Alcohol and Cigarette Use From Ages 23 to 55: Links With Health and Well-Being in the Long-Term National Child Development Study

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ABSTRACT. Objective: Using longitudinal data from the National Child Development Study, an ongoing study of a nationally representative British cohort born in 1958 ($n = 9,137$; 51% female), we examined how patterns of alcohol and cigarette use from young adulthood (age 23) to midlife (age 55) are associated with health and well-being. **Method:** We first used a nonparametric multilevel latent class specification to identify eight unique paths of alcohol and cigarette use from ages 23 to 55, and then assessed how these long-term latent paths related to overall health, heart problems, chronic illness, and quality of life at midlife. **Results:** Results show that adults who consistently drank within current U.K. low-risk guidelines (i.e., not exceeding 14 units of alcohol per week) and abstained from smoking from young adulthood to midlife reported the best overall health and well-being compared with latent paths

involving steady, light to moderate drinking and both current and prior smoking, increasing drinking and smoking, and infrequent drinking/abstention. **Conclusions:** British adults who consistently drank within new lower risk guidelines and abstained from smoking from young adulthood to midlife reported the best overall health and well-being across numerous indicators. However, apparent observed health benefits of stable low-dose alcohol use (vs. abstention) are weakened by the fact that by age 55 almost all alcohol “abstainers” in the National Child Development Study sample were former drinkers, and that respondents who followed infrequent drinking/abstention paths were the mostly likely to report poor health, psychological distress, and low educational qualifications in early adulthood. (*J. Stud. Alcohol Drugs*, 78, 394–403, 2017)

HEAVY ALCOHOL AND CIGARETTE USE are leading causes of chronic health problems and early death (Lim et al., 2012; Rehm et al., 2003, 2009; U.S. Department of Health and Human Services, 2010). Light to moderate alcohol users, but not light smokers, evidence lower rates of morbidity and mortality compared with abstainers. The notion that light to moderate alcohol users are healthier and live longer than abstainers attracts considerable media attention (Carroll, 2015) and is reflected in some health guidelines (e.g., U.K. Department of Health, 2016). However, mechanisms underlying observed health benefits of light to moderate alcohol consumption remain unclear and controversial (Chikritzhs et al., 2015; Fekjaer, 2013; Gunzerath et al., 2004; Power et al., 1998; Stockwell et al., 2016), particularly in light of elevated risk for major diseases such as cancer (Bagnardi et al., 2015; Connor, 2017).

Why do alcohol abstainers exhibit poorer adult health than light to moderate drinkers? At least three explanations have been proposed, other than a lack of alcohol being

harmful. First, compared with light to moderate drinkers, alcohol abstainers may appear to have poorer physical and mental health because some are former dependent or heavy drinkers, former drinkers who quit because of poor health, or individuals with long-term chronic illness. Cross-sectionally, both lifetime and recent alcohol abstainers are more likely to report limiting long-standing illness or poor health compared with current drinkers (Liang & Chikritzhs, 2011; Ng Fat & Shelton, 2012). Recent longitudinal analyses using the National Child Development Study (NCDS) show that respondents with limiting long-standing illness had increased odds of being a lifetime alcohol abstainer, former drinker, or special occasion-only drinker (Ng Fat et al., 2014, 2015). Thus, health differences between light to moderate drinkers and abstainers may result not from health benefits of low alcohol use but because abstainers are biased toward poor health (Stockwell et al., 2016). Cross-sectional or longitudinal analyses that fail to consider selection, such as on prior health and long-term drinking patterns, risk misattributing deleterious health outcomes to alcohol abstention.

Second, alcohol abstainers may systematically differ from light to moderate drinkers in other powerful risk factors that are true causes of their poor health. In particular, drinkers are likely to be smokers, and vice versa, especially during young adulthood (Bachman et al., 1997; Jiang & Ling, 2013; Ng Fat & Shelton, 2012). Among former heavy drinkers who smoked in young adulthood, poor health later in life may be partly caused by harmful effects of even light and infrequent smoking. Given nicotine’s addictive power (U.S. Department

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of Health and Human Services, 2010), alcohol abstainers who are “sick quitters” may find it especially difficult to also abstain from smoking, in turn exacerbating later health problems. Health benefits from low-dose alcohol consumption may also be negated by current (or prior) smoking. Low educational attainment is an additional risk factor that is strongly linked to smoking, alcohol abstention, heavy drinking, and poor health (Jefferis et al., 2007; Staff et al., 2008; Woolf & Aron, 2013). Studies that fail to account for the negative impact of smoking and low educational attainment on health may incorrectly attribute the health benefits of light to moderate drinking to physiological effects of the alcohol itself.

Last, health differences between alcohol abstainers and light to moderate drinkers may result from misclassifying infrequent drinkers as abstainers (Fillmore et al., 2007; Stockwell et al., 2016). In a recent meta-analysis, Stockwell and colleagues (2016) found no differences in mortality risk between occasional and light to moderate drinkers, suggesting that even very infrequent drinkers should be distinguished from abstainers when assessing the health benefits of alcohol abstention.

In the present study, heavy drinkers were hypothesized to evidence the least positive health outcomes, and abstainers were hypothesized to show significant but smaller decrements in health and well-being, both relative to light to moderate drinkers. Following recommendations of scholars questioning the quality of evidence for beneficial health impacts of light to moderate alcohol use (e.g., Chikritzhs et al., 2015; Stockwell et al., 2016), we (a) assessed relationships of longer term patterns of alcohol use with health and well-being; (b) controlled for existing health and educational differences between drinking groups and other likely confounders; (c) better accounted for complex, over-time links between alcohol and cigarette use, as well as harmful effects of prior smoking; and (d) conducted more fine-grained comparisons differentiating light to moderate alcohol users from infrequent users and abstainers. In summary, analyses examine links of drinking and smoking patterns across adulthood with health, focusing on alternative explanations for prior findings showing lower morbidity among light to moderate drinkers than abstainers. Using nationally representative, longitudinal data from the NCDS, multilevel latent class methods modeled both the precursors and health impacts of long-term patterns of alcohol and cigarette use from young adulthood to midlife.

Method

Participants

The NCDS focuses on all those living in Britain born in one week in March 1958. Following initial assessment of 17,415 infants (99% of births), the cohort was assessed at

ages 7, 11, 16, 23, 33, 42, 46, 50, and 55 years. Immigrants born the same week were added at ages 7, 11, and 16 (Power & Elliott, 2006). Participation has remained high across decades, with 9,137 respondents taking part at age 55 (58% of respondents not lost to death or migration and 83% of the targeted sample for that wave; Johnson & Brown, 2015). Survey retention rates for these years ranged from 76% at age 23 to 58% at age 55. Unlisted analyses reveal that attrition by age 55 was more likely among men, non-Whites, and respondents from disadvantaged social backgrounds at birth (e.g., low parental social class, unmarried or teenage mother, prenatal tobacco exposure, living in social or rented accommodation). Analyses include the 9,137 respondents who completed the age 55 survey, with a focus on reports of health at ages 23 and 55 as well as alcohol and cigarette use at ages 23, 33, 50, and 55. As we describe more fully in the *Analytical strategy* section, we used multiple imputation to address item-missing data in regression analyses.

Measures

Health outcomes. To gain a broader understanding of alcohol and cigarette use consequences, we assessed multiple dimensions of health in midlife. At age 55, respondents were asked if they had any non-temporary heart problems or any long-term physical or mental health conditions or illnesses lasting or expected to last 12 months or more (both coded 1 = *yes*, 0 = *no*). Respondents also reported whether they had poor overall health on a 5-point scale from *excellent* to *poor*. Last, an additive measure of quality of life at age 55 was based on six 4-point items ($\alpha = .79$), such as *feel left out of things* and *feel full of energy these days*. Higher scores indicate greater control and self-realization (Wiggins et al., 2008).

Alcohol and cigarette use. At ages 23, 33, 50, and 55 respondents were asked, “How often do you have an alcoholic drink of any kind?” Those reporting drinking more than once per month indicated the number and type of drinks consumed the previous week. To index standard U.K. units of alcohol consumed, we summed across drinks (one unit equals a half pint of beer, small glass of wine, standard pub measure of spirits [25 ml], or small glass of vermouth or sherry [50 ml]). Based on new U.K. Department of Health (2016) recommendations defining a low-risk-drinking threshold of not drinking regularly more than 14 units of alcohol per week for both men and women, we created five mutually exclusive categories at each wave: (a) never nowadays; (b) less than once per month or only on special occasions; (c) more than once a month but 0 units in the past week; (d) light to moderate drinking not exceeding low-risk guidelines (≤ 14 units); and (e) drinking that exceeds these guidelines (> 14 units). Categories a, b, and c represent variations in abstinence that may have different links with health. Assessments of alcohol use in the 40s were not included in

TABLE 1. Descriptive statistics ($N = 9,137$)

Variable	<i>M</i> or %	<i>SE</i>	Variable range	% Imputed
Self-reported health, age 55				
Heart problems	6%			1%
Longer term illness	33%			1%
Poor overall health	2.65	0.01	1–5	1%
Quality of life	3.12	0.01	1–4	1%
Background variables, age 23				
Poor health	1.62	0.01	1–4	14%
Psychological distress	1.14	0.02	0–9	15%
Educational attainment				18%
No qualification	10%			
NVQ1 (CSE 2–5)	13%			
NVQ2 (O levels)	36%			
NVQ3 (A level)	19%			
NVQ4 (Higher qualifications)	11%			
NVQ5 (Degree or higher)	11%			
Male (vs. female)	49%			0%

Notes: NVQ = National Vocational Qualification; CSE = Certificate of Secondary Education.

analyses because of interviewer coding errors at age 42 and non-equivalent survey questions at age 46.

Assessments of cigarette use at ages 23, 33, 50, and 55 were used to distinguish occasions when respondents were (a) not currently smoking; (b) averaging 1–19 cigarettes per day; or (c) averaging 20 or more cigarettes per day.

Background variables. The prospective design of the NCDS allowed us to control for key risk factors in early adulthood that may be related to both substance use and health in later life. Educational qualifications by age 23 were assessed using Makepeace et al.'s (2003) five-level categorization of National Vocational Qualification (NVQ) levels. Overall health was measured on a 4-point scale from *excellent* to *poor*. Finally, psychological distress was assessed with a nine-item malaise inventory (e.g., depression, anxiety; $\alpha = .70$ to $.77$), based on the Cornell Medical Index (Sacker & Wiggins, 2002). Table 1 provides descriptive statistics for the background variables and health outcomes.

Analytical strategy

Following research that has highlighted the benefits of latent class methods for capturing polysubstance use profiles (Lanza et al., 2010; Tomczyk et al., 2016), we first used multilevel latent class analysis (Vermunt, 2003) to assess how successive combinations of alcohol and cigarette use come together in distinct configurations from ages 23 to 55 (i.e., latent paths), and we then assessed how these latent paths relate to health and well-being in young adulthood and midlife.

More specifically, our analyses strategy proceeded in three steps. (a) Multilevel latent class analysis was used to generate a set of latent variables capturing probabilistic profiles of alcohol and cigarette use at each age (i.e., within-age Level 1 patterns), and a set of latent variables assessing patterns of

movement between such profiles over time (across-age Level 2 patterns). Following Macmillan and Eliason (2003), as well as recent research (Eliason et al., 2015; Vuolo et al., 2014), we estimated a nonparametric multilevel latent class specification in Latent GOLD (Vermunt & Magidson, 2015) to assess the number of unique latent paths (based on fit statistics) and estimates of expected distributions of respondents in each path. We then used a modal prediction rule to group respondents into latent paths (Clogg, 1995); that is, each respondent was assigned to the path with the largest posterior membership probability. (b) Next, to examine the precursors of alcohol and cigarette use paths, gender, educational attainment, and age 23 health were included in multinomial regression models predicting path assignment. (c) Last, we estimated a series of regression models examining how the paths distinguished the age 55 health outcomes. To address item-missing data among the 9,137 respondents who completed the age 55 survey (which ranged from 0% for gender to 18% for age 23 educational attainment), we used the *mi* command in STATA (StataCorp LP, College Station, TX) to first impute 10 data sets using chained regressions, and then to combine estimates and adjust standard errors across the 10 data sets.

Results

Long-term patterns of substance use and their early adulthood precursors

A series of multilevel latent class models was generated with up to nine latent classes at Level 1 (within-age patterns of alcohol and cigarette use) and up to nine paths at Level 2 (across-age patterns). Appendix A lists Bayesian information criterion (BIC) statistics for the full series of latent class analyses; the model with the lowest BIC (in bold italics)

had eight latent classes at each age of observation (Level 1) and eight latent across-age patterns (Level 2). Although not shown in Appendix A, the model with the lowest BIC also had acceptable levels of entropy and classification errors (.85 and .09, respectively).

In Appendix B, we display the probabilities of the observed alcohol and cigarette use for each of eight substance use configurations (Level 1), as well as the probabilities of the substance use configurations by age for each latent across-age path (Level 2). Our primary focus is on how alcohol and cigarette use behavior at ages 23, 33, 50, and 55 is embedded in each of the eight latent across-age paths. To best illustrate these paths, we followed other researchers (Eliason et al., 2015; Macmillan & Eliason, 2003; Vuolo et al., 2014) and used the Level 1 and Level 2 probabilities to calculate changes in the probabilities of substance use by age within each latent path. These calculated probabilities for the eight latent paths are depicted in Figure 1 (steady light to moderate drinking), Figure 2 (increasing drinking), and Figure 3 (decreasing drinking). More specifically, the lines in the figures represent predicted probabilities of levels of alcohol and cigarette use at ages 23, 33, 50, and 55 among respondents in each latent path. To ease interpretation, only lines with predicted probabilities above .20 for nearly all of the four waves are displayed; Appendix C presents the full set of calculated predicted probabilities.

Steady light to moderate drinking with varied smoking probabilities. Paths 1, 2, and 3, shown in Figure 1, encompass steady, light to moderate drinking from young adulthood to midlife but differ in the over-time predicted probability of smoking. Respondents in Path 1, comprising about 37% of the sample, had steady and high predicted probabilities of both light to moderate drinking and not smoking. Path 2, involving only about 5% of respondents, was also characterized by a high predicted probability of light to moderate drinking at all waves. However, Path 2 respondents also had a relatively high and steady probability of light smoking (i.e., 1–19 cigarettes per day). Finally, Path 3 respondents (about 9% of sample) also maintained a steady predicted probability of light to moderate drinking. However, in comparison to Paths 1 and 2, the predicted probability of not smoking in Path 3 increased dramatically over time, rising from near zero at age 23 to close to 1.0 by age 55.

What background factors distinguish the three paths characterized by steady light to moderate drinking? Table 2 presents odds ratios from a multinomial regression model predicting the latent paths based on age 23 poor overall health, psychological distress, educational attainment, and gender. Path 1 served as the reference category because it is the most common and hypothesized to be healthiest. Compared with steady light to moderate drinkers who did not smoke (Path 1), light to moderate drinkers who were current (Path 2) or former (Path 3) smokers were more likely to have poor health and less education at age 23. Men were

FIGURE 1. Latent paths of alcohol and cigarette use from ages 23 to 55: Steady, light to moderate drinking (LM). To simplify presentation, lines with consistently low predicted probabilities are not shown in the Figure. UPW = Standard U.K. alcohol units in the past week. CPD = cigarettes per day.

also more likely than women to follow Path 3 compared with Path 1. In unlisted analyses, the background variables did not significantly distinguish light to moderate drinkers who consistently smoked versus those who later quit (Paths 2 vs. 3).

Increasing drinking with varied smoking probabilities. Paths 4 and 5, shown in Figure 2, capture respondents who showed increasing drinking from ages 23 to 55 but differed in smoking behavior. Path 4 (about 7% of respondents) was characterized by increased predicted probabilities of heavy drinking across adulthood. The probability of heavy smoking (i.e., ≥ 20 cigarettes per day) decreased but remained at roughly 1 in 2 at midlife. Path 5 respondents (about 18%) showed dramatic shifts away from light to moderate alcohol use at ages 23 and 33 to use that exceeded the new U.K.

FIGURE 2. Latent paths of alcohol and cigarette use from ages 23 to 55: Increasing drinking. To simplify presentation, lines with consistently low predicted probabilities are not shown in the figure. UPW = Standard U.K. alcohol units in the past week. CPD = cigarettes per day.

FIGURE 3. Latent paths of alcohol and cigarette use from ages 23 to 55: Decreasing drinking. To simplify presentation, lines with consistently low predicted probabilities are not shown in the figure. UPW = Standard U.K. alcohol units in the past week. CPD = cigarettes per day.

TABLE 2. Multinomial regression estimates of long-term paths of drinking and smoking

Variable	Path 1: Steady light to moderate drinking and no smoking (ref. path)		Path 2: Steady light to moderate drinking and light smoking		Path 3: Steady light to moderate drinking and former smoking		Path 4: Increasing drinking and decreasing heavy smoking	
	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
Background variables (age 23)								
Poor health			1.29**	[1.08, 1.54]	1.41***	[1.23, 1.63]	1.55***	[1.30, 1.86]
Psychological distress			1.15***	[1.07, 1.24]	1.15***	[1.08, 1.22]	1.22***	[1.14, 1.31]
Educational attainment (ref. = NVQ2, O levels)								
No qualification			2.03***	[1.44, 2.85]	1.71***	[1.28, 2.29]	2.57***	[1.89, 3.49]
NVQ1 (CSE 2-5)			1.34	[0.99, 1.81]	1.24	[0.97, 1.59]	1.73***	[1.31, 2.27]
NVQ3 (A level)			0.75	[0.53, 1.06]	0.63***	[0.48, 0.83]	0.51***	[0.37, 0.70]
NVQ4 (Higher qualifications)			0.61*	[0.41, 0.92]	0.51***	[0.37, 0.69]	0.52***	[0.36, 0.75]
NVQ5 (Degree or higher)			0.30***	[0.18, 0.49]	0.50***	[0.36, 0.69]	0.20***	[0.11, 0.34]
Male (vs. female)			1.05	[0.85, 1.28]	1.73***	[1.47, 2.04]	2.66***	[2.20, 3.21]
	Path 5: Increasing drinking and no smoking		Path 6: Decreasing drinking and no smoking		Path 7: Increasing abstaining and no smoking		Path 8: Decreasing drinking and smoking	
	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
Background variables (age 23)								
Poor health	1.00	[0.89, 1.11]	1.22***	[1.08, 1.37]	1.42***	[1.17, 1.72]	1.58***	[1.34, 1.87]
Psychological distress	1.02	[0.96, 1.08]	1.07*	[1.01, 1.13]	1.09*	[1.00, 1.19]	1.20***	[1.13, 1.28]
Educational attainment (ref. = NVQ2, O levels)								
No qualification	0.70*	[0.51, 0.95]	1.69***	[1.27, 2.25]	2.95***	[1.96, 4.44]	4.10***	[3.04, 5.53]
NVQ1 (CSE 2-5)	0.77	[0.57, 1.04]	1.42**	[1.11, 1.81]	1.10	[0.70, 1.74]	1.89***	[1.43, 2.48]
NVQ3 (A level)	0.98	[0.81, 1.20]	0.78	[0.60, 1.02]	1.07	[0.76, 1.51]	0.49***	[0.34, 0.70]
NVQ4 (Higher qualifications)	0.83	[0.66, 1.05]	0.72**	[0.57, 0.90]	0.80	[0.52, 1.21]	0.34***	[0.22, 0.53]
NVQ5 (Degree or higher)	1.14	[0.94, 1.39]	0.40***	[0.29, 0.55]	0.65	[0.41, 1.03]	0.11***	[0.05, 0.23]
Male (vs. female)	3.77***	[3.29, 4.32]	0.66***	[0.57, 0.77]	0.70**	[0.55, 0.89]	0.87	[0.72, 1.06]

Notes: Sample size = 9,137 (10 imputed data sets). OR = odds ratio; CI = confidence interval; ref. = reference; NVQ = National Vocational Qualification; CSE = Certificate of Secondary Education.

* $p < .05$; ** $p < .01$; *** $p < .001$.

guidelines at ages 50 and 55. In contrast to Path 4, the predicted probability of not smoking in Path 5 began high and approached 1.0 by age 55. Turning to Table 2, Path 4 respondents were more likely to report poor overall health, greater psychological distress, and less education at age 23, compared with Path 1, and to be male. Path 5 was similar to Path 1 in age 23 health and educational attainment, although men were more likely to be in Path 5. Unlisted analyses reveal that Path 4 respondents were more likely than Path 5 respondents to report poor health, psychological distress, and lower educational attainment at age 23 and to be male.

Infrequent drinking and abstention with varied smoking probabilities. The three remaining latent paths, shown in Figure 3, capture respondents with relatively high probabilities of infrequent drinking and alcohol abstention who differed in smoking over time. In Path 6 (about 13%), the predicted probability of light to moderate drinking was only slightly higher than infrequent drinking at age 23. However, by age 55, the predicted probability of infrequent drinking was above .50, the probability of light to moderate drinking declined to about .10, and the probability of exceeding drinking guidelines dropped to near 0. Path 6 respondents had high probabilities of not smoking at all waves. Path 7 respondents (about 4%) had a high probability of not smoking

across adulthood and were increasingly likely to report that they never drink “nowadays.” Path 8 respondents (about 7%) showed declines in both drinking and heavy smoking over time. At age 23, Path 8 respondents engaged in infrequent and light to moderate drinking, as well as light and heavy smoking. By age 55, light to moderate drinking probability declined, although infrequent drinking and smoking continued. Examining multinomial estimates in Table 2, clearly all three infrequent drinking-abstention paths revealed more poor health and psychological distress at age 23 compared with Path 1. Women were more likely than men to follow Paths 6 and 7 compared with Path 1. Educational attainment was especially low among respondents in Path 8.

Patterns of substance use and long-term health

We next examined how multiple indicators of age 55 self-reported health varied by these eight latent paths. In Model 1 of Table 3—with age 23 poor health, psychological distress, educational attainment, and gender being controlled for—respondents in abstention paths (i.e., Paths 6, 7, and 8) were more likely to report heart problems compared with Path 1 respondents. Increasing drinking and heavy smoking (Path 4) and steady light to moderate drinking combined with for-

TABLE 3. Logistic and regression estimates predicting self-reported health measures at age 55 based on long-term paths of drinking and smoking

Variable	Model 1. Age 55 heart problems		Model 2. Age 55 longer term illness		Model 3. Age 55 poor overall health		Model 4. Age 55 quality of life	
	OR	[95% CI]	OR	[95% CI]	<i>b</i>	[95% CI]	<i>b</i>	[95% CI]
Latent paths (ages 23–55)								
Path 1: Steady light to moderate drinking and no smoking	(ref. path)		(ref. path)		(ref. path)		(ref. path)	
Path 2: Steady light to moderate drinking and light smoking	1.35	[0.87, 2.10]	0.99	[0.80, 1.22]	0.19***	[0.10, 0.29]	-0.04	[-0.09, 0.02]
Path 3: Steady light to moderate drinking and former smoking	1.99***	[1.45, 2.75]	1.37***	[1.16, 1.63]	0.17***	[0.09, 0.25]	-0.03	[-0.08, 0.01]
Path 4: Increasing drinking and decreasing heavy smoking	1.57*	[1.09, 2.26]	0.96	[0.79, 1.16]	0.41***	[0.33, 0.50]	-0.15***	[-0.20, -0.10]
Path 5: Increasing drinking and no smoking	1.07	[0.79, 1.43]	1.08	[0.94, 1.24]	0.04	[-0.02, 0.10]	-0.01	[-0.04, 0.03]
Path 6: Decreasing drinking and no smoking	1.70***	[1.26, 2.31]	1.52***	[1.32, 1.75]	0.28***	[0.22, 0.35]	-0.11***	[-0.15, -0.07]
Path 7: Increasing abstaining and no smoking	2.22***	[1.43, 3.44]	1.95***	[1.55, 2.44]	0.38***	[0.27, 0.49]	-0.20***	[-0.26, -0.13]
Path 8: Decreasing drinking and smoking	2.65***	[1.89, 3.71]	2.40***	[2.00, 2.90]	0.74***	[0.65, 0.83]	-0.31***	[-0.36, -0.25]
Background variables (age 23)								
Poor health	1.09	[0.92, 1.29]	1.35***	[1.24, 1.47]	0.30***	[0.26, 0.34]	-0.11***	[-0.13, -0.09]
Psychological distress	1.09*	[1.02, 1.17]	1.11***	[1.07, 1.15]	0.09***	[0.07, 0.10]	-0.09***	[-0.10, -0.08]
Educational attainment (ref. = NVQ2, O levels)								
No qualification	1.23	[0.85, 1.78]	1.09	[0.91, 1.32]	0.22***	[0.14, 0.30]	-0.04	[-0.09, 0.01]
NVQ1 (CSE 2–5)	0.85	[0.59, 1.23]	0.92	[0.78, 1.09]	0.03	[-0.05, 0.11]	-0.01	[-0.05, 0.04]
NVQ3 (A level)	0.97	[0.69, 1.36]	1.01	[0.87, 1.17]	-0.13***	[-0.19, -0.06]	0.00	[-0.03, 0.04]
NVQ4 (Higher qualifications)	1.04	[0.70, 1.57]	1.09	[0.91, 1.31]	-0.13***	[-0.21, -0.05]	0.05	[0.01, 0.09]
NVQ5 (Degree or higher)	0.83	[0.56, 1.24]	1.01	[0.84, 1.21]	-0.23***	[-0.31, -0.15]	0.01	[-0.04, 0.06]
Male (vs. female)	2.01***	[1.64, 2.47]	1.02	[0.93, 1.13]	0.10***	[0.06, 0.15]	-0.09***	[-0.11, -0.06]
Constant	0.02***	[0.02, 0.03]	0.21***	[0.18, 0.25]	1.88***	[1.80, 1.96]	3.50***	[3.45, 3.55]

Notes: Sample size = 9,137 (10 imputed data sets). OR = odds ratio; CI = confidence interval; ref. = reference; NVQ = National Vocational Qualification; CSE = Certificate of Secondary Education.

* $p < .05$; *** $p < .001$.

mer smoking (Path 3) heightened the predicted probability of heart problems. These associations were similar when predicting longer term illness (Model 2), with one exception: Respondents on Paths 1 and 4 did not significantly differ in their risk of midlife heart problems.

When predicting age 55 overall health (Model 3) and quality of life (Model 4), respondents on all three infrequent drinking-abstention paths reported significantly worse health and poorer quality of life in midlife compared with those on Path 1. Steady light to moderate drinking and light smoking (Path 2) as well as former smoking (Path 3) were linked to poor health, as was increasing drinking and decreasing heavy smoking (Path 4). Respondents who increased drinking but did not smoke fared no worse in health and quality of life compared with steady light to moderate drinkers and nonsmokers.

Discussion

Why do alcohol abstainers report worse health in adulthood compared with light to moderate drinkers? Using national multiwave data with consistent measurement over time, we used multilevel latent class methods to assess long-

term links of adult patterns of alcohol and cigarette use with self-rated health and well-being in both early adulthood (age 23) and in midlife (age 55). Of note, we used the new U.K. Department of Health (2016) lower risk alcohol guidelines to define light to moderate drinking.

One explanation for alcohol abstainers' apparent poorer health is that this group is biased toward poor physical and mental health because they include former heavy users, sick quitters, or sick never-drinkers (Stockwell et al., 2016). Multilevel latent class analyses revealed three paths characterized by higher probabilities of alcohol abstention or infrequent drinking, especially by age 50. Respondents reporting poor health and psychological distress at age 23 were more likely than their healthier counterparts to follow an abstention/infrequent drinking path versus a light to moderate path in adulthood. Findings are consistent with the hypothesis that unwell persons may be both less likely to drink and to experience greater morbidity (Shaper, 1990).

Scholars have expressed concern that former drinkers have been misclassified in past research as alcohol abstainers (Fillmore et al., 2007; Greenfield, 2016; Stockwell et al., 2016). In this U.K. cohort born in 1958 and now in midlife, the latent class analyses did not reveal a group of long-term

alcohol abstainers. Furthermore, at age 55 only 157 respondents (1.7%) reported having never consumed alcohol, and 34 (22%) of these self-identified lifetime abstainers had reported drinking in at least one of the previous waves (see also Caldwell et al., 2006). The small number of “true” lifetime alcohol abstainers, coupled with the fact that the vast majority of abstainers in each wave were former drinkers, casts additional doubt on observed health benefits of low-dose alcohol use.

We also considered whether alcohol abstainers report poorer health than light to moderate drinkers because of differences in smoking behavior or education, two powerful predictors of long-term health. Respondents who combined steady light to moderate drinking with smoking abstinence (i.e., Path 1) were the most advantaged educationally at age 23, whereas alcohol abstinence was negatively linked to education, especially among respondents who showed decreasing alcohol use but smoked (Path 8). Although the steady light to moderate drinking and smoking abstinence path displayed the best health at midlife independent of educational differences, steady light to moderate drinking with light smoking was associated negatively with health and well-being, suggesting that smoking may offset possible physiological benefits of low-dose alcohol consumption or serve as a lifestyle indicator of other correlated risk factors for poor health such as physical inactivity, poor diet, obesity, or health care quality. Furthermore, respondents in Path 8—which predicted poor long-term health—had relatively higher predicted probabilities of smoking at age 23 that decreased somewhat over time. Similarly, the National Epidemiologic Survey on Alcohol and Related Conditions found the combination of past-year smoking without past-year drinking to be quite rare (6%) among U.S. adults (Falk et al., 2006). Thus, researchers should consider over-time links of alcohol and smoking behavior across the life course when examining alcohol and health associations in midlife and beyond.

Limitations

Like all studies, our findings have some notable limitations. First, although the NCDS sample was representative of the U.K.-born population in 1958 and is diverse with respect to social class and education, it is homogeneous with regard to ethnicity and to culture. Future research should examine variations across additional population subgroups. Second, the NCDS sample has experienced attrition over the 55 years of observation through death, migration, and nonresponse, with higher rates of attrition among men, non-Whites, and those born into less advantaged households. However, findings remained substantially the same with and without a calculated inverse probability weight (Scharfstein et al., 1999) to account for early life differences in long-term survey retention. Moreover, higher rates of early mortality among

heavy drinkers and abstainers in the NCDS (Evans-Polce et al., 2016) likely make our findings a conservative test of health differences between light to moderate drinkers and abstainers. Third, all data are based on self-reports, although recall bias may be reduced by the short recall windows (i.e., past week) and the repeated assessments across more than 30 years. Last, although we controlled for key sources of selection bias in early adulthood, unobserved early life and time-varying factors in adulthood, such as changes in social support or lifestyle (e.g., diet), remain possible rival sources of residual selection and confounding (Bergmann et al., 2013).

Conclusions

Public debate about healthy, responsible alcohol use and policies on lower-risk-drinking guidelines seeks to rely on solid evidence about potential dangers of abstinence and benefits of light to moderate drinking. Our results suggest that purported health benefits of lower risk light to moderate drinking compared with abstinence are complicated by (a) complex, over-time links of drinking and smoking behavior from young adulthood to midlife; (b) the powerful role of health and education in early adulthood in shaping long-term adult substance use patterns; and (c) a long-term prospective design that revealed a very low percentage of lifetime alcohol abstainers, even in this large, nationally representative data set. Moving forward, alcohol researchers should carefully distinguish true lifetime abstainers from occasional or stable, infrequent low-quantity drinkers as the reference group, especially given the rarity of true lifetime alcohol abstinence and the possibility for underreporting among very low drinking subgroups. Research, health recommendations, and medical practice alike should reflect the importance of substance use patterns across a lifetime rather than over-relying on behavior at a single point in time. For practitioners in substance use prevention, our results stress the important role of poor health and psychological distress in young adulthood shaping long-term substance use patterns through adulthood (i.e., a sick quitter effect). Finally, with important qualifications noted above, our study adds to a growing body of research that questions purported health risks of alcohol abstinence.

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