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Risk factors associated with early smoking onset in two large birth cohorts

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HIGHLIGHTS

- Childhood smoking has been linked to later use and long-term health problems.
- We examined changes in childhood smoking and related risk factors in two cohorts.
- The risk of childhood smoking was 8 times higher among those born in 1970 vs 2001.
- Cohort decline mediated by changes in maternal education and parental/peer smoking.
- Early life disadvantages are more strongly linked to child smoking in 2001 cohort.

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ABSTRACT

We use prospective data from the ongoing British Cohort Study (BCS) and Millennium Cohort Study (MCS) to: 1) document changes in the prevalence of childhood smoking onset; 2) assess whether broad historic shifts in key risk factors, such as maternal education, parental smoking, and peer childhood smoking, explain observed cohort changes in childhood smoking; and 3) evaluate whether inequalities in onset have narrowed or widened during this period. The children in these two studies were born 31 years apart (i.e., BCS in 1970; MCS in 2001), and were followed from infancy through early adolescence ($n = 23,506$ children). Our outcome variable is child self-reports of smoking (ages 10, 11). Early life risk factors were assessed via parent reports in infancy and age 5. Findings reveal that the odds of childhood smoking were over 12 times greater among children born in 1970 versus 2001. The decline in childhood smoking by cohort was partly explained by increases in maternal education, decreases in mothers' and fathers' smoking, and declines in the number of children whose friends smoked. Results also show that childhood smoking is now more linked to early life disadvantages, as MCS children were especially likely to smoke if their mother had low education or used cigarettes, or if the child had a friend who smoked. Although the prevalence of child and adult smoking has dropped dramatically in the past three decades, policy efforts should focus on the increased social inequality resulting from the concentration of early life cigarette use among disadvantaged children.

1. Introduction

Of smokers, approximately 40% start by early to middle adolescence and early initiation is associated with heavier, chronic use and dependence in later adolescence and adulthood, as well as increased morbidity and mortality (Dunstan, 2012; GBD Tobacco Collaborators, 2015; U.S. Department of Health and Human Services [DHHS], 2012). The prevention of childhood experimentation with smoking is of urgent public health importance because so many individuals lose autonomy and develop dependence after smoking for very brief periods of time (Difranza, Savageau, Fletcher, et al., 2007). In the United Kingdom

(UK), smoking is estimated to have cost the health system £5.2 billion and the wider society £96 billion during 2005–2006 (Allender, Balakrishnan, Scarborough, et al., 2009; Nash & Featherstone, 2012). In the United States (US), the economic cost of smoking due to medical care and lost productivity was estimated to be between \$289 and \$332 billion annually from 2009 to 2012 (DHHS, 2014). Smoking among young people is subject to social stratification (Wellman et al., 2016) and is a major source of lifelong health inequalities (Dunstan, 2012).

Importantly, the number of youth who have smoked cigarettes has declined in recent years in the US, UK, and the vast majority of European countries (DHHS, 2012; Fuller, 2015; Johnston, O'Malley,

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Miech, et al., 2017; Kraus, Guttormsson, Leifman, et al., 2016; Scholes, Mindell, & Neave, 2016). Declining rates of youth and young adult cigarette use have been attributed to broad tobacco control efforts focused on making tobacco products less affordable (e.g., increased taxes), less desirable (e.g., marketing restrictions; graphic health warnings on tobacco products; school-based quit programs), and less accessible (e.g., increased smoke-free public spaces; prohibiting sales to minors; GBD Tobacco Collaborators, 2015; DHHS, 2012). Though numerous studies have examined the impact of tobacco control policy efforts on declines in youth smoking (DHHS, 2012; Brown, Platt, & Amos, 2014), less research has examined whether broad shifts in family and peer risk factors have also contributed to overall decreases in childhood cigarette use. Parents and peers feature prominently in theories of youth substance use (Chassin & Hussong, 2009) with empirical support for both sources of influence (Avenevoli & Merikangas, 2003; Leonardi-Bee, Jere, & Britton, 2011; Simons-Morton & Farhat, 2010). In addition to tobacco control efforts, changes over time in how parents and peer influences operate may provide additional explanations for why children currently are less likely to smoke cigarettes compared to children from past cohorts (Green, Leyland, Sweeting, et al., 2016).

Three key demographic changes in particular may help directly explain the decline in childhood smoking or operate as mechanisms of influence between increased tobacco control in later cohorts and youth smoking. 1) *Increases in Maternal Education*. It is well known that female educational accessibility has increased in recent decades in the UK and internationally (Gakidou, Cowling, Lozano, et al., 2010), and cigarette use is inversely correlated with years of education in adults (Giskes et al., 2005). Furthermore, parental education is a consistent predictor of child smoking initiation (Chassin, Presson, Sherman, et al., 1992; Conrad, Flay, & Hill, 1992; Green et al., 2016; Hiscock, Bauld, Amos, et al., 2012; Kandel, Griesler, & Hu, 2015; Staff J, Maggs, Cundiff, and Evans-Polce, 2016; Taylor-Robinson, Wickham, Campbell, et al., 2017). Thus, the risk of youth smoking may have declined partly due to historic increases in maternal education. 2) *Decreases in Parental Smoking*. Children are significantly more likely to smoke if one or more of their parents is a current or even prior smoker (Jackson & Henriksen, 1997; Kandel et al., 2015; O'Loughlin, Paradis, Renaud, et al., 1998; Sylvestre, Wellman, O'Loughlin, et al., 2017; Vuolo and Staff, 2013). Given the substantial drop in rates of adult smoking due to tobacco control efforts, mothers and fathers may be less likely to smoke when they have a young child than in prior generations, reducing the well-established intergenerational transmission risk for offspring use. 3) *Decreases in Peer Smoking*. Children who smoke often report that friends had given them cigarettes (Fuller, 2015), peer influences may be especially important earlier in adolescence (Fuemeller, Lee, Ranby, et al., 2013), and some studies show that friends have a stronger effect on childhood smoking initiation than do parents (Jackson, 1997; Kelly, O'Flaherty, Connor, et al., 2011). Given tobacco control efforts to make tobacco products less affordable, accessible, and desirable to youth in recent years, children today may be less likely to smoke because they do not have any friends who smoke.

When documenting cohort changes in childhood smoking, it is also important to assess whether inequalities in smoking have narrowed or widened in recent cohorts of children. Among UK 11–15 year olds born roughly 1979 to 1997, Green et al. (2016) found that social inequalities indexed by parents' education were maintained across the years 1994 to 2008, though some fluctuations were observed. Wellman et al. (2018), using a 2005 longitudinal sample of 10 year old children in Montréal, Canada, found a higher risk of cigarette initiation among children whose mothers have low education.

In this article, we use nationally representative data from two national birth cohorts in the UK (born in 1970 and 2001) to: 1) replicate prior research showing the substantial decline in childhood cigarette use over the past three decades; 2) assess whether the inclusion of a series of variables capturing cohort changes in parental and peer risk factors (i.e., increases in maternal education coupled with decreases in

parental and peer smoking) mediates cohort differences in the risk of childhood smoking; and 3) evaluate whether inequalities in childhood smoking initiation have changed. These multigenerational, longitudinal datasets are particularly advantageous for addressing these questions for three reasons. First, early life confounders (e.g., sociodemographic background) and mediators (e.g., maternal education, parental cigarette use) were assessed prospectively, which provides appropriate temporal ordering to control for spurious influences with respect to the direction of association, as well as conduct tests of mediation using Karlson, Holm, and Breen's (KHB) method for testing indirect effects in logit models (Breen, Karlson, & Holm, 2013; Karlson, Holm, & Breen, 2012). Second, data were collected directly from mothers, fathers, and children, which reduces potential biases due to children incorrectly reporting their parents' use or older youth misremembering their age of first use. Finally, few prospective studies linking parent and child cigarette use are based on nationally-representative samples (Avenevoli & Merikangas, 2003; Wellman et al., 2016). The large birth cohorts we use here allow us to assess changes in the prevalence of early initiation as well as whether smoking prevalence has become more common or less in certain population subgroups in recent years (Chassin, Presson, Seo, Sherman, et al., 2008; Kandel et al., 2015).

2. Method

2.1. Participants

We rely on two nationally representative birth cohorts: The British Cohort Study (BCS) focuses on all those living in Britain who were born in one week in April 1970. After the initial assessment of 16,571 infants (96% of births), follow-ups were conducted at ages 5, 10, 16, 26, 30, 34, 38, 42, and 46 (Brown & Hancock, 2014). The Millennium Cohort Study (MCS) targeted infants born between September 2000 and January 2002 who were alive and residing in the UK at 9 months of age (Hansen, 2014; Plewis, 2007). Cohort members were selected from a random sample of electoral wards, and wards were oversampled to achieve representation from the four UK countries, economically deprived areas, and areas with high concentrations of racial/ethnic minority families. In total, 18,552 nine-month old children participated (91% of targeted sample). Follow-up surveys occurred at ages 3, 5, 7, 11, and 14, with age 17 data collection in progress in 2018. In both cohorts, multiple sources of data were collected from multiple informants (e.g., parents, teachers, etc.).

In the current study, we rely on self-report surveys from the BCS and MCS children at ages 10–11 years, as well as interview data from their mothers and fathers regarding their socioeconomic background and smoking behavior when the child was an infant and age 5. Since families were not followed past the age of 5 in Northern Ireland in the BCS, for comparability across cohorts we included only children who were born in England, Wales and Scotland in our analyses. In the BCS (MCS) 89% (72%) of children completed the survey at age 10 (11). Prior research in both samples has shown that boys and children from disadvantaged backgrounds were less likely to be retained than girls and more advantaged children (Mostafa, 2014; Mostafa & Wiggins, 2014). Approximately 52% of BCS children are male and 4% were ethnic minority, compared to 50% and 11% of MCS children, respectively. These differences in minority/majority group representation reflect increased immigration to the UK and the sampling strategies used in the two studies.

2.2. Measures

2.2.1. Outcome variable: childhood cigarette use

BCS and MCS children completed confidential self-report surveys in 1980 and 2012, respectively (mean age: BCS = 10.16 years; MCS = 11.16 years), indicating whether they had ever tried a cigarette. For MCS children, lifetime cigarette users included even those children

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