

Joint Association of Active and Passive Smoking with Psychiatric Distress and Violence Behaviors in a Representative Sample of Iranian Children and Adolescents: the CASPIAN-IV Study

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Abstract

Background Mental health and smoking have been receiving increasing attention in adolescents all over the world. Although some studies have assessed the independent association of active/passive smoking with mental health, joint association of active and passive smoking with mental health remains unclear. **Purpose** This study was designed to evaluate the joint association of smoking status (active and passive smoking) with psychiatric distress and violent behaviors in Iranian children and adolescents.

Method In this national survey, 13,486 students, aged 6–18 years, living in rural and urban areas of 30 provinces of Iran were selected via multistage, cluster sampling method. Psychiatric distress (including worthless, anger, worrying, insomnia, confusion, depression, and anxiety), violence behaviors (including bullying, victim, and physical fight), and

smoking status (nonsmoker, only passive smoker, only active smoker, and active and passive smoker) were assessed. The questionnaire was prepared based on the World Health Organization Global School-based Student Health Survey (WHO-GSHS). Data were analyzed by the Stata package.

Results Psychiatric distress and violent behaviors had linearly positive association with smoking status (p trend < 0.001). Compared to “nonsmoker” group, participants who were exposed to passive smoking besides active tobacco use were at increased risk of having anger (odds ratio (OR) 2.55, 95 % confidence interval (CI) 1.86–3.48), worrying (OR 1.66, 95 % CI 1.24–2.20), and anxiety (OR 1.99, 95 % CI 1.52–2.61) and victim (OR 1.77, 95 % CI 1.34–2.33) and bully behaviors (OR 3.08, 95 % CI 2.33–4.07).

Conclusion The current findings suggest that active and passive tobacco smoking has synergistic effect on psychiatric

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distress. Since majority of smokers with psychiatric distress do not receive mental health services or counseling on smoking, strategies to address mental health problems and smoking prevention should be included as a part of school health services.

Keywords Pediatric · Psychiatric distress · Violent behaviors · Tobacco smoking

Introduction

Psychological and mental morbidities are widespread problems throughout the world [1, 2]. Mental health in adolescents and corresponding interventions attract much attention due to their perceived consequences later in life [2–7] and some unique conditions during this period of life [8]. Conduct or emotional problems in adolescents have been associated with unfavorable outcomes as educational underachievement, poor interpersonal relationships, unemployment, increased costs for health care systems, crime, or mental problems in adulthood [3, 9]. During the past two decades, mental health has been studied throughout Iran, with an increasing emphasis on younger individuals [2, 10, 11]. A representative summary on mental health of adolescents in Iran has been reported by Emami et al. [2] who concluded that a significant portion of senior high school students had psychiatric morbidities and girls experienced such problems more frequently.

Although trends of adolescence violence are not the same everywhere, aggression in children and adolescents continues to attract the attention of researchers worldwide [12–17], because violence in adolescence might be linked to criminal behavior in adulthood, current trend toward early diagnosis of “psychopathic traits,” or simply the vulnerability of children and adolescents to violence. A study in Iran reported that 63.9 % of adolescents who participated in their study were involved in at least one intentional injury [18].

A meta-analysis on 274,992 Iranian adults estimated a prevalence rate of 21.7 and 3.6 % for smoking in men and women, respectively [19]. Some previous studies in Iran have assessed different aspects of smoking among adolescents [20–24]. A national study on 11–18-year-old students in 20 provinces of Iran showed that 13.4 % of boys and 8.1 % of girls were cigarette smokers. In this study, having a smoker relative in the household was the strongest influencing factor to begin smoking [23]. In a study on teenager boys in the Metropolitan Tehran, it was shown that having a smoker father, quitting home after a quarrel, monthly money allowance, and personal history of psychological and hyperactivity/attention deficit disorders were associated with a higher risk of becoming a smoker, whereas social capital was protective against smoking [24]. Studies in other countries demonstrate that young people start smoking as a way for fighting and

overcoming their problems and for increasing their self-esteem [25, 26].

Hazardous effects of passive or second-hand exposure to tobacco smoke have been stressed before [27]. Substance use and smoking have been viewed by the public as a close correlate of violence and a predictor of delinquency [28], and many authors have explored smoking as either a cause or a consequence of bullying/victimization [28–38]. A number of these studies have suggested that smoking could be associated with several psychological conditions such as depression, impulsivity, aggression, and delinquency in adolescents [29, 33, 34, 39]. Furthermore, the effects of parental smoking on behavioral problems in adolescents have been documented [30, 32, 33].

Most studies have assessed the independent association of active/passive smoking with mental distress [28, 34, 36] and violence-related behaviors in adolescents [29, 35, 37]. However, joint association of active and passive smoking with mental distress and violent behaviors remains unclear. This study was designed to evaluate the association of smoking status (active and passive smoking alone and in combination) with psychiatric distress and violent behaviors in a representative sample of Iranian children and adolescents.

Methods and Materials

The information was gathered from a national study as the fourth survey of the school-based surveillance system entitled “Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable disease” (CASPIAN-IV) Study (2011–2012). The methodology of this study has been explained in detailed before [40]. In brief, 14,880 students aged 6–18 years were selected from elementary, intermediate, and high schools of rural and urban areas of the central counties of 30 provinces by multistage, cluster sampling methods (48 clusters of ten students in each province). Stratification was performed according to the location (urban/rural) and school grade level (elementary, intermediate, high school). A verbal consent and a written informed consent were gathered from the students and parents, respectively, after complete explanation of the study objectives and protocols for them.

The questionnaire was prepared based on the World Health Organization Global School-based Student Health Survey (WHO-GSHS). The psychiatric distress included worthless, angeriness, worrying, insomnia, confusion, depression, and anxiety distress and violence behavior section included bullying, victim, and physical fight behaviors. List of questions for psychiatric distress and violent behaviors according to the GSHS questionnaire is presented in [Appendix](#). After translation into Persian and modifying questions with problems in understanding, the validity of questionnaire was evaluated in 120 urban and rural students in one of the regions around Tehran. The validity and reliability of the questionnaire were

confirmed (the Cronbach's reliability coefficient >0.7), as described before [41].

We defined students as active smoker if they reported using tobacco products (cigarette, pipe, hookah etc.) every day (current smoker). If they reported that people smoked tobacco products in their presence, they were considered as passive smoker. Students who answered "no" to both of the above questions were defined as "nonsmoker," those who answered "yes" only to passive smoking question were defined as "only passive smoker," and students who answered yes only to active smoking question were defined as "only active smoker." Those who answered yes to both questions were defined as "active and passive smoker."

Body image was assessed by a single item: "Do you think how is your body size?" Response options included were as follows: 1=thin, 2=normal, and 3=obese). Socioeconomic status (SES) score was estimated by using principle component analysis (PCA) method based on parent education, parent job, type of school (private or governmental), and family assets (private car and computer); then, the obtained scores were categorized into tertiles. The first tertile was defined as a low SES and the second and third tertiles as intermediate and high SES, respectively. Likewise, physical activity was estimated with the same statistical method based on the students' physical activity at school and out of school. This variable was also categorized into tertiles as mild, moderate, and vigorous physical activity level.

Table 1 Characteristics of participants according to the age groups: the CASPIAN-IV Study

	6–10 years $n=4349$	11–14 years $n=4678$	15–18 years $n=4455$	<i>P</i> value
Sex				
Boys	52.9 (48.8–57.0) ^a	50.5 (46.5–54.6)	48.8 (44.3–53.2)	0.38
Girls	47.0 (42.9–51.2)	49.4 (45.3–53.4)	51.1 (46.7–55.6)	
Family size				
≤4	58.2 (56.1–60.3)	49.4 (47.4–51.5)	39.2 (37.2–41.3)	<0.001
>4	41.7 (39.6–43.8)	50.5 (48.4–52.5)	60.7 (58.6–62.7)	
Physical activity				
Mild	27.5 (25.1–29.9)	30.8 (28.7–23.9)	34.1 (32.6–35.5)	<0.001
Moderate	37.8 (35.8–39.8)	38.6 (36.9–40.4)	33.7 (31.8–35.7)	
Vigorous	34.6 (32.1–37.2)	30.5 (28.4–32.5)	22.2 (20.3–24.3)	
SES				
Low	35.4 (32.7–38.2)	33.1 (30.7–35.5)	31.9 (29.4–34.4)	0.02
Intermediate	34.2 (32.3–36.2)	33.2 (31.4–35.1)	31.7 (29.9–33.6)	
High	30.3 (27.5–33.2)	33.6 (30.9–36.3)	36.3 (33.5–39.2)	
Hours of sleep per week				
<5	0.2 (0.1–0.4)	0.5 (0.3–0.8)	0.6 (0.5–0.8)	<0.001
5–8	11.5 (10.3–12.9)	21.0 (19.5–22.6)	35.0 (33.2–36.9)	
>8	88.2 (86.8–89.4)	78.3 (76.8–79.8)	63.7 (61.8–65.6)	
Passive smoker	41.4 (39.4–43.5)	42.8 (40.9–44.6)	47.3945.3–49.3)	<0.001
Active smoker	0.5 (0.3–0.7)	1.1 (0.8–1.5)	6.1 (5.2–7.1)	<0.001
Smoking status				
Nonsmoker	59.3 (57.2–61.3)	57.7 (55.8–59.5)	51.9 (49.9–53.9)	<0.001
Only passive smoker	40.1 (38.1–42.2)	41.0 (39.2–42.9)	41.9 (40.0–43.8)	
Only active smoker	0.18 (0.1–0.4)	0.19 (0.1–0.4)	1.52 (1.2–2.0)	
Active and passive smoker	0.32 (0.19–0.54)	0.98 (0.7–1.3)	4.6 (3.9–5.4)	
BMI (kg/m ²)	16.2 (16.0–16.4) ^a	18.8 (18.7–19.04)	21.3 (21.2–21.5)	<0.001
Abdominal obesity (cm)	58.5 (58.1–58.9)	67.9 (67.4–68.4)	74.2 (73.7–74.8)	<0.001
Body image				
Underweight	44.6 (42.7–46.5)	30.5 (29.1–31.9)	27.8 (26.3–29.4)	<0.001
Normal	42.9 (41.0–44.8)	48.1 (46.5–49.6)	48.5 (46.9–50.2)	
Obese	12.4 (11.4–13.5)	21.3 (20.0–22.7)	23.5 (22.1–24.9)	

$P < 0.05$ is significant

BMI body mass index, SES socioeconomic status

^a% (95 % CI)

^aMean±95 % CI

Statistical Analyses

Categorical variables are presented as a percentage and 95 % confidence interval (CI). Mean of continuous variable was reported with 95 % CI. Comparison of variables across smoking status was assessed by trend analysis. Association between smoking status with psychiatric distress and violence behaviors was assessed using three different logistic regression models. In model I, crude associations were assessed. In model II, the association was adjusted for age, sex, and living place and model III additionally adjusted for screen time, physical activity, SES, family size, and BMI. In all models, nonsmoker group was considered as reference group. Statistical measures were estimated using survey data analysis methods in the StataCorp. 2011, Stata Statistical Software: Release 12. College Station, TX: StataCorp LP. Package. P value < 0.05 was considered as statistically significant.

Results

The participants of this national survey were 13,486 out of 14,880 invited children and adolescents (response rate 90.6 %) with a mean age of 12.47 ± 3.36 years, including 50.8 % boys and 49.2 % girls. The numbers of subjects in 6–10, 11–14, and 15–18 years olds were 4349 (32.3 %), 4678 (34.7 %), and 4459 (33.06 %), respectively. The numbers of subjects classified as nonsmoker, only passive smoker, only active smoker, and active and passive smoker were 7599 (56.4 %), 5538 (41.1 %), 85 (0.6 %), and 264 (1.9 %), respectively. Table 1 presents the anthropometric measures and other characteristics of subjects according to the age groups. As it is shown, boys and girls were evenly distributed among different age groups ($p=0.3$). Associations between age groups and family size ($p<0.001$), SES ($p=0.02$), prevalence of passive ($p<0.001$),

and active smoking ($p<0.001$), as well as their smoking status ($p<0.001$), were statistically significant. Participants with 15 to 18 years of age had the highest prevalence of only active smoker and active and passive smoker status with a prevalence of 1.5 % (95 % CI 1.1–2.0) and 4.5 % (95 % CI 3.8–5.4), respectively.

Prevalence of various psychiatric disorders and violent behaviors according to age groups is presented in Table 2. The prevalence of all psychiatric variables and violent behaviors was statistically significant across age groups ($p<0.001$). Students in the 15–18-year-old age group had the highest prevalence of psychological problems except for victimization, bullying, and physical fights, with the highest prevalence documented among 11- to 14-year-old students.

A comparison of participants' psychiatric distress, violent behaviors, and other characteristics according to smoking status suggested that all psychiatric distress, violent behaviors, anthropometric characteristics, and SES had a linear increase with the smoking status (p trend < 0.001). The highest prevalence of each psychiatric distress was as follows: worthlessness, insomnia, and involvement in physical fights were most frequent among only active smoker group (26.1, 35.7, and 65.8 %, respectively). Participants with "active and passive smoking" status had the highest prevalence of angeriness, worrying, confusion, anxiety, victimization, and bullying (65.5, 47.7, 19.7, 48.4, 35.6, and 40.6 %, respectively). Prevalence of depression was 42.5 and 45.3 % among "only active" smokers and "active and passive" smokers, respectively (Table 3).

The odds ratios for risk of psychiatric distress and violent behaviors across smoking status category are presented in Table 4. It shows that in all models, the risk of all psychiatric distress and violent behaviors linearly increased with smoking status (p trend < 0.001), except for the risk of victimization in only active smoker groups that was not statistically significant compared to that in nonsmoker group. Results of model III

Table 2 Psychiatric distress and violent behaviors of participants according to the age groups: the CASPIAN-IV Study

	6–10 years	11–14 years	15–19 years	P value
Worthless	4.3 (3.6–5.2)	12.0 (11.0–13.20)	14.4 (13.2–15.6)	<0.001
Angriness	25.4 (23.5–27.5)	39.4937.5–41.4)	47.8 (45.8–49.8)	<0.001
Worry	13.1 (11.8–14.5)	32.6 (30.7–34.6)	41.9 (39.9–43.9)	<0.001
Insomnia	7.9 (7.0–9.0)	16.9 (15.5–18.3)	22.9 (21.4–24.5)	<0.001
Confusion	4.3 (3.6–5.2)	8.5 (7.6–9.6)	12.8 (11.7–14.1)	<0.001
Depression	11.1 (10.0–12.4)	20.3 (18.9–21.8)	31.2 (29.5–33.0)	<0.001
Anxiety	12.5911.3–13.9)	26.3 (24.7–27.9)	36.3 (34.5–38.2)	<0.001
Victim	27.7 (25.8–29.6)	30.3 (28.6–32.1)	23.8 (22.2–25.5)	<0.001
Bully	13.4 (12.1–14.8)	19.9 (18.5–21.5)	19.0 (17.6–20.4)	<0.001
Physical fight	36.4 (34.2–38.7)	45.0 (43.0–47.0)	38.0 (36.0–40.0)	<0.001

Data are presented as % (95 % CI)

suggested that the largest increase in odds of having each of psychiatric problems was as the following: odds of feeling worthless increased by almost threefold (odds ratio (OR) 2.93, 95 % CI 1.69–5.07) in only active smokers compared to those in nonsmoker group. Odds of anger increased by 2.5 times (OR 2.55, 95 % CI 1.86–3.48) in active and passive smoker groups compared to those in nonsmoker group. Odds of feeling worry increased by 63 % (95 % CI 1.03–2.58) and 66 % (95 % CI 1.24–2.20) in only active smoker and active and passive smoker groups compared to those in nonsmoker group, respectively. Odds of presence of insomnia increased by 135 % (95 % CI 1.42–3.86) in only active smoker category compared to

those in nonsmoker group. Odds for having confusion increased more than two times in only active smokers (OR 2.18, 95 % CI 1.23–3.87) and active and passive smokers (OR 2.10, 95 % CI 1.48–2.99) compared to those in nonsmoker group. Odds of reporting depression increased by 165 % (95 % CI 1.60–4.38) and 153 % (95 % CI 1.90–3.38) in only active smoker and active and passive smoker groups compared to nonsmoker group, respectively. Odds of feeling anxious increased by 70 % (95 % CI 1.04–2.79) and 99 % (95 % CI 1.52–2.61) in “active smoker” and active and passive smoker groups, respectively. Odds of victimization increased more in active and passive smokers (OR 1.77, 95 % CI 1.34–

Table 3 Psychiatric distress, violent behaviors, and other characteristics of participants according to smoking status: the CASPIAN-IV Study

Smoking status	Nonsmoker	Only passive smoker	Only active smoker	Active and passive smoker	<i>P</i> trend ^b
Age (year)	12.2 (12.0–12.4) ^a	12.5 (12.3–12.7)	15.5 (14.9–16.2)	15.5 (15.1–15.9)	<0.001
BMI	18.6 (18.5–18.8)	18.9 (18.7–19.1)	20.8 (19.8–21.9)	21.0 (20.4–21.5)	<0.001
Abdominal obesity	66.4 (65.9–66.9)	67.3 (66.8–67.8)	74.5 (72.1–76.9)	74.4 (72.8–75.9)	<0.001
Worthless	8.8 (8.1–9.6)	11.6 (10.6–12.6)	26.1 (17.9–36.5)	22.7 (17.9–28.3)	<0.001
Angriness	32.9 (31.5–34.3)	42.7 (41.0–44.3)	53.5 (43.3–63.5)	65.5 (58.9–71.5)	<0.001
worry	26.4 (25.1–27.8)	32.4 (30.8–3.0)	43.3 (34.0–53.1)	47.7 (41.3–54.2)	<0.001
Insomnia	14.1 (13.1–15.1)	17.6 (16.4–18.8)	35.7 (15.9–46.8)	31.9 (26.1–38.3)	<0.001
Confusion	7.5 (6.8–8.3)	9.4 (8.5–10.3)	19.0 (12.2–28.4)	19.7 (15.3–24.9)	<0.001
Depression	18.0 (16.9–19.1)	23.5 (22.2–24.9)	45.2 (34.9–55.9)	45.3 (39.2–51.6)	<0.001
Anxiety	22.2 (21.1–23.5)	27.7 (26.3–29.2)	43.5 (33.3–54.3)	48.4 (42.3–54.6)	<0.001
Victim	24.3 (23.1–25.5)	31.1 (29.6–32.6)	27.0 (18.1–38.2)	35.6 (29.8–41.7)	<0.001
Bully	14.9 (14.0–15.9)	19.8 (18.6–21.0)	28.2 (19.2–39.3)	40.6 (34.9–46.7)	<0.001
Physical fight	34.5 (33.1–36.0)	45.8 (44.1–47.5)	65.8 (55.5–74.8)	61.6 (55.5–67.3)	<0.001
Physical activity					
Mild	33.2 (31.6–34.8) ^b	34.8 (32.9–36.7)	40.0 (29.2–51.8)	41.8 (35.4–48.4)	0.05
Moderate	36.8 (35.4–38.2)	37.0 (35.5–38.6)	32.9 (22.4–45.4)	30.4 (24.9–36.5)	
Vigorous	29.9 (28.3–31.5)	28.1 (26.4–29.8)	27.0 (18.3–37.9)	27.7 (22.2–34.0)	
SES					
Low	31.7 (30.0–33.4)	36.2 (34.3–38.0)	27.5 (19.5–37.1)	27.7 (21.9–34.4)	<0.001
Intermediate	32.0 (30.7–33.3)	34.3 (32.8–35.8)	38.7 (28.8–49.6)	34.8 (29.3–40.8)	
High	36.2 (34.3–38.2)	29.4 (27.6–31.3)	33.7 (24.3–44.6)	37.3 (31.1–44.0)	
Hours of sleep per week					
<5	0.5 (0.4–0.7)	0.6 (0.5–0.9)	0	2.2 (1.0–4.9)	0.0001
5–8	21.9 (20.7–23.3)	23.0 (21.6–24.4)	26.5 (17.9–37.3)	32.7 (26.8–39.1)	
>8	77.4 (76.1–78.7)	76.3 (74.8–77.7)	73.4 (62.6–82.0)	65.0 (58.5–70.9)	
Body image					
Lean	33.4 (32.2–34.7)	35.2 (33.8–36.7)	35.2 (26.2–45.4)	32.2 (27.0–37.8)	<0.001
Normal	48.6 (47.3–49.9)	44.1 (42.6–45.5)	42.3 (32.4–52.9)	41.6 (36.0–47.5)	
Obese	17.8 (16.9–18.8)	20.6 (19.4–21.8)	22.3 (14.7–32.3)	26.1 (21.2–31.7)	

p values are for trend analysis. *P*<0.05 is significant

BMI body mass index, *SES* socioeconomic status

^a Mean±CI 95 %

^b % (CI 95 %)

Table 4 Odds ratios (CI 95 %) for psychiatric distress and violent behaviors across smoking status: the CASPIAN-IV Study

Smoking status		Nonsmoker	Only passive smoker	Only active smoker	Active and passive smoker	P trend
Worthless						
Model I ^a	1		1.34 (1.19–1.51)*	3.64 (2.22–5.95)*	3.01 (2.21–4.11)*	<0.001
Model II ^b	1		1.30 (1.16–1.47)*	2.81 (1.68–4.70)*	2.21 (1.61–3.03)*	<0.001
Model III ^c	1		1.28 (1.13–1.46)*	2.93 (1.69–5.07)*	2.07 (1.46–2.93)*	<0.001
Angriness						
Model I	1		1.52 (1.40–1.64)*	2.35 (1.55–3.55)*	3.87 (2.91–5.14)*	<0.001
Model II	1		1.49 (1.38–1.61)*	1.75 (1.15–2.66)*	2.86 (2.14–3.82)*	<0.001
Model III	1		1.50 (1.38–1.63)*	1.73 (1.10–2.71)*	2.55 (1.86–3.48)*	<0.001
Worry						
Model I	1		1.33 (1.23–1.44)*	2.12 (1.42–3.17)*	2.53 (1.94–3.30)*	<0.001
Model II	1		1.30 (1.20–1.41)*	1.47 (0.96–2.25)*	1.66 (1.26–2.20)*	<0.001
Model III	1		1.32 (1.20–1.44)*	1.63 (1.03–2.58)*	1.66 (1.24–2.20)*	<0.001
Insomnia						
Model I	1		1.29 (1.17–1.43)*	3.37 (2.12–5.35)*	3.37 (2.12–5.35)*	<0.001
Model II	1		1.25 (1.13–1.38)*	2.36 (1.48–3.76)*	1.97 (1.45–2.66)*	<0.001
Model III	1		1.21 (1.09–1.34)*	2.35 (1.42–3.86)*	1.78 (1.30–2.44)*	<0.001
Confusion						
Model I	1		1.27 (1.11–1.46)*	2.87 (1.68–4.91)*	2.99 (2.18–4.11)*	<0.001
Model II	1		1.22 (1.07–1.41)*	2.10 (1.22–3.62)*	2.13 (1.54–2.95)*	<0.001
Model III	1		1.22 (1.05–1.41)*	2.18 (1.23–3.87)*	2.10 (1.48–2.99)*	<0.001
Depression						
Model I	1		1.39 (1.28–1.52)*	3.75 (2.43–5.79)*	3.77 (2.91–4.89)*	<0.001
Model II	1		1.36 (1.24–1.49)*	2.55 (1.60–4.07)*	2.54 (1.96–3.29)*	<0.001
Model III	1		1.37 (1.24–1.51)*	2.65 (1.60–4.38)*	2.53 (1.90–3.38)*	<0.001
Anxiety						
Model I	1		1.34 (1.23–1.46)*	2.68 (1.74–4.15)*	3.28 (2.55–4.21)*	<0.001
Model II	1		1.30 (1.19–1.41)*	1.89 (1.21–2.93)*	2.21 (1.73–2.82)*	<0.001
Model III	1		1.28 (1.17–1.40)*	1.70 (1.04–2.79)*	1.99 (1.52–2.61)*	<0.001
Victim						
Model I	1		1.40 (1.28–1.52)*	1.15 (0.68–1.93)	1.71 (1.32–1.93)*	<0.001
Model II	1		1.41 (1.30–1.54)*	1.18 (0.70–1.99)	1.83 (1.40–2.38)*	<0.001
Model III	1		1.42 (1.30–1.55)*	1.13 (0.68–1.90)	1.77 (1.34–2.33)*	<0.001
Bully						
Model I	1		1.40 (1.27–1.54)*	2.23 (1.34–3.70)*	3.89 (3.02–5.01)*	<0.001
Model II	1		1.39 (1.26–1.53)*	1.74 (1.04–2.91)*	3.28 (2.52–4.27)*	<0.001
Model III	1		1.38 (1.25–1.53)*	1.78 (1.05–3.03)*	3.08 (2.33–4.07)*	<0.001
Physical fight						
Model I	1		1.59 (1.47–1.72)*	3.65 (2.36–5.64)*	3.03 (2.35–3.90)*	<0.001
Model II	1		1.61 (1.49–1.75)*	2.95 (1.89–4.58)*	2.77 (2.14–3.58)*	<0.001
Model III	1		1.60 (1.47–1.74)*	3.22 (2.00–5.18)*	2.55 (1.95–3.32)*	<0.001

^a Without adjusted (crude models)^b Adjusted for age, sex, and region^c Additionally adjusted for screen time, physical activity, socioeconomic status, family size, and BMI* $P < 0.05$

2.33). Odds of bullying increased by twofold (OR 2.08, 95 % CI 2.33–4.07) in “active and passive smokers.” However,

odds of involvement in physical violence were higher in only active smokers (OR 3.22, 95 % CI 2.00–5.18).

Discussion

This study suggested that smoking, either active or passive, had a linear positive association with different kinds of mental health problems. These findings are concordant with some previous studies [29, 35, 42–48]. Association of cigarette smoking and various psychological problems such as depression, anxiety, aggression, or bullying has been reported before [29, 34, 45, 49]. Different studies have approached smoking as a cause or effect of mental health problems [29, 35, 37, 38, 50].

In the present study, participants with “passive smoking” were at increased risk of having different kinds of mental health problems. These findings are compatible with those of studies on prenatal exposure to tobacco smoke on psychological abnormalities in smokers’ offspring [30, 32, 51]. Another way of interpreting this finding is the associations of smoking of family members and dysfunctional family environment which could lead to psychological problems [33].

Likewise, in those participants who were only active smoker, the odds of having all kinds of mental and psychological problems increased, except for victimization. The majority of aforementioned studies had focused on active smoking among adolescents with behavioral and psychological problems [39, 52–55].

Controversial results exist from studies on second-hand or passive exposure to smoking and psychological problems in nonsmokers, while Bot et al. [48] reported that passive tobacco exposure is not associated with depression and anxiety in nonsmokers. Likewise, Lam et al. did not find any significant association between passive smoking and poor mental health in general population [56]. However, some other studies have reported associations between second-hand smoking and psychological problems both in adult population [43, 57] and children [58].

Several studies have explored the biological plausibility of smoking as a trigger for initiation of particular psychological problems, namely panic attacks, panic disorder, and anxiety [59–61]. Some studies have also documented concomitant lung disease [59], effects of carbon monoxide on carotid body chemoreceptors [62], and direct effects of nicotine [63].

The innovative aspect of our study was comparison of those who were exposed to both active and passive smoking with nonsmokers. These participants were at increased odds of having all of psychological problems; moreover, compared with only passive smoker and only active smoker groups, members of this category were at even greater odds of having some mental health problems such as anger, confusion, worrying, anxiety, victimization, and bullying. A possible explanation would be the association of smoking and certain behavioral or mental health problems in either parents or siblings and their subsequent contribution to an unhealthy environment at home; hence, active smokers who live with other smokers in a household are at increased odds of having some psychological problems, compared to nonsmokers, only passive smokers, and only active smokers.

The Iranian government has taken steps to mitigate the increasing prevalence of smoking. In 2007, the Iranian parliaments banned smoking in roofed places and public buildings. In 2008, warning images of diseases caused by smoking were incorporated on cigarette packages. In addition, advertising of tobacco products was fully prohibited. However, smoking cessation is the only strategy to reduce health risks of smoking, the efficacy of which has not been yet studied comprehensively in Iran. Instead, programs on preventing smoking initiation should be implemented, especially in elementary schools, by educating children aged between 6 and 12 years. Moreover, the role of families should be underscored in this regard. In addition, a comprehensive tobacco control program should include methods to reduce risks in those individuals who continue to smoke.

Limitations and Strengths

Cross-sectional design of the study prevents us from deducing any causal relations between our findings. Furthermore, instead of assessment of lifetime prevalence of smoking, we asked the participants about their current smoking status. We did not either quantify smoking or inquire about the duration of exposure to tobacco in the subjects. Recall bias should be considered whenever self-report is used; however, some previous studies [64] suggest that, generally, there is an acceptable consistency between biological markers and assessments of tobacco exposure by individuals.

This study benefited from a large sample size, and its findings could be generalized to other settings.

Conclusion

Associations of tobacco exposure on both physical and psychological aspects of health have been studied widely. We found that both passive exposure to tobacco and active smoking are associated with greater odds of having various mental health problems. Moreover, a combination of these factors contributes to a slight additional increase in these odds. Interventions that target smoking exposure in adolescent can be beneficial for mental illness prevention. Since majority of smokers with mental health problems do not receive mental health services or counseling on smoking cessation, therefore, strategies to address mental health problems and smoking prevention should be included as a part of school health services.

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Appendix

Table 5 List of questions for psychiatric distress and violent behaviors according to the Global School-based student Health Survey (GSHS) questionnaire

Variables	Question	Response options
Worthless	During the past 6 months, how often did you experience worthless so that you cannot do your daily activity?	Almost every day (considered as yes)
Angriness	During the past 6 months, how often did you experience aggression so that you cannot do your daily activity?	More than once a week (considered as yes)
Anxiety	During the past 6 months, how often did you experience anxiety so that you cannot do your daily activity?	Almost every week (considered as yes)
Insomnia	During the past 6 months, how often did you experience insomnia so that you cannot do your daily activity?	Almost every month (considered as no)
Confusion	During the past 6 months, how often did you experience confusion so that you cannot do your daily activity?	Rarely or never (considered as no)
Depression	During the past 12 months, did you ever feel so sad or hopeless?	1. Yes 2. No
Worry	During the past 12 months, how often have you been so worried about something that you could not sleep at night?	Never (considered as no) Rarely (considered as no) Sometimes (considered as no) Most of the time (considered as yes) Always (considered as yes)
Physical fight	During the past 12 months, how many times you had physical fight?	None (considered as no) Once (considered as yes) Two times (considered as yes) Three times (considered as yes) Four times (considered as yes)
Victim	During the past 3 months, how many times you were bullied?	None (considered as no) One to two times (considered as yes) Two to three times (considered as yes) Four times or more (considered as yes)
Bullying	During the past 3 months, how many times you got bullied?	None (considered as no) One to two times (considered as yes) Two to three times (considered as yes) Four times or more (considered as yes)

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