Prevalence of smoking and smoking predictors among adolescents in Qassim, Saudi Arabia: Does the Healthy City Program make any Difference?

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Research Article

Keywords: Adolescents, smoking, Saudi Arabia, Healthy City Program

Posted Date: July 21st, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-45211/v1>

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Version of Record: A version of this preprint was published on January 6th, 2021. See the published version at <https://doi.org/10.1007/s10389-020-01449-y>.

Abstract

Aim: To compare the prevalence of smoking and smoking predictors among adolescents between cities running a healthy city program (HCP cities) and the cities that are not running such a program (NHCP cities) in the Qassim region, Saudi Arabia.

Subject and Methods: A cross-sectional survey using a self-reported questionnaire on the prevalence of smoking and smoking predictors among adolescents in Qassim region, Saudi Arabia was undertaken between April and September 2017. Using multi-staged cluster sampling, probability proportionate to the size, we surveyed 364 adolescents from three HCP cities and 769 adolescents from three NHCP cities.

Results: The overall prevalence of smoking among school-aged adolescents in Qassim is 5.2% (95% CI: 3.9-6.5). Smoking prevalence among adolescents in the HCP cities is 8.8% (95% CI: 5.9-11.7); while in the NHCP cities it is 3.5% (95% CI: 2.2-4.8). The prevalence of at least one smoker among close friends in HCP and NHCP cities is 67.3% (62.5-72.1) and 72.2% (69-75.3), respectively. The prevalence of at least one smoker in the family of the adolescents in HCP and NHCP cities is 58% (52.9-63.1) and 44.3% (40.8-47.9), respectively. Among the socio-demographic variables, smoking is significantly associated with gender (OR: .08) *, age (OR: 1.61) and academic performance (OR: .27). Prevalence of smoking among adolescents is significantly higher in HCP cities than in NHCP cities (OR: 3.03; 95% CI: 1.7-5.4).

Conclusion: Prevalence of smoking and key smoking risk factors were found to be higher in cities implementing the healthy city program, despite exposure to an anti-smoking campaign being higher in these cities. Given these findings, we recommend further in-depth evaluation of the program.

Background

Tobacco use during adolescence is associated with adverse health effects later in life. Adolescence is the most critical period of life and is accompanied by rapid physical, psychological and emotional developments and changes, and smoking at this age can be more harmful to adolescents' health by increasing the risk of developing chronic diseases. Research reports that people who commence smoking at an early age are more likely to continue to smoke into their adult years (So and Yeo 2015). While smoking prevalence is declining in developed countries, the prevalence of smoking is increasing in many developing countries including Saudi Arabia (Ng et al. 2014). The Kingdom of Saudi Arabia (KSA) is a developing country with a relatively high prevalence of smoking among the population. Recent estimates indicate that approximately 20% of Saudi Arabian citizens are smokers and similar rates of tobacco smoking have been reported among adolescents.

The Ministry of Health in Saudi Arabia has implemented a variety of public health programs to improve population health, yet the effectiveness of these programs has not been evaluated. The World Health Organisation's (WHO) Healthy City project (HCP) was launched in Saudi Arabia in 1998. The program has been expanding through various stages and currently 30 cities from across the country have joined the program, five of them have been recognized by the WHO as healthy cities. The aim of the HCP is to

improve the health and quality of life of city residents on a continuous basis through continual community participation and inter-sectoral collaboration. Yet, to date, no published research has examined the impact of the HCP on adolescents' health risk behaviours, particularly smoking. Therefore, the current study aimed to explore the smoking-related characteristics of adolescents in secondary schools living in three cities that have implemented the HCP and compare those with adolescents living in three cities that have not implemented the project (NHCP) within the Qassim region, Saudi Arabia. The study also aimed to determine variables that predict smoking among the sample.

Methods

Study design and settings

This paper is part of a larger cross-sectional survey to evaluate the impact of the HCP among adolescents in Qassim, Saudi Arabia between April and September 2017. In this study, we investigated differences in the prevalence of smoking and smoking risk factors between HCP and NHCP cities. The Qassim region is one of the 13 administrative regions of the KSA and is located in the centre of the country. It consists of 10 cities with an estimated population of 1.37 million (GAS 2015). Approximately one fifth (19.7%) of the population is aged between 10 and 19 years. The Human Research Ethics Committee of the University of New England approved the study (number HE17-021). Permission to conduct this study was also received from Qassim Education (approval number 38644423). Additionally, completion of the questionnaire was considered informed implied consent.

Sampling and data collection

We used multi-staged cluster sampling to recruit 10th to 12th grade high school students aged between 15 and 19 years. First, we purposively selected six cities within the Qassim region, Saudi Arabia. These cities were Buraidah, Unaizah, Alrass, Albukayriah, Albadea and Almedhnab. Three of these cities (Buraidah, Unaizah and Alrass) were running the healthy city programme while the others were not. We recruited 1,133 participants. We stratified the schools by geographical location, type of school and gender of students to yield a representative sample of 1,133 students. We randomly selected students, probability proportionate to the size, from the randomly selected schools. We used a self-reported structured questionnaire. The questionnaire covered aspects of smoking behaviours including practices, knowledge and attitudes, and socio-demographic characteristics. In this study, non-smokers included those who had never smoked any tobacco product, had tried it only once or who had stopped smoking; while, smokers included those who had occasionally smoked or had smoked cigarettes or another tobacco product every day over the previous 30 days. Data were collected between April and September 2017. The first author collected data from the male students; while a trained female research assistant collected data from the female students. Detailed instructions on completing the questionnaire were written in the questionnaire and verbal explanations were given to potential participants. Students recorded their responses on the questionnaire without any assistance. No identifying data were collected to ensure anonymity. Students

who were absent during data collection and students aged less than 15 years or more than 19 years were excluded from the study.

Statistical analysis

IBM SPSS Statistics for Windows (version 22.0) (Armonk, NY: IBM Corp.) was utilized for data entry and analysis. Data were screened for missing values, outliers and collinearity. We performed descriptive analysis of socio-demographic variables by the type of cities. All socio-demographic variables were categorical; hence, proportion and frequency were computed. For prevalence estimate of smoking and smoking risk factors we computed proportion with 95% confidence interval (CI). Multivariable logistic regression was used to investigate the socio-demographic determinants of smoking among adolescents. Another multivariable logistic regression analysis was also performed to investigate the differences in smoking prevalence between HCP and NHCP cities. Simple logistic regression was also performed to investigate the differences in smoking-related factors between HCP and NHCP cities. We computed the odds ratio (OR) with 95% CI for all logistic regression analysis

Results

Characteristics of participants

We surveyed 364 adolescents from the three cities implementing the HCP and 769 adolescents from another three cities which were not implementing that program. However, following data cleaning, we retained 750 participants from the cities which were not implementing the HCP and 358 participants from the HCP cities for further analysis. Participants were excluded for not meeting our inclusion criteria or for not responding to more than 10% of the questions. **Table 1** presents socio-demographic characteristics of the participants. More than half of the participants in both groups were females: 414 (55%) in NHCP and 194 (54%) in HCP. Most of the participants in both groups were between 17 and 19 years old: 470 (66%) in NHCP and 227 (63%) in HCP. Participants were randomly selected from 10th to 12th grades in high schools. Most of the participants in both groups were enrolled in public schools: 627 (84%) in NHCP and 317 (89%) in HCP. More than half of the participants in both groups reported that they had excellent academic performance: 438 (58%) in NHCP and 224 (63%) in HCP. The majority of participants in both groups resided with both parents: 649 (87%) in NHCP and 315 (88%) in HCP. The percentage of fathers of the participants with at least college education was 41% (n=304) for those not exposed to HCP and 44% (n=157) for those in HCP. Most of the mothers of those of whom were not exposed to the HCP had at most upper secondary education (n= 353; 47%), while most of the mothers of those in HCP had at least college education (n= 160; 45%). Most of the participants who were not exposed to the HCP had an estimated combined family monthly income $\leq$ 3999 USD (n= 293; 39%), while those in HCP did not indicate the estimated combined family monthly income (n= 134; 37%).

Prevalence of smoking and smoking risk factors among adolescents

The prevalence of smoking and smoking risk factors among adolescents in the Qassim region is presented in **Table 2**. Prevalence of smoking among adolescents in the Qassim region was 5.2% (95% CI: 3.9-6.5%). A higher prevalence of smoking was observed in the cities running the HCP (8.8%) than in the cities without this program (3.5%). We found that 48.7% of adolescents in the Qassim region had at least one smoker in their family. Again, prevalence of at least one smoker in family was higher in the cities running a HCP, 58%, compared to 44.3% in other cities. However, prevalence of at least one smoker among close friends was higher in cities not running the HCP: 67.3% in healthy cities compared to 72.2% in other cities. Overall, the prevalence of having at least one smoker friend was 70.6% in the Qassim region. Regarding attitude towards banning smoking in public places, 93.7% of adolescents in healthy cities and 93% in other cities were in favour of this, with a regional rate of 93.2%. In the Qassim region, 66.1% of current adolescent smokers reported that they had tried to quit in the previous year. This rate was higher in cities not implementing the HCP (69.9%) than in the cities implementing the program (60.8%). Thirty-eight point five per cent of adolescent smokers in the Qassim region believed that they could quit smoking if they wanted to. This rate is higher in healthy cities-40.9% compared to 36.1% in other cities. Overall, 52.4% of adolescents mentioned that they knew where to seek support if they wanted to quit smoking. This rate is higher in healthy cities, 53.3%, compared to 52% in other cities. In the previous year, 42.5% of adolescents in the Qassim region were exposed to antismoking campaigns. This exposure rate was higher in healthy cities (47.8%) than other cities (40.1%). In healthy cities, 51.1% adolescents mentioned that their parents discussed the harmful effects of smoking with them. This rate is 47.6% in other cities with an overall regional rate of 48.7%. In healthy cities 86.5% and in other cities 83% mentioned that the harmful effect of smoking was discussed in their school. Only 16.5% of adolescents in the Qassim region believed that smokers have more friends than non-smokers. This figure is almost the same irrespective of the type of the city. Majority of adolescents 95.7% believed that smoking was harmful to their health. This rate was higher in healthy cities (97.3%) than in other cities (94.9%). 26.5% of adolescents believed that smoking makes one appear attractive. This figure was almost the same irrespective of the type of city. 32.8% of adolescents in the Qassim region believed that smoking gave one a feeling of independence. This belief was higher in healthy cities (38.7%) compared to other cities (30%).

Logistic regression analysis of adolescents' current smoking behaviour by their socio-demographic variables

We have investigated socio-demographic determinants of smoking among adolescents in the Qassim region. Analysis of results of this multivariable model are presented in **Table 3**. We found that gender, age, type of school and academic performance were associated with adolescents' current smoking behaviour. The odds of smoking among females were .08 times less than the odds of smoking among males. With each year's increase in age the odds of smoking increased by 1.61 times. The odds of smoking were 2.33 times greater in private schools compared to 1 in public schools. The odds of smoking among the higher academic achievers were .27 times lower than the odds of smoking among the students who achieved a lower grade.

We investigated the effect of the healthy city program on adolescents' current smoking behaviour. This logistic regression analysis is presented in **Table 4**. We found that the odds of smoking among adolescents in healthy cities was 3.03 times greater than the odds of smoking among adolescents in other cities, when adjusted for type of school, gender, age and academic performance.

Odds of smoking risk factors among adolescents by type of city health program

We also investigated smoking risk factors among adolescents by the type of cities HCP and NHCP. The analysis of results is presented in **Table 5**. Among different environmental and attitudinal risk factors, we found that the prevalence of at least one smoker in the family, exposure to an antismoking campaign and belief that smoking gives a feeling of independence had statistically significant differences between cities. We found that in the healthy cities, the odds of having a smoker in the adolescents' family were 1.73 times greater than the other cities. The odds of the belief that smoking gives a feeling of independence were higher (OR: 1.47) in the healthy cities than in the other cities. However, we found that the odds of exposure to any antismoking campaign in the previous year were higher (OR: 1.37) in the healthy cities than in other cities.

Discussion

This study segregated the adolescents into two major groups which included those exposed to the HCP and those not exposed to the program. With regards to smoking, adolescents were classified as current smokers or non-smokers. Current smokers included anyone who occasionally or regularly smoked any tobacco products in the previous 30 days. Non-smokers included adolescents who had never smoked, who had stopped smoking or who had just tried tobacco smoking a few times but had not smoked a single cigarette in the previous 30 days.

We found that the prevalence of smoking among adolescents in Qassim was 5.2%. This estimate is much lower than the estimates suggested by previous studies in Saudi Arabia. Al Nohair estimated the prevalence of smoking among adolescents in Qassim region at 23.6%, based on data collected between January and June 2014 (Al Nohair 2017). However, Al Nohair included students aged 13 to 21 years, while we included only students aged 13 to 19 years. Additionally, our study findings suggest that with a year's increase in age the odds of smoking increase 1.61 times. In the current study, the prevalence of participants from the healthy city who stated they had the ability to quit smoking was 40.9% versus 30.1% in non-healthy cities. Chapman and MacKenzie (2012) stated that those who smoke need specific support in smoking cessation particularly considering smoking cessation can be difficult without support. Given the higher prevalence of smoking among those who were exposed to the HCP, we hypothesize that the HCP was not particularly effective in convincing smokers to quit.

In the present study, the participants' gender had an association with adolescents' current smoking behaviour. The odds of smoking among females was .08 times which is less than the odds of smoking among males. A study among middle school students conducted in Jeddah, Saudi Arabia, also revealed that gender had been associated with students' attitudes and social influences towards tobacco

consumption (Park et al. 2012). Similar findings were reported in Jeddah among middle school students (Al Agili and Park 2012), and in Riyadh among adolescents (Al-Makadma et al. 2015). The study by Amin et al. (2010) also demonstrated that smoking in males was higher in prevalence than in females in secondary schools in Al-Hassa, Saudi Arabia. Similar findings were reported among 16- to 18-year-old adolescents, where the prevalence of smoking was 31.2% for males and 8.9% for females (Al Ghobain et al. 2011).

In our study, the prevalence of participants who felt that smoking made them attractive or feel independent was 26.5% and 32.8%, respectively. Of note, the influence of the society was found to be significantly associated with tobacco consumption among Saudi middle school students (Park et al. 2012). A previous study in Dammam city showed that seeing someone smoking was more likely to influence a female university student to smoke (Ansari and Farooqi 2017).

The prevalence of having friends who smoke was higher in the cities without the health programs compared to healthy cities (72.2% vs. 67.3%), with an overall prevalence of 70.6% in the Qassim region. Friends who smoke has been found to influence adolescents to practice smoking by several studies conducted in Saudi Arabia (Al-Zalabani and Kasim 2015; Alsubaie 2018; Fida and Abdelmoneim 2013). Similar findings have been reported among students in King Faisal University by Al-Mohamed and Amin (2010), and among students in three other universities in the Kingdom by Almogbel et al. (2013). A study among medical students also showed that imitation of behaviours from the environment and the influence of peers were closely associated with smoking (Al-Kaabba et al. 2011). Being with friends who smoke has been shown to encourage boys and girls aged 16 to 18 years in Riyadh to engage in smoking (Al Ghobain et al. 2011). Male secondary school students in Saudi Arabia mostly began smoking at the early age of 14 years or younger (Fida and Abdelmoneim 2013). In fact, having a close friend who smokes was found to be the strongest predictor of smoking among students in the Kingdom (Al-Bedah et al. 2010; Beaver et al. 2016). These results are consistent with findings involving adolescents in Madinah city, as the prevalence was higher among those who had parents and friends who smoked (Al-Zalabani 2015).

In our study, it was noticeable that with each year's increase in age, the odds of smoking increased 1.61 times. In a study carried out by Mandil et al. (2011), the authors identified age as a significant predictor of smoking among undergraduate students. They found that the 17-year-olds in the group were more likely to be smokers than the 16-year-olds in the group. These age groups are most noticeable in terms of practice smoking in the High Schools of Saudi Arabia. In fact, one in five adolescents from 14 to 19 years of age practice smoking. As their age increases, smoking habits also increases. According to a study in Riyadh Saudi Arabia, high school students have high prevalence of waterpipe smoking among males and females. Waterpipe smoking is a traditional way of smoking in Saudi Arabia, known as Shisha, where tobacco is warmed, then the fumes passed via an elastic hosepipe to the mouth. In addition, it was noted that smoking was common among those in early adulthood (Al Moamary et al. 2012). In the study of Al Ghobain et al. (2011), the prevalence of smoking among the group aged 16 to 18 years in Saudi Arabia was approximately 50%. A similar age range has been identified as the commencement age of smoking

among male medical students in Saudi Arabia (Taha et al. 2010). Furthermore, reports have revealed that among female college students in the Kingdom, smoking starts at a mean age of 16 ± 2.4 years (Koura et al. 2011). These consistent findings emphasize the significance of directing the efforts towards this age group.

In a city with the HCP, we found that the odds of having a smoker in the adolescents' family were 1.73 times higher than in the other cities. It was reported in the study by Al-Mohamed and Amin (2010) that having a family member who smoked, irrespective of their friends, was one of the most common significant predictors to smoking among male university students. Furthermore, nearly 50% of the respondents in their study were smoking. The influence of a family member on smoking in Saudi Arabia has been reported in other studies such as those of Almogbel et al. (2013); Mandil et al. (2011) and Al-Turki and Al-Rowais (2008b). Most of these studies emphasized the importance of parental influence in smoking. The fathers were mostly cited as the smoker in the family rather than the mothers (Mandil et al. 2011). In a study conducted in the Kingdom among male secondary school students, both family members and smoker friends were the most significant influencers (Fida and Abdelmoneim 2013). These studies support our finding of a high percentage of family and friends in those who smoked. It is worth mentioning that a study in Madinah reported that most second-hand smoking is experienced by adolescents outside their homes (Al-Zalabani et al. 2015). Similarly, according to the study by Park et al. (2012), adolescents who spent most of the time outside their homes, were more likely to engage in smoking. However, the home environment was also perceived as a source of second-hand smoking. For instance, the study by Al-Zalabani et al. (2015) noted that both, parents at home, and friends who were commonly gathered outside, were the highest risk factors for passive smoking.

According to the reviewed literature, most adolescents in Northern Saudi Arabia claimed to smoke between four and ten cigarettes per day (Algorinees et al. 2016). A study conducted by Al Nohair (2011) reported that secondary school students in Saudi Arabia were influenced by watching teachers smoke. In addition, the most common reason for their smoking was to relieve stress and to fill their spare time. Other determinants for smoking among adolescents in the Kingdom were high family income or belonging to wealthy families (Mohammed et al. 2014). Other research has suggested that perceptions of the effects of smoking on health, and the religious beliefs were barriers to smoking among medical students in Riyadh Saudi Arabia (Al-Turki and Al-Rowais 2008a). Although the present study did not investigate religious beliefs regarding smoking, it did find that most of the subjects in both city programs were aware that smoking is harmful to health.

Another advantage of the health program is the relatively superior knowledge of smoking among enrolled subjects in the healthy cities compared to those in the non-healthy cities. Of note, 47.8% of participants from the healthy cities had been exposed to anti-smoking campaigns versus only 40% in the non-healthy cities. Nonetheless, the prevalence of smoking in participants from healthy cities was markedly higher than in those from non-healthy cities.

A limitation encountered when conducting the study was that the sample population was composed of adolescents in high schools aged between 15 and 19 years. The study did not take into account any adolescents not attending school. Hence, for a thorough understanding of the smoking behaviours of Saudi Arabian adolescents, research should include adolescents between the ages of 10 and 19 irrespective of their schooling status.

Conclusion

The findings showed that gender, the presence of an influencer, having a smoker friend, and smoker family member significantly contributed to predicting smoking behaviour. The characteristics of the adolescents relevant to smoking were found to significantly vary between those within the program and those who were not. The health program may be effective; however, future evaluation should consider recent research inferences and approaches to derive more meaningful results.

Declarations

Ethics approval and consent to participate: We received ethical approval from the Human Research Ethics Committee, University of New England, Armidale NSW 2351, Australia (approval no: HE17-021). Approval was also received from the Ministry of Education, Saudi Arabia. All participants gave their written informed consent.

Consent for publication: not applicable

Availability of data and materials: Data is available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests

Funding: Not applicable

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Tables

Table 1. Characteristics of participants (n = 1108)

Characteristics	NHC		HC	
	(N = 750)		(N = 358)	
	F	%	F	%
Gender				
Male	336	44.80	164	45.81
Female	414	55.20	194	54.19
Age in years				
15 years old	29	3.87	13	3.63
16 years old	251	33.47	118	32.96
17 years old	283	37.73	111	31.01
18 years old	148	19.73	93	25.98
19 years old	39	5.20	23	6.42
Education level				
Grade 10	256	34.13	122	34.08
Grade 11	255	34.00	120	33.52
Grade 12	239	31.87	116	32.40
School category				
Public	627	83.60	317	88.55
Private	123	16.40	41	11.45
Academic performance				
Poor	3	0.40	6	1.68
Average	18	2.40	7	1.96
Good	87	11.60	31	8.66
Very good	204	27.20	90	25.14
Excellent	438	58.40	224	62.57
Residing with				
Not with parents	14	1.87	3	0.84
Either mother or father	87	11.60	40	11.17
Both parents	649	86.53	315	87.99
Father's education level				
No formal education	123	16.40	63	17.60
At most upper 2ndary educ.	323	43.07	138	38.55
At least college education	304	40.53	157	43.85
Mother's education level				
No formal education	134	17.87	52	14.53
At most upper 2ndary educ.	353	47.07	146	40.78
At least college education	263	35.07	160	44.69

Estimated combined monthly family income				
No idea	269	35.87	134	37.43
≤3999 US\$	293	39.07	107	29.89
≥4000 US\$	188	25.07	117	32.68

Table 2. Prevalence of smoking and smoking risk factors among adolescents: a cross-sectional survey, Qassim, Saudi Arabia, April-September 2017

Variables	Healthy cities	Non healthy cities	Total
Prevalence per 100 (95% CI)			
Current smokers	8.8 (5.9-11.7)	3.5 (2.2-4.8)	5.2 (3.9-6.5)
Male smokers			
Female smokers			
Family members smoking	58 (52.9-63.1)	44.3 (40.8-47.9)	48.7 (45.8-51.6)
Close friends smoking	67.3 (62.5-72.1)	72.2 (69-75.3)	70.6 (68-73.3)
Support banning smoking in public places	93.7 (91.2-96.2)	93 (91.2-94.8)	93.2 (91.7-94.7)
Tried to quit smoking	60.8 (46.9-74.7)	69.9 (59.1-80.6)	66.1 (57.7-74.6)
Would be able to quit smoking if I wanted to	40.9 (25.8-56)	36.1 (22-50)	38.5 (28.3-48.6)
Know where to seek support to quit smoking	53.3 (48.1-58.4)	52 (48.5-55.6)	52.4 (49.5-55.3)
Exposed to anti-smoking campaign	47.8 (42.6-53)	40.1 (36.6-43.5)	42.5 (39.7-45.4)
Parents discuss the harmful effect of smoking	51.1 (45.9-56.3)	47.6 (44.1-51.1)	48.7 (45.8-51.6)
Harmful effect of smoking discussed in school	86.5 (83-90.1)	83 (80.3-85.6)	84.1 (82-86.2)
Smokers have more friends	15.7 (11.9-19.4)	16.9 (14.3-19.6)	16.5 (14.3-18.7)
Smoking is harmful to health	97.3 (95.6-98.9)	94.9 (93.4-96.5)	95.7 (94.5-96.9)
Smoking makes one attractive	26.6 (22.1-31.2)	26.4 (23.3-29.5)	26.5 (24-29.1)
Smoking gives feeling of independence	38.7 (33.7-43.8)	30 (26.8-33.3)	32.8 (30-35.6)

Table 3. Logistic regression analysis of adolescents' current smoking behaviour by their socio-demographic variables: a cross-sectional survey, Qassim, Saudi Arabia, April-September 2017

Variables	OR (95% CI)	Std. Err.	z	p > z
Gender- Male	1			
Female	.08(.03-.21)	.04	-5.19	.000
Age	1.61 (1.25-2.07)	.21	3.73	.000
Type of school- Public	1			
Private	2.33	.75	2.65	.008
Academic performance- Poor or average	1			
Very good or excellent	.27	.08	-4.19	.000
Living with- Both parents	1			
Father	1.18 (.14-10.16)	1.3	.15	.880
Mother	1.5 (.57-3.98)	.75	.82	.415
Not living with parent	1.06 (.13-8.52)	1.13	.06	.955
Father's education- No university degree	1			
University degree	1.72 (.89-3.31)	.57	1.62	.105
Mother's education- No university degree	1			
University degree	1.12 (.59-2.08)	.36	.32	.752
Nationality- Saudi				
Non-Saudi	.58 (.17-1.97)	.36	-.87	.384

Table 4. Logistic regression analysis of adolescents' current smoking behaviour by the type of city health program: a cross-sectional survey, Qassim, Saudi Arabia, April-September 2017

Variables	OR (95% CI)	Std. Err.	z	p > z
Cities running healthy city program- No	1			
Yes	3.03 (1.7-5.4)	0.89	3.77	0.000
Type of school- Public	1			
Private	2.66 (1.41-5.06)	0.87	3.02	0.003
Academic performance- Poor or average	1			
Very good or excellent	0.29 (0.16-0.53)	0.09	-4.06	0.000
Gender- Male	1			
Female	0.08 (0.03-0.21)	0.04	-5.17	0.000
Age	1.59 (1.23-2.05)	0.89	3.55	0.000

Table 5. Odds of smoking risk factors among adolescents in the city health program: a cross-sectional survey, Qassim, Saudi Arabia, April-September 2017

Smoking risk factors	OR in the health cities (95% CI)
Family members smoking	1.73 (1.35-2.23)
Close friends smoking	1.26 (.96-1.65)
Support banning smoking in public places	1.12 (.68-1.85)
Tried to quit smoking	.67 (.32-1.42)
Would be able to quit smoking if I wanted to	1.22 (.52-2.85)
Know where to seek support to quit smoking	1.05 (.82-1.35)
Exposed to anti-smoking campaign	1.37 (1.07-1.76)
Parents discuss the harmful effect of smoking	1.15 (.90-1.48)
Harmful effect of smoking discussed in school	1.31 (.93-1.88)
Smokers have more friends	.91 (.65-1.28)
Smoking is harmful to health	1.89 (.93-3.83)
Smoking makes one attractive	1.01 (.76-1.34)
Smoking gives feeling of independence	1.47 (1.13-1.91)