Short report

Do socio-economic gradients in smoking emerge differently across time by gender? Implications for the tobacco epidemic from a pregnancy cohort in California, USA

Katherine M. Keyes [a,b,*], Dana March [a], Bruce G. Link [a,c], Howard D. Chilcoat [d], Ezra Susser [a,b]

[a] Department of Epidemiology, Columbia University, 722 West 168th Street, #720E, New York, NY 10032, USA
[b] New York State Psychiatric Institute, New York, NY, USA
[c] Department of Sociomedical Sciences, Columbia University, New York, NY, USA
[d] Purdue Pharma, Stamford, CT, USA

ARTICLE INFO

ABSTRACT

Understanding current patterns of population smoking by socioeconomic position (SEP) can be substantially enhanced by research that follows birth cohorts over long periods of time, yet such data in the US are rare. Information from birth cohorts followed during critical time periods when the health consequences of smoking became widely known can inform the ways in which current smoking prevalence has been shaped by the historical processes that preceded it. The present study utilizes data from a substudy of the Child Health and Development Study pregnancy cohort ($N = 1612$). Women were queried about smoking status in 1959–1962, 1971–1972 and 1977–1980. Women were divided into three cohorts based on date of birth. Offspring represented another birth cohort assessed for smoking in 1977–1980. Results indicated that the overall prevalence of smoking exhibited cohort-specific patterns that persisted across time. Notably, the youngest maternal cohort (born 1937–1946) had high smoking prevalence throughout and showed no appreciable decrease (44.7%, 41.4%, 40.1% for 1959–1962, 1971–1972, and 1977–1980). Results also indicated that the relation of smoking to SEP exhibited cohort-specific patterns over time. Among the oldest birth cohort (born 1914–1930), no inverse relation of SEP to smoking was observed at any time; in contrast, an inverse relation emerged by 1959–1962 among the youngest cohort of mothers. Among the adolescent offspring, there was a strong SEP gradient (OR = 2.0, 95% CI = 1.4–3.0) that was stronger than in any maternal birth cohort at any assessment ($\beta = 0.40$, SE = 0.1, $p < 0.01$). We conclude that SEP gradients in smoking emerge across birth cohorts rather than time alone, with increasingly strong gradients across time especially among younger cohorts.

© 2012 Elsevier Ltd. All rights reserved.

Introduction

Understanding the health consequences of cigarette smoking has been one of the fundamental undertakings of epidemiologic research in the 20th century (Doll & Hill, 1954; Pearl, 1938), and the magnitude of the adverse effects of cigarette smoking on health continues to unfold (Doll, Peto, et al., 2004; Klebanoff, Levine, et al., 2001). While rates of smoking have declined in many high-income countries over the past thirty years (Pierce, 1989; Pierce, Messer, et al., 2011),a strong gradient in smoking by socioeconomic position (SEP) has simultaneously emerged in the U.S. as well as in many other high-income countries; low SEP is associated with higher probability of smoking (Chilcoat, 2009). Moreover, cigarette smoking in low-income countries is an increasing public health concern (Abdullah & Husten, 2004).

Despite an extraordinary body of research on cigarette smoking, there remain some fundamental gaps in our understanding of how health consequences of smoking arise across gender and socio-economic subgroups. An especially salient gap pertains to changes in cigarette smoking across birth cohorts of women in the 20th century, and the emergence of SEP gradients among women in these birth cohorts. These gaps hamper progress in the field by leaving open the question of how historical processes, policies, and norms shape cigarette consumption. As discussed by Lopez et al. (1994), countries often exhibit a predictable evolution of population-level tobacco use, with women consistently exhibiting lower overall prevalence, a lag in peak prevalence, and a slower

* Corresponding author. Department of Epidemiology, Columbia University, 722 West 168th Street, #720E, New York, NY 10032, USA. Tel.: +1 212 543 5002; fax: +1 212 543 5913
E-mail address: kmk2104@columbia.edu (K.M. Keyes).

decline compared to men.(Lopez, Collishaw, et al., 1994). This is evident in the US (Harris, 1983; National Cancer Institute, 1997) and other countries (Davy, 2006; Kemm, 2001). Data from repeated cross-sectional analyses of women indicate that prevalence of smoking increased among women of low socio-economic position during the 1970s and 1980s, during which time the prevalence of smoking among women with higher education and men with any education were leveling off or decreasing, both in the US (Escobedo & Peddicord, 1996) as well as Finland (Laaksonen, Uutela, et al., 1999) and the UK (Evandrou & Falkingham, 2002). Yet to our knowledge, no longitudinal cohort studies have examined evidence for birth cohort effects in the relation between SEP and smoking explicitly among women, during the pivotal period from 1960 to 1980, when the harmful effects of smoking became widely known.

A better understanding of the historical trends among women is critical for elaborating the implications of smoking for public health, developing policies to reduce smoking, and anticipating future trends in countries where smoking is on the rise. Evidence that rates of smoking initiation are now increasing among young women (Goodwin, Keyes, et al., 2009; Johnston, O'Malley, et al., 2007) further underscores the need to examine gender-specific smoking patterns. The present study utilizes a prospectively assessed sample of women representing various birth cohorts who were observed across 1959–1980 in the US. We use these data to examine trends by age, period, and cohort in cigarette smoking and in gradients by familial resources, as measured by husband's education, as a salient measure of SEP for this time period. Furthermore, to evaluate change across generations, we examine overall smoking prevalence and SEP gradient for the offspring of these women, interviewed in adolescence (age 15–18 years).

Methods

Study population and design

Data are drawn from the Child Health and Development Study (CHDS) (van den Berg, & Christianson, et al., 1988), the first large epidemiologic sample of pregnancies assembled and studied at a single site ($N = 20,754$). The CHDS included more than 95% of pregnant women receiving prenatal care in the Kaiser Permanente Health Plan and residing in the East Bay Area of California from late 1959 to the fall of 1966. A broad range of SEP was represented, similar to that of the East Bay Area at the time of first data collection in 1959–1966, save the extremes (Krieger, 1992). The smoking prevalence among age and birth cohort strata of the CHDS sample were comparable to national averages derived from the NHIS (National Cancer Institute, 1997).

The present study focuses on a subsample of women and children who participated in a baseline survey from 1959 to 1962 and three follow-up assessments into the children's adolescence in 1977–1980 ($N = 1752$). Compared to the full CHDS sample, this subsample included a greater proportion of subjects whose mothers were married and living with a husband at the original intake, who were white, and who were high school graduates; it also includes a smaller proportion of first-born offspring. Detailed information can be found elsewhere (van den Berg, 1984; Keyes, Keyes, et al., 2011). Women who reported abstaining from smoking solely because of pregnancy were excluded ($N = 140$) for a final sample of 1612 women and their children.

Measures

Smoking

Women were queried regarding quantity and frequency of cigarette smoking at the pregnancy interview (1959–1962) and

two follow-up assessments in 1971–1972 and 1977–1980. Self-reported smoking during pregnancy was highly correlated with serum cotinine levels during pregnancy (English, Eskenazi, et al., 1994). Offspring were asked about quantity and frequency of smoking status at the adolescent interview. Individuals were considered current smokers if they reported any use of cigarettes at the time of the interview; pack-a-day smoking was defined as an average of ≥ 20/day.

Socioeconomic position

For a single stable measure of familial SEP that would reflect familial resources, we used husband's education at the baseline interview and categorized it as less than high school($N = 236$), high school($N = 456$), or more than high school($N = 920$). Sensitivity analyses were conducted using alternative measures of familial resources: husband's income [which had reduced power due to substantial missing data of 9.8%] and husband's occupation [manual/non-manual]), and results were unchanged. We chose husband's education over women's own education as an indicator of familial resources because 96.4% of women were married at the baseline survey, and 60.1% reported that they were not involved in an independent career outside the home at the baseline survey. Furthermore, husband's education was remarkably stable across time; e.g., among those with less than a high school education at baseline, 92.7% reported less than a high school education 20 years later, while women's changed substantially over time (women increased educational attainment across the survey waves). Thus husband's education was a more valid and more stable indicator of familial resources than women's education. We recognize, however, that women's education is an important indicator of other dimensions of SEP. Sensitivity analyses using women's educational level are reported in the results.

Birth cohort

Each woman's year of birth was derived by subtracting her current age from the year of the baseline interview (1959–1962) yielding a range of 1914–1945. Using this information we estimated three cohort groups of mothers: 1937–1946, 1931–1936, and 1914–1930, to reflect early (age 15–23), average (age 24–31) and later child-bearing years (age 32–47), respectively. These categories were based on distributions in the data. Because the age ranges of cohorts across surveys were not directly comparable, we conducted sensitivity analyses matching age groups as closely possible across the baseline and final follow-up survey. Women who were <20 at the baseline interview were directly compared to the adolescent offspring (age 15–18); women who were 30–39 and 40–49 at the baseline interview were compared to women ages 30–39 and 40–49 at the 1977–1980 interview, respectively. Women who were 20–29 at baseline or over 50 at the 1977–1980 interview had no comparison group.

Analysis

First, we examined trends in the prevalence of cigarette smoking across ages, periods, and birth cohorts. Next, we examined the relationship between familial SEP and smoking within each cohort at each of the three time periods of assessment, in order to determine whether SEP gradients in smoking emerged across time in a cohort-specific manner. We estimated the odds of smoking compared to a referent category of more than high school education, within each birth cohort at each time period. Analyses controlled for sex, race, age, and maternal smoking at previous time points. Analyses of adolescents additionally controlled for mother's birth cohort. We tested for trend by examining education as a continuous variable predicting the odds of smoking in each