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Time trends of cigarette and waterpipe smoking among a cohort of school children in Irbid, Jordan, 2008–11

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Background: Coordinated high-impact interventions and community-level changes in smoking behaviour norms effectively reduced prevalence of smoking among youth in many developed countries. Smoking trends among Jordanian adolescents are likely different than their Western counterparts and must be understood in the context of their daily lives to tailor interventions specifically for adolescents in this setting. **Methods:** Between 2008 and 2011, a school-based longitudinal study was conducted in Irbid, Jordan. All seventh-grade students in 19 randomly selected schools (of 60) were surveyed annually for 4 years. Outcomes of interest were time trends in smoking behaviour, age at initiation and change in frequency of smoking. **Results:** Among 1781 participants, baseline prevalence of current smoking (cigarettes or waterpipe) for boys was 22.9% and 8.7% for girls. Prevalence of ever-smoking and current any smoking, cigarette smoking, waterpipe smoking and dual cigarette/waterpipe smoking was significantly higher in boys than girls each year ($P < 0.001$). Smoking prevalence increased every year after year 2 for current smoking ($P < 0.05$) across all methods (any, cigarette, waterpipe and dual). At all time points for both boys and girls, prevalence of waterpipe smoking was higher than that of cigarette smoking ($P < 0.001$). **Conclusion:** This study shows intensive smoking patterns at early ages among Jordanian youth in Irbid, characterized by a predominance of waterpipe smoking and steeper age-related increase in cigarette smoking. It also points to the possibility of waterpipe being the favourite method for introducing youth to tobacco, as well as being a vehicle for tobacco dependence and cigarette smoking.

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Introduction

In the developed world, huge successes in curbing the tobacco epidemic were achieved over the past 40 years due to a mixture of policies and interventions that led to the de-normalization of smoking within the society. Much of the developing world, however, has not shared this success story, but witnessed an escalation in tobacco use instead.^{1,2} This was mostly due to the tobacco industry's effort to compensate for the loss of markets in countries with strong tobacco-control regulations, and in many regions, the emergence of new tobacco-use methods—most notably the waterpipe (a.k.a. hookah, shisha and narghile).³ In the Middle East, for example, where the waterpipe has been known for centuries, recent years have witnessed a dramatic increase in its popularity, particularly among youth. In Middle Eastern countries where waterpipe is popular, such as Lebanon, Jordan and Syria, smoking prevalence among youth has reached staggering levels (e.g. 66% among boys and 54% among girls aged 13–15 years in Lebanon).⁴

To curb the tobacco epidemic among youth, it is crucial to understand the patterns and determinants of tobacco use in this population.⁵ Yet, the local evidence-base needed to guide policy and interventions to curb smoking among youth in the Middle East is either lacking or arises from cross-sectional studies, which are limited in their usefulness for the identification of important determinants contributing to future smoking behaviours. An understanding of the dynamics of smoking behaviour at the early stages of smoking acquisition among youth is necessary. Such an understanding can only be achieved through longitudinal studies with an adequate follow-up period to allow monitoring of important trends in the smoking behaviour of youth, and to study the influence of a wider variety of proximal and distal factors on youth smoking behaviour.^{6,7} This study is the first longitudinal study of tobacco-use behaviours among youth in the Middle East, with detailed information about cigarette and waterpipe smoking, and with four data points, collected annually. The aim of this study is to describe the dynamics of tobacco-use behaviour among school children in Irbid (Jordan), to understand time trends of tobacco use, cigarette and waterpipe acquisition and progression of tobacco-use behaviour among youth in Irbid. Such information will help guide interventions to curb tobacco use among youth in light of their early tobacco-use trajectory, as well as according to age, gender and tobacco-use method. This may benefit tobacco control for youth not only in Irbid but also in the rest of Jordan and in other countries in the Middle East that share many of the same tobacco-use patterns.⁸

Methods

Participants

Detailed methodology of this study is published elsewhere.^{8,9} Briefly, from 2008 to 2011, we conducted a school-based longitudinal study among students who we followed from 7th through 10th grades in the city of Irbid, Jordan (population ≈330 000). The cohort was surveyed annually. The 60 schools in the city were stratified by gender (boys, girls and mixed) and type of school attended (public and private). A cluster random sample of 19 schools (eight male, nine female, two mixed and six private) was selected with probability proportional to size to ensure representativeness of the sample. In 2008, all seventh-grade students (1877) in the selected schools were invited to participate, and 1781 students (95%) were enrolled in the study after obtaining parental consent and student assent.

Participants were followed prospectively by matching identification numbers each year. Follow-up rates each year were at least 89% (Y2 = 90%, Y3 = 95% and Y4 = 89%), and over the study period, 83% of the participants completed all four surveys. At each time

point, participants lost to follow-up were more likely to be male and baseline smokers (current, cigarette and/or waterpipe). Differential participation within these groups may have weakened some results of this study. For example, the gap in current smoking prevalence between boys and girls may appear narrower because boys, who are more likely to be current smokers, were disproportionately lost to follow-up.

This study was reviewed and approved by the Institutional Review Boards of Jordan University for Science and Technology, University of Memphis, Syrian Society Against Cancer and Florida International University.

Survey instrument

Development of the questionnaire was guided by international guidelines¹⁰ and other instruments that have been used and validated in Arabic.^{10,11} The questionnaire was composed of six sections pertaining to sociodemographics, tobacco-use behaviour (cigarette and waterpipe), tobacco advertisement and warning labels, family and school environment, peer influences and students' attitudes and beliefs regarding quitting smoking. Before the study, the questionnaire and study protocol were piloted among 86 boys and 67 girls from four schools in Irbid and modifications were introduced accordingly.

Definitions

A student was defined as an 'ever smoker' if he/she reported ever experimenting with smoking. A student was defined as a 'current smoker' if he/she reported smoking at least once within the past 30 days. 'Age at initiation' was the reported age at which a student experimented with cigarette (or waterpipe) for the first time. 'Smoking frequency' among current smokers was dichotomized as 'daily' vs. 'less than daily' for cigarette use and 'weekly' vs. 'less than weekly' for waterpipe use. Parental education was dichotomized into 'less than high school' (ranging from illiterate to high school graduate) and 'more than high school' education (at least some college).

Data analysis

Statistical analyses were performed using SPSS v21 (SPSS Inc., Chicago, IL) and Epi Info 7.0.9.34 (CDC, Atlanta, GA). All analyses were restricted to baseline participants ($n = 1781$).

The data were described using frequency and percent of total for categorical variables, and mean and standard deviation for continuous variables. The prevalence at each time point was stratified by gender (boys/girls), smoking method (cigarette/waterpipe) and smoking status (ever/current). Students who reported ever-smoking (cigarettes or waterpipe) were counted as ever-smokers at all subsequent time points. Chi-square test (or Fisher exact test when appropriate) was used to compare prevalence by gender and smoking method. The chi-square test for trend (extended Mantel-Haenszel) was used to test linear trends in prevalence of smoking and smoking frequency among current smokers. We established a two-tailed statistical significance level of $P < 0.05$. To account for the complex sampling design, all analyses were weighted by the school weight using 'Weight Cases' in SPSS v21. School weights were calculated by multiplying number of schools selected from each stratum with the probability of selecting a particular school and taking the inverse of the result.

Results

Description of sample

Of the 1781 participants enrolled at baseline, a minimum of 89% were measured at each time point, with 1482 (83%) being measured at all time points. The mean age of the sample was 12.73 (± 0.61) years at baseline. The sample was approximately half boys at each

time point. At baseline, roughly half the participants' parents (55.1% of fathers and 49.1% of mothers) had at least some college education (table 1).

Smoking behaviour at year 1 (baseline)

Year 1 prevalence of ever-smoking and current any smoking (cigarettes or waterpipe) was 47.1% and 22.9% for boys and 26.4% and 8.7% for girls, respectively. Prevalence of ever-smoking and current any smoking was 36.8% and 15.9% within the entire sample, respectively. For ever-smoking and current cigarette smoking, the prevalence was 26.9% and 8.0% for boys and 10.6% and 2.3% for girls (18.8% and 5.2% overall), respectively. For ever-smoking and current waterpipe smoking, the prevalence was 39.2% and 20.6% for boys and 24.1% and 7.7% for girls (31.7% and 14.2% overall), respectively. Prevalence of ever-smoking and current dual smoking of both cigarettes and waterpipe was 19.0% and 5.7% for

boys and 8.3% and 1.3% for girls (13.7% and 3.5% overall), respectively. Baseline smoking prevalence of ever-smoking and current smoking (any, cigarette, waterpipe and dual smoking) was significantly higher among boys than girls ($P < 0.001$ for all).

Time trends

Prevalence of ever-smoking and current any smoking, cigarette smoking, waterpipe smoking and dual cigarette/waterpipe smoking was significantly higher in boys than girls at all follow-ups ($P < 0.001$). Smoking prevalence increased every year for ever-smoking ($P < 0.001$) and every year after year 2 for current smoking ($P < 0.05$) across all methods (any, cigarette, waterpipe and dual). At all time points for both boys and girls, the prevalence of waterpipe smoking was significantly higher than that of cigarette smoking ($P < 0.001$) (table 2).

Over the study period, the prevalence of ever any smoking (cigarettes or waterpipe) increased 67% among boys, 105% among girls and 80% overall. Prevalence of ever-smoking cigarettes increased 130% among boys, 220% for girls and 153% overall; ever waterpipe smoking increased by 79% among boys, 98% for girls and 86% overall and ever dual cigarette/waterpipe increased by 177% among boys, 230% for girls and 189% overall. Similarly, current any smoking (cigarettes or waterpipe) increased 80% among boys, 136% for girls and 91% overall. Current cigarette smoking increased 218% for boys, 226% for girls and 208% overall; current waterpipe smoking increased by 72% for boys, 136% for girls and 86% overall and current smoking of both cigarettes and waterpipe rose by 247% for boys, 300% for girls and 246% overall. All these trends were significant using chi-square test for trend ($P < 0.001$ for all).

Age at initiation

For both boys and girls, the majority of participants reported initiating cigarettes (54% boys, 52% girls) and waterpipe (58%, 63%) between the ages of 11 and 14. For all participants, smoking initiation for both cigarette and waterpipe steadily increased until

Table 1 Sociodemographic characteristics of a school-based sample of adolescents in Irbid, Jordan, 2008–11

Characteristic	N= 1781 Year 1 n (%) ^a	N= 1597 Year 2 n (%) ^a	N= 1687 Year 3 n (%) ^a	N= 1587 Year 4 n (%) ^a
Age (mean ± SD)	12.73 ± 0.61	13.31 ± 0.65	14.72 ± 0.60	15.72 ± 0.61
Boys	915 (50.4)	797 (47.4)	857 (48.7)	795 (47.5)
Girls	866 (49.6)	800 (52.6)	830 (51.3)	792 (52.5)
Father's education				
≤High school	864 (44.9)	783 (45.7)	820 (45.4)	757 (44.6)
>High school	916 (55.1)	813 (54.3)	865 (54.6)	814 (55.4)
Mother's education				
≤High school	942 (50.9)	844 (51.1)	893 (51.4)	871 (53.6)
>High school	838 (49.1)	752 (48.9)	794 (48.6)	704 (46.4)
Household size				
<8	1276 (71.8)	1037 (67.3)	1160 (69.5)	1081 (69.7)
≥8	504 (28.2)	560 (32.7)	522 (30.5)	480 (30.3)

a: Weighted proportions are reported.

Table 2 Prevalence of smoking at each time point by gender and smoking method in a school-based sample of adolescents in Irbid, Jordan, 2008–11

Smoking status	Year 1 N= 915 ^a n (%) ^b	Year 2 N= 1014 ^a n (%) ^b	Year 3 N= 1068 ^a n (%) ^b	Year 4 N= 988 ^a n (%) ^b	χ ² trend P-value
Boys					
Ever any	421 (47.1)	529 (61.8)	637 (69.4)	688 (78.6)	<0.001
Ever cigarettes	245 (26.9)	343 (39.7)	471 (50.6)	537 (61.8)	<0.001
Ever waterpipe	354 (39.2)	454 (53.4)	558 (61.2)	609 (70.2)	<0.001
Ever both	178 (19.0)	267 (30.7)	392 (42)	457 (52.7)	<0.001
Current any	213 (22.9)	212 (24.1)	294 (32.9)	339 (41.1)	<0.001
Current cigarettes	82 (8.0)	103 (10.6)	197 (20.1)	215 (25.4)	<0.001
Current waterpipe	185 (20.6)	177 (20.9)	209 (23.8)	284 (35.5)	<0.001
Current both	54 (5.7)	68 (7.3)	112 (12.2)	160 (19.8)	<0.001
	Year 1 N= 866 ^a n (%) ^b	Year 2 N= 976 ^a n (%) ^b	Year 3 N= 988 ^a n (%) ^b	Year 4 N= 937 ^a n (%) ^b	χ ² trend P-value
Girls					
Ever any	204 (26.4)	293 (37.8)	391 (47.3)	443 (54.0)	<0.001
Ever cigarettes	82 (10.6)	153 (19.3)	225 (26.6)	285 (33.9)	<0.001
Ever waterpipe	184 (24.1)	264 (34.4)	354 (43.2)	386 (47.8)	<0.001
Ever both	62 (8.3)	124 (15.9)	188 (22.4)	226 (27.4)	<0.001
Current any	74 (8.7)	85 (10.4)	132 (16.8)	172 (20.5)	<0.001
Current cigarettes	20 (2.3)	30 (3.5)	53 (5.7)	67 (7.5)	<0.001
Current waterpipe	65 (7.7)	69 (8.5)	106 (13.9)	152 (18.2)	<0.001
Current both	11 (1.3)	14 (1.6)	27 (3.2)	47 (5.2)	<0.001

a: Weighted proportions are reported.

b: Participants who report ever-smoking are counted as ever-smokers at all subsequent time points.

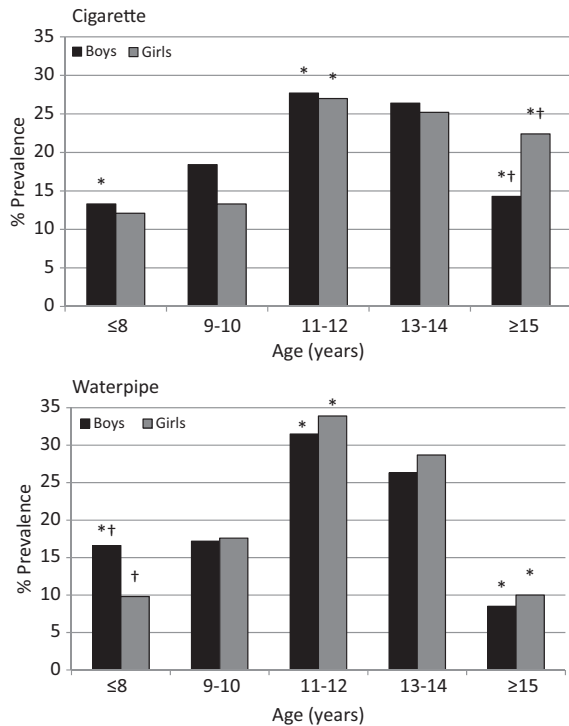


Figure 1 Age of smoking initiation by smoking method and by gender among a school-based sample of adolescents in Irbid, Jordan, 2008–11. Note: *Significant difference by smoking method within gender ($p < .05$). †Significant difference by gender within smoking method ($p < .05$)

ages 13–14. For cigarette smoking among girls, the prevalence dropped slightly from ages 11–12 to age ≥ 15 , whereas for boys, the decrease between ages 13–14 and ≥ 15 was much greater. However, the decline in waterpipe initiation between ages 11–12, 13–14 and ≥ 15 was similar for boys and girls. It is notable that the largest drop in prevalence of initiation was evidenced at ≥ 15 years of age (see figure 1 for details).

Smoking progression

Among current smokers, we analysed the time trend of daily and weekly use of cigarettes and waterpipe, respectively. All trends were significant ($P < 0.001$ for all, except girls' daily cigarette smoking $P < 0.05$); however, the sole *increasing* trend in smoking frequency was for daily cigarette smoking in boys. Boys in particular reported more intensive smoking patterns compared with girls, with a larger proportion of boys reporting daily cigarette smoking at years 2 through 4 ($P < 0.001$) and weekly waterpipe smoking at years 3 and 4 ($P < 0.001$) (see details in figure 2).

Discussion

This is the first cohort study exploring the evolution of smoking behaviour among youth (13–16 years) in a Middle Eastern country, and with detailed information about cigarette and waterpipe smoking with 4 years of follow-up. It shows that even at the early age of 13, 16% of these youth in Irbid were already current smokers and more than one-third (37%) of the sample had at least experimented with smoking by age 13. Whereas waterpipe smoking was more prevalent at every time point of this study and in both sexes, cigarette smoking showed a bigger increase during the 4 years of observation. Generally, girls showed the same predominance of waterpipe smoking at every time point of the study, but generally at lower levels of smoking than boys for both cigarettes and waterpipe. The time dynamics of smoking acquisition among girls seems in general ~ 2 years delayed compared with that

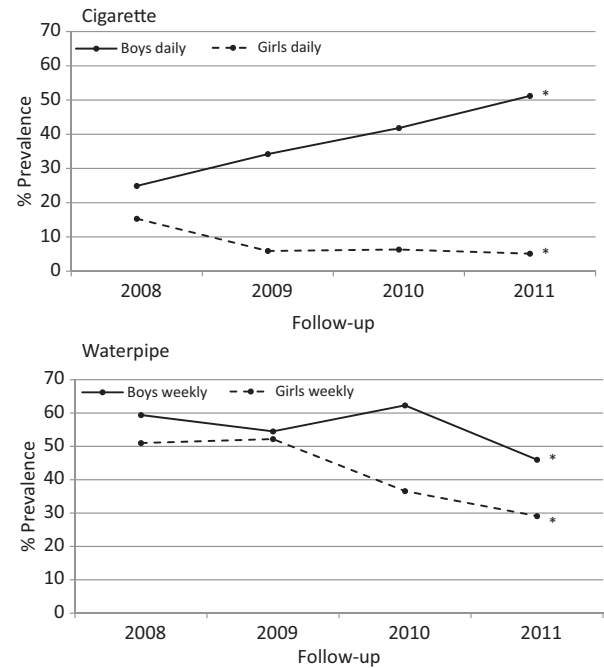


Figure 2 Frequency of daily smoking of cigarettes and weekly smoking of waterpipe by gender among current smokers in a school-based sample of adolescents in Irbid, Jordan, 2008–11. Note: *Significant linear trend ($p < .05$)

of boys. Most youth smokers in this population initiated smoking before the age of 15, with the age-group 11–12 showing the most intense smoking initiation for both boys and girls. Cigarette initiation among girls, moreover, showed a delayed pattern compared with waterpipe. Such information provides valuable insights about early tobacco-use trajectories among youth in Irbid according to age, gender and tobacco-use method. These insights can guide interventions to curb tobacco use among youth in Irbid and perhaps Jordan overall, as well as other countries in the Middle East that share many of the same tobacco-use patterns.⁸

The predominance of waterpipe smoking at early stages and the faster rise of cigarette smoking suggest that more youth are having their first experience with tobacco through the waterpipe. Our results show generally that waterpipe initiation is occurring at earlier stages compared with cigarettes. Whether this reflects more interest in experimenting with the exotic waterpipe,¹² societal tolerance for the culturally acceptable waterpipe (especially for girls),^{13,14} a belief in waterpipe's reduced harm and addictiveness¹⁵ or earlier exposure to the waterpipe by family and peers remains to be seen.¹⁶ Most likely, it is a combination of all these and other factors, but a more systematic study of the predictors of waterpipe initiation is needed to understand this phenomenon.

Waterpipe early predominance and steeper cigarette time trends also suggest that the waterpipe can potentiate cigarette smoking among youth. In fact, an earlier study from the same cohort—with a shorter follow-up—showed that waterpipe smokers at baseline were twice as likely as never-smokers to be current cigarette smokers 2 years later.⁹ One suggested mechanism for this could be the recently illustrated dependence-inducing properties of waterpipe smoking in youth and its limited accessibility compared with cigarettes.¹⁷ Accordingly, once waterpipe smokers become hooked on nicotine in a way that requires frequent dosing, cigarettes become a more practical way to obtain the 'fix' compared with the waterpipe, which requires time and arrangement for smoking.¹⁸

The gender difference in tobacco-use method and time dynamics also suggests some interesting patterns. Generally, smoking among women/girls is less tolerated by traditional societies in the Middle East compared with men's smoking.^{14,17} As this and other studies

suggest however, this gender-based intolerance to girls' smoking is less pronounced for the traditional/indigenous waterpipe compared with the 'Western' cigarettes.^{14,19–21} So although girls in this study smoked mostly less than boys, the gender-based predominance of waterpipe smoking (over cigarettes) was more pronounced for girls compared with boys. For example, at each time point of the study, current waterpipe smoking was more than double that of cigarettes among girls, but the difference between the two tobacco-use methods was less pronounced for boys. This is also supported by the later cigarette initiation by girls compared with boys shown in this study. These observations perhaps illustrate that experimenting with waterpipe is a more culturally acceptable act for girls in traditional Middle Eastern societies compared with smoking cigarettes.⁴

This unfavourable environment for smoking by girls is likely influencing not only initiation/preference of waterpipe vs. cigarettes but also their smoking progression. Interestingly, whereas the frequency of daily smoking increased for boys, reflecting perhaps progression to dependence, the observed trend for girls was one of diminishing daily smoking. A decline in frequent users was also seen for girls' waterpipe smoking—evidenced by the decrease in weekly smokers—despite the general increase in waterpipe smoking among them. So although more girls seem to be experimenting with smoking as they grow up, their use patterns do not intensify as seen in boys. Another related interesting pattern is that in contrast to age-related increase in frequent cigarette smokers (daily smokers) among boys, the same was not noticed for the frequency of (weekly) waterpipe smoking (which decreased). This is likely related to the earlier point suggesting switching to the more accessible cigarettes among the more nicotine-dependent waterpipe smokers among boys, but the traditional barrier for girls is somehow prohibiting such a switch.

Limitations and strengths

One of the main limitations of this study is that all measures assessed were self-reported, which could result in underreporting of smoking, especially among girls, because of the social undesirability of girls' smoking in this region of the world. However, self-reported smoking has been strongly correlated with biomarkers of smoking in cohort studies of adolescents.²² Moreover, our previous experience studying smoking habits of youth in the Middle East shows that adolescents will share openly their smoking experiences, provided that confidentiality and anonymity are assured.²³

On the other hand, this is the first cohort study to investigate this top-priority public health problem among youth in the region. This study analyses time trends of smoking assessed cross-sectionally at each time point; i.e., not the development of smoking for each study participant across time. This is intentional, because we wanted to draw a general picture of group behaviour change across time rather than the progression of the smoking habit among individuals. Although both types of information are important, they reflect different aspects of the problem with different implications for tobacco control in this population.

The presented information provides unique insights on time-related patterns that are gender- and tobacco-use-method-specific among youth in Irbid, Jordan. The length and completeness of follow-up combined with the detailed information of both smoking methods relevant to this population and region (cigarettes, and waterpipe) add to the strength of this study.

Conclusions

This study shows intensive smoking patterns at early ages among youth in Irbid, characterized by the predominance of waterpipe smoking and a steeper increase in cigarette smoking. It points at the possibility of waterpipe being the favourite method for introducing youth to tobacco, as well as being a vehicle for tobacco dependence and cigarette smoking. Such information

necessitates more attention to waterpipe at early ages for any tobacco-control strategy among youth in Irbid. The reasons behind this early predominance of waterpipe and factors influencing the gender- and tobacco-use-method-specific time trends noticed in this study provide very valuable research questions for further studies aimed at understanding tobacco use and addiction among youth in Irbid, Jordan, and the Middle East. Going forward, risk and protective factors for initiation of cigarette and waterpipe and the potential interaction of these smoking behaviours, together with further investigation of waterpipe as a gateway to cigarettes, are all viable avenues of investigation and could provide clear direction for smoking-prevention interventions.

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Conflicts of interest: None declared.

Key points

- This is the first longitudinal study of tobacco use among youth in a Middle Eastern country (Jordan).
- This study shows intensive smoking patterns at early ages characterized by a predominance of waterpipe smoking and steeper age-related increase in cigarette smoking.
- Our results point at the possibility of waterpipe being the favourite method for introducing youth to tobacco in Jordan, as well as serving as a vehicle for tobacco dependence and cigarette smoking.
- This information necessitates more attention to waterpipe tobacco use at early ages for tobacco-control strategies aiming to reduce smoking among youth.

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Investigating cervical, oesophageal and colon cancer risk and survival among migrants in The Netherlands

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Background: Studies on cancer in migrants can shed light on grey areas in cancer aetiology and can help assessing the effectiveness of prevention measures. In this study, we aimed to determine the impact of migration and different ethnic backgrounds on cervical, colon and oesophageal cancer risk and survival. **Methods:** Cancers diagnosed in 1996–2009 were selected from The Netherlands Cancer Registry. Besides standardized incidence ratios, differences in survival were explored using Cox regression and relative survival analysis. **Results:** All migrant women had increased risks for cervical cancer when compared with Dutch native women, ranging from standardized incidence ratio = 1.8 (95% confidence interval 1.6–2.2) in Surinamese women to 1.2 (0.9–1.5) in Turkish women. Relative survival was better among Moroccan, Surinamese and Antillean migrants [5-year relative survival rates (RSR) range: 71–73%] compared with that of native Dutch (66%); however, it was poorer in Indonesians (51%). Although oesophageal cancer risk was lower in all migrants with Standardized incidence ratios ranging from 0.1 to 0.6, survival was slightly lower relative to Dutch natives (1-year RSR: 21–32% compared with 37%; Turkish: 42%). Colon cancer was less common among migrants, particularly among Moroccans and Turkish. Five-year RSR from colon cancer was equal or better in all migrants (range: 48% in Indonesians to 62% in Turkish) compared with Dutch natives (48%). **Conclusion:** Risk of cervical, oesophageal and colon cancer in migrants mainly reflects the risks in their countries of origin. Almost similar cancer survival rates in migrants and native Dutch individuals points towards successful and comprehensive health care in The Netherlands. Primary cancer prevention should target high-risk groups and involve migration-sensitive approaches.

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Introduction

Studies on cancer in migrant populations may provide valuable insight into carcinogenesis and be helpful in exploring the contributions of environmental and genetically determined risk factors as well as their interaction.¹

Cervical cancer is the second most common female cancer worldwide, and it varies greatly on a global scale, being most prevalent in developing countries. Studies from Sweden reported

increased risks of cervical cancer in immigrant women,^{2,3} especially among those who originate from Central America and Middle Africa.^{2,5} The opposite was true for women from Eastern Africa and Asia, who had lower risks than Swedish-born women.² The heterogeneous geographical and ethnic distribution of cervical cancer has been found to be strongly linked to human papillomavirus (HPV) infection.

Oesophageal cancer was reported to be less common in various migrant groups⁴; however, it was particularly high in African