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Smoking initiation among Israeli adolescents: A 24-year time-to-event analysis

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ABSTRACT

Introduction. Preventing smoking initiation will protect future generations from smoking-attributable death and disease. This study examines the correlates and patterns of initiation among Israeli youth using time-to-event analysis and other methods.

Methods. Twenty-four consecutive representative samples (1986–2009) of new military recruits (N = 50,254) were analyzed. Cox regression and Kaplan–Meier analysis were used to identify factors associated with smoking initiation, and logistic regression was used to identify factors associated with smoking status.

Results. The most hazardous age for smoking initiation was seventeen, subsequent to the mean age of smoking initiation (males: 15.7, females: 16.0). Age of initiation and age of greatest hazard for initiation declined among recruits between the years 1986 and 2009. Earlier smoking initiation among boys and girls was significantly associated with low education levels (<12 years) (males: HR = 2.98, CI: [2.79, 3.18]; females: HR = 3.35, CI: [2.96, 3.80]), low paternal education levels, Russian birthplace, and religion. Earlier initiation in boys was associated with high fitness levels and low/medium socio-economic status. Earlier initiation in girls was associated with being Western-born and ever-use of contraception.

Conclusions. Smoking initiation among Israeli youth recruited to the armed forces is associated with individual and family characteristics, particularly low education levels. Time-to-event analysis complements traditional means of understanding smoking initiation by identifying ages at which initiation hazard is high.

Introduction

Tobacco can harm all of its users and kill as many as half (WHO, 2008a). Currently used by a billion people, it is a major cause of premature death and illness throughout the world (WHO, 2008a). Most smokers begin during youth, and are not fully aware of the magnitude of the risk when they initiate smoking (Weinstein, 1998; Weinstein and Klein, 1996). Many smokers want to quit but are unable to (Fiore et al., 2008). In addition to harm from active smoking (US DH&H, 2004), exposure of others to tobacco smoke increases morbidity and mortality among non-smokers (US DH&H, 2006).

Preventing smoking initiation is an important element of tobacco control. The individual remains a nonsmoker, does not experience harm due to active smoking (which may be significant even during early adulthood (Levine et al., 2012)), does not become addicted, and does not expose others to tobacco smoke. Complete prevention of initiation would ultimately eradicate smoking-attributable mortality and morbidity.

Youth tobacco use has been studied in various populations (HBSC; WHO, 2008a,b). Two types of research are most common: surveillance of youth populations, and statistical modeling. Surveillance tracks tobacco use over time, using serial, representative population samples. The US Centers for Disease Control (US CDC) Office of Smoking and Health monitors tobacco use behavior in states with the Youth Risk Behavior Surveillance System (US CDC, a). Internationally, the WHO collects data from countries around the world with the collaborative cross-national study, the Health Behaviors of School Children (HBSC) survey (43 participant countries) (HBSC) and the Global Youth Tobacco Survey (GYTS) (165 sites surveyed) (US CDC, a; WHO, 2014). Disparities between populations are often large. For example, according to the 2005/6 HBSC report (WHO, 2008b), the prevalence of daily smoking among 15-year olds ranged from 5.7% (Swedish boys) to 53.6% (Greek girls), while the average age of smoking initiation among 15-year olds

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ranged from 10.7 (Lithuanian boys) to 14.0 (Greek and Israeli girls) (WHO, 2008b).

The second type of research is analytic, usually based on cross-sectional (Chen and Unger, 1999; Gritz et al., 1998) or longitudinal data (O'Loughlin et al., 2009; Wahlgren et al., 1997). The primary goal is to understand factors associated with smoking behavior. Logistic regression is often used to identify smoking correlates (Baron-Epel and Haviv-Messika, 2004; Sperber et al., 2001; Wahlgren et al., 1997).

Israel, a multi-ethnic country, collects data on smoking behavior as part of on-going health surveillance at the start of mandatory military service (Huerta et al., 2005). These data enable studying patterns of smoking initiation among various ethnic populations within Israel.

The objective of this study was to understand patterns of initiation among Israeli youth, using Israeli army data from the years 1986 to 2009. We used time-to-event analysis to understand correlates and patterns of initiation, and to identify ages of highest risk for smoking initiation among various subpopulations. We used logistic regression to compare correlates of smoking initiation with correlates of smoking prevalence. We examined changes in trends of smoking patterns over 24 years.

Methods

Study population, setting, and data sources

Study participants were those who took part in an ongoing, prospective survey of soldiers recruited to mandatory military service in the Israel Defense Forces (IDF) between January 1, 1986 and December 31, 2009. Data on medical status, health behavior, attitudes, and demographics were routinely collected from a fixed proportion of recruits on the day of recruitment (Huerta et al., 2005). The selection process for the survey was representative but not random: it was based on sampling up to a fixed percent of new recruits, using a code calculated from the soldier's serial number. All survey participants were interviewed by trained medical assistants from the Army Public Health Branch.

The data represents the young-adult population in Israel, with the exception of populations exempt from military service: most Arabs, Haredi Jews, religious women, and people with severe physical or mental disabilities.

Data from regular army records on socio-economic status (SES), education of soldier, birth country, military fitness, and religion augmented the survey data. Military fitness, determined prior to recruitment, was based on medical records from physical examination and additional work-up as needed.

Ethical approval

The research was approved and supervised by the Helsinki Committee of the IDF Medical Corps. Informed consent was not required.

Response variables

Age of initiation of smoking was the primary response variable. Current smoking status at time of recruitment was a secondary response variable.

Explanatory variables

The following explanatory variables were included: education (<12 years, ≥12 years), paternal education (<12 years, ≥12 years), birthplace (Africa/Asia/Israel/USSR or Eastern Europe/West), socio-economic status (SES) of residence area (low, medium, high) (Israel CBS, 2006), military fitness (low (unfit for combat duty), medium (fit for combat duty but not infantry), high (fit for any type of service)), religion (Jew/Druze/other), use of contraceptive pills in women (ever/never), and year of entry into military.

Statistical methods

Kaplan–Meier graphs were used to illustrate patterns of age of smoking initiation and to identify correlates of smoking initiation. We were particularly interested in identifying ages at which the hazard of smoking initiation was greatest, overall and for specific subpopulations. The hazard of smoking initiation is defined as the probability of smoking initiation at a given age, on the condition that the individual did not initiate smoking previously. We identified the age at which the hazard was greatest for smoking initiation for males and females overall and by subgroup. In identifying maximum hazard age, we considered only data on soldiers up to the age of 18, because the percentage of soldiers who were recruited after that age was small. Cox proportional hazard models were used to identify correlates of initiation. If the respondent was a nonsmoker at recruitment, age at initiation was considered censored at the current age of the respondent.

In order to compare our results with the more common approach of assessing current smoking status at a specific time point or age, we performed multiple logistic regression, with current smoking (yes/no) as the main outcome. The logistic model differs from the Cox model in that the Cox model uses age of smoking initiation, a quantitative variable, as the dependent variable, while the logistic regression uses smoking status, a binary variable, as the dependent variable.

Separate analyses were conducted for male and female recruits because (1) — there was information available for females on use of birth control which was not available for males, and (2) — significant interactions existed between smoking status, gender, and some independent variables.

SAS Version 9.2 was used to perform the analyses.

Results

The total sample size was 50,254 recruits (males: 28,365, females: 21,889). The smoking prevalence at recruitment over all years was 31.0% among males and 25.7% among females. The average age of initiation was 15.7 years for males and 16.0 for females. The age of maximum hazard for smoking initiation was 17 for both males and females.

Trends over time

Fig. 1 presents age at smoking initiation, prevalence of smoking, and age of greatest hazard for initiation for each year over the period of 1986–2009. Age of initiation decreased steadily over most of the period but then increased. Prevalence of smoking decreased after 1986 in both men and women, increased around 1992 in women and 1999 in men, and was relatively stable for the last decade of the study. The age of greatest hazard decreased gradually, but not monotonically, over time.

Life table results

The pattern of smoking initiation in different strata is presented graphically with Kaplan–Meier curves in Fig. 2. Differences between initiation patterns in different subpopulations are evident. The most striking differences, among both girls and boys, occurred between low (<12 years) and high (≥12) educational levels. Soldiers with low educational levels had begun smoking earlier, and had higher levels of smoking prevalence, than those soldiers with high educational status. Differences in age of initiation are also apparent for soldier birthplace.

The standard indicators of smoking — prevalence of smoking and mean age of initiation — are presented in Table 1 for all variables included in the analysis. These numbers are augmented by age at which the hazard for initiating smoking is greatest, which is available from the Kaplan–Meier analyses (See: Kleinbaum and Klein, 2012). Overall and for most subgroups, the age of greatest hazard for smoking initiation occurred after the mean age of smoking initiation.

Multivariate results

Results from the Cox regression and multiple logistic regression analyses are presented in Table 2. The Type 3 analyses from the Cox model and the logistic regression showed statistical significance for the following variables, for males and females: education, paternal education, birthplace, and religion. Contraception use was significant for females in both the Cox model and the logistic regression model. SES and military fitness were statistically significant in both the Cox and the logistic regression model for males but not for females.