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Original Article

Educational inequalities in smoking among Japanese adults aged 25–94 years: Nationally representative sex- and age-specific statistics

Takahiro Tabuchi [a, *], Naoki Kondo [b]

[a] Center for Cancer Control and Statistics, Osaka Medical Center for Cancer and Cardiovascular Diseases, Osaka, Japan
[b] School of Public Health, The University of Tokyo, Tokyo, Japan

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ABSTRACT

Background: Few studies have investigated differences in age- and gender-specific educational gradients in tobacco smoking among the whole range of adult age groups. We examined educational inequality in smoking among Japanese adults aged 25–94 years.

Methods: Using a large nationally representative sample (167,925 men and 186,588 women) in 2010, prevalence of current smoking and heavy smoking among daily smokers and their inequalities attributable to educational attainment were analyzed according to sex and age groups.

Results: Among men aged 25–34 years, junior high school graduates had the highest current smoking prevalence at 68.4% (95% confidence interval [CI], 66.0%–70.6%), and graduate school graduates had the lowest at 19.4% (95% CI, 17.2%–21.9%). High school graduates had the second highest current smoking prevalence (e.g., 55.9%; 95% CI, 54.9%–56.8% in men aged 25–34 years). Among men aged 75–94 years, the difference in current smoking across educational categories was small. A similar but steeper educational gradient in current smoking was observed among women. Among women aged 25–34 years, junior high school graduates had the highest current smoking prevalence at 49.3% (95% CI, 46.3%–52.3%), and graduate school graduates had the lowest at 4.8% (95% CI, 2.9%–7.4%). Compared with older age groups, such as 65–94 years, younger age groups, such as 25–54 years, had higher estimates of inequality indicators for educational inequality in both current and heavy smoking in both sexes.

Conclusions: Educational inequalities in current and heavy smoking were apparent and large in the young population compared with older generations. The current study provides basic data on educational inequalities in smoking among Japanese adults.

Introduction

Tobacco smoking is the most attributable and preventable risk factor for adult mortality and morbidity in Japan.[1,2] Tobacco smoking has been confirmed as an independent risk factor for many disorders, such as cancer and cardiovascular diseases, with dose-response verifications.[3,4] Heavy smokers are more likely to suffer from tobacco-related harm than light smokers.[3] Smoking cessation and tackling regional and socioeconomic inequalities in smoking are key public health targets throughout the world. The World Health Organization (WHO)'s Commission on Social Determinants of Health recommended, in its final report, monitoring and evaluating socioeconomic inequalities in health and health behavior, including smoking.[5] Japan's new health promotion strategy, Health Japan 21 (Second term),[6] follows the WHO recommendations and includes monitoring socioeconomic inequalities in tobacco smoking and other public health targets.

When monitoring socioeconomic inequality in smoking, using educational attainment as a socioeconomic indicator is important. Educational attainment is a representative socioeconomic factor[7] that barely changes in adulthood after around 25 years of age, whereas other socioeconomic variables, such as income and occupation, could change considerably during a life-course. Moreover, educational attainment could reflect key determinants of the initiation and habituation of smoking and other health behaviors, such as health literacy.[8] Although some Japanese studies have

* Corresponding author. Center for Cancer Control and Statistics, Osaka Medical Center for Cancer and Cardiovascular Diseases, 3-3, Nakamichi 1-chome, Higashinari-ku, Osaka 537-8511, Japan.
E-mail address: tabuchitak@gmail.com (T. Tabuchi).
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investigated smoking inequalities according to socio-economic factors, such as income and occupation,[9,10] no study has examined smoking according to education in Japan.

Recent European studies have consistently shown higher prevalence of tobacco smoking among poorly educated populations, whereas patterns of smoking prevalence in terms of sex and age groups vary across regions.[11] Although there is relatively rich evidence from western countries, data from Asian regions are scarce. Moreover, data on educational inequality in smoking in older persons, especially those aged 75 years or more, are scarce even worldwide.[3,11] To start continuous monitoring of educational inequality in health, in 2010, the Comprehensive Survey of Living Conditions of People on Health and Welfare (CSLC), a large nationally representative population-based cross-sectional survey in Japan, collected information on education, in addition to health behavior indicators, including smoking status.

Thus, our objective in this study was to investigate the magnitude of educational inequality in smoking and the prevalence of current and heavy smoking according to sex, age, and education among Japanese adults. Utilizing the large nationally representative dataset, we sought to provide detailed evaluations of age- and sex-specific variations in smoking inequality in Japan, covering the whole range of adult age groups from 25 to 94 years old.

Methods

Data

We used data from a nationally representative cross-sectional survey: the 2010 CSLC, conducted by the Japanese Ministry of Health, Labour and Welfare (MHLW).[12] Out of 940,000 inhabited census tracts (the sampling unit for national census in 2005), 5510 were randomly sampled across Japan in 2010 for the collection of data from all household members within each census tract. Data were available for 228,864 households (response rate, 79.1%). Data were used with permission from MHLW. The study was reviewed and approved by the Research Ethics Committee of the Osaka Medical Center for Cancer and Cardiovascular Diseases.

Education

Levels of completed education were categorized as six groups: "junior high school (9 years of mandatory education)" was defined as persons who graduated junior high school without graduating high school; "high school (12 years of education)" was defined as persons who graduated high school without graduating further educational steps; "technical school (10–19 years of education[13])" was defined as persons who graduated technical professional school without going to college; "2-year college (14 years of education)" was defined as persons who graduated 2-year college without going to 4-year college; "4-year university (16 years of education)" was defined as persons who graduated 4-year university without going to graduate school; "graduate school (17–22 years of education)" was defined as persons who graduated graduate school having previously graduated 4-year university.

Smoking status

Current smokers were those who smoked cigarettes regularly at the time of survey, including daily and sometimes smokers. Among daily smokers (93.8% of the current smokers in the data), heavy smokers were those who smoked more than 20 cigarettes per day.[14]

Statistical analysis

We analyzed Japanese adults aged 25–94 years because education status was less likely to change after 25 years of age. We compared current smoking prevalence and heavy smoking proportions among daily smokers according to sex, age, and education group. The percentages are shown with 95% confidence intervals (CIs) calculated by the Wald method. To show the summarized relationship between education and smoking, the age-adjusted smoking prevalence for young and middle-aged adults (25–64 years) was also calculated via the direct standardization method using population figures from the 2010 Japanese Census.

Following recent recommendations, to evaluate educational inequality in current and heavy smokers, we calculated multiple health disparity indicators, including absolute indicators (rate difference and between-group variance) and relative indicators (rate ratio, index of disparity, and mean log deviation),[15–17] using HD*calc software, version 1.2.4 (the National Cancer Institute, Rockville, MD, USA).[18] Detailed explanations of these indicators are given in the supplementary data (eAppendix 1) and elsewhere.[19,20] Population weight was used to calculate measures of inequality, because the population size differed according to the education categories, reflecting educational distributions. The proportion of highly educated people in the general population has been increasing over time. Such a demographic shift has an impact on population health and needs to be considered for the assessment of inequalities. Inequality measures of index of disparity, mean log deviation, and between-group variance accounted for the population size of the groups in the calculation.

Subject numbers according to sex, age, and education group are shown in eTable 1 (for current smoking prevalence) and eTable 2 (for heavy smoking prevalence among daily smokers). To maintain precision of estimates, we did not calculate the smoking prevalence (proportion) of the groups that included fewer than 100 subjects. Although there are no convincing criteria for the sample size cut-off point, we chose a sample size of 100 based on statistical considerations of the relationship between sample size and precision. According to Machin et al,[21] the width of a 95% CI depends on the size of the point estimate. However, a sample size of 100 can maintain at least 20% point width of the 95% CI regardless of the size of the point estimates.[21] This choice of sample size cut-off resulted in some groups for which we did not estimate smoking prevalence (proportion). We evaluated the educational inequality in smoking where smoking prevalence (proportion) data were available for at least three education groups. All statistical analyses, except for the inequality index calculation, were performed using SAS version 9.3 (SAS Institute Inc., Cary, NC, USA).

Results

Table 1 shows the current smoking prevalence according to sex, age, and education group in Japan. Among men aged 25–34 years, junior high school graduates had highest current smoking prevalence at 68.4% (95% CI, 66.0%–70.6%), and graduate school graduates had the lowest at 19.4% (95% CI, 17.2%–21.9%). These figures were lower in the higher age groups: among men aged 65–74 years, the corresponding figures were 27.6% (95% CI, 26.7%–28.6%) and 12.2% (95% CI, 7.9%–17.7%) for junior high school graduates and graduate school graduates, respectively. Among men aged 75–94 years, the differences in current smoking across educational categories were small, though we did not calculate the smoking prevalence of graduate school graduates in that age group because of the small sample size. A similar but steeper educational gradient in current smoking was observed among women. Among women aged 25–34 years, junior high school graduates had the highest