Established in 1871

Swiss Medical Weekly

Formerly: Schweizerische Medizinische Wochenschrift

An open access, online journal • www.smw.ch

Original article | Published 30 December 2018 | doi:10.4414/smw.2018.14708
Cite this as: Swiss Med Wkly. 2018;148:w14708

Lung cancer and smoking trends in the young in Switzerland: a study based on data of the National Institute for Cancer Epidemiology and Registration and of the Swiss Health Surveys

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Summary

AIMS: We explored the trend in lung cancer incidence rates among a young Swiss population (30–54 years old) by sex from 1990 to 2014 to investigate the birth cohort effect on lung cancer. We evaluated smoking rates from 1992 to 2012 to explain sex differences in lung cancer incidence rates.

METHODS: The data of the Swiss National Institute for Cancer Epidemiology and Registration (NICER) were used. We extracted the data of age-standardized (world) and age-specific incidence rates (per 100,000 people at risk) of trachea, bronchus, and lung cancers by sex and year of diagnosis from 1990 to 2014. The data on tobacco consumption were generated from the Swiss Federal Statistical Office. These data were based on Swiss Health Surveys, involving 5-year intervals from 1992 to 2012.

RESULTS: Incidence rates decreased among men in the age groups 40–44, 45–49, and 50–54 years. An increased rate was seen among women in age group 50–54 years. Among men, rates generally decreased in successive birth cohorts, whereas among women, the rates increased from the cohort born in 1935–1939 up to the 1950s, and then were steady. In the cohort born in 1940–1944 an increased rate was seen until the 1960s, and then they decreased. In the cohort born in 1945–1949 the rates remained steady. Smoking prevalence was higher among men than among women in all age and birth groups. Among men born in the mid-1950s or mid-1960s, smoking prevalence has become higher for younger compared to older men. This pattern was only seen among younger women born in the mid-1960s.

CONCLUSIONS: Decreasing lung cancer incidence rates in young Swiss men but increasing rates in young women reflect the evolution of the smoking epidemic in the world. Our findings indicate an urgent need for implementing prevention strategies that target tobacco cessation and prevention among young women.

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Keywords: *lung cancer, incidence, prevalence, smoking, Switzerland, young population*

Introduction

Lung cancer remains the most common cancer worldwide. Estimates in 2012 suggested 1.8 million new cases and 1.6 million deaths worldwide [1]. In Europe, there were 41,000 new cases and 353,000 deaths [2]. In Switzerland 2500 new cases in men and 1500 in women were reported in 2012 [3]. The proportion of patients dying from lung cancer compared with all cancer deaths is 22% (2000 patients per year) in men and 15% (1100 patients per year) in women. The median age at lung cancer diagnosis is 70 years in men and 69 years in women. Median 5-year survival rates continue to be low and are 15 and 19% in men and women, respectively. A decrease in lung cancer incidence and mortality has been reported among Swiss men since the 1980s, they are increasing in Swiss women. Historically, lung cancer age-standardised incidence and mortality rates are lower among women as a result of lower smoking rates [4, 5].

A study on lung cancer mortality trends in 36 European countries, particularly in northern and western Europe, showed a decrease in mortality in men during the last two decades, but a continued increase in women in many European countries [6]. In certain Southern states in the USA, lung cancer death rates among women born in the 1960s are twice as high as in women born in the 1930s [7]. A recent US study showed that the patterns of historically higher incidence rates of lung cancer among men than women have reversed among non-Hispanic whites and Hispanics born since the mid-1960s [8]. Interestingly, this trend could not be fully explained by sex differences in smoking. Another US study indicated significant regional differences in lung cancer mortality within the last 30 years in young women [7]. The lung cancer mortality in women <50 years increased in Alabama whereas it decreased in California where many women stopped smoking at the age of 35–50

as a result of tobacco preventive measures taken in the 1970s and 1980s. Table 1 compares the studies.

Our study aimed to explore the trend in lung cancer incidence rates among a young Swiss population (30–54 years old) by sex from 1990 to 2014 to investigate the birth cohort effect on lung cancer. We evaluated smoking rates from 1992 to 2012 in a cohort of 15- to 54-year-old persons to explain sex differences in lung cancer incidence rates.

Materials and methods

The data of the Swiss National Institute for Cancer Epidemiology and Registration (NICER) were used for this study [12]. These data meet standards for completeness, accuracy and timeliness of collection, and cover 94% of the Swiss population (i.e., 21 Cantons with the exclusion of Schaffhausen, Schwyz and Solothurn, which have no cancer registry) [13]. There were no missing data. Complete data for all study years were available for 11 cantons, which covered 54% of the Swiss population (Appenzell Innerrhoden, Appenzell Ausserrhoden, Basel country, Basel city, Geneva, Grisons, Neuchâtel, St Gallen, Vaud, Valais and Zurich). We extracted data on age-standardised (world) and age-specific incidence rates (per 100,000 people at risk) of trachea, bronchus, and lung cancers (ICD-10 codes: C33 and C34) in the Swiss population by sex and year of diagnosis from 1990 to 2014. Age at diagnosis was grouped into 5-year intervals (30–34, 35–39, 40–44, 45–49 and 50–54 years) and by the year of diagnosis. We calculated the year of birth by subtracting the mid-year of age from the mid-year of diagnosis, which yielded eight birth 5-year band cohorts corresponding to the mid-year of birth (1935–1939, 1940–1944, 1945–1949, 1950–1954, 1955–1959, 1960–1964, 1965–1969 and 1970–1974). We left out the two curves below age 40 (30–34 and 35–39). In these age groups numbers were too low to present trends (25 cases per year).

The data on tobacco consumption were generated from the Swiss Federal Statistical Office (BFS) [4]. These data were based on Swiss Health Surveys, involving 5-year intervals from 1992 to 2012. The surveys presented the prevalence by 10-year bands of age groups (15–24, 25–34, 35–44, and 45–54). We translated these data to eight 5-year band birth cohorts (1918–1927 1928–1937, 1938–1947, 1948–1957, 1958–1967, 1968–1977, 1978–1987 and 1988–1997).

Results

We considered lung cancer cases from 1990 to 2014 in this analysis. A total of 61,650 lung cancer cases in men and 28,937 cases in women have been reported by NICER. These data included 7,196 cases in men (11.7%) and 4,395 cases in women (15.2%) young population.

Figure 1A shows trends in the lung cancer incidence rates among men and women 30 to 54 years of age from 1990 to 2014. The incidence rates decreased among men in the age groups 40–44, 45–49 and 50–54 years. On the other hand, an increased rate was seen among women in the age group 50–54 years.

Figure 1B shows the lung cancer incidence rates among men and women by birth cohort. Among men, rates generally decreased in successive birth cohorts, whereas the rates increased in women in cohorts born in 1935–1939 until the 1950s from 25 (per 100,000 people at risk) up to 40, and then the rates were steady. In the cohort born in 1940–1944, the rate until 1960s, up to 30 per 100,00 at risk, with decreasing rates thereafter. In the cohort born in 1945–1949, the rates remained around 10 per 100,00 at risk.

Figure 2 shows the prevalence of current smoking according to age, sex and birth cohort. Smoking prevalence was higher among men than among women in all age and birth groups. Among men born in the mid-1950s or mid-1960s, smoking prevalence has become higher (up to 47%) for

Table 1: Comparing studies on smoking and lung cancer trends by sex.

Author Ref.	Year	Title	Country	Summary of results
Hansen MS [9]	2018	Sex Differences in Risk of Smoking-Associated Lung Cancer: Results From a Cohort of 600,000 Norwegians	USA	Women have an increased susceptibility to lung cancer compared with men, given the same lifetime smoking exposure.
Jemal A [8]	2018	Higher Lung Cancer Incidence in Young Women Than Young Men in the United States	USA	The patterns of historically higher incidence rates of lung cancer among men than among women have reversed among non-Hispanic whites and Hispanics born since the mid-1960s, and they are not fully explained by sex differences in smoking behaviours.
Jemal A [7]	2012	Increasing lung cancer death rates among young women in southern and midwestern States	USA	The lung cancer trend in white women born after 1950s in southern and midwestern states underscores the need for additional interventions to promote smoking cessation in these high-risk populations.
Mousavi SM [10]	2011	Risk of lung cancer by histology among immigrants to Sweden	Sweden	The ethnic-specific lung cancer rates by histology followed the rates in the countries of origin, suggesting a preservation of smoking habits in the host country is linked to the ethnic diversity of lung cancer incidence by histology.
Bray F [6]	2010	Lung cancer mortality trends in 36 European countries: secular trends and birth cohort patterns by sex and region 1970-2007	Europe	Lung cancer mortality trends in men are on a downwards path in most European countries while female rates continue to rise.
Cerny D [5]	2009	Lung cancer in the Canton of St Gallen, Eastern Switzerland: sex-associated differences in smoking habits, disease presentation and survival	Switzerland	In Eastern Switzerland, women with lung cancer were younger, more likely to have smoked significantly less and more likely to have adenocarcinoma, compared to men with lung cancer.
La Vecchia C [11]	1988	Trends in smoking and lung cancer mortality in Switzerland	Switzerland	The peak rates in men were reached by the generation born around 1910. In females, marked increases were observed in each subsequent birth cohort. This pattern of trends is consistent with available information on smoking prevalence in successive generations, showing a peak among men for the 1910 cohort, but steady upward trends among females.

younger compared with older men. This pattern was seen among younger women born in the mid-1960s, with an increase up to 40%.

Discussion

In line with the study on trends in smoking and lung cancer mortality in Switzerland from 1950 to 1982, our findings indicate that the current decrease in lung cancer incidence rates in Swiss men has mainly resulted from a decrease in the birth cohort effect, which is in line with a decrease in smoking rates [11]. We found increasing in lung cancer rates in young women (40–54 years old), which in line with an increase in smoking rates.

The lung cancer rate difference between men and women in Switzerland is more likely attributable to smoking habits, although we were not able to further explore this in this study because of the lack of data on smoking rates in the Swiss population before 1992; our study was based on the data of tobacco consumption generated from the Swiss Federal Statistical Office from 1992 to 2012. Smoking habits may develop at an early age, when teenagers and young adults are particularly susceptible to social pressure and tobacco advertisements. The latency period of smoking and lung cancer risk is such that much more than 20 years is needed to see an effect. A direct comparison of point estimates cannot provide the basis to establish an association between lung cancer incidence and gender. Hence, longer follow-up studies will be needed to further evaluate the reasons for the observed gender difference in more detail.

A cohort study of 600,000 Norwegians showed the sex difference in risk of smoking-associated lung cancer is due to an increased susceptibility to lung cancer in women compared with men, given the same lifetime smoking exposure [9]. However, current study results are conflicting in this regard [8].

As has been demonstrated by Jemal et al, tobacco prevention programmes decrease lung cancer mortality, par-

Figure 1: Age-specific incidence rates of lung cancer according to sex, year of diagnosis and birth cohort in Switzerland.

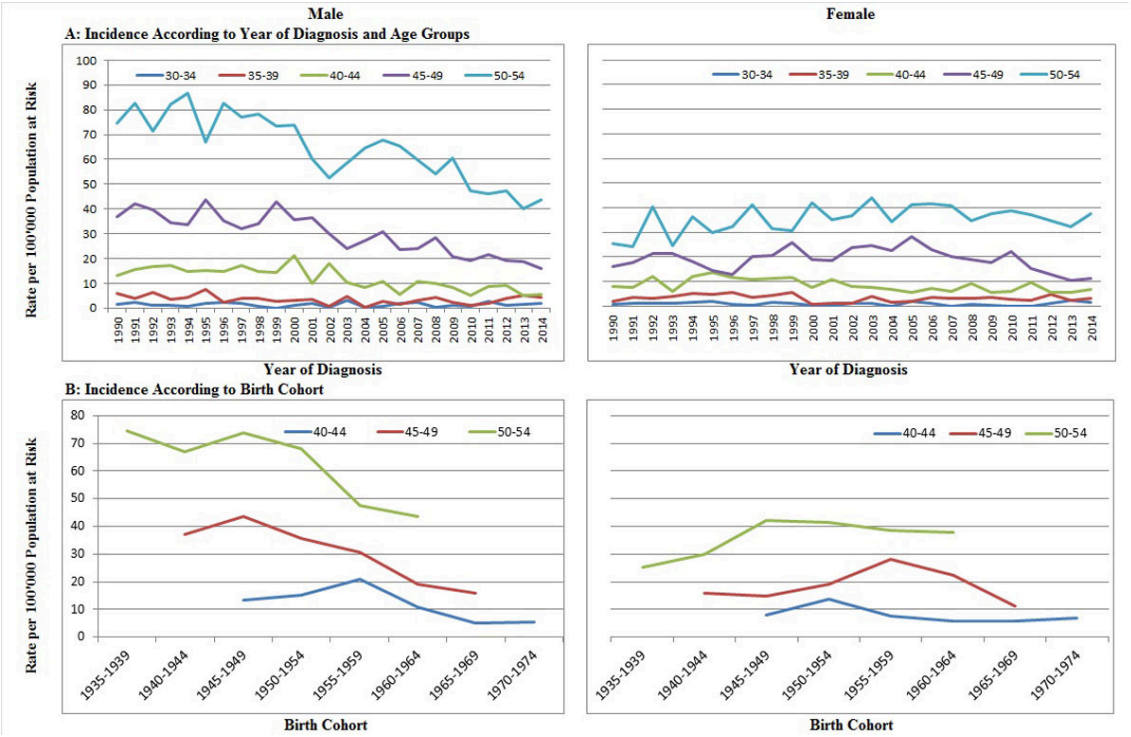
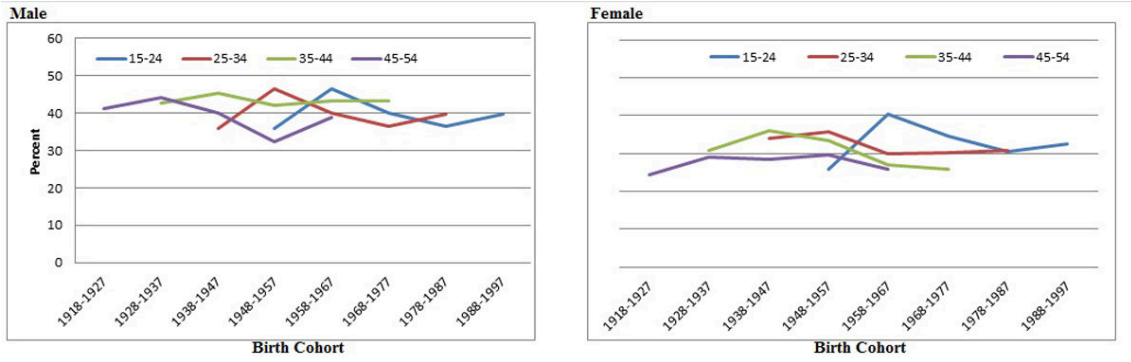


Figure 2: Prevalence of current smoking (percent) by sex, age group and birth cohort in Switzerland.



ticularly in the young population, decades later [7]. Unfortunately, our observation with a recent increase in lung cancer incidence in young Swiss women is reflecting the lack of a systematic tobacco prevention programme in our country.

Adenocarcinoma is more common in women than in men, and the risk for developing an adenocarcinoma decreases less after smoking cessation than does the risk for squamous cell carcinoma. We and others have already suggested a possible higher susceptibility to tobacco associated carcinogens in women [5, 9].

Our findings indicate that the current decrease in lung cancer incidence rates in Swiss young men has mainly resulted from a decrease in the birth cohort effect, which suggests a decrease in smoking rates [9]. Increasing lung cancer rates in young women suggest an increase in smoking rates. Recent trends in lung cancer reflect the evolution of the same smoking epidemic throughout the world [1]. As smoking is the single greatest risk factor, avoiding tobacco smoke exposure remains the most important preventive measure against lung cancer for young women in Switzerland. Therefore, national prevention strategies should target tobacco cessation and prevention among Swiss young women [14].

Financial disclosure
This study was supported by the Cancer League Eastern Switzerland.

Potential competing interests
Author forms not yet received

The authors declare no conflicts of interest.

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