Original Article

Trend of cigarette smoking in Iranian adult population from 2000 to 2011 based on four national surveys

Alipasha Meysamie[1*], Reza Ghalehtaki[2], Saeed Ghodsi[3], Alireza Esteghamati[4], Kazem Mohammad[5], Kouroush Etemad[6], Jalil Koohpayezadeh[7], Ehsan Shojaeefar[8]

[1] Department of Preventive and Community Medicine, Tehran University of Medical Sciences, Tehran, Iran
[2] Department of Radiation Oncology, Tehran University of Medical Sciences, Tehran, Iran
[3] Department of Cardiology, Tehran University of Medical Sciences, Tehran, Iran
[4] Endocrinology and Metabolism Research Center (EMRC), Vali-Asr Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran
[5] Department of Biostatistics and Epidemiology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
[6] Center for Disease Control, Ministry of Health and Medical Education, Tehran, Iran
[7] Department of community medicine, Iran University of Medical Sciences, Tehran, Iran
[8] Iranian Scientific Association of Community Medicine, Tehran, Iran

Corresponding author and reprints: Alipasha Meysamie. Department of Preventive and Community Medicine, Tehran University of Medical Sciences, Tehran, Iran.
Email: meysamie@tums.ac.ir

Abstract

Background: Tobacco smoking has been a major health concern for many years. People's awareness of the potential health hazards and government policies might change its pattern and prevalence of use. In order to monitor its conversion, determining the overall pattern of tobacco use and trend analyses would be crucial, which were aimed in the present study.

Methods: Patterns of smoking in four national surveys conducted in years 2000, 2005, 2007, and 2011 with 33300, 89337, 5287, and 8837 participants, respectively, were assessed. Current status of cigarette, pipe and water-pipe smoking, the number of cigarettes used per day, and the age of smoking initiation were major parameters. After weighting based on province, residential area, gender, and age group, trend analysis was done through complex samples general linear model using IBM SPSS Statistics for Windows, Version 20.0. The values in the first survey (2000) were considered as reference points and categories.

Results: While current cigarette smoking prevalence has been decreased (13.5% in 2000 to 11.3% in 2011) $P<0.001$, the average of pack-years increased. There was no significant decline in the mean age of initiation. It is also true for the prevalence of pipe and water-pipe smoking, which showed no noticeable difference compared to 2000.

Conclusion: According to our findings it seems that health policy makers should focus more on designing programs targeting water-pipe consumption and also pay attention to the trends among subgroups for tailoring policies and scheme implementation.

Introduction

Tobacco smoking has become the second risk factor of non-communicable diseases which contributes to 9% of worldwide death (1). In Iran, it is ranked the fifth in the list of disease burden (2).

In addition, tobacco consumption led to 5.7 million mortalities, 6.9% of years of life lost, and 5.5% of disability adjusted life-years in 2010 (1, 3). It is predicted that 1 billion deaths will be resulted from tobacco smoking in the 21st century (4). Therefore, many countries have made their best efforts to combat this problem by redesigning health policies (5-7) and legislations (8,9). On the other hand, commercial strategies of the tobacco manufacturing companies are very impressive (10), especially regarding young adults (11). Hence, to evaluate the consequences of the governments' interventions, trend analyses of tobacco smoking would be advantageous.

Many studies have shown decreasing pattern of tobacco smoking (12-14), while others like WHO MONICA Project, conducted in 21 countries over a ten-year period, depicted a decline in men rather than in women (15). Furthermore, in one systematic review carried out in Portugal between 1987 and 2008, the smoking prevalence in women was reported to experience an increase (16). In Brazil, in three birth cohorts in elderly population, the prevalence of tobacco consumption did not change over time; however, the trend was on the rise in women (17). In Iran, although numerous studies have reported the prevalence of tobacco smoking, only one study was based on the national data which considered two points in 1991 and 1999 (18). Therefore, little is known about the recent scope of smoking in the country.

In the current investigation, the smoking trend was evaluated considering four national surveys. The concept of Current smoking as a well-established tool represents and helps measure the smoking burden appropriately. It is also applicable for low-prevalence regions (19). The first aim of the study was to determine the overall pattern of tobacco smoking with regard to cigarette, pipe, and water pipe consumption. Second, comparing the trend in subpopulation could shed light on targeting health programs and interventions.

Methods

Trend analysis was performed according to the data of four national studies about current cigarette, water pipe, and pipe smoking prevalence, pack-years, as well as initiation age. The pack-year variable was calculated via multiplying duration of use in years by "sticks/20". The surveys conducted in 2005, 2007, and 2011 were according to the tool used to collect data and measure Non-Communicable Disease (NCD) risk factors within the WHO STEP-wise approach to surveillance (STEPS), whereas the first survey (in 2000) was part of the "national health surveillance". The numbers of participants in these studies were 33300, 89337, 5287, and 8837 pertaining to the consecutive surveys in 2000, 2005, 2007, and 2011, respectively.

The national health survey in 2000:
Data collection was done using systematic clustered sampling. Each cluster was comprised of eight households, from urban and rural parts of the country. The ratio of sample to general population was 1 to 1000. The framework of selecting cluster in regions with existing list of households was systematic and in regions without it, the cluster was chosen randomly according to population estimate of the city and the address of hospital birth (18, 20). In total, the number of participants was 36,966.

The 2005 survey
It was the first national surveillance risk factors of non-communicable disease (SURFNCD) as a part of WHO STEPS. The STEPS instrument consists of guidelines to perform population-based surveys related to non-communicable diseases in adults aged 15-64. A multi-stage randomized cluster sampling method was used. The postal address, making use of an Iranian zip code, was applied for starting points in each cluster. The minimal sample size was for provinces with population less than 2,500,000 and the maximum sample size was for Tehran. Generally, there were about 89,000 participants in the study (21).

The 2007 and 2011 surveys

The 2007 survey was designed based on a randomized clustered sampling scheme. After selecting each cluster, stratification was performed according to the reference structure of the population defined by age intervals and genders. Each age group consisted of 10 males and 10 females. The samples were chosen proportionally according to urban and rural population (22).

In 2011, randomized multistage cluster sampling was used in four steps considering World Health Organizations (WHO) Kish tables (Kish selection grid). At first, counties were determined as Primary Sampling Units then in each of the units, areas were chosen as secondary sampling units (SSUs). At the third stage, postal codes in each SSU were randomly selected. Then, the interviews were conducted (23, 24). Details of these studies were also mentioned elsewhere (23, 25, 26).

The weighing was based on stratification levels (province, residential area, age group, and gender). Total national population estimates of the year 2011 were achieved from the consensus presented by "Islamic Republic of Iran National Statistics Organization", which was available on its website (www.amar.org.ir). Complex sample survey analysis, according to general linear model, was recruited to perform the trend analyses using IBM SPSS Statistics for Windows, Version 20.0. Estimated values of the first survey (2000) were considered as the reference points. The LSD (Least Significant Difference) statistic and post-hoc test were used as adjustments for multiple comparisons for deriving *P* values compared to reference categories. All point estimates and confidence intervals (95% CI) of frequencies and means were also calculated. Subgroup analyses were performed based on gender, residential area, and age groups.

Results

National weighed population estimates and prevalence rates of current smoking as well as the mean pack-years of consumption and age of initiation are provided in Tables 1-4. Generally, observed changes in smoking prevalence since 2000 to 2005 and 2000 to 2011 were statistically significant. During the total period, the overall prevalence rate decreased from 13.5% (in 2000) to 11.3% in 2011; however, a completely predictable trend was not detected. There was an increase in 2007 reaching the frequencies of 2000 after a considerable decline in 2005. In addition, except for 25-34 age group, the decreasing trend was not observed in the other age groups (2000 to 2011). It seems that the most dramatic drop in percentage of current smokers happened in 25-34 years (from 16.3% in 2000 to 10.8% in 2011). In fact, in this age group, after a significant fall in prevalence rate in 2005, there was a slight reduction until 2011. Furthermore, in 15-24 age group, there was a rise in the prevalence in 2007, although there was no considerable difference with the reference points in other time periods.

The rate of current cigarette smoking in males decreased significantly over the time period (from 25.6% to 21.3%) $P<0.001$, while the same trend in females was not found to be significant (from 1.2% to 1.0%) $P=0.34$ (Table 1). Moreover, the prevalence of current smoking was considerably greater in males than in females in all four periods (23.3 vs 1.75). Area of residence did not make a significant difference in the prevalence rates except in 2005, where rural areas had higher prevalence. Regarding the trend between 2000 and 2011, while both rural and urban rates went down considerably, the urban rate had a slight rise in 2007 before a fall in 2011.

Regarding pack-years of smoking, the pattern was rather different. Generally, a significant rise in the mean number of pack-years for cigarette smoking occurred between 2000-2011, even though the observed rising means among 5-year age categories were not statistically

Table 1. Prevalence of current smokers and its trend in Iranian adult population, 2000–2011

	Current Smokers	2000 Number (95%CI) Percent (95%CI)	2005 Number (95%CI) Percent (95%CI)	P	2007 Number (95%CI) Percent (95%CI)	P	2011 Number (95%CI) Percent (95%CI)	P
Sex	Male	6880438 (6502779-7258097) 25.6% (24.4%-26.9%)	5775528 (5660680-5890377) 21.5% (21.1%-21.9%)	<0.001	6683329 (6129748-7236910) 24.9% (23.1%-26.7%)	0.51	5732093 (5257627-6206558) 21.3% (19.8%-23.0%)	<0.001
	Female	325965 (253013-398917) 1.2% (1.0%-1.5%)	775978 (733209-818747) 2.9% (2.8%-3.1%)	<0.001	500304 (319515-681093) 1.9% (1.3%-2.7%)	0.07	273946 (193132-354759) 1.0% (0.8%-1.4%)	0.34
Residential Area	Urban	5124609 (4771853-5477366) 13.2% (12.4%-14.1%)	4564115 (4456440-4671790) 11.7% (11.5%-12.0%)	0.002	5290491 (4798029-5782953) 13.6% (12.5%-14.8%)	0.56	4368301 (3965896-4770706) 11.2% (10.3%-12.2%)	0.003
	Rural	2081794 (1928460-2235127) 14.4% (13.5%-15.4%)	1987391 (1928863-2045919) 13.8% (13.4%-14.2%)	0.23	1893142 (1582308-2203976) 13.1% (11.2%-15.2%)	0.24	1637737 (1373694-1901780) 11.3% (9.7%-13.2%)	0.002
Age group	15-24	455722 (384870-526575) 3.1% (2.6%-3.6%)	480498 (439742-521254) 3.2% (3.0%-3.5%)	0.55	898963 (672948-1124978) 6.0% (4.7%-7.7%)	<0.001	510339 (355809-664869) 3.4% (2.5%-4.6%)	0.52
	25-34	2541226 (2303450-2779002) 16.3% (14.9%-17.7%)	1925235 (1845324-2005147) 12.3% (11.8%-12.8%)	<0.001	1980286 (1618643-2341929) 12.7% (10.7%-15.0%)	0.006	1688122 (1440852-1935393) 10.8% (9.4%-12.4%)	<0.001
	35-44	2185249 (1995945-2374553) 20.7% (19.1%-22.3%)	1977155 (1913135-2041175) 18.7% (18.1%-19.3%)	0.02	2208620 (1898203-2519037) 20.9% (18.4%-23.6%)	0.88	1946699 (1650290-2243107) 18.4% (16.1%-21.0%)	0.13
	45-54	1337730 (1151485-1523975) 17.6% (15.5%-19.9%)	1433749 (1387162-1480337) 18.8% (18.3%-19.5%)	0.28	1457960 (1239516-1676405) 19.2% (16.7%-21.9%)	0.3	1227192 (1001774-1452609) 16.1% (13.7%-19.0%)	0.41
	55-64	686475 (560508-812442) 15.0% (12.6%-17.7%)	734868 (708345-761392) 16.0% (15.5%-16.6%)	0.43	637804 (522952-752655) 13.9% (11.7%-16.4%)	0.53	633686 (544494-722879) 13.8% (12.1%-15.7%)	0.47
Total		7206403 (6821763-7591043) 13.5% (12.9%-14.2%)	6551506 (6428953-6674060) 12.3% (12.1%-12.5%)	0.001	7183633 (6601279-7765988) 13.5% (12.5%-14.5%)	0.94	6006038 (5524739-6487337) 11.3% (10.5%-12.1%)	<0.001

P value for comparing prevalence with 2000

Table 2. Mean (95%CI) pack year of cigarette smoking and its trend in Iranian adult population, 2000–2011

	Pack year	2000 Mean (95%CI)	2005 Mean (95%CI)	P	2007 Mean (95%CI)	P	2011 Mean (95%CI)	P
Sex	Male	12.8 (12.1-13.5)ß	12.2 (12.0-12.4)	0.14	13.7 (12.7-14.8)	0.15	15.1 (13.8-16.3)	0.002
	Female	6.8 (5.5-8.0)	8.2 (7.4-9.1)	0.06	12.1 (8.4-15.7)	0.008	11.0 (7.0-14.9)	0.04
Residential Area	Urban	12.0 (11.1-12.9)	11.8 (11.5-12.0)	0.64	13.3 (12.2-14.5)	0.07	14.0 (12.7-15.3)	0.012
	Rural	13.9 (12.7-15.0)	12.6 (12.2-13.0)	0.04	14.5 (12.4-16.7)	0.61	17.4 (14.6-20.3)	0.02
Age group	15-24	2.3 (1.8-2.8)	2.7 (2.4-3.0)	0.17	2.8 (1.8-3.7)	0.42	4.1 (2.0-6.2)	0.10
	25-34	5.8 (5.3-6.4)	5.5 (5.3-5.8)	0.35	6.6 (5.2-8.1)	0.29	7.0 (5.8-8.2)	0.07
	35-44	12.8 (11.9-13.6)	12.4 (12.0-12.8)	0.48	14.0 (12.5-15.4)	0.14	13.3 (11.9-14.7)	0.50
	45-54	21.3 (19.3-23.4)	18.0 (17.4-18.6)	0.002	21.9 (19.5-24.3)	0.71	23.6 (20.2-27.0)	0.25
	55-64	25.7 (22.2-29.3)	22.8 (21.9-23.8)	0.12	27.9 (23.9-31.8)	0.43	28.8 (24.4-33.2)	0.29
Total		12.5 (11.8-13.2)	12.0 (11.8-12.2)	0.16	13.6 (12.6-14.7)	0.08	14.9 (13.7-16.1)	0.001

P values for comparing means with 2000

significant. The most obvious increase occurred in females from 6.8% in 2000 to 11% in 2011. Concerning residential areas, although both urban and rural rates experienced considerable increase in 2011 compared with that in 2000, the pattern of increase was not linear, due to a drop in 2005 (Table 2).

Turning to the age of initiation, generally, there was no significant decrease in mean age of initiation in spite of considerable rise and fall in mean age in 2005 and 2007, respectively, compared with 2000. In addition, there was a notable decrease in the mean age of initiation only in 2 subgroups (females and 25-34 age group) in 2011 compared with the reference point. In 2005, most subgroups showed considerable differences with 2011 in terms of increasing mean age of initiation. Besides, female group and 25-34 age group experienced a significant drop throughout the period (Table 3).

Despite statistically significant decline in water pipe and pipe smoking prevalence in 2005 and 2007 compared to 2000, there was generally no considerable change from 2000 to 2011. Among age subgroups, there was noticeable rises in water pipe and pipe smoking prevalence in 15-24 reaching from

1.6% in 2000 to 4.4% in 2011. Meanwhile, participants above 35 years old showed considerable drops and, the most fall in prevalence occurred in 55-64 years olds reaching from 6.3% to 3.1%. An upward pattern of water pipe and pipe smoking prevalence was detected in men while the pattern pertaining to women was downward. These changes had some fluctuations in both genders. In addition, in 2000 and 2005, the prevalence was higher among women compared with men; however, the prevalence in males increased gradually in 2 consecutive periods (2007 and 2011). Based on residential areas, both areas have shown significant declines in 2005 (Table 4).

Discussion
In the current study, although the only significant decline among the age-groups was observed in 25-34 years, the overall decreasing trend was persistent. The only study which evaluated the trend of smoking prevalence on the basis of two national studies in 1991 and 1999 in Iran (18) showed a decreasing pattern in all age groups. Based on the results reported by Bilano et al. study, which forecasted worldwide trend of tobacco use by 2025,

Iran will be among countries with low prevalence both in men and women (19). According to one study in the United States from 2005 to 2010, the prevalence of current smoking had been decreasing in individuals above 18. Meanwhile, the drop was not noticeable in younger participants, a finding, which was consistent with our findings in 15-24 age group (27). Another study during 1991 to 1995 on high school students in the United States showed an increase in current smoking prevalence (28).

In order to explain the descending trend of current cigarette smoking, we must indicate the rising prevalence of substance abuse and illicit drug consumption, demonstrated in an investigation over a 30-year period in Iran (29). In other words, a transition in the paradigm of consumption has occurred. At a glance, participants in the second age category (25-34 years old) have made the difference. Comparison of the individuals below and above 34 years resulted in the same conclusion. Since younger individuals often start cigarette smoking as a new experiment, smoking frequency in the first age group has been persistent in spite of the next category and the overall trend. In 25-34 they have broader access to products other than cigarette. Another optimistic interpretation for the decreasing trend is people's awareness of cigarette smoking health hazards. Also, one study in Pakistan expressed that the prevalence of smoking in healthcare workers was the same as that of general population (30).

Table 3. Mean (95%CI) of initiation age of cigarette smoking and its trend in Iranian adult population, 2000–2011

	Initiation age	2000 Mean (95%CI)	2005 Mean (95%CI)	P	2007 Mean (95%CI)	P	2011 Mean (95%CI)	P
Sex	Male	21.0 (20.7-21.3)	24.3 (24.1-24.4)	<0.001	20.4 (19.9-20.9)	0.03	20.8 (20.2-21.4)	0.55
	Female	28.1 (26.3-30.0)	28.7 (28.3-29.2)	0.54	24.4 (21.6-27.2)	0.02	24.0 (21.5-26.5)	0.009
Residential area	Urban	21.5 (21.1-21.9)	24.9 (24.8-25.1)	<0.001	20.9 (20.3-21.4)	0.07	21.3 (20.6-21.9)	0.55
	Rural	20.8 (20.4-21.3)	24.4 (24.2-24.7)	<0.001	19.8 (18.8-20.7)	0.04	19.9 (18.7-21.1)	0.16
Age group	15-24	17.5 (17.0-18.0)	17.1 (16.8-17.4)	0.14	17.0 (16.1-17.9)	0.38	16.0 (14.4-17.6)	0.07
	25-34	20.0 (19.6-20.4)	21.5 (21.3-21.7)	<0.001	19.5 (18.7-20.2)	0.25	18.8 (18.1-19.6)	0.01
	35-44	21.4 (20.9-21.9)	24.2 (23.9-24.5)	<0.001	21.1 (20.2-22.0)	0.57	21.8 (20.8-22.8)	0.48
	45-54	23.0 (22.1-24.0)	28.4 (28.0-28.8)	<0.001	21.9 (20.7-23.1)	0.15	22.4 (20.7-24.1)	0.51
	55-64	25.0 (23.4-26.5)	33.0 (32.5-33.5)	<0.001	23.5 (21.6-25.5)	0.25	23.7 (22.5-24.8)	0.18
Total		21.3 (21.0-21.6)	24.8 (24.6-24.9)	<0.001	20.6 (20.1-21.1)	0.01	20.9 (20.3-21.5)	0.24

P values for comparing means with 2000

Table 4. Prevalence of Water Pipe/Pipe smokers and the trend in Iranian adult population, 2000–2011

	Water Pipe/Pipe	2000 Number (95%CI) Percent (95%CI)	2005 Number (95%CI) Percent (95%CI)	P	2007 Number (95%CI) Percent (95%CI)	P	2011 Number (95%CI) Percent (95%CI)	P
Sex	Male	958798 (822722-1094874) § 3.6%§§ (3.1%-4.1%)	343559 (313998-373121) 1.3% (1.2%-1.4%)	<0.001*	947622 (733074-1162171) 3.5% (2.8%-4.4%)	0.93	1324984 (1107056-1542912) 4.9% (4.2%-5.8%)	0.004
	Female	1090862 (955129-1226596) 4.1% (3.7%-4.7%)	443688 (412541-474835) 1.7% (1.6%-1.8%)	<0.001	575233 (420421-730046) 2.2% (1.7%-2.8%)	<0.001	604053 (493428-714678) 2.3% (1.9%-2.7%)	<0.001
Residential area	Urban	1390714 (1214737-1566690) 3.6% (3.2%-4.1%)	441077 (406811-475343) 1.1% (1.1%-1.2%)	<0.001	924774 (718808-1130740) 2.4% (1.9%-3.0%)	0.001	1407185 (1188753-1625617) 3.6% (3.1%-4.2%)	0.90
	Rural	658946 (581665-736228) 4.6% (4.1%-5.1%)	346171 (320288-372053) 2.4% (2.2%-2.6%)	<0.001	598082 (432022-764141) 4.1% (3.1%-5.4%)	0.50	521852 (412226-631477) 3.6% (2.9%-4.4%)	0.04
Age group	15-24	237152 (177771-296533) 1.6% (1.2%-2.0%)	83949 (66475-101423) 0.6% (0.5%-0.7%)	<0.001	388903 (243445-534361) 2.6% (1.8%-3.8%)	0.05	650098 (504716-795480) 4.4% (3.5%-5.4%)	<0.001
	25-34	477213 (386482-567944) 3.1% (2.5%-3.7%)	188508 (162498-214519) 1.2% (1.1%-1.4%)	<0.001	423583 (271872-575295) 2.7% (1.9%-3.9%)	0.54	574113 (433085-715141) 3.7% (2.9%-4.7%)	0.25
	35-44	635618 (538409-732828) 6.0% (5.2%-7.0%)	208179 (186762-229595) 2.0% (1.8%-2.2%)	<0.001	383784 (252846-514721) 3.6% (2.6%-5.1%)	0.002	333320 (234738-431902) 3.2% (2.3%-4.2%)	<0.001
	45-54	410579 (319284-501875) 5.4% (4.3%-6.7%)	180702 (163877-197527) 2.4% (2.2%-2.6%)	<0.001	218205 (137753-298656) 2.9% (2.0%-4.1%)	0.002	230772 (142569-318976) 3.0% (2.1%-4.4%)	0.005
	55-64	289097 (203090-375105) 6.3% (4.7%-8.4%)	125910 (114937-136883) 2.7% (2.5%-3.0%)	<0.001	108381 (61410-155352) 2.4% (1.5%-3.6%)	<0.001	140733 (105988-175479) 3.1% (2.4%-3.9%)	0.001
Total		2049660 (1857462-2241858) 3.8% (3.5%-4.2%)	787247 (744305-830190) 1.5% (1.4%-1.6%)	<0.001	1522856 (1258285-1787427) 2.9% (2.4%-3.4%)	0.001	1929037 (1684639-2173435) 3.6% (3.2%-4.1%)	0.43

P values for comparing means with 2000

Although in individuals over 35 the overall trend in current smoking did not show a significant change over the 12 year period, water-pipe and pipe smoking consumption trend was downward in these age groups. It may show the poor intention to quit smoking in older people (31), meanwhile, older people have less desire for water-pipe smoking compared to the youth nowadays (32).

Findings of the current study showed that, although sex differences were tapered over time, the prevalence of current smoking remained higher in men than in women, which is similar to the trend of tobacco smoking in Canada and Australia (33-34).

The present study has demonstrated a reduction in current cigarette smoking percentage, while the average of pack-years has increased simultaneously. The discrepancy could be explained by the decrease in initiation age especially in 25-34 group and women in comparison between 2011 and 2000 surveys. Mean age of starting to smoke had a significant decline that could result in more years of smoking, and increased pack-years. Furthermore, it seems that these variables have different nature and definitions. Current smoking prevalence was assessed with binary response, while pack-year was defined as an aggregated variable. Hence, mean pack-years of smoking does not necessarily drop concurrently with a decline in prevalence. Ex-smokers are also included in the concept of pack-year in addition to current smokers, so the cumulative data might have resulted in the rise compared with the prevalence of current smoking. Regarding age groups, in the present study, the highest rise in pack year mean point estimate occurred in 55-64 year group which may indicate less intention to quit smoking in older people (31). In addition, according to Ng et al study (3), who assessed the pattern of cigarette smoking from 1980-2012 in 187 countries, the estimated age adjusted prevalence of daily smoking declined notably around the world. However, as a consequence of population growth, the number of daily smokers rose sharply and Iran was among the countries with "low prevalence (age-standardized prevalence for both genders combined was below the median across all countries (18.7%))" and "high consumption (≥20 cigarettes per smoker per day)". The result implied non-stopping market of various tobacco-containing products.

The overall trend in current smoking prevalence was downward, while as for pipe and hookah smoking, there was no difference between 2000 and 2011. This result was similar to that reported in Mohammad et al study (18) during 1991-1999, which stated that water-pipe have been in favour with smokers. Although the comparison of point estimates for pipe and hookah smoking prevalence in the cited study showed a decrease, the drop was not statistically significant. Both studies have also found a significant rise in the prevalence of water-pipe smoking in the first age category. They had shown decreasing prevalence of current smoking in all age groups, while the present study expressed the decline only in one of the intervals (25-34 year).

One explanation for the decrease in current smoking may be due to self-reporting data collection that is, with the help of mass media and people's awareness of health effects of cigarette smoking, its report by people may be affected with wish bias and people try to underreport it. Hence, because of the aforementioned reason, people think that cigarette smoking is more hazardous to their health than water-pipe, so they smoke less.

Besides, there are some misconceptions about water-pipe smoking like being less hazardous than cigarette (35-37) and also the idea that it is easier to quit (36, 38).

Water-pipe smoking is going to be more prevalent among the youth (32, 39), especially among high school students (40), which is consistent with our findings in 15-24 groups. In addition, many other reasons could have made water pipe smoking

attractive like the sharing nature of use, adding flavour and taste and also serving it in traditional restaurants (41). Finally, the long duration of hookah smoking which lasts for about one hour in each episode is not also comparable with that of cigarette smoking providing enough time for entertainments (38).

In the current study, men have experienced a significant rise in water-pipe and pipe smoking, while the concurrent trend was descending in women. With regard to age categories, the only considerable rise was observed in 15-24 age group. We concluded that the younger individuals and male participants have made the major alterations of the trend. In other words, these subgroups were observed to be responsible for increasing the prevalence of water-pipe smoking after 2005, which had a descending trend since 2000.

Decreasing age of initiation seen in the present study is worrisome, because he who starts smoking under 18 years of old is more susceptible to become daily smoker and less likely to quit in the future. Moreover, age of initiation has been proposed as an important factor, even more than the quantity of smoking, in some investigations (18, 42). A transition in the age of starting to smoke to earlier ages was observed in a 44-year study in Spain (43), while other studies have not reported this change (42). Results from the Global Adult Tobacco Survey (GATS) carried out in 16 countries and one study in Japan showed decreasing age of initiation in women, which was in line with the findings of our results. However, we did not observe this pattern neither in males nor in the overall trend (44-45).

To the best of our knowledge, the present study is the first study in Iran applying the data of sequential national surveys to analyse the trend of tobacco smoking. Second, using large sample sizes results in fewer errors and could also show quadratic change. Third, combining groups which have similar characteristics like residential areas or age groups and evaluating pattern according to these categories could be helpful for designing and implementing health interventions. Also, performing the analyses on standardized samples according to demographic features helped to extrapolate the results.

Major limitations were related to the type of data collection in national surveys. First, merging data in the surveys could hidden some realities, especially about water-pipe and pipe smoking which expressed different patterns. Although there is a rise in water-pipe smoking in most of the countries particularly in adolescents (32), Nelson et al. have depicted the descending trend of pipe smoking. This was also found among the Iranians, so merging the trends of pipe and water-pipe might have partially diluted the noticeable rise in water-pipe smoking (46). Different methods of data collection in the surveys might have also led to fluctuating prevalence rates. Besides, different sample sizes and the questionnaire formats (different in 2000) of national surveys might be a potential source of errors. In addition, current tobacco smoking trends and those of water-pipe smoking refer to separate and different types of smoking habits. Despite continuous or daily cigarette smoking, most water pipe smokers are intermittent users (47). Moreover, using self-report questionnaires might underestimate the prevalence of smoking especially in adolescents who are at experimental phase and hesitate to tell the truth. This could also be true for women who may be more unwilling to talk about their smoking habits (28). Although a majority of studies have mentioned that the questionnaire is a valid tool for evaluation (48), others have suggested the use of biochemical assays in these subgroups (49). Focusing on young females and tailoring health policies for them is warranted since they are more prone to carcinogenic impacts of tobacco and also they become addicted faster than males. Moreover, some advertisements have targeted young females with exaggerating some

effects of smoking like lowering the appetite and weight reduction. Health Policy makers and legislators should also target water-pipe smoking and try to inform people of its health hazard through social media and educational centers. Finally, uniform questionnaires and definitions in national surveys help to facilitate the comparisons.

Conflict of interest

Authors declare no conflict of interests.

Acknowledgements

References

1. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, Amann M, Anderson HR, Andrews KG, Aryee M, Atkinson C. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2224.

2. Ghasemian A, Ataie-Jafari A, Khatibzadeh S, Mirarefin M, Jafari L, Nejatinamini S, Parsaeian M, Peykari N, Sobhani S, Jamshidbeygi E, Jamshidi HR, Ebrahimi M, Etemad K, Moradi-Lakeh M, Larijani B, Farzadfar F. National and sub-national burden of chronic diseases attributable to lifestyle risk factors in Iran 1990 - 2013; study protocol. Arch Iran Med. 2014;17(3):146-58.

3. Ng M, Freeman MK, Fleming TD, Robinson M, Dwyer-Lindgren L, Thomson B, Wollum A, Sanman E, Wulf S, Lopez AD, Murray CJ, Gakidou E. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA. 2014;311(2):183-92.

4. Lando HA, Wilson K. Combating the global tobacco epidemic. Preventive medicine. 2010;50(1):11-2.

5. Warner KE. Tobacco taxation as health policy in the Third World. Am J Public Health. 1990; 80(5): 529–531.

6. Jacobson PD, Warner KE. Litigation and public health policy making: the case of tobacco control. J Health Polit Policy Law. 1999;24(4):769-804.

7. World Health Organization, Research for International Tobacco Control. WHO report on the global tobacco epidemic, 2008: the MPOWER package. World Health Organization; 2008.

8. Haw SJ, Gruer L, Amos A, Currie C, Fischbacher C, Fong GT, Hastings G, Malam S, Pell J, Scott C, Semple S. Legislation on smoking in enclosed public places in Scotland: how will we evaluate the impact? J Public Health (Oxf). 2006;28(1):24-30.

9. Brown A, Moodie C, Hastings G. A longitudinal study of policy effect (smoke-free legislation) on smoking norms: ITC Scotland/United Kingdom. Nicotine Tob Res. 2009; 11(8): 924–932.

10. Dearlove J, Bialous S, Glantz S. Tobacco industry manipulation of the hospitality industry to maintain smoking in public places. Tob Control. 2002; 11(2): 94–104.

11. Ling PM, Glantz SA. Why and How the Tobacco Industry Sells Cigarettes to Young Adults: Evidence From Industry Documents. Am J Public Health. 2002; 92(6): 908–916.

12. Secades-Villa R, Olfson M, Okuda M, Velasquez N, Pérez-Fuentes G, Liu SM, Blanco C. Trends in the prevalence of tobacco use in the United States, 1991-1992 to 2004-2005. Psychiatr Serv. 2013;64(5):458-65.

13. Arnett DK, Sprafka JM, McGovern PG, Jacobs Jr D, Shahar E, McCarty M, et al. Trends in cigarette smoking: the Minnesota Heart Survey, 1980 through 1992. Am J Public Health. 1998 August; 88(8): 1230–1233.

14. Corsi DJ, Boyle MH, Lear SA, Chow CK, Teo KK, Subramanian SV. Trends in smoking in Canada from 1950 to 2011: progression of the tobacco epidemic according to socioeconomic status and geography. Cancer Causes Control. 2014;25(1):45-57.

15. Molarius A, Parsons RW, Dobson AJ, Evans A, Fortmann SP, Jamrozik K, Kuulasmaa K, Moltchanov V, Sans S, Tuomilehto J, Puska P. Trends in cigarette smoking in 36 populations from the early 1980s to the mid-1990s: findings from the WHO MONICA Project. Am J Public Health. 2001; 91(2): 206–212.

16. Carreira H, Pereira M, Azevedo A, Lunet N. Trends in the prevalence of smoking in Portugal: a systematic review. BMC Public Health. 2012;12:958.

17. Wagner GA, Rocha FM, Lebrão ML, Duarte YA, Zanetta DM. Trends in tobacco consumption in three different birth cohorts of elderly of São Paulo, Brazil. Drug Alcohol Depend. 2015 Feb 1;147:53-9.

18. Mohammad K, Noorbala A, Majdzadeh S, Karimloo M. Trend of smoking prevalence in Iran from 1991 to 1999 based on two national health survey. Hakim Res J. 2001;4(3):290-7. (Full text in Persian)

19. Bilano V, Gilmour S, Moffiet T, d'Espaignet ET, Stevens GA, Commar A, Tuyl F, Hudson I, Shibuya K. Global trends and projections for tobacco use, 1990-2025: an analysis of smoking indicators from the WHO Comprehensive Information Systems for Tobacco Control. Lancet. 2015 Mar 14;385(9972):966-76.
20. Massarrat M-S, Tahaghoghi-Mehrizi S. Iranian national health survey: a brief report. Arch Iranian Med. 2002;5(2):73-9.
21. Asgari F, Aghajani H, Haghazali M, Heidarian H. Non-communicable diseases risk factors surveillance in Iran. Iranian Journal of Public Health. 2009;38(Suppl. 1):119-22.
22. Asgari F, Mirzazadeh A, Heidaria H. Iran Non-Communicable Diseases Risk Factors Surveillance, Data-Book For 2007. Center for Non-communicable Disease Control and management.
23. Esteghamati A, Etemad K, Koohpayehzadeh J, Abbasi M, Meysamie A, Noshad S, Asgari F, Mousavizadeh M, Rafei A, Khajeh E, Neishaboury M, Sheikhbahaei S, Nakhjavani M. Trends in the prevalence of diabetes and impaired fasting glucose in association with obesity in Iran: 2005-2011. Diabetes Res Clin Pract. 2014;103(2):319-27.
24. Hosseini M, Navidi I, Yousefifard M, Heshmat R, Koohpayehzadeh J, Asgari F, Etemad K, Rafei A, Gouya MM. Serum HDL-C level of Iranian adults: results from sixth national Surveillance of Risk Factors of Non-Communicable Disease. J Diabetes Metab Disord. 2014; 13: 67.
25. Meysamie A, Ghaletaki R, Haghazali M, Asgari F, Rashidi A, Khalilzadeh O, Esteghamati A, Abbasi M. Pattern of tobacco use among the Iranian adult population: results of the national Survey of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007). Tob Control. 2010;19(2): 125–128.
26. Esteghamati A, Khalilzadeh O, Mohammad K, Meysamie A, Rashidi A, Kamgar M, Abbasi M, Asgari F, Haghazali M. Secular trends of obesity in Iran between 1999 and 2007: National Surveys of Risk Factors of Non-communicable Diseases. Metab Syndr Relat Disord. 2010;8(3):209-13.
27. Centers for Disease Control and Prevention (CDC). Vital signs: current
cigarette smoking among adults aged ≥18 years--United States, 2005-2010. MMWR
Morb Mortal Wkly Rep. 2011;60(35):1207-12.
28. Everett SA, Husten CG, Warren CW, Crossett L, Sharp D. Trends in tobacco use among high school students in the United States, 1991-1995. J Sch Health. 1998;68(4):137-40.
29. Rahimi Movaghar A, Mohammad K, Razzaghi EM. Trend of drug abuse situation in Iran: A three-decade survey. Hakim Res J. 2002;5(3):171-81. (Full text in Persian).
30. Bhatti MU, CHOKSI HM, BASHIR NS. Tobacco knowledge, attitudes and trends amongst staff and students of University College of dentistry

Lahore, Pakistan. Pakistan Oral & Dental Journal. 2010;30(2).
31. Panda R, Venkatesan S, Persai D, Trivedi M, Mathur MR. Factors determining intention to quit tobacco: exploring patient responses visiting public health facilities in India. Tob Induc Dis. 2014; 12(1): 1.
32. Maziak W, Taleb ZB, Bahelah R, Islam F, Jaber R, Auf R, Salloum RG. The global epidemiology of waterpipe smoking. Tob Control. 2015 Mar; 24(Suppl 1): i3–i12.
33. Reid JL, Hammond D, Rynard VL, Burkhalter R. Tobacco use in Canada: patterns and trends 2014.
34. White V, Hill D, Siahpush M, Bobevski I. How has the prevalence of cigarette smoking changed among Australian adults? Trends in smoking prevalence between 1980 and 2001. Tob Control. 2003 Sep; 12(Suppl 2): ii67–ii74.
35. Maziak W, Ward KD, Eissenberg T. Interventions for waterpipe smoking cessation. Cochrane Database Syst Rev. 2007;(4):CD005549. Review. Update in: Cochrane Database Syst Rev. 2015;7:CD005549.
36. Ward KD, Eissenberg T, Gray JN, Srinivas V, Wilson N, Maziak W.
Characteristics of U.S. waterpipe users: a preliminary report. Nicotine Tob Res. 2007;9(12):1339-46.
37. Noonan D, Kulbok PA. New tobacco trends: waterpipe (hookah) smoking and implications for healthcare providers. J Am Acad Nurse Pract. 2009;21(5):258-60.
38. Smith-Simone S, Maziak W, Ward KD, Eissenberg T. Waterpipe tobacco smoking: Knowledge, attitudes, beliefs, and behavior in two US samples. Nicotine Tob Res. 2008;10(2): 393–398.
39. Salloum RG, Thrasher JF, Kates FR, Maziak W. Waterpipe Tobacco Smoking in the United States: Findings from the National Adult Tobacco Survey. Prev Med. 2015;71: 88–93..
40. Akl EA, Gunukula SK, Aleem S, Obeid R, Jaoude PA, Honeine R, Irani J. The prevalence of waterpipe tobacco smoking among the general and specific populations: a systematic review. BMC Public Health. 2011;11:244.
41. Nakkash RT, Khalil J, Afifi RA. The rise in narghile (shisha, hookah) waterpipe tobacco smoking: A qualitative study of perceptions of smokers and non smokers. BMC Public Health. 2011; 11: 315.
42. Lantz P. Smoking on the rise among young adults: implications for research and policy. Tob Control. 2003; 12(Suppl 1): i60–i70.
43. Borras JM, Fernandez E, Schiaffino A, Borrell C, La Vecchia C. Pattern of smoking initiation in Catalonia, Spain, from 1948 to 1992. Am J Public Health. 2000;90(9): 1459–1462.

44. Marugame T, Kamo K, Sobue T, Akiba S, Mizuno S, Satoh H, Suzuki T, Tajima K, Tamakoshi A, Tsugane S. Trends in smoking by birth cohorts born between 1900 and 1977 in Japan. Prev Med. 2006;42(2):120-7.

45. Giovino GA, Mirza SA, Samet JM, Gupta PC, Jarvis MJ, Bhala N, Peto R, Zatonski W, Hsia J, Morton J, Palipudi KM, Asma S; GATS Collaborative Group. Tobacco use in 3 billion individuals from 16 countries: an analysis of nationally representative cross-sectional household surveys. Lancet. 2012;380(9842):668-79.

46. Nelson DE, Davis RM, Chrismon JH, Giovino GA. Pipe smoking in the United States, 1965-1991: prevalence and attributable mortality. Prev Med. 1996;25(2):91-9.

47. Wasim M. The Waterpipe: Time for Action. Addiction. 2008; 103(11): 1763–1767.

48. Wong SL, Shields M, Leatherdale S, Malaison E, Hammond D. Assessment of validity of self-reported smoking status. Health Rep. 2012;23(1):47-53.

49. Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. The validity of self-reported smoking: a review and meta-analysis. Am J Public Health. 1994; 84(7): 1086–1093.