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Heterogeneity in educational pathways and the health behavior of U.S. young adults

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Abstract

An increasing number of U.S. adults are progressing through college in decidedly more complex ways. Little is known, however, about how this growing heterogeneity may be associated with the health behaviors and ultimately health of young adults. Using a life course perspective, we investigate whether and why different educational pathways – that is, variation in when people attend and complete school – are associated with daily smoking and binge drinking among U.S. young adults. We use 14 waves (1997–2011) of data from the National Longitudinal Survey of Youth 1997 cohort ($n=7,359$) that enable us to identify the most common educational pathways, as well as their association with young adult health behaviors. Bachelor's degree recipients who enrolled immediately after high school but did not attain their degree within 4 years were more likely to smoke daily in early adulthood (i.e., ages 26 to 32) than those who enrolled in college immediately after high school and attained a bachelor's degree within 4 years. Conversely, bachelor's degree recipients who delayed college enrollment were less likely to binge drink in early adulthood than individuals who enrolled in college immediately after high school and attained a bachelor's degree within 4 years. Marital status and household income in young adulthood accounted for some of the relationships between educational pathways and health behavior. These findings highlight the complexity of education's relationship to health behavior and strongly suggest that heterogeneity in educational pathways should be explicitly examined in population health research. Word Count: 241

Keywords

smoking; binge drinking; timing; college; non-traditional student; life course; non-normative

Educational attainment is one of the strongest and most consistent predictors of health and health behavior in the United States. Individuals who attain higher levels of education report better physical and mental health (Herd 2010; Mirowsky and Ross 2008; Walsemann, Gee, and Geronimus 2009), have lower mortality rates (Hummer and Lariscy 2011; Montez, Hummer, and Hayward 2012), and engage in healthier behaviors (Cutler and Lleras-Muney 2010) than individuals with less education. Moreover, health and mortality disparities between individuals with a college degree and those with less than a high school diploma are widening (Hayward, Hummer, and Sasson 2015; Montez et al. 2011; Sasson 2016), suggesting that education is likely to be a *more* important determinant of health and health behavior among recent cohorts entering young adulthood than it was for previous cohorts.

Most population health research assumes education is completed by age 25 (Elo 2009), which ignores variation in when people attend and complete school – or what can be referred to as educational pathways. This is particularly concerning because an increasing number of U.S. adults are progressing through school in decidedly more complex ways (Goldrick-Rab 2006; Hussar and Bailey 2008). The purpose of this paper is to investigate the extent to which different educational pathways are associated with the smoking and binge drinking behaviors of U.S. young adults using prospective data from the National Longitudinal Survey of Youth 1997. We focus on these two health behaviors because of their high societal costs (American Cancer Society 2013; Courtney and Polich 2009; Kanny et al. 2013), their critical role in premature mortality (Center for Disease Control and Prevention 2008; Stahre et al. 2014), and their changing associations with education over time (Link 2008; Serdula et al. 2004; Kanny et al. 2011; Kanney et al. 2013). Moreover, prior research suggests education is not always beneficial for health behavior (c.f., Kanny et al. 2013); thus, we examine smoking and binge drinking to better interrogate the ways in which educational pathways correlates with these two behaviors. Our conceptualization and measurement of educational pathways provides an innovative lens into the complex relationship between education and health behavior among U.S. young adults.

Background

The sequencing of the adult life course is often considered quite structured, with a set of standardized age norms for when each phase of life (e.g., education, work, marriage, family, retirement) should commence, and for some, conclude (Elder, Shanahan, and Jennings 2015; Settersten and Hagestad 1996; Settersten and Lovegreen 1998; Settersten 2003). Recent cohorts, however, are following more individualized pathways through the life course, particularly as they relate to education (Shanahan 2000). Recent estimates show that about one-third of adults experience interruptions in their education (Goldrick-Rab, Carter, and Wagner 2007), 38% attend college part-time (National Center for Education Statistics 2015), and 31% of undergraduates are 25 years of age or older (National Center for Education Statistics 2014b). Greater individuation in educational pathways has occurred simultaneous to the rising importance of a college degree for attaining a middle-class lifestyle (Hout 2012).

Few studies have examined the implications of individuals following less traditional educational pathways – henceforth referred to as “non-normative” – when investigating the relationship between education and health (Walsemann, Bell, and Hummer 2012). Yet, growing educational heterogeneity at the population-level, coupled with the dynamic and demographically dense nature of young adulthood (Rindfuss 1991), suggests that such a question is important and timely. In particular, conventional thinking regarding the pace/timing of educational attainment (e.g., college-goers are full-time students who finish before age 25) and the use of crude categories to measure educational attainment (e.g., <high school, high school degree, more than high school degree) may no longer be satisfactory in the current era of educational heterogeneity.

Our study draws upon the life course perspective to better understand how educational pathways are associated with young adults’ health behavior (Elder et al. 2015). Our approach recognizes that individual life courses are structured by the institutions to which they are exposed as well as the agency that individuals display within these institutions, particularly related to the timing of entrance and exit from schooling.

Applying the Life Course Perspective to Educational Pathways and Health Behavior

Timing—According to Elder and colleagues (2015), the outcomes of life course transitions depend on when these transitions occur. This is often referred to as the principle of timing, which is evident in the sensitive period model within life course epidemiology. The sensitive period model posits exposure to an event, circumstance, or context may have a stronger effect on health behavior depending on the timing of exposure (Kuh et al. 2003). As it relates to educational pathways, college is an important social context for young adults that may influence health behavior, though the direction and strength of its influence may be contingent on when in the life course individuals enroll in and complete college. Indeed, individuals who immediately enroll in college after high school may have a different college experience than individuals who delay enrollment or take longer to complete college, the latter of whom may be less attached to the institution or less exposed to certain aspects of it.

Take, for example, binge drinking. Colleges have been uneven in how they respond to student drinking on campus or at university-sponsored events, often targeting individual behavior rather than campus culture or policy (Wechsler et al. 2002). As a result, some colleges foster an environment where binge drinking is more common or deemed to be more acceptable (Schulenberg and Maggs 2002). For example, exposure to Greek life, on-campus housing, and collegiate athletics increase participation in binge drinking (Merrill and Carey 2016). Yet, not all students are equally exposed to these environments. Compared to individuals who enroll in college immediately after high school, individuals who delay enrollment in college are older and typically balancing other social roles (e.g., parent, partner, worker) (Bozick and DeLuca 2005; Roksa and Velez 2012). These roles and responsibilities often compete with leisure time activities that traditional college students participate in (i.e., Greek life, attendance at athletic events), thereby restricting which environments non-traditional students interact with during their time in college (Merrill and Carey 2016). To the extent that colleges foster binge drinking – a proposition supported by recent research (Carter, Brandon, and Goldman 2010; Merrill and Carey 2016) – and the

transition to adulthood represents an important developmental period for the establishment of this behavior, the timing of college enrollment could play an important role in later engagement in binge drinking.

Conversely, the college environment may increase students' exposure to anti-smoking norms and social networks that discourage smoking (Christakis and Fowler 2008; Pampel, Krueger, and Denney 2010). For instance, because individuals who immediately enroll in college do so when peers are still strongly influential (Kirst et al. 2014), they may be less likely to smoke given the lower rates of smoking among individuals on college campuses who are often highly educated (i.e., faculty) or from educated families where smoking is less common (Pampel et al. 2010). The reverse may be the case for individuals who delay college enrollment or who take longer to earn their degree. These young adults may find themselves employed in service-sector jobs where a greater percentage of workers smoke (Pampel et al. 2010), be embedded in social networks where smoking is more common (Christakis and Fowler 2008), or have less interaction with faculty and students on campus where anti-smoking norms are often transmitted. It is also possible that delays in college enrollment or degree attainment increase exposure to stress in other life domains – e.g., family, work, school – that are associated with smoking initiation or persistence (Slopen et al. 2013).

Economic & Social Pathways—From a life course perspective, educational pathways that reflect social expectations about when education should be completed are likely to yield greater economic and social resources than pathways that deviate from these expected norms. This is in part due to the fact that educational pathways structure future life paths (Elder et al. 2015). Individuals who take longer to complete college – either because they start college later, complete their degree later, or both – relative to individuals who enroll immediately after high school and earn their bachelor's degree in four years have fewer years to accumulate the social, economic, and health benefits a college degree brings. Delaying college enrollment is associated with lower lifetime earnings (Crawford and Cribb 2012) and wages (Elman and O'Rand 2004; Taniguchi 2005) independent of family background and cognitive abilities, whereas enrolling but not completing college is associated with lost time and wages (Patrick, Schulenberg, and O'Malley 2013). These consequences are likely similar for individuals who delay attainment of their degree, since they will enter the job market later than individuals who complete their degree within four years, thus falling behind in terms of promotions, raises, and retirement savings.

Additionally, education increases the likelihood of marriage (Goldstein and Kenney 2001; Martin, Astone, and Peters 2014). Marriage, in turn, is associated with a reduction in riskier health behaviors, including heavy drinking and smoking (Umberson, Crosnoe, and Reczek 2010). Some evidence suggests, however, that among the least economically advantaged college-goers, attending college actually reduces their chances of marriage (Musick, Brand, and Davis 2012). Because economically disadvantaged students are the most likely to follow “non-normative” educational pathways (Ewert 2010; Goldrick-Rab 2006), individuals who follow these educational pathways may gain the least in terms of social advantages – like marriage – from attending college.

If “non-normative” educational pathways are associated with fewer economic and social resources in adulthood, individuals who follow these pathways may engage in select coping behaviors in young adulthood, such as smoking, in response to financial and social stress (Pampel et al. 2010). For example, Siahpush and Carlin (2006) found that current smokers who reported greater financial stress were less likely to quit than current smokers who reported less financial stress; former smokers were also more likely to relapse if they experienced financial stress than if they did not. Alternatively, binge drinking may be a more common coping behavior among young adults who follow a “normative” educational pathway, perhaps because they find it more socially acceptable given their experiences with drinking in college (Carter et al. 2010; Merrill and Carey 2016) or they find themselves working in careers with peers who also binge drink. Indeed, prior research documents higher rates of binge drinking among individuals in high status jobs (Diala, Muntaner, and Walrath 2004) and who have higher household incomes (Kanny et al. 2013).

Research Questions and Hypotheses

In this paper, we investigate the extent to which educational pathways are associated with the smoking and binge drinking behaviors of U.S. young adults. A central question is whether the *timing* of college enrollment and degree attainment is related to these health behaviors, given that college environments may impact health behavior to a greater or lesser degree depending on when young adults enter and exit schooling. Because individuals from economically disadvantaged backgrounds as well as those who are less academically successful in high school are more likely to follow “non-normative” educational pathways (Bailey and Dynarski 2011; Goldrick-Rab 2006) than individuals who are more advantaged and academically successful, we explicitly account for potential selection effects in our analyses. We also include controls for adolescent smoking and binge drinking given that adolescent health behavior is a strong predictor of both educational pathways and adult health behavior (Chassin et al. 1996; Courtney and Polich 2009; Patrick et al. 2013). Indeed, accounting for adolescent health behavior is particularly important as it relates to smoking, since many smokers initiate smoking before they turn 18 (Maralani 2014). Finally, because the life course experience of “non-normative” educational pathways might be associated with the accumulation of fewer economic and social resources in adulthood, we also examine if economic and social resources in young adulthood attenuate disparities in these relationships. We test the following hypotheses:

- H1** Among individuals who attain a bachelor’s degree, we expect that young adults who delay enrollment or attainment will be more likely to smoke and less likely to binge drink than those who enter college immediately after high school and attain a bachelor’s degree within four years.
- H2** Among individuals who attain a bachelor’s degree, individuals who delay college enrollment or attainment will be less apt to secure higher status jobs and higher incomes and be less likely to marry compared to those who enroll in college immediately after high school and attain a bachelor’s degree within four years. These differences will attenuate disparities in smoking and binge drinking between bachelor’s degree recipients who delay enrollment or attainment and those who attain a bachelor’s degree within four years.

Data and Methods

Data

Data come from the National Longitudinal Survey of Youth 1997 (NLSY97), a nationally representative sample of 8,984 individuals born between 1980 and 1984. Baseline interviews were conducted in 1997, with annual follow-up interviews ongoing. The retention rate over the 14-year period we analyzed was 82.6%. The NLSY97 is ideal for this study as it collects detailed information on college enrollment patterns, dates of degree attainment, and health behavior.

Our analyses include data through 2011, when respondents were 26 to 32 years old ($n=7,359$). We do not use 2013 data because the NLS did not collect measures of binge drinking that year. Missing data on other variables ranged from <1% to about 20%. To address issues of item non-response, we used multiple imputation methods (details provided below).

Measures

Dependent Variables—In 2011, respondents reported the number of days in the past 30 they smoked cigarettes. Those who reported smoking at least one cigarette every day were coded as *daily smokers*; all others were coded as non-smokers/occasional smokers. Supplemental analyses using three categories – non-smoker, occasional smoker, and daily smoker – yielded similar results as those we present here.

Binge drinking was also assessed in 2011 using an item that asked respondents the number of times in the past month they reported consuming 5 or more alcoholic beverages in one sitting. Those who indicated they had done so on at least one occasion were coded as having binge drank in the past month.

Independent Variable—We constructed a measure of *educational pathways* using monthly arrays of college enrollment, highest degree attained, and the month and year of degree attainment. Monthly arrays of college enrollment were recoded to indicate if the respondent was enrolled in college during each respective calendar year (from 1997 through 2011).

Using information from these variables we categorized respondents into 10 educational pathways that accounted for timing of college enrollment and timing of degree attainment, as applicable (see Table 1 for detailed definitions). First, respondents were identified as enrolling in college immediately after high school (within 6 months to a year, depending on graduation date), delaying college enrollment, or never enrolling in college. Next, respondents were classified as having attained their degree “on-time” if they attained their highest degree within 2 years for an associate’s or 4 years for a bachelor’s. If they did not complete their associate’s or bachelor’s degree within that timeframe they were classified as delayed. Our definitions of on-time and delayed degree attainment follow standard norms for how long it takes to complete a degree. More conservative definitions of on-time degree attainment (i.e., 6 years for a bachelor’s degree and 3 years for an associate’s degree) yielded similar estimates as those we present, even though doing so reduced the number of

respondents in the non-normative pathways (e.g. 12.4% vs. 4.4% of respondents are in pathway 2 when using the less vs. more conservative definition).

As shown in Table 1, pathways 3 and 6 ignore timing of degree attainment because of concerns with small cell sizes when we used timing to further delineate these categories, whereas pathways 7 and 9 are not further subdivided by timing of enrollment or degree attainment since ultimately these individuals never completed a college degree (i.e., associate's or bachelor's degree). Finally, we collapsed respondents with a GED and no degree into similar pathways (with or without college enrollment) due to prior studies that find that the health of GED recipients is more similar to the health of high school dropouts than to high school graduates (Zajacova and Everett 2014).

Early Adult Characteristics

To assess the role of social relationships in understanding educational pathways and health behavior, we include *marital status in 2011* – categorized as married versus not married – and a dummy variable indicating whether or not the respondent reported *any children* living in the household in 2011.

To examine the role of adult socio-economic status, we include indicators of household income and occupational status, both measured in 2011. *Household income* ranged from \$0 to \$316,618. We divided household income by \$10,000 to ease the interpretation of the regression coefficients. *Occupational status* was based on respondents' current or most recent job and was categorized as professional or managerial versus all other occupations using the 2002 Census Occupation Codes. More refined categories yielded similar results.

Covariates

We include a set of covariates to account for potential selection into educational pathways and health behaviors and to facilitate more precise estimates of the association between educational pathways and health behaviors. *Parents' education* measured the highest year of school either resident parent completed (range 1 to 20 years). If there was only one resident parent, that parent's education was used. In 1997, parents reported their *net worth*, which was calculated as the amount of debt subtracted from assets (home equity, bonds/CDs/stocks, life insurance policies, pension and retirement savings, car values, etc.). Values ranged from – \$935,251 to \$600,000 (NLS researchers top-coded net-worth). Similar to household income, we divided net worth by \$10,000. *Family structure* in 1997 was dichotomized as households with two biological, married parents versus all others. *Delinquency* was measured using 10 items that assessed delinquent and/or criminal acts respondents reported in 1997 (i.e., running away, belonging to a gang, carrying a hand gun, damaging or destroying property, stealing [$< \$50$ value, $> \$50$ value], selling drugs, attacking someone, selling stolen property, or been arrested), which was summed for a possible count of 10. *High school grades* was a self-reported indicator of the overall marks respondents received in 9th – 12th grades and was categorized as mostly A's, mostly B's, mostly C's, and mostly D's and F's. The *Armed Services Vocational Aptitude Battery (ASVAB)* was administered to respondents in 1997–98 and provides a summary percentile score of math and verbal ability based on assessment in four subareas: mathematical knowledge, arithmetic

reasoning, word knowledge, and paragraph comprehension. We divided the percentile score by 10 to ease interpretation of the regression coefficients (i.e., one unit = 10 percentage points).

Using survey items administered to respondents from 1997 through 2001, we constructed indicators of *daily smoking* before age 18 (i.e., smoked at least 1 cigarette every day in the past 30 days prior to turning 18), *binge drinking* before age 18 (i.e., consumed 5 or more alcoholic beverages in one sitting in the past 30 days prior to turning 18), *marriage* before age 18, *having a child* before age 18, and working in a *professional or managerial occupation* before age 18.

Additional covariates included *race/ethnicity* and *gender* (non-Hispanic white men, non-Hispanic black men, Hispanic men, men from other racial/ethnic groups, non-Hispanic white women, non-Hispanic black women, Hispanic women, and women from other racial/ethnic groups); *nativity* (born a US-citizen versus born outside the US to non-citizen parents); *age* in 2011; *region* of residence in 1997 (northeast, north central, south, and west); and if a female respondent was *pregnant* at the time of her interview.

Analyses

To address issues of item non-response, we imputed data using the *mi impute* command with chained equations specification in Stata v14. This produced 50 data sets. Analyses were replicated across the 50 datasets and combined using *mi estimate*. Our analyses were also weighted to account for the complex sampling design and respondent attrition from 1997 to 2011 using the *svy* commands and the sampling weights provided by the NLS.

Results

Sample Characteristics

Table 2 presents sample characteristics. Approximately 22% of young adults reported daily smoking and about one-third reported binge drinking (34.2%) in the past 30 days. Although 30.3% of young adults completed a bachelor's degree by 2011, only 14.4% enrolled in college immediately after high school and completed their bachelor's degree within 4 years (hereafter, this is referred to as the normative pathway to a bachelor's degree), whereas 12.4% enrolled in college immediately after high school but took longer than 4 years to complete their bachelor's degree, and 3.5% delayed college enrollment. The modal educational pathway was a high school diploma with college enrollment (but no degree) at some point during early adulthood (25.6%).

During adolescence, the average respondent lived with a parent who had completed over 13 years of schooling and reported an average net worth of \$111,836. More than half lived with both biological parents (52.6%). As young adults, almost half had a child living in their household, one-quarter was working in a professional or managerial occupation, and the average household income was \$67,776.

Bivariate Associations

Table 3 presents bivariate associations between educational pathways and selected study variables. Overall, young adults who followed a normative pathway to a bachelor's degree were less likely to smoke daily in early adulthood (3.9%), more likely to grow up in advantaged circumstances (e.g., mean parental education = 15.7 years), and performed better academically in high school (93.4% reported earning mostly A's and B's) compared to those who followed non-normative pathways to a bachelor's degree and/or had completed less education. Further, these young adults were the most advantaged of any group in early adulthood (51.3% were married, 66.7% worked in professional/managerial occupations, and their average income was \$101,000).

Even so, young adults who followed a normative pathway to a bachelor's degree reported the highest rates of binge drinking (40.5%). In contrast, about one-quarter to one-third of young adults who followed other educational pathways reported binge drinking (range = 26.3% to 34.1%), with the exception of college graduates with delayed degree attainment who had a similar percentage of binge drinking (39.6%) as young adults who followed a normative pathway to a bachelor's degree.

Daily smoking and binge drinking prior to age 18 were significantly correlated with educational pathways. Young adults who followed a normative pathway to a bachelor's degree were significantly less likely to smoke daily before age 18 (4.6%) than all other educational pathways with the exception of those who immediately enrolled in college but delayed their degree attainment or followed a normative pathway to an associate's degree (this latter null finding was likely due to low statistical power). Conversely, the least educated – high school graduates, GED recipients, and high school dropouts, regardless of college enrollment – were significantly more likely to binge drink before age 18 (e.g., 31.2% to 46.9%) than young adults who followed a normative pathway to a bachelor's degree (26.4%).

Multivariable Analyses

Table 4 presents estimates from weighted multivariable logistic regression models. Model 1 examines the association between educational pathways and each health behavior after adjusting for demographics, family background, high school academic performance, adolescent behavior, and adolescent entry into adult social roles. Model 2 tests if social relationships and socio-economic characteristics in early adulthood attenuate the relationship between educational pathways and daily smoking or binge drinking.

We examine the relative contribution of each early adult characteristic added to Model 2 in explaining the association between educational pathways and each health behavior. Due to the scaling issue when comparing logit coefficients across nested models, we use the *khb* method in Stata to decompose the total effect of the independent variable (i.e., educational pathways) into direct and indirect effects (Karlson, Holm, and Breen 2012). We examine the total percentage of the association explained by all early adult characteristics jointly and the percentage of the association that is explained uniquely by each early adult characteristic. As

appropriate, we report these estimates in the text below. The full set of estimates is available from the authors on request.

Daily Smoking

Model 1 shows that young adults who followed “non-normative” pathways to a bachelor’s degree and/or had completed less education had higher odds of daily smoking than young adults who followed a normative pathway to a bachelor’s degree, after adjustment for demographics, family background, academic performance, adolescent behavior, and adolescent entry into adult social roles. Among young adults who attained a bachelor’s degree, those who immediately enrolled in college but delayed their degree attainment had 2.05 times the odds of daily smoking compared to those who followed a normative pathway to a bachelor’s degree. The two educational pathways with the highest odds of smoking were individuals with a GED/no degree, with or without college enrollment (OR=7.29, OR=11.72, respectively).

Comparing within young adults who earned an associate’s degree, results indicated no statistical differences in the odds of daily smoking by timing of enrollment (Wald test = -0.03 , $p>0.05$) or timing of degree attainment (Wald test = 0.94 , $p>0.05$). Similarly, high school graduates who enrolled in college reported statistically equivalent odds of daily smoking as high school graduates who never enrolled in college (Wald test = 1.62 , $p>0.05$). Individuals with a GED/no degree who enrolled in college, however, had statistically lower odds of daily smoking than their counterparts who never enrolled in college (Wald test = -2.94 , $p<0.006$).

Early adulthood characteristics partly attenuated the association between most educational pathways and daily smoking (Model 2). Marital status mostly accounted for this attenuation between Model 1 and Model 2 (kfb estimates available upon request).

Binge Drinking

After adjustment for demographics, family background, academic performance, adolescent behavior, and adolescent entry into adult social roles, young adults who completed less than a bachelor’s degree had lower odds of binge drinking than young adults who followed a normative pathway to a bachelor’s degree (OR=0.44 to OR=0.70; Model 1), with the exception of young adults who followed a normative pathway to an associate’s degree (OR=0.68, 95% CI: 0.38, 1.21) and young adults with an associate’s degree who delayed college enrollment (OR=0.69, 95% CI: 0.46, 1.04). Among young adults with a bachelor’s degree, those who delayed their enrollment in college had about half the odds of binge drinking (OR=0.44, 95% CI: 0.30, 0.65) compared to individuals who followed a normative pathway to a bachelor’s degree. Thus, these young adults were about as likely to engage in binge drinking as young adults who never attended college.

Comparing within young adults who earned an associate’s degree, we found no differences in the odds of binge drinking by timing of enrollment (Wald test = 0.95 , $p>0.05$) or timing of degree attainment (Wald test = 0.25 , $p>0.05$). Similarly, young adults who enrolled in college but did not graduate with an associate’s or bachelor’s degree were similar in their

odds of binge drinking as their counterparts who never enrolled in college (Wald test = 0.94 (high school graduates), Wald test = 0.78 (GED/no degree), $p > 0.05$).

Collectively, early adulthood characteristics did little to attenuate the relationship between educational pathways and binge drinking (Model 2). Individually, however, household income diminished the strength of the association across most educational pathways and binge drinking; whereas marriage suppressed this association (kfb estimates available upon request).

Sensitivity Analysis

Given potential gender and racial/ethnic differences in the relationship between education and health behavior, we re-estimated gender-stratified and race-stratified (Black and White respondents only, due to sample size constraints) models. Stratified results yielded similar findings as non-stratified results. These results were confirmed in non-stratified models that included interactions between gender or race and educational pathways (available upon request). Thus, to maintain power, we report non-stratified results only.

Discussion

U.S. young adults are experiencing greater individuation in their educational pathways. Although enrolling in college is now a normative experience among U.S. young adults (National Center for Education Statistics 2014a), there is significant variation in when individuals attend and complete college (Buchmann, DiPrete, and McDaniel 2008; Ewert 2010; Goldrick-Rab 2006). Few population health studies have considered such heterogeneity when attempting to understand the relationship between education and health. Our study begins to address this important gap by investigating how educational pathways are associated with the daily smoking and binge drinking behaviors of U.S. young adults using a nationally representative sample of individuals born between 1980 and 1984.

We hypothesized that among individuals who attained a bachelor's degree, young adults who delayed college enrollment or delayed degree attainment would be more likely to smoke daily and less likely to binge drink than young adults who followed a normative pathway to a bachelor's degree, after adjustment for family background, academic performance during high school, adolescent behavior, and adolescent entry into adult social roles (see Table 1 for detailed definitions of delayed enrollment and delayed degree attainment). Our results provide support for our main hypothesis. Compared to young adults who followed a normative pathway to a bachelor's degree, young adults who did not attain their bachelor's degree within 4 years had higher odds of daily smoking, whereas bachelor's recipients who delayed their college enrollment were half as likely to binge drink.

We also expected that economic and social resources in early adulthood would attenuate the relationship between educational pathways and health behavior. Our results support our expectations. In our sample, young adults who followed a normative pathway to a bachelor's degree were more likely to be working in professional or managerial occupations, be married, and earn more money than bachelor's degree recipients who either delayed college enrollment or delayed degree attainment. Marriage and household income individually

worked to attenuate the lower odds of binge drinking among bachelor's degree recipients who delayed their college enrollment, whereas a lower likelihood of marriage partially attenuated the higher odds of daily smoking found among bachelor's degree recipients who delayed their degree attainment relative to young adults who followed a normative pathway to a bachelor's degree.

Prior studies find that marriage is associated with lower levels of smoking and binge drinking, because partners often regulate and facilitate healthier behaviors through encouragement, coercion, and obligation (Duncan, Wilkerson, and England 2006; Umberson et al. 2010). Our results, however, suggest that young adults who follow a normative pathway to a bachelor's degree are at greatest risk for both binge drinking *and* marriage. It is therefore unsurprising that marriage suppressed the relationship between most educational pathways and binge drinking; in other words, had young adults who followed "non-normative" and/or less advantaged educational pathways married at similar rates as individuals who followed a normative pathway to a bachelor's degree, the differences between these groups would have been greater. Household income worked in opposite ways as marriage as it relates to binge drinking. Prior research finds that individuals with higher incomes binge drink more than individuals with lower incomes (Kanny et al. 2013). As a result, young adults who follow a normative pathway to a bachelor's degree appear to binge drink more in part because they earn higher salaries in young adulthood.

Our findings have important theoretical implications. First, among bachelor's degree recipients, timing of college enrollment seems to matter for early adult health behavior, perhaps because delayed enrollment or delayed degree attainment can result in different levels of exposure to the traditional college environment. For example, students who delay college enrollment or degree attainment may do so because they are balancing other roles, such as full-time employment, marriage, or parenthood (Roksa and Velez 2012). These other roles are likely to compete with the social activities offered on college campuses that often facilitate engagement in binge drinking, reduce interactions with faculty and peers where smoking norms and behaviors are often transmitted, or increase exposure to stress across these life domains, which has implications for smoking initiation and cessation (Slopen et al. 2013). Delays in college enrollment may also facilitate the maturation of individuals, making them less susceptible to negative peer influences in college such as binge drinking. Alternatively, enrollment in college immediately post-high school may increase exposure to anti-smoking norms via social networks and enhance problem-solving skills that one could use to avoid smoking initiation or successfully quit (Pampel et al. 2010), which could in turn alter life course patterns of smoking. Our results suggest that ignoring such heterogeneity can lead to erroneous conclusions about the relationship between education and different health behaviors.

Second, we documented a significant association between educational pathways and daily smoking and binge drinking in early adulthood, even after adjustment for adolescent health behaviors. Prior research suggests that much of the educational gradient in smoking occurs prior to age 18 (Maralani 2014). Although we also find significant correlations between educational pathways and daily smoking prior to age 18, no differences in adolescent daily smoking were found between bachelor's degree recipients who followed a normative

pathway and bachelor's degree recipients who delayed their degree attainment. Yet, by early adulthood, significant differences between individuals following these two educational pathways had emerged, suggesting that at least some of the educational gradient in daily smoking occurs after age 18. Our findings are consistent with recent work by Pampel and colleagues (2017) who document widening educational disparities in smoking across early- to mid-adulthood. Additionally, in our sample, *adolescent* binge drinking was more prevalent among individuals who eventually earned no more than a high school diploma than among eventual bachelor's degree recipients, but we found an opposite pattern for binge drinking in *early adulthood* except for bachelor's degree recipients who delayed college enrollment. Such a finding provides preliminary evidence that exposure to the college environment immediately after high school increases the odds that one will engage in binge drinking in early adulthood.

Third, we found heterogeneity in the extent to which attaining a bachelor's degree resulted in economic and social advantages. In our bivariate results, bachelor's degree recipients who delayed college enrollment or degree attainment accrued fewer economic and social benefits from their bachelor's degree relative to young adults who followed a normative pathway to a bachelor's degree. We also found these patterns in multivariable models that examined the relationship between educational pathways and each of the early adulthood characteristics after adjustment for covariates (results available upon request). Thus, our study supports the idea that population health researchers should explicitly examine educational pathways as another marker of social stratification—even among individuals who eventually earn a bachelor's degree.

Finally, although prior research has documented gender and racial/ethnic variation in the relationship between education and some health behaviors and outcomes (Backholer et al. 2017; Montez et al. 2011; Walsemann et al. 2012), supplemental analysis indicated that the relationships between educational pathways and health behavior were similar for men and women and for Blacks compared to Whites. Issues with sample size likely limited our ability to detect significant differences, however. Future studies should consider possible gender and/or racial/ethnic differences in the relationship between educational pathways and health behavior to determine if our results are robust.

Limitations

We note a number of limitations. First, based on available data, we were only able to investigate educational pathways and health behavior in early adulthood. Economic and social advantages or risks tend to accumulate over time (Ferraro and Shippee 2009); thus, the associations between educational pathways and health behavior may become more pronounced as respondents enter mid-life. Alternatively, as time from exposure to college increases, differences in health behavior by timing of enrollment or degree attainment may diminish. Second, educational pathways are likely to differ by factors beyond what we assessed, including part-time versus full-time enrollment and transferring from college to college (Goldrick-Rab 2006). Capturing such nuances was not possible given the size of the NLSY97 sample, but such heterogeneity may be important. Third, although we adjusted for observed confounders available in the NLSY97, there may be other unobserved factors

related to educational pathways, daily smoking, and binge drinking that may help to explain their associations. Fourth, while our models adjusted for adolescent entry into adult social roles prior to age 18 to account for potential selection effects into educational pathways, sample size limitations precluded us from further refining educational pathways by timing of transitions into and out of these adult social roles, but efforts to do so may help advance our understanding of the mechanisms linking educational pathways to health behavior. For example, recent work by Miech and colleagues (2015) finds that the sequencing of a college degree in relation to the sequencing of marriage and parenthood is associated with obesity; entering these social roles prior to college completion increased young adults' risk for obesity. These findings raise the intriguing possibility that the timing of these role transitions may be an additional explanation for why educational pathways were related to early adult health behavior in our sample, beyond timing of exposure to the college environment. Likewise, examining how smoking or binge drinking trajectories unfold concurrent with educational pathways may yield additional insights, but this level of analysis would require extensive, detailed histories of smoking and binge drinking behavior unavailable in the NLSY97. Fifth, recent investigations suggest opioid drug use is contributing to widening educational disparities in mortality among Whites (Case and Deaton 2015); however, the NLSY97 did not collect specific information about opioid or prescription drug use so we were unable to consider this important health behavior in our study. Finally, our study includes one birth cohort in the United States and, as such, we can only make inferences to this birth cohort. The transition to adulthood, however, is historically bound. Indeed, there is greater variation in the transition to adulthood during periods of rapid social change (Rindfuss 1991) suggesting that more recent birth cohorts could experience even greater individuation in their educational pathways than that experienced by the NLSY97 cohort.

Conclusion

College exposes students to knowledge, skills, social norms, environments, and networks that may facilitate or prevent engagement with certain health behaviors. Our results show that the association between a college education and health behavior is contingent upon the timing of college enrollment and the timing of degree attainment. Thus, public policies to reduce the prevalence of daily smoking and binge drinking among U.S. young adults may need to take into account heterogeneity in educational pathways to be most effective. For example, anti-smoking policies directed at contexts beyond the college environment may be important for reducing smoking among young adults who follow “non-normative” educational pathways. On the other hand, a sustained effort to develop and implement university policies and programs will be particularly important for reducing the high rates of binge drinking among young adults who enroll in college immediately after high school. Given that education's association with U.S. adult health and mortality has strengthened in recent decades (Hayward et al. 2015; Sasson 2016), heterogeneity in educational pathways needs to be explicitly measured, examined, and taken into account in both the scientific and policy arenas.

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Table 1

Description of how educational pathways were categorized and defined

	Highest Degree	College Enrollment	Immediate Enrollment	Delayed Enrollment	On-time Degree	Delayed Degree
Pathway 1	Bachelor's	Yes	Yes		Yes	
Pathway 2	Bachelor's	Yes	Yes			Yes
Pathway 3	Bachelor's	Yes		Yes		
Pathway 4	Associate's	Yes	Yes		Yes	
Pathway 5	Associate's	Yes	Yes			Yes
Pathway 6	Associate's	Yes		Yes		
Pathway 7	High School Diploma	Yes				
Pathway 8	High School Diploma	No				
Pathway 9	GED/No degree	Yes				
Pathway 10	GED/No degree	No				

Notes:

College enrollment: Enrolled in college at least once from 1997 through 2011.

Immediate enrollment: Enrolled in college the same year respondent graduated from high school or earned her GED or enrolled in college the year after respondent graduated high school or earned her GED (if graduated high school/earned GED after June).

Delayed enrollment: Enrolled in college the year after respondent graduated from high school or earned her GED (if graduated high school/earned GED in as of June) or two or more years after graduating from high school or earning her GED (if graduated high school/earned GED after June).

On-time degree: Attained a bachelor's degree within 4 years of first college enrollment; attained an associate's degree within 2 years of first college enrollment

Delayed degree: Attained a bachelor's degree after 4 years of first college enrollment; attained an associate's degree after 2 years of first college enrollment

Table 2

Sample characteristics of NLSY97 respondents, n=7,359

	Mean (SE) or %
Health Behavior in Early Adulthood, % ^a	
Binge drinker	34.2
Daily smoker	22.2
Educational Pathways, %	
BA/BS, immediate enrollment and on-time degree	14.4
BA/BS, immediate enrollment and delayed degree	12.4
BA/BS, delayed enrollment	3.5
AA/AS, immediate enrollment and on-time degree	1.1
AA/AS, immediate enrollment and delayed degree	3.4
AA/AS, delayed enrollment	2.9
High school diploma with college enrollment	25.6
High school diploma, no college enrollment	16.9
GED or no degree with college enrollment	4.3
GED or no degree, no college enrollment	15.4
Demographic Characteristics	
Race and Gender, % ^b	
White Men	34.1
Black Men	7.8
Hispanic Men	6.9
Other Men	2.4
White Women	32.8
Black Women	7.6
Hispanic Women	5.9
Other Women	2.4
Age (years) ^a	28.8 (0.02)
Foreign-born, % ^a	4.3
Region of residence, % ^b	
Northeast	18.0
North Central	26.7
South	34.3
West	20.9
Adolescent Experiences	
Parent education (years) ^b	13.6 (0.07)
Parental net worth (\$) ^b	111183.6 (3322.4)
Lived with both biological parents, % ^b	52.6
Delinquency behavior scale ^b	1.4 (0.03)
ASVAB percentile ^c	49.2 (0.64)

	Mean (SE) or %
High school GPA, %	
Mostly Ds and Fs	10.4
Mostly Cs	35.4
Mostly Bs	40.0
Mostly As	14.2
Adolescent binge drinker, % ^d	32.9
Adolescent daily smoker, % ^d	20.6
Married, % ^d	0.6
Had a child, % ^d	3.9
Professional/managerial job, % ^d	2.7
Characteristics in Early Adulthood ^a	
Married, %	39.2
Any child in the household, %	49.8
Professional/managerial occupation, &	26.4
Household income (\$)	67776.6 (974.0)
Pregnant at time of interview, %	2.7

Notes:

^aMeasures collected in 2011.

^bMeasure collected in 1997.

^cArmed Services Vocational Aptitude Battery Math and Verbal Percentile Score.

^dPrior to age 18.

Table 3Bivariate associations (% or Mean (SE)) between educational pathways and selected key variables, NLSY97, n=7,359 ^a

	1	2	3	4	5	6	7	8	9	10
Health Behavior in Early Adulthood ^b										
Binge drinker, %	40.5	39.6	26.3 *	34.5	30.2 *	33.9	34.1 *	33.2 *	28.9 *	28.4 *
Daily smoker, %	3.9	7.9 *	8.5 *	16.3 *	11.8 *	20.6 *	21.7 *	27.9 *	39.1 *	46.8 *
Adolescent Experiences										
Parent education (years) ^c	15.7	15.1 *	14.7 *	13.2 *	14.0 *	13.5 *	13.4 *	12.4 *	12.8 *	11.8 *
	(0.1)	(0.1)	(0.2)	(0.3)	(0.2)	(0.2)	(0.1)	(0.1)	(0.2)	(0.1)
Parental net worth (\$) ^{c, d}	23.4	16.8 *	14.7 *	11.3 *	12.9 *	6.6 *	9.5 *	6.5 *	4.2 *	4.4 *
	(0.9)	(0.8)	(1.5)	(2.3)	(1.4)	(0.7)	(0.4)	(0.4)	(0.5)	(0.3)
Lived with both biological parents, % ^c	78.0	68.7 *	67.9 *	63.1	62.3 *	43.2 *	49.9 *	47.2 *	29.3 *	28.4 *
Delinquency behavior scale ^c	0.7	0.9 *	1.1 *	1.0 *	1.1 *	1.4 *	1.4 *	1.5 *	2.4 *	2.2 *
	(0.04)	(0.05)	(0.11)	(0.17)	(0.11)	(0.15)	(0.05)	(0.07)	(0.15)	(0.08)
ASVAB percentile ^e	77.3	67.1 *	62.8 *	54.5 *	58.2 *	48.1 *	49.3 *	33.5 *	39.3 *	23.3 *
	(0.7)	(1.0)	(2.0)	(2.6)	(1.8)	(2.0)	(0.8)	(0.9)	(1.7)	(0.8)
High school grades, %										
Mostly Ds and Fs	0.2	0.6	1.6	2.9	3.8	7.7	4.6	11.7	30.5	35.1
Mostly Cs	6.4	17.2	29.5	28.9	29.4	41.3	42.5	50.2	43.0	49.0
Mostly Bs	46.2	57.2	53.8	60.5	53.2	45.5	44.9	34.2	22.7	14.7
Mostly As	47.2	25.0	15.1	7.7	13.6	5.5	8.0	3.9	3.8	1.2
Adolescent binge drinker, % ^f	26.3	26.7	31.8	29.7	22.3	32.9	31.2 *	34.9 *	46.9 *	43.3 *
Adolescent daily smoker, % ^f	4.6	6.8	12.2 *	12.0	12.0 *	22.7 *	17.0 *	23.9 *	47.6 *	45.6 *
Married, % ^f	0.2	0.2	0.4	0.2	0.1	0.1	0.1	0.3	1.9	2.1 *
Had a child, % ^f	0.1	0.5	1.1	0.6	1.7 *	2.6 *	2.3 *	3.3 *	14.8 *	11.9 *
Professional/managerial job, % ^f	4.0	4.4	2.1	1.6	4.3	2.2	2.9	1.3 *	1.6 *	1.1 *
Characteristics in Early Adulthood ^b										
Married, %	51.3	41.5 *	42.6 *	51.7	46.9	45.5	37.2 *	39.1 *	28.4 *	28.1 *

	1	2	3	4	5	6	7	8	9	10
Any child in the household, %	33.0	33.0	32.5	53.6 [*]	43.4 [*]	54.7 [*]	52.9 [*]	60.1 [*]	63.8 [*]	62.5 [*]
Professional/managerial, %	66.7	56.0 [*]	51.4 [*]	23.5 [*]	28.6 [*]	23.9 [*]	14.4 [*]	8.0 [*]	8.1 [*]	5.1 [*]
Household income (\$) ^d	10.1	8.0 [*]	8.0 [*]	9.1	7.6 [*]	6.7 [*]	6.7 [*]	5.8 [*]	5.0 [*]	3.9 [*]
	(0.3)	(0.2)	(0.5)	(1.3)	(0.4)	(0.4)	(0.2)	(0.2)	(0.4)	(0.1)

Notes:

^aColumn headers: (1) Bachelor's degree (immediate enrollment & on-time degree attainment); (2) Bachelor's degree (immediate enrollment & delayed degree attainment); (3) Bachelor's degree (delayed enrollment); (4) Associate's degree (immediate enrollment & on-time degree attainment); (5) Associate's degree (immediate enrollment & delayed degree attainment); (6) Associate's degree (delayed enrollment); (7) High school diploma with college enrollment; (8) High school diploma without college enrollment; (9) GED or no degree with college enrollment; and (10) GED or no degree without college enrollment.

^bMeasures collected in 2011.

^cMeasures collected in 1997.

^dDivided by 10,000.

^eArmed Services Vocational Aptitude Battery Math and Verbal Percentile Score.

^fBefore age 18.

^{*}p<0.05 (pathway 1 is the referent group), two-tailed test

Odds ratios (95% CIs) estimated from logistic regression models predicting smoking and binge drinking in early adulthood, NLSY97, n=7,359^a

Table 4

	Smoking		Binge Drinking	
	Model 1	Model 2	Model 1	Model 2
Educational Pathways				
BA/BS, immed. enroll, on-time deg.	1.00	1.00	1.00	1.00
BA/BS, immed. enroll, delayed deg.	2.05 (1.22, 3.42)	1.93 (1.15, 3.24)	0.92 (0.73, 1.17)	0.92 (0.73, 1.15)
BA/BS, delayed enroll	1.84 (0.87, 3.87)	1.75 (0.85, 3.61)	0.44 (0.30, 0.65)	0.43 (0.29, 0.64)
AA/AS, immed. enroll, on-time deg.	4.23 (1.82, 9.80)	4.14 (1.79, 9.56)	0.67 (0.38, 1.20)	0.75 (0.41, 1.36)
AA/AS, immed. enroll, delayed deg.	2.81 (1.56, 5.07)	2.66 (1.48, 4.78)	0.63 (0.43, 0.92)	0.66 (0.44, 1.00)
AA/AS, delayed enroll	4.28 (2.53, 7.24)	4.06 (2.38, 6.93)	0.69 (0.46, 1.04)	0.78 (0.51, 1.19)
H.S. diploma, college	5.56 (3.56, 8.69)	4.92 (3.12, 7.76)	0.70 (0.54, 0.90)	0.77 (0.59, 1.01)
H.S. diploma, no college	6.77 (4.01, 11.42)	5.98 (3.49, 10.22)	0.65 (0.48, 0.88)	0.75 (0.55, 1.01)
GED / no degree, college	7.46 (4.08, 13.65)	6.28 (3.39, 11.61)	0.49 (0.33, 0.74)	0.55 (0.34, 0.84)
GED / no degree, no college	11.94 (7.11, 20.03)	10.07 (5.89, 17.24)	0.50 (0.36, 0.69)	0.57 (0.40, 0.80)
Adolescent Experiences				
Parent education (years)	0.99 (0.95, 1.03)	0.99 (0.95, 1.03)	1.01 (0.98, 1.04)	1.00 (0.97, 1.03)
Parental net worth (\$) ^c	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Lived with both biological parents ^b	0.84 (0.72, 0.98)	0.86 (0.74, 1.01)	0.97 (0.84, 1.12)	0.96 (0.83, 1.11)
Delinquency behavior scale	1.03 (0.98, 1.07)	1.02 (0.98, 1.07)	1.03 (0.99, 1.07)	1.03 (0.99, 1.06)
ASVAB percentile ^d	1.02 (0.98, 1.06)	1.03 (0.99, 1.07)	1.07 (1.04, 1.11)	1.06 (1.03, 1.09)
High school grades				
Mostly Ds and F's	1.12 (0.85, 1.48)	1.11 (0.84, 1.47)	1.05 (0.83, 1.32)	1.04 (0.82, 1.31)
Mostly Bs	1.09 (0.88, 1.34)	1.08 (0.88, 1.34)	1.16 (0.98, 1.37)	1.15 (0.98, 1.36)
Mostly As	0.72 (0.54, 0.96)	0.74 (0.55, 0.99)	0.81 (0.65, 1.01)	0.81 (0.64, 1.01)
Adolescent binge drinker ^b	1.00 (0.83, 1.20)	1.00 (0.83, 1.20)	1.87 (1.62, 2.17)	1.86 (1.60, 2.15)
Adolescent daily smoker ^b	5.71 (4.71, 6.93)	5.70 (4.71, 6.90)	1.21 (1.01, 1.45)	1.21 (1.01, 1.45)
Married before 18 ^b	0.70 (0.26, 1.90)	0.62 (0.52, 0.74)	0.48 (0.14, 1.66)	0.50 (0.15, 1.66)
Had a child before 18 ^b	0.87 (0.60, 1.27)	0.89 (0.60, 1.31)	0.80 (0.56, 1.15)	0.87 (0.60, 1.25)
Professional/managerial job before 18 ^b	1.09 (0.64, 1.85)	1.12 (0.66, 1.89)	0.67 (0.46, 0.98)	0.66 (0.46, 0.96)

	Smoking		Binge Drinking	
	Model 1	Model 2	Model 1	Model 2
Characteristics in Early Adulthood				
Married ^b		0.62 (0.52, 0.74)		0.65 (0.56, 0.75)
Any child in the household ^b		1.09 (0.91, 1.31)		0.70 (0.61, 0.80)
Professional/managerial ^b		0.87 (0.67, 1.11)		1.13 (0.97, 1.33)
Household income (\$) ^c		0.99 (0.98, 1.01)		1.02 (1.01, 1.03)

Notes:

^a All models control for race/ethnicity and gender, age, nativity, pregnancy status, and region in 1997.

^b reference categories: lived in any other family structure, earned mostly C's, non-smoker/occasional smoker before 18, non-binge drinker before 18, non-married before 18, no child before 18, not in a professional/managerial occupation before 18, non-married, no children in household, and other occupation.

^c Divided by 10,000.

^d Armed Services Vocational Aptitude Battery Math and Verbal Percentile Score; divided by 10.