Considering the age-graded nature of associations between socioeconomic characteristics and smoking during the transition towards adulthood

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ABSTRACT

Young adulthood is a sensitive period characterized by the accumulation of resources and transitions in and out of education, employment, family, and housing arrangements. The association between these characteristics and smoking outcomes likely varies with age yet few studies address its dynamic age-graded nature. To explore this, we examined 2083 young adults ages 18–25 from the 2011–2012 cross-sectional sample of the Montreal-based Interdisciplinary Study of Inequalities in Smoking. We operationalized participants' socioeconomic characteristics using their resources (e.g., education, income, financial difficulties) and transition stages (i.e., studying, working full-time, living arrangements with parents and children, and being in a relationship). We examined differences in these characteristics' associations with occasional and daily smoking across two-year categories (18–19, 20–21, 22–23, and 24–25) using multinomial logistic regression models with age-based interaction terms. Findings highlighted four characteristics, i.e., educational attainment, personal income, student status, and relationship status, with significant differences in associations with smoking outcomes across age categories. Between the age groups of 18–19 and 24–25: 1) the negative association between low educational attainment and daily smoking increased; 2) the positive association between personal income and daily smoking decreased; 3) the negative association between student status and both outcomes decreased; 4) the negative association between relationship status and occasional smoking increased. Findings support that the associations between young adults' socioeconomic characteristics and smoking outcomes vary substantially during the second and third decades of life. Addressing this has critical implications for identifying vulnerable populations and developing appropriate age-based policies in this age group.

1. Introduction

Young adulthood represents a distinct public health target period for intervention (IOM (Institute of Medicine) and NRC (National Research Council), 2014; Public Health Agency of Canada, 2011). As a case example, smoking prevalence is higher among young adults than in any other age group in Canada (Reid et al., 2017). Despite successes among youth and adult populations, smoking initiation and cessation rates in this age group have been stagnating in the last fifteen years (Gagné and Veenstra, 2017; Reid et al., 2017). Smoking is also disproportionately distributed among socially disadvantaged young adults in keeping with their family background, trajectory in education and occupation, and family and housing arrangements (Gagné and Veenstra, 2017; Green et al., 2007; Hammond, 2005). In turn, young adulthood and equity considerations have been considered as two key priority areas for future tobacco control initiatives (Health Canada, 2017; U.S. Department of Health and Human Services, 2012).

Few studies, however, question the implications of the deeply dynamic nature of the transition towards adulthood. In comparison to those who have just turned eighteen, young adults in their third decade of life experience substantially different circumstances with regard to education, employment, family, and housing (Clark, 2007; Vespa, 2017). Despite this, expert reports and peer-reviewed publications tend to examine the unequal distribution of smoking in this age group using average estimates across broad age categories (e.g., 18–29), obfuscating the important and quickly changing processes during this period. These processes hold important implications for our capacity to detect the most vulnerable groups and support appropriate age-based public health policies during this period (IOM (Institute of Medicine), 2015; IOM (Institute of Medicine) and NRC (National Research Council),

2014). A critical issue in understanding the unequal distribution of young adult smoking outcomes, therefore, resides in our capacity to appropriately demonstrate its age-graded distribution.

A large body of work has investigated these age-based changes by focussing on the implication of transition stages for risk-taking behaviour uptake (Green et al., 2017; Pampel et al., 2014; Staff et al., 2010). These include finishing studies, entering full-time employment, leaving parents, establishing relationships, and having children (Clark, 2007; Vespa, 2017). On the one hand, transition stages have been conceptualized as difficult, complex, and stress-inducing events that influence those with the least resources to seek deleterious coping strategies (Green et al., 2017; Staff et al., 2010). On the other hand, transitions stages are also understood to involve the embodiment of adult roles (e.g., worker, spouse, parent) associated with the uptake of beneficial health practices (Bricard et al., 2017; Green et al., 2017; Pampel et al., 2014; Staff et al., 2010).

In both cases the health implications of these transition stages have been shown to depend on their age-graded timing (Bell and Lee, 2006; Bricard et al., 2017; Graham et al., 2006; Green et al., 2017; Pampel et al., 2014; Staff et al., 2010; Wickrama and Baltimore, 2010). Demonstrating this, Wickrama and Baltimore (2010) found in the US that transitions before the median age in education, full-time work, sexual activity, leaving home, cohabitation, and pregnancy were each independently associated with a higher risk of smoking between the ages of 24 and 32. While most studies have focused on the determinants and implications of precocious transitions (Conger et al., 2010; Penman-Aguilar et al., 2013), transitions also negatively influence smoking uptake when they occur later than average. Illustrating this, Pampel et al. (2014) found in the US that young adults who delayed employment after finishing their studies and delayed marriage after having children faced an excess risk of smoking upon ending their third decade of life. In each case, socially disadvantaged young adults are disproportionally likely to experience these transition stages precociously or belatedly (Furstenberg, 2015; Settersten et al., 2005).

These life-course principles extend to the age-graded nature of social inequalities in smoking during young adulthood. To understand how the "SES-smoking" association varies over time, Link and Phelan (2009) proposed that socioeconomic status provides access to different resources (e.g., knowledge, money, power, prestige, and beneficial social connections) reinforcing individuals' capacity to avoid smoking. To operationalize these, studies have predominantly focused on traditional adult indicators such as education and income (Gagné et al., 2018; Schaap and Kunst, 2009). Socioeconomic circumstances, however, are the product of a complex arrangement of individual, contextual, and structural influences, which are poorly captured by using one or few such indicators. Supporting this, Villanti et al. (2017) found in the US that, controlling for educational attainment and household income, full-time employment, perceived financial situation, and parents' education and marital history were each distinct correlates of smoking behaviour.

As young adults become autonomous and begin to accumulate their own resources, we expect the role of most of these characteristics to change in shaping their behaviour. Studies in France, Germany, and the US examined education- and income-based inequalities in smoking across the life-course and found that these increased rapidly towards the end of adolescence and stabilized during the third decade of life (Bricard et al., 2016; Khlat et al., 2016; Pampel et al., 2017; Siegel, 2014). Few studies, however, have examined in finer detail the age-graded nature of the associations between socioeconomic characteristics and smoking during the transition towards adulthood.

1.1. Objective

Social inequalities in smoking are likely to rapidly vary with age as socially disadvantaged young adults face repeated obstacles to transitioning "in time" and accumulating resources into adulthood. This paper seeks to demonstrate the age-graded nature of associations

between socioeconomic circumstances and smoking behaviour in relation to the transition towards adulthood. To do so, we examine differences across two-year categories in the associations of young adults' transition stages and socioeconomic resources with smoking in a large sample of young adults aged 18–25 in Montreal, Canada.

2. Methods

2.1. Data

We analyzed cross-sectional data from the 2011–2012 panel of the Interdisciplinary Study of Inequalities in Smoking (ISIS), a study developed with the objective of better understanding the joint contribution of individual and contextual factors in shaping social inequalities in smoking among young adults in an urban context (Frohlich et al., 2017). Despite having being collected some time ago, this dataset remains relevant to our objective for two main reasons: 1) social inequalities in smoking have remained stable in Canada over the last decade (Canadian Institute for Health Information, 2015); 2) despite the growth of e-cigarette use over the last few years, its use remains rare and is unlikely to have influenced social inequalities in tobacco smoking among Canadian young adults (Lucherini et al., 2019; Reid et al., 2017).

The target population was non-institutionalized young adults aged 18 to 25 living in Montreal, Canada who had resided at their current address for at least one year at the time of the first contact. Ineligibility reasons also included being physically or mentally unfit to fill in the questionnaire and non-fluency in either English or French. Potential respondents were reached via mail and offered four response options (online, by mail, by phone, or in person). Respondents who agreed to participate were offered a $10 gift certificate as financial compensation.

From an initial sample of 6020 randomly selected individuals from the Quebec health insurance program (a comprehensive sample frame used to capture this population), 349 refused to participate, 458 were declared ineligible, and 3111 could not be reached, for a total sample size of 2093 participants. Ninety percent of respondents completed the questionnaire online. Full details on sampling, survey, and questionnaire procedures are available elsewhere (Frohlich et al., 2017). This study received ethics approval from the Université de Montréal health research ethics board.

2.2. Measures

Smoking-related items used in the ISIS questionnaire were taken from standardized questionnaires developed by Statistics Canada and Health Canada. Our main dependant variable is smoking status: 1) non-smoker, 2) occasional smoker, and 3) daily smoker. Respondents were asked whether they currently smoked 'every day', 'occasionally' or 'never'. Non-smokers represent both never smokers and former smokers.

Our main independent variables represent participants' transition stages and socioeconomic resources. To operationalize participants' transition stages, we examined five indicators related to their living arrangements with parents and children, their student status, their full-time employment status, and their relationship status, based on the following questions: "Who do you currently live with?" (with one of or both my parents, Y/N; with my children or my partner's children, Y/N), "Are you currently a student?" (Y/N), "If you are currently in paid employment, are you working full-time?" (Y/N), and "What is your marital status?" (married or in couple, Y/N). The question on employment was preceded by the filter question: "Are you currently in paid employment? This includes full-time work or part-time work, whether you are an employee, self-employed, a freelancer, on contract, in an internship, on vacation, on parental leave, on sick leave or work-accident leave, on strike or lock-out situation".

To operationalize participants' resources, we used nine indicators

related to their education, personal income, financial difficulties, the capacity of their father, mother, friend, and/or partner to provide financial aid in case of emergency, the capacity of their family to provide a job-related contact, and the size of their social support network. Educational attainment was measured asking 'What is the highest diploma you have ever obtained?' and was subsequently divided into two categories: 'High school completed or less' and 'Post-secondary education completed'. Post-secondary education in Quebec includes CEGEP (*Collège d'enseignement général et professionel*), which is an institution that provides mandatory pre-university education or vocational training. We note that it is possible that some 18- and 19-year-old participants had not finished CEGEP, even if they did not experience interruptions, depending on their program.

Personal income was measured by asking participants' income over the last year and was recoded into six categories to prevent outliers (No income, $1 to $4999, $5000 to $9999, $10,000 to $14,999, $15,000 to $19,999, $20,000 or more). Financial difficulties were measured based on three items that asked if participants' household encountered difficulties in paying for rent, utilities, or food in the last year ($\alpha = 0.74$) (Y/N). Participants were categorized as having a father, mother, friend, or partner who could provide money in case of emergency based on the question "If you needed money urgently, could you borrow $500 quickly from the following persons?" (Y/N). Family's capacity to provide a job-related contact was measured by asking "If needed, can anyone in your family put you in contact with people who can help you improve your employment situation?" using a 4-point Likert scale ('Not at all' to 'Most probably'). Social support network size is a continuous score computed as the sum of three items asking participants how many friends they could confide in, could receive help from, and felt close to ($\alpha = 0.74$, range = 0–15).

2.3. Statistical analyses

We used a three-step approach to examine differences in associations between participants' socioeconomic characteristics and smoking status between the ages of 18–19, 20–21, 22–23, and 24–25. First, we estimated a multinomial logistic regression model where we regressed smoking status on the independent variables, controlling also for age and sex. Family's capacity to provide a job-related contact, personal income, and social support network size were modeled as continuous variables. We tested for multicollinearity by regressing a continuous outcome on independent variables and found that VIF values varied between 1.15 (family's capacity to provide a job-related contact) and 1.87 (personal income), supporting that multicollinearity was not likely to be an issue here (Vatcheva et al., 2016). Second, from this base full model, we entered interaction terms with age for each independent variable separately. We did not test the age-based interaction for 'living with children' because an insufficient number of participants (*n* = 51) were living with children to produce reliable estimates. Finally, from each of these interaction models, we estimated their predicted marginal probabilities (Muller and MacLehose, 2014).

Given the large number of independent variables, we used a multiple imputation approach assuming data missing-at-random (MAR) to make full use of the sample. We used Stata's implementation of multiple imputations with chained equations (MICE) to create 20 imputed sets using aforementioned variables (Royston and White, 2011). We restricted our analyses to participants with valid answers on smoking status (*n* = 2083) (Von Hippel, 2007). All analyses were performed using Stata 14 (StataCorp, 2015).

3. Results

3.1. Sample characteristics

Table 1 presents the distribution of participants' smoking status and socioeconomic characteristics. Participants were on average 21.5 years

old (SD = 2.3), with 57% of them being women. With regard to smoking, 13% and 10% of participants were occasional and daily smokers, respectively. Smoking status did not significantly vary across age groups (*p* = .80). The majority of participants' socioeconomic circumstances, however, varied significantly across age groups. Compared to participants ages 24–25, those who were ages 18–19 were more likely to have only finished high school or less (76% vs 19%). Regarding economic resources, those who were ages 18–19 were less likely to have a personal income (81% vs 97%) and to have a friend (31% vs 52%) or a partner (17% vs 43%) from whom they could borrow $500 in case of an emergency. They were also less likely to have experienced financial difficulties in the last year (14% vs 18%). With regard to transition stages, those who were ages 18–19 were more likely to be living with parents (98% vs 53%) and studying (85% vs 47%), and less likely to be working full-time (7% vs 45%), being in a relationship (26% vs 44%), and living with children (0% vs 7%).

3.2. Associations between young adults' socioeconomic circumstances and smoking: average and age-specific differences

Table 2 presents the point estimates (relative risk ratios, RRR) of the associations between participants' socioeconomic characteristics and smoking outcomes. Three characteristics were found to be associated with occasional smoking: 1) having only completed high school or less was associated with 76% higher relative odds of smoking occasionally (95% CI 1.28; 2.43); 2) living with parents was associated with 41% lower relative odds of smoking occasionally (95% CI 0.40; 0.86); 3) living with children was associated with 81% lower relative odds of smoking occasionally (95% CI 0.04; 0.84).

Three characteristics were found to be associated with daily smoking: 1) having only completed high school or less was associated with 226% higher relative odds of smoking daily (95% CI 2.26; 4.68); 2) having experienced financial difficulties in the last year was associated with 79% higher relative odds of smoking daily (95% CI 1.18; 2.73); 3) having a $5000 increase in personal income was associated with 38% higher relative odds of smoking daily (95% CI 1.21; 1.57).

We found significant differences between the associations of two resources and three transition stages with smoking outcomes across age groups. Using ages 24–25 as the reference category, we found statistically significant interaction terms for: 1) educational attainment with daily smoking at 18–19 (*p* = .01); 2) personal income and daily smoking at 18–19 (*p* = .03) and 20–21 (*p* = .03); 3) student status with occasional smoking at 20–21 (*p* < .01) and with daily smoking at 18–19 (*p* = .06); 4) full-time employment status with occasional smoking at 20–21 (*p* = .02) and with daily smoking at 18–19 (*p* = .04); 5) relationship status with occasional smoking at 20–21 (*p* = .02).

Tables 3 and 4 present the predicted marginal probabilities of occasional and daily smoking for these characteristics. For occasional smoking, findings supported age-based differences for student status and relationship status: 1) students at ages 20–21 were 49% less likely to be occasional smokers compared with non-students (*p* = .03); 2) partnered participants at ages 24–25 were 47% less likely to be occasional smokers compared with non-partnered participants (*p* = .01).

For daily smoking, findings supported age-based differences for educational attainment, personal income, and student status. First, the association between post-secondary education and daily smoking increased from a low of a 29% higher risk of being a daily smoker (*p* = .39) at ages 18–19 to highs of 199% (*p* < .001), 99% (*p* = .03), and 269% (*p* < .001) higher risks of being a daily smoker at ages 20–21, 22–23, and 24–25, respectively. Second, the association between personal income and daily smoking (comparing those who made $20,000 or more last year with those with no income) decreased from a high of a 586% higher risk of being a daily smoker (*p* = .007) at ages 18–19 to lows of 502% (*p* = .001), 221% (*p* = .01), and 51% (*p* = .35) higher risks of being a daily smoker at ages 20–21, 22–23, and 24–25, respectively.

Table 1
Sample characteristics. Interdisciplinary Study of Inequalities in Smoking (ISIS), Montreal, Canada, 2011–2012 (n = 2083).

		Whole sample (n = 2083)	Ages 18–19 (n = 541)	Ages 20–21 (n = 515)	Ages 22–23 (n = 527)	Ages 24–25 (n = 500)	Missing
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Outcome	Smoking status						0
	Non-smoker	1606 (77.1)	426 (78.7)	403 (78.3)	401 (76.1)	376 (75.2)	
	Occasional smoker	270 (13.0)	66 (12.2)	62 (12.0)	74 (14.0)	68 (13.6)	
	Daily smoker	207 (9.9)	49 (9.1)	50 (9.7)	52 (9.9)	56 (11.2)	
Demographic	Sex						0
	M	904 (43.4)	**263 (51.4)**	**218 (57.7)**	**206 (60.9)**	**217 (56.6)**	
	F	1179 (56.6)	**278 (48.6)**	**297 (42.3)**	**321 (39.1)**	**283 (43.4)**	
Resources	Educational attainment						9 (0.4)
	High school or less	813 (39.0)	**408 (75.6)**	**185 (36.0)**	**121 (23.0)**	**93 (18.8)**	
	Post-secondary education	1270 (61.0)	**132 (24.4)**	**329 (64.0)**	**405 (77.0)**	**401 (81.2)**	
	Personal annual income						219 (10.5)
	0$	186 (10.0)	**88 (19.0)**	**52 (11.5)**	**30 (6.2)**	**16 (3.4)**	
	$1–$4999	417 (22.3)	**200 (43.1)**	**107 (23.6)**	**73 (15.1)**	**37 (8.0)**	
	$5000–$9999	442 (23.7)	**110 (23.7)**	**149 (32.9)**	**119 (24.6)**	**64 (13.8)**	
	$10,000–$14,999	303 (16.3)	**46 (9.9)**	**85 (18.8)**	**101 (20.9)**	**71 (15.3)**	
	$15,000–$19,999	145 (7.8)	**10 (2.2)**	**34 (7.5)**	**56 (11.6)**	**45 (9.7)**	
	$20,000 or more	371 (19.9)	**10 (2.2)**	**26 (5.7)**	**104 (21.5)**	**231 (49.8)**	
	Financial difficulties in the last year						187 (8.9)
	No	1586 (83.6)	**406 (86.2)**	**388 (86.0)**	**399 (80.8)**	**393 (81.9)**	
	Yes	310 (16.4)	**65 (13.8)**	**63 (14.0)**	**95 (19.2)**	**87 (18.1)**	
	Father's capacity to provide $500 in case of emergency						28 (1.3)
	No	629 (30.6)	156 (29.3)	152 (29.7)	156 (30.2)	165 (33.3)	
	Yes	1426 (69.4)	377 (70.7)	359 (70.3)	360 (67.8)	330 (66.7)	
	Mother's capacity to provide $500 in case of emergency						29 (1.4)
	No	543 (26.4)	148 (27.8)	125 (24.5)	129 (25.0)	141 (28.5)	
	Yes	1511 (73.6)	385 (72.2)	286 (75.5)	387 (75.0)	353 (71.5)	
	Friends' capacity to provide $500 in case of emergency						92 (4.4)
	No	1128 (56.7)	**352 (68.8)**	**287 (58.2)**	**255 (51.0)**	**234 (48.1)**	
	Yes	863 (43.3)	**160 (31.2)**	**206 (41.8)**	**245 (49.0)**	**252 (51.9)**	
	Partner's capacity to provide $500 in case of emergency						144 (6.9)
	No	1358 (70.0)	**417 (83.4)**	**342 (72.0)**	**325 (67.4)**	**274 (56.8)**	
	Yes	581 (30.0)	**83 (16.6)**	**133 (28.0)**	**157 (32.6)**	**208 (43.2)**	
	Family's capacity to provide a job-related contact						149 (7.0)
	Not at all…	234 (12.1)	**45 (9.1)**	**55 (11.3)**	**63 (12.9)**	**71 (15.0)**	
	Not very…	315 (16.3)	**60 (12.2)**	**69 (14.2)**	**94 (19.3)**	**92 (14.2)**	
	Probably	809 (41.8)	**212 (43.1)**	**209 (43.0)**	**190 (39.0)**	**198 (39.0)**	
	Most probably	579 (29.9)	**175 (35.6)**	**153 (31.5)**	**140 (28.7)**	**111 (23.5)**	
	Size of social support network						0
	Mean (SD), range 0–15	10.4 (3.9)	10.2 (3.9)	10.2 (4.0)	10.5 (3.9)	10.6 (3.9)	
Transition stages	Living with parents						106 (5.0)
	No	396 (20.0)	**10 (1.9)**	**49 (9.9)**	**126 (25.5)**	**211 (46.7)**	
	Yes	1581 (80.0)	**525 (98.1)**	**446 (90.1)**	**369 (74.5)**	**241 (53.3)**	
	Studying						22 (1.1)
	No	621 (30.1)	**79 (14.8)**	**105 (20.5)**	**174 (33.5)**	**263 (53.1)**	
	Yes	1440 (69.9)	**456 (85.2)**	**406 (79.5)**	**346 (66.5)**	**232 (46.9)**	
	Working full-time						64 (3.1)
	No	1595 (79.0)	**489 (93.1)**	**450 (90.2)**	**389 (76.7)**	**267 (54.7)**	
	Yes	424 (21.0)	**36 (6.9)**	**49 (9.8)**	**118 (23.3)**	**221 (45.3)**	
	Being in a relationship						4 (0.1)
	No	1427 (68.6)	**400 (74.1)**	**386 (75.1)**	**361 (68.6)**	**280 (56.1)**	
	Yes	652 (31.4)	**140 (25.9)**	**128 (24.9)**	**165 (31.4)**	**219 (43.9)**	
	Living with children						106 (5.0)
	No	1935 (97.4)	**540 (100.0)**	**488 (98.0)**	**484 (97.8)**	**423 (93.4)**	
	Yes	51 (2.6)	**0 (0.0)**	**10 (2.0)**	**11 (2.2)**	**30 (6.6)**	

Differences between bold numbers are statistically significant at the .05 level.

With regard to transition stages, the association between student status and daily smoking was high at ages 18–19, with students being 60% less likely to be daily smokers compared with non-students at this age (p = .01), and subsequently subsided among later age groups. While age-based interaction terms for full-time employment status were statistically significant, the sizable differences associated with occasional smoking at ages 20–21 (20.8% vs 11.7%, p = .15) and with daily smoking at ages 18–19 (18.2% vs 8.3%, p = .10) were not statistically significant. This may be explained in part by the relatively small number of participants in full-time employment at ages 18–19 (n = 36) and 20–21 (n = 49) in this sample.

4. Discussion

This study explores the dynamic nature of the transition to adulthood and its implications for the study of social inequalities of smoking among young adults. One key dimension of this issue is that those in the transition to adulthood face different challenges and role expectations in keeping with the ages at which they navigate milestones and secure resources. Publications tend to use broad age categories to understand health-related outcomes in this age group, thus obfuscating the heterogeneity of experiences during this age period. Even when young adult outcomes are stratified by age, it is rare to find divisions that are

Table 2

Associations between young adults' socioeconomic characteristics and smoking. Interdisciplinary Study of Inequalities in Smoking (ISIS), Montreal, Canada, 2011–2012 (*n* = 2083).

Variable	Occasional smoking				Daily smoking			
	RRR	95% CI	p	Δ age	RRR	95% CI	p	Δ age
Demographics								
Sex								
Man (ref. = woman)	1.14	(0.87; 1.50)			1.26	(0.92; 1.73)		
Age								
18–19 (ref. = 24–25)	0.76	(0.46; 1.25)			1.05	(0.59; 1.87)		
20–21 (ref. = 24–25)	0.90	(0.58; 1.39)			1.42	(0.86; 2.35)		
22–23 (ref. = 24–25)	1.07	(0.73; 1.57)			1.19	(0.76; 1.85)		
Family characteristics								
Father's capacity to provide $500								
Yes (ref. = no)	0.83	(0.60; 1.16)			0.78	(0.54; 1.13)		
Mother's capacity to provide $500								
Yes (ref. = no)	1.12	(0.78; 1.61)			1.07	(0.72; 1.57)		
Family's capacity to provide a job contact								
Continuous (1 – Not at all; 4 – Very probably)	1.08	(0.93; 1.25)			1.15	(0.97; 1.36)		
Individual characteristics								
Educational attainment								
High school or less (ref. = post-*sec*. education)	**1.76**	**(1.28; 2.43)**	***		**3.26**	**(2.26; 4.68)**	***	*
Financial difficulties in the last year								
Yes (ref. = no)	1.07	(0.73; 1.59)			**1.79**	**(1.18; 2.73)**	**	
Partner's capacity to provide $500								
Yes (ref. = no)	0.84	(0.57; 1.23)			0.71	(0.46; 1.08)		
Friends' capacity to provide $500								
Yes (ref. = no)	1.05	(0.78; 1.40)			1.17	(0.84; 1.65)		
Personal annual income								
Continuous (1 – No income; 6 - $20,000 or more)	1.08	(0.97; 1.20)			**1.38**	**(1.21; 1.57)**	***	*
Social network size								
Continuous (1 – No peer; 15–15+ peers)	0.99	(0.95; 1.02)			1.00	(0.96; 1.04)		
Transition stages								
Living with parents								
Yes (ref. = no)	**0.59**	**(0.40; 0.86)**	**		0.85	(0.54; 1.33)		
Studying								
Yes (ref. = no)	0.91	(0.65; 1.28)		**	0.73	(0.50; 1.07)		
Employed full-time								
Yes (ref. = no)	0.83	(0.55; 1.27)		*	1.10	(0.70; 1.74)		*
Being in a relationship								
Yes (ref. = no)	0.82	(0.57; 1.17)		*	1.45	(0.99; 2.14)		
Living with children								
Yes (ref. = no)	**0.19**	**(0.04; 0.84)**	*		0.77	(0.92; 1.73)		

Point estimates are the results of a multinomial logistic regression model on 20 imputed datasets. The reference category represents non-smokers. Bolded coefficients are statistically significant at the .05 level. Additional models were produced separately for each independent variable to test age-based interactions (with three "indicator × age" dummy variables). The "Δ age" columns report whether there was at least one statistically significant interaction term among these additional models.

 *** *p* < .001.
 ** *p* < .01.
 * *p* < .05.

smaller than five years (e.g., ages 15–19, 20–24, 25–29). To explore the contribution of these life-course processes to the distribution of smoking, we examined the age-based variation of associations between socioeconomic characteristics and smoking behaviour between the ages of 18 and 25.

Three trends informed the nuanced role of socioeconomic characteristics on the risk of smoking over the course of this period. First, with financial difficulties and living arrangements with parents, we did not find differences in their association with smoking outcomes between age groups, supporting the idea that some household circumstances are likely to have a consistent influence on the risk of smoking during the first half of the third decade of life.

Second, with educational attainment and relationship status, growing differences in the risk of smoking between age groups suggest that, for some characteristics, we may expect an increase in their contribution to inequalities in smoking with age (Green et al., 2007; Hammond, 2005). Supporting this, Gagné and Veenstra (2017) found in Canada a gradient-like association between educational attainment and

the risk of progressing to daily smoking between the ages of 18 and 25. Studies also suggest that young adults who do not pursue post-secondary education are less likely to quit during this period; results, however, have been inconsistent across studies (Khati et al., 2015; Mendel et al., 2012; Solberg et al., 2007). Similarly, the establishment and maintenance of marital relationships have been associated with positive changes in smoking outcomes in adulthood (Bricard et al., 2017; Green et al., 2017; Pampel et al., 2014). However, the same relationship arrangements might be indicative of precocious transitions around the ages of 18–19 and normative transitions around the ages of 24–25. The changes associated with role expectations and hypothesized to accompany this transition, therefore, might only occur when partnerships are performed "in time" starting in the mid-twenties.

Third, with personal income and student status, we found that some social differences in smoking also rapidly decline between age groups. These findings imply that, for other socioeconomic characteristics, we may expect a decrease in their capacity to inform the unequal distribution of smoking with age. In particular, these findings might reflect

Table 3
Differences in associations between selected characteristics and occasional smoking, by age: predicted probabilities. Interdisciplinary Study of Inequalities in Smoking (ISIS), Montreal, Canada, 2011–2012 (*n* = 2083).

Variable	Full sample		Age 18–19		Age 20–21		Age 22–23		Age 24–25	
	%	*p*	%	*p*	%	*p*	%	*p*	%	*p*
Completed post-secondary education										
No	**15.9**		13.8		14.2		16.7		20.4	
Yes	**11.2**		9.0		11.2		12.8		11.3	
Difference (95% CI)	**4.8 (1.0; 8.5)**	*	4.8 (−1.2; 10.9)		3.0 (−3.1; 9.2)		3.9 (−3.7; 11.6)		9.1 (−0.1; 18.4)	
Personal annual income*										
1 – No income	11.8		11.0		9.0		14.9		12.9	
6 – $20,000 or more	13.7		9.0		16.8		14.3		15.1	
Average difference (95% CI)	0.4 (−0.8; 1.6)		−0.3 (−2.6; 1.8)		1.5 (−0.8; 3.9)		−0.1 (−2.2; 2.0)		0.5 (−1.6; 2.5)	
Studying										
No	13.4		10.4		**20.2**		13.4		12.5	
Yes	12.8		11.4		**10.4**		14.9		15.5	
Difference (95% CI)	−0.6 (−4.3; 3.1)		1.0 (−6.2; 8.1)		**−9.9 (−18.5; −1.2)**	*	1.5 (−5.1; 8.1)		2.9 (−3.5; 9.4)	
Working full-time										
No	13.5		11.7		11.7		15.4		15.5	
Yes	11.3		7.9		20.8		11.6		11.0	
Difference (95% CI)	−2.3 (6.9; 2.3)		−3.9 (−13.2; 5.4)		9.1 (−3.3; 21.4)		−3.9 (−10.9; 3.2)		−4.6 (−10.7; 1.6)	
Being in a relationship										
No	13.8		12.0		12.0		15.0		**17.1**	
Yes	11.1		9.1		14.8		13.5		**9.1**	
Difference (95% CI)	−2.7 (−6.7; 1.2)		−2.9 (−8.7; 2.9)		2.8 (−4.8; 10.4)		−1.5 (−8.5; 5.4)		**−8.0 (−14.2; −1.8)**	*

Percentages are predicted probabilities produced from multinomial logistic regression models with interaction terms with age (i.e., 18–19, 20–21, 22–23, 24–25) on 20 imputed datasets, controlling for age, gender, living with children, and all other independent variables. Models were produced separately for each independent variable. For continuous variables, the "average difference" refers to the average increase in the probability of reporting smoking for a one-unit increase in the independent variable. Bolded coefficients are statistically significant at .05.

  * $p < .05$.

changes in social norms during the transition towards adulthood. For instance, evidence supports an inverse association between income and smoking in the adult population (Casetta et al., 2017), yet a growing number of studies suggest that it is not the case for personal income during young adulthood (Blakely et al., 2014; Pampel et al., 2014). This decline may reflect the rapid change in the consumption practices that follow the end of adolescence, where disposable income is positively associated with smoking (Soteriades and DiFranza, 2003; Tyas and Pederson, 1998). Similarly, we found that studying was associated with lower risks of smoking between the ages of 18 and 21. Across the

Table 4
Differences in associations between selected characteristics and daily smoking, by age: predicted probabilities. Interdisciplinary Study of Inequalities in Smoking (ISIS), Montreal, Canada, 2011–2012 (*n* = 2083).

Variable	Full sample		Age 18–19		Age 20–21		Age 22–23		Age 24–25	
	%	*p*	%	*p*	%	*p*	%	*p*	%	*p*
Completed post-secondary education										
No	**16.1**		14.3		**20.6**		**14.3**		**18.1**	
Yes	**6.4**		11.1		**6.9**		**7.2**		**4.9**	
Difference (95% CI)	**9.7 (6.3; 13.2)**	***	3.3 (−4.2; 10.7)		**13.7 (7.0; 20.4)**	***	**7.0 (0.7; 13.4)**	*	**13.2 (6.1; 20.4)**	***
Personal annual income*										
1 – No income	**4.7**		**3.5**		**4.3**		**5.3**		8.7	
6 – $20,000 or more	**17.9**		**24.0**		**25.9**		**17.0**		13.1	
Average difference (95% CI)	**2.6 (1.5; 3.7)**	***	**4.1 (1.1; 7.0)**	**	**4.3 (1.7; 6.9)**	**	**2.3 (0.6; 4.1)**	*	0.9 (−0.9; 2.7)	
Studying										
No	11.5		**17.6**		15.8		7.7		10.1	
Yes	9.0		**7.1**		10.2		12.2		8.0	
Difference (95% CI)	−2.4 (−5.5; 0.6)		**−10.5 (−18.4; −2.6)**	*	−5.5 (−13.0; 1.9)		4.5 (−0.8; 9.8)		−2.0 (−6.9; 2.9)	
Working full-time										
No	9.6		8.3		11.3		10.2		9.5	
Yes	10.7		18.2		14.3		10.1		8.6	
Difference (95% CI)	1.1 (−2.7; 4.8)		9.9 (−1.9; 21.7)		3.0 (−6.3; 12.3)		−0.1 (−6.1; 5.9)		−0.9 (−5.7; 3.9)	
Being in a relationship										
No	**8.6**		**7.8**		10.8		9.4		8.2	
Yes	**12.4**		**14.4**		14.3		11.6		10.1	
Difference (95% CI)	**3.4 (0.2; 6.6)**	*	**6.6 (0.1; 13.0)**	*	3.5 (−4.3; 11.3)		2.2 (−3.9; 8.2)		1.9 (−3.2; 7.0)	

Percentages are predicted probabilities produced from multinomial logistic regression models with interaction terms with age (i.e., 18–19, 20–21, 22–23, 24–25) on 20 imputed datasets, controlling for age, gender, living with children, and all other independent variables. Models were produced separately for each independent variable. For continuous variables, the "average difference" refers to the average increase in the probability of reporting smoking for a one-unit increase in the independent variable. Bolded coefficients are statistically significant at .05.

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

different institutions in which young adults progress, being a student may provide distinct smoking-related benefits, including through the presence of anti-smoking bans and the lack of smoking accommodations (Fallin et al., 2015). However, these benefits may only appeal to the expectations of younger students and not to older students' wants and needs.

Building on these findings, we suggest that, by not questioning the definition of the exact ages used to study young adult outcomes, researchers are missing the heterogeneity of life-course processes associated with these socioeconomic characteristics and their influence on behavioural uptake. In the context of smoking, we encourage future studies of the mechanisms through which: 1) lack of post-secondary education influences smoking up to the age of 25; 2) income influences smoking up to the age of 21; 3) student status no longer influences smoking after the age of 21; and 4) relationship status influences smoking around the two ages of 18 and 25.

4.1. Limitations

First, we note that our cross-sectional design cannot address the longitudinal processes implied here. It also cannot disentangle reverse causality or unobserved confounding, meaning that we cannot claim causal relations from our results. Second, the relatively low response rate precludes us from claiming that findings are fully representative of the target population. In particular, the sample was found to be slightly more educated than the Montreal average, suggesting that we might have underestimated some of the associations between socioeconomic characteristics and smoking (Frohlich et al., 2017). Additionally, whereas findings may be representative of urban areas similar to Montreal, these may not be generalizable to other regions with substantially different contexts. Finally, we note that our sample size precluded us from appropriately testing the presence of gender-based differences.

5. Conclusion

Young adults are facing elevated risks of encountering multiple health issues after the end of adolescence (IOM (Institute of Medicine) and NRC (National Research Council), 2014; Public Health Agency of Canada, 2011). Our findings add support to the critique of one common practice across public health research on this age group. Understanding how health behaviours such as smoking unequally progress during this period requires integrating their dynamic age-graded nature. Researchers should be encouraged to more systematically address this in future surveillance, evidence synthesis, and policymaking efforts.

Acknowledgments

Declaration of interests

We have no conflict of interest to declare.

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