than 25 is generally considered overweight (DHHS 2000). Weight is self-reported at wave I but is measured by the interviewer at waves II and III. Height is measured by the interviewer at all waves. Cole et al. (2000) identify adolescent equivalences to adult

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[2]There are a number of ways to construct an index of healthy behaviors; one could weigh some healthy behaviors as more important than others, or construct a healthy behavior index using multidimensional measures of each healthy behavior (for example, taking into consideration how much a young adult smokes, rather than simply whether or not he or she smokes). However, the Add Health data often only provide a single measure of a given healthy behavior (for example, eating breakfast or sleep habits), making the decision to include more detail on some healthy behaviors and not others somewhat arbitrary as data limitations would act as the guide for where to add detail. In addition, there is not yet strong consensus regarding whether some healthy behaviors are more important than others with regard to the development of chronic conditions. I choose to weigh each behavior equally, which is in line with previous research documenting that each of these behaviors has a strong independent association with health in adolescence and adulthood. In addition, previous scholars have used an index similar to this one in prospective analyses predicting incidence of chronic disease in middle age (e.g. Breslow & Enstrom 1980).

BMI scores using international data from children and adults. I use this scale to assign individuals under age 18 a score of 1 if the respondent's weight falls within the specified age and sex-specific healthy weight range. Those over 18 are assigned a score of 1 if his or her BMI is between 18.5 and 25, and 0 otherwise. Pregnant women (wave I n=41, wave II n=42, wave III n=160) are automatically assigned a score of 1 so as to not penalize them for the weight gain that is expected to occur during pregnancy.

6. *Avoidance of binge drinking* -Respondents are assigned a value of 1 if they do not report having 5 or more drinks at one sitting on more than one day during the last month, and 0 otherwise (Miller et al. 2007).

Although this healthy behavior index extends previous research by depicting how adolescents and young adults fare across multiple healthy behaviors over an eleven-year period, it is limited in that it provides only a 1/0 score for each healthy behavior at a given age. For example, an individual who smokes two cigarettes a week will receive the same score for non-smoking behaviors as an individual who smokes a pack of cigarettes a day (both receive a score of zero). The benefit of such an approach, however, is that I assign a relatively homogenous group of individuals a score of '1' on each behavior – for example, all individuals with a score of '1' on smoking behaviors have not smoked any tobacco products at all in the last 30 days. Supplemental analyses (described in the discussion) further support the use of this index in detecting health differences among adolescents and young adults.

3.4.2. Independent variables: Psychosocial resources, social support, and family of origin—The following variables are included as predictors of both initial (age-13) healthy behaviors and, when interacted with age, rate of healthy behavior change between ages 13 and 24. Each variable is measured during the wave I interview. *Psychological distress* and *self-efficacy* are psychosocial resources that influence individuals' engagement in healthy behaviors (Resnick et al. 1997). Psychological distress is measured using the CES-D (Center for Epidemiological Studies – Depression) scale; higher scores indicate greater distress (Cronbach's α= .89) Self-efficacy is measured using a seven-item scale including items such as "You usually go out of your way to avoid having to deal with problems in your life" and "You have a lot to be proud of." Higher scores indicate greater self-efficacy (Cronbach's α =.60). These measures are mean-centered in models. *Social support from peers* is a dichotomous indicator where 1=respondent feels that their friends care about them "very much" on a Likert-type scale ranging from "not at all" to "very much" (the modal category). *Social support from family* averages two (if living only with a residential mother) or four (if living with a residential mother and father) Likert-type questions asking whether respondents feel "not at all" to "very much" cared for by and close to residential parent(s); this score is also highly skewed and therefore dichotomized so that 1= respondent feels very close to and cared for by residential parent(s). *School connectedness* evaluates whether respondents feel like they belong in and are a part of their school, and whether they are treated fairly at school; higher scores indicate greater connectedness (Cronbach's α =.79).

Structural resources include family composition, parent healthy behaviors, and parent socioeconomic resources. *Family composition* distinguishes between adolescents living with a single biological parent, a single biological parent plus grandparent, a biological parent and step-parent, two biological or adoptive married parents (reference), and adolescents living in all other family forms. *Parent education* is coded as 1=at least one residential parent reports a bachelor's degree and 0=no parent reports a bachelor's degree. Very few parents of Add Health adolescents do not complete high school, and previous research suggests that the outcomes of children with at least one college-educated parent vary significantly from

children who do not have at least one college-educated parent (McLanahan 2004). *Household income-to-needs ratio* (logged) is measured using the log of parents' reported combined household income at the time of the wave I interview, divided by the poverty threshold in 1994-1995 adjusted for household size. *Parent healthy behaviors* are parent (typically the mother) self-reports of whether any residential parent smokes, any residential parent drinks heavily (reports more than five drinks in one sitting in the last month), or whether the interviewed parent self-identifies as obese (actual height and weight are not recorded). I recode each of these variables so that 1=parent is non-obese, 1=does not binge drink, and 1=does not smoke. *Race-ethnicity* is self-reported by the adolescent at the wave I interview and all analyses include Asian, Hispanic, non-Hispanic black, and non-Hispanic white respondents. Models also control for *US nativity*, as foreign-born adolescents are generally healthier than second or later-generation (US born) counterparts (Harris 1999). Finally, *gender* is self-reported at wave I.

4. RESULTS

4.1 Descriptive Statistics

Descriptive statistics are presented in Table 1. At wave I, when respondents provide the first person-year observation between ages 13 and 18, average household income is 318% above the poverty line, or about $48,000 in 1994-1995 dollars for a family of four. Slightly more than thirty percent of adolescents live with at least one college educated parent. Fifty-five percent of adolescents live with two biological or adoptive married parents. The majority of parents did not smoke, binge drink, or report obesity. Supplemental chi-square tests (not shown) indicate that respondents are less likely to engage in all six healthy behaviors at age 24 compared to age 13.

4.2 Results

Model 1 of Table 2 describes the average number of healthy behaviors for a typical 13 year old attending a typical school, along with the average rate of healthy behavior change per year between ages 13 and 24. At age 13, adolescents engage in an average of 5.37 healthy behaviors and report a .16 unit decline in healthy behaviors each year between ages 13 and 24. By age 24, the typical young adult reports only [5.37-(.16 * 11)] 3.80 healthy behaviors, supporting previous research on single healthy behaviors demonstrating a decline in health promoting behaviors over time.

In Model 2 of Table 2, I add demographic characteristics, including gender, race-ethnicity, and nativity. Positive coefficients at the intercept and slope indicate positive associations with health-promoting behaviors at age 13 or a less rapid rate of healthy behavior decline per year between ages 13-24, respectively. Although not the primary focus of this analysis, Model 2 of Table 2 provides evidence of gender, race-ethnic, nativity, and physical health differences in healthy behavior trajectories. Young women report fewer healthy behaviors than young men at age 13, but significantly less rapid rates of healthy behavior decline. In fact, by age 24, women report higher levels of healthy behaviors than men (calculations not shown). Hispanic adolescents experience a less rapid decline in healthy behaviors between ages 13 and 24 relative to non-Hispanic white peers. Black and non-US born adolescents report higher levels of healthy behaviors at age 13, and statistically similar rates of healthy behavior decline as their non-Hispanic white or US native peers, meaning that black and non-US native adolescents retain this initial healthy behavior advantage through young adulthood (age 24). Not surprisingly, fair or poor self-rated health and experiencing functional limitations negatively influences baseline healthy behaviors.

Model 3 of Table 2 adds psychosocial characteristics to Model 2 to account for personal resources during adolescence that protect or inhibit healthy behaviors. Both variables are significant and indicate that adolescents with low psychological distress and high self-efficacy engage in significantly more healthy behaviors at age 13, and the magnitude of this advantage is constant through age 24. This means that although self-efficacy and psychological distress during adolescence are enduring influences on healthy behaviors, the advantages associated with personal resources do not change over time, as the slope terms are not significant.

Model 4 of Table 2 adds social support resources from family, friends, and schools along with demographic controls from Model 2. Peer, parent, and school support influence healthy behaviors at age 13 and the slope of healthy behavior change through age 24. High levels of perceived support from parents is associated with higher engagement in healthy behaviors at age 13, but the negative slope term indicates that this advantage is lost during the transition to young adulthood, as adolescents who are close to parents report greater losses in healthy behaviors over time. Each year between ages 13 and 24, adolescents who are close to parents lose [−.17+−.03] .20 behaviors per year while adolescents who were not close to their residential parents lose only .17 behaviors per year. Peer support exerts a counterbalancing influence, as it is associated with .12 fewer healthy behaviors at age 13, but a less steep rate of healthy behavior loss over time. Higher school connectedness also positively influences healthy behaviors at age 13, but this influence diminishes over time, as indicated by the negative slope term. These findings support previous studies indicating that parents, schools, and friends exert simultaneous and often conflicting influences on adolescents' health, and adds to these studies that these influences alter healthy behavior trajectories over time.

Model 5 evaluates the influences of family composition, socioeconomic status, and parent healthy behaviors. Net of other variables in the model, adolescents with a college-educated parent report a modest but significant advantage (.07 more healthy behaviors) at age 13 relative to adolescents who do not have a college-educated parent. The non-significant slope term for parent education indicates that this advantage persists, but does not narrow or widen through the transition to adulthood. Parent income-to-needs ratio is negatively associated with healthy behaviors at age 13, but the coefficient is quite small in magnitude and diminishes over time, as indicated by the positive slope term. Living with a single parent is associated with fewer healthy behaviors during adolescence, and this disadvantage persists over time. This suggests not only that the advantage of living with married parents, step-parents, or grandparents endures through age 24, but also that living with two biological or adoptive married parents does not have an added protective effect on the rate of healthy behavior decline during the transition to adulthood; thus, this period of the life course is equally deleterious to healthy behavior trajectories regardless of family composition during adolescence. Living with non-smoking parents during adolescence is associated with higher levels of healthy behaviors at age 13, and parent non-smoking and non-obesity during adolescence is associated with less rapid rates of healthy behavior decline between ages 13-24. This suggests a cumulative benefit of having a non-smoking parent, as these adolescents report both more healthy behaviors at age 13 as well as a less rapid rate of healthy behavior decline over time through age 24. The full analytical model in Model 6 of Table 2 demonstrates that all previously significant variables remain significant in the full model.

5. DISCUSSION

The importance of healthy behaviors for overall health throughout the life course is well-established: Healthy behaviors inhibit the onset of cardiovascular disease, some cancers, and

Type-II diabetes, which are leading causes of death and disability among US adults. I contribute to this research by using a life course perspective to examine the relationships between psychosocial, social support, and family of origin characteristics and healthy behavior trajectories between adolescence and adulthood. I find that as adolescents transition to young adulthood, they engage in significantly fewer healthy behaviors. However, adolescents are not equally vulnerable to low healthy behaviors during young adulthood. Resources during adolescence, including psychosocial characteristics, social support from peers, parents, and schools, and family of origin characteristics are protective of adolescents' healthy behaviors, and these protective effects persist through young adulthood. Given that healthy behavior engagement is not constant over time, it is important to continue to refine existing theoretical models to reflect the need to examine how the social environment alters healthy behaviors across life course stages, as well as how resources early in the life course continue to protect or inhibit healthy behaviors over time.

These findings provide strong support for the use of a life course perspective to study the ways that healthy behaviors change over time. Resources during adolescence have a persistent role in promoting healthy behavior engagement during the transition to adulthood, and with the exception of social support resources, these effects generally do not accumulate or diminish over time. A life course perspective reorients the scope of healthy behavior research to evaluate the persistent influences of early social environments across life course stages, and the role of changing social environments on individuals' behaviors. Recognizing the contribution of the adolescent social environment to young adults' engagement in health-promoting behaviors advances researchers' understandings of the life course processes that help to create and maintain adolescent and young adult stratification in health-promoting behaviors.

There are a number of limitations to this research. The first is related to the index of healthy behaviors. Although it is possible that a single healthy behavior drives overall differences seen in the results, I find in supplementary models that with one exception, results remain the same when any one of the six behaviors is excluded from the model. The exception is that black adolescents' healthy behavior advantage is driven primarily by a reduced likelihood to smoke during adolescence. I also run all models after excluding those currently attending college at any wave in order to test whether the observed decline in healthy behaviors is primarily attributable to relatively advantaged adolescents experimenting with smoking and binge-drinking as college students. Results remain the same when current college students are excluded from the models. Moreover, supplemental models fitting a squared term to the rate of healthy behavior change indicate that the squared term does not improve model fit.

An additional limitation to these analyses is that adolescent household characteristics are measured at one point in time and I am not able to take into account the duration of each characteristic, which may have an important influence on healthy behaviors. For example, an adolescent who has spent his or her life living in a single parent household is grouped with an adolescent whose parents may have recently divorced. Similarly, adolescents with similar income-to-needs ratios may not have lived at a given level of poverty (or affluence) for the same amount of time. Future research should include more measures of duration for these important contextual variables. Finally, healthy behavior trajectories are also likely to be modified by the multiple transitions related to family formation, schooling, home-leaving, and employment often occurring through age 25. However, the scope of this study cannot accommodate an investigation of the relationships between these events and healthy behavior trajectories. However, future work should address how these important events influence healthy behavior trajectories.

Studying variation in healthy behaviors during the transition to adulthood is especially important given the strong relationships between these behaviors and incidence of chronic illness. This study clearly identifies the transition to adulthood as an important point of healthy behavior decline that likely contributes to the development of chronic disease later in life. Future research should continue to study the long-term associations between early life circumstances, young adult health outcomes, and the development of chronic disease, as well as the relationships between young adult transitions such as family formation, schooling, home-leaving, and employment on healthy behavior trajectories.

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TABLE 1

Unweighted descriptive statistics model variables (N=10,775)

Continuously measured covariates	Range	Mean (SD)
Healthy behaviors, Age 13	0-6	5.36 (.80)
Healthy behaviors, Age 24	0-6	3.76 (1.26)
Self-efficacy (seven items, averaged)	1-5	2.89 (.48)
Depressive symptoms (CES-D scale)	0-26	5.77 (4.29)
School connectedness (six items, averaged)	1-5	3.70 (.77)
Parent income-to-needs ratio (continuous)	0-100	3.18 (.52)
Parent income-to-needs ratio (logged)	−4.6 - 4.6	.73 (1.02)
Dichotomous covariates		Percent
Self-reported health is fair or poor		6.8%
Reports limitation in physical mobility		3.5%
Feels cared for and supported by parents		52.8%
Feels cared for by friends		43.9%
Any residential parent has college degree		31.7%
Family composition during adolescence		
-Two biological or adoptive married parent (reference)		55.1%
-Grandparent and single biological parent		2.8%
-Biological parent and step-parent		9.7%
-Single biological parent		26.1%
-Other family formation		6.2%
Residential parents non-binge drinkers		75.1%
Residential parents non-smokers		74.6%
Interviewed parent is not obese		81.4%
Female		52.3%
Race-ethnicity		
-Non-Hispanic white (reference)		65.8%
-Non-Hispanic black		18.5%
-Hispanic		11.9%
-Asian		3.7%
Non-US native		3.2%

Note: Data are from wave I parent and adolescent interviews (adolescents ages 13-18, attending middle or high school, and living at home with parent or guardian). Healthy behaviors at age 24 are from the wave III interview.

TABLE 2

Multilevel growth models of healthy behavior trajectories, ages 13–24 (N=10,775, 23,138 person-year observations)[a†]

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
Healthy behaviors	5.37***	-.16***	5.44***	-.19***	5.39***	-.19***	5.36***	-.17***	5.42***	-.22***	5.33***	-.21***
Female	---	---	-.19***	.04***	-.10***	.04***	-.14***	.04***	---	---	-.08***	.04***
Race-ethnicity												
[Non-Hispanic white]	---	---	---	---	---	---	---	---	---	---	---	---
-Black	---	---	.18***	.00	.21***	.00	.21***	.00	.21***	.00	.20***	.00
-Hispanic	---	---	-.06	.02*	.00	.01	-.05	.02	-.06	.01	.00	.01
-Asian	---	---	-.01	.02	.03	.01	-.06	.02**	-.04	.02	.01	.01
Foreign-born	---	---	.13*	.01	.13*	.02	.10[a†]	.02	.11	.02	.08	.02[a†]
Physical limitations	---	---	-.31***	.02*	-.24***	.02	-.23***	.02	-.31***	.03*	-.20**	.02
Fair or poor self-rated health	---	---	-.44***	.00	-.23***	.00	-.33***	.00	-.42***	.01	-.21***	.00
Depressive symptoms	---	---	---	---	-.05***	.00	---	---	---	---	-.04***	.00
Self-efficacy	---	---	---	---	.11***	.00	---	---	---	---	.04[a†]	.01[a†]
Feels cared for and supported by parents	---	---	---	---	---	---	.23***	-.03***	---	---	.20***	-.03***
Feels cared for by friends	---	---	---	---	---	---	-.12***	.02**	---	---	-.14***	.01*
School connectedness	---	---	---	---	---	---	.26***	-.01***	---	---	.18***	-.01[a†]
Any residential parent has college degree	---	---	---	---	---	---	---	---	.07**	.00	.04	.02
Parent income-to-needs ratio, logged	---	---	---	---	---	---	---	---	-.03*	.01**	-.03*	.01*
Family composition [Lived with two married parents]	---	---	---	---	---	---	---	---	---	---	---	---
-Single parent and grandparent	---	---	---	---	---	---	---	---	-.06	-.02	-.09	.02
-Step-parents	---	---	---	---	---	---	---	---	-.03	.00	.04	-.01[a†]
-Single parent	---	---	---	---	---	---	---	---	-.16***	.00	-.14***	.00
-Other family composition	---	---	---	---	---	---	---	---	-.19**	.01	.09	.00
No parent smokes	---	---	---	---	---	---	---	---	.09**	.01*	.06*	.02*

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
No parent binge drinks	---	---	---	---	---	---	---	---	$.06^{a\dagger}$	.00	.03	.00
Interviewed parent is not obese	---	---	---	---	---	---	---	---	.02	$.02^{*}$	−.02	$.02^{*}$
Deviance (−2LL)	−36626.3		−36414.9		−36104.9		−36098.4		−36301.2		−35857.9	
AIC (Akaike Information Criterion)	73266.6		72871.8		72259.9		72250.8		72680.4		71820.1	

$a\dagger$ p<10

$*$ p<05

$**$ p<01

$***$ p<.001, two tailed hypothesis tests