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Short Communication

Smoking family, secondhand smoke exposure at home, and nicotine addiction among adolescent smokers

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ABSTRACT

Introduction: Smoking family predicts adolescent smoking, but whether the level of nicotine addiction is affected by exposure to secondhand smoke (SHS) is unclear. We investigated the associations of smoking family and SHS exposure at home with morning smoking and heavier smoking among Chinese adolescent smokers.

Methods: In a school-based anonymous survey, 2182 adolescent smokers reported their smoking behaviors, smoking status of family members and peers, and SHS exposure at home and outside home in the past 7 days. Families with one or more smoking members (excluding the subject) were classified as smoking families and otherwise as non-smoking families. Smoking or wanting to smoke first thing in the morning (morning smoking), and consuming more cigarettes (heavier smoking) denoted higher levels of nicotine addiction. Regression analysis yielded adjusted odds ratios (AORs) for morning smoking and β-coefficients for heavier smoking adjusting for potential confounders.

Results: Living with siblings and other co-residing family members who smoked was significantly associated with morning smoking and heavier smoking. Compared with non-smoking families without SHS exposure at home, the AORs (95% CI) for morning smoking were 0.99 (0.76 to 1.29) for 0 day/week, 1.19 (0.95 to 1.50) for 1–3 days/week, 1.76 (1.41 to 2.21) for 4–7 days/week (p for trend <0.001) and 1.50 (1.23 to 1.83) for any days/week of SHS exposure at home in smoking families. Similarly, 4–6 days/week of SHS exposure at home significantly predicted heavier smoking.

Conclusion: Living with smoking family members and SHS exposure at home are associated with nicotine addiction in Chinese adolescent smokers.

1. Introduction

Worldwide, SHS exposure at home is prevalent (73%) among smoking adolescents (Warren, Jones, Eriksen, Asma, & Global Tobacco Surveillance System (GTSS) collaborative group, 2006). In Hong Kong, over 60% of adolescents living with smokers were exposed to secondhand smoke (SHS) at home in the past 7 days (Ho, Lo, & Wang, 2011). The effects of SHS exposure in smokers were often ignored, but studies have found increased respiratory symptoms in adolescent and adult smokers (Lai, Ho, Wang, & Lam, 2009; Lam et al., 2005).

Apart from health effects, having smoking family members was a well-established risk factor for smoking initiation (Leonardi-Bee, Jere, & Britton, 2011). Living with smoking family members was also linked with nicotine addiction among adolescents (Brook, Saar, Zhang, & Brook, 2009), probably through genetic predisposition (Audrain-McGovern et al., 2007), role modeling (Azjen & Fishbein, 1980) and a lack of parental restriction on smoking (O'Byrne, Haddock, & Poston, 2002). Little is known about the effect on nicotine addiction of adolescent exposure to the smoking act of family members, especially non-parental members.

Seeing others smoke is effectively a visual cue to smokers (Sargent, Morgenstern, Isensee, & Hanewinkel, 2009). Together with the olfactory stimulation (Sayette & Parrott, 1999) and nicotine inhalation from SHS, they may constitute an even more potent smoking stimulus. Studies have suggested an addictive effect of SHS in animals and human (Brody et al., 2011; Small et al., 2010). Others have linked SHS exposure to nicotine dependence in never-smoking children and adolescents (Bélanger et al., 2008; Racicot, MaGrath, & O'Loughlin, 2011), and adult smokers (Okoli, Browning, Rayens, & Hahn, 2008; Wilson-Frederick et al., 2011), but less is known in adolescent smokers.

SHS exposure at home remained prevalent and intense among adolescents (Lai et al., 2009) and children (Ho et al., 2010b) in Hong Kong, a densely populated (6349 people per km^2) Chinese city typical of small residential flats and families with non-parent members. Due to the traditional parental influence in Chinese families, exposure to SHS from parents or grandparent at home probably has an effect on children's tobacco addiction that is stronger than that in Western families. We therefore investigated the associations of smoking family and SHS

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exposure at home with nicotine addiction among Chinese adolescent smokers.

2. Methods

2.1. Study design

A school-based survey was conducted using a questionnaire in Chinese among secondary 1 (US grade 7) to 5 students (98% response) in 2003/4. Survey methods were detailed elsewhere (Ho, Lai, Wang, & Lam, 2010a; Lai et al., 2009; Wang, Ho, Lo, Lai, & Lam, in press). Briefly, 36612 students from 85 secondary schools (63.9% response) were recruited with a probability proportional to school enrolment size as in the Global Youth Tobacco Survey (GYTS) (The GTSS Collaborative Group, 2006). All classes in secondary 1, and 2 classes in each upper grades were randomly selected. Questionnaires were administered in classrooms and teachers were present to maintain classroom order and were instructed to let students answer independently. To ensure candid reporting, completed anonymous answer sheets were immediately collected and sealed by our research personnel. Ethical approval was granted by a local Institutional Review Board.

2.2. Smoking and SHS exposure

Current smoking was defined as any smoking in the past 30 days (The GTSS Collaborative Group, 2006). A total of 2182 current smoking adolescents were included in the analysis. Students reported the number of days in the past 7 days that someone smoked near them at home and outside home in two separate questions. Smoking status of co-residing parents, siblings, grandparents and others was also reported. Families with one or more smoking members (excluding the subject) were classified as smoking families and otherwise as non-smoking families. SHS exposure at home was classified as non-smoking families without SHS exposure (reference), and smoking families with SHS exposure of 0, 1–4 and 5–7 days/week. A separate validation study among 76 students and 66 never-smoking students found satisfactory agreements of hair nicotine with self-reported smoking (83.5%) and SHS exposure (62.3%).

2.3. Nicotine addiction

Nicotine addiction was indicated by 2 items. First, a question adapted from the Fagerström Test of Nicotine Dependence (FTND): "Have you smoked or wanted to smoke first thing in the morning?" Three responses of "yes, sometimes", "yes, always" and "no" were provided with the first two being affirmative and hereafter abbreviated as morning smoking. Time to first cigarette in the morning was deemed a good single-item for measuring nicotine dependence (Transdisciplinary Tobacco Use Research Center (TTURC) et al., 2007). Second, students reported the number of cigarettes consumed in a day where smoking occurred, and consuming more cigarettes denoted heavier smoking. Smoking more cigarettes is an essential feature of nicotine addiction (O'Loughlin et al., 2003) and an important predictor of quitting (Borland, Yong, O'Connor, Hyland, & Thompson, 2010).

2.4. Covariates

Information about socio-demographic characteristics including sex, age, socioeconomic status as measured using the highest parental education (none, primary school, secondary school and matriculation) and housing types (public housing estates, subsidies housing, private and temporary), SHS exposure outside home (yes or no), smoking in friends (yes, no) were also collected and adjusted for as potential confounders.

2.5. Statistical analysis

STATA 9.2 was used for data analysis. Logistic and linear regressions yielded adjusted odds ratios (AORs) for morning smoking and regression coefficients (β) for heavier smoking, respectively, by SHS exposure at home. The AORs and β coefficients were calculated for students in smoking families with SHS exposure at home for 0 day, 1–3 days and 4–7 days/week compared with unexposed students in non-smoking families. To test the potential confounding effect of genetic predisposition of smoking dependence, students with smoking parents were excluded in a separate model. Much weaker associations in this model would suggest the studied associations might mainly be due to genetic predisposition. Mediation effects of SHS exposure at home on the associations of smoking family with morning smoking and heavier smoking were estimated with standard procedures (Baron & Kenny, 1986; MacKinnon & Dwyer, 1993) and Sobel test (Sobel, 1982) of $p<0.05$ indicating significant mediation.

3. Results

3.1. Basic characteristics

The mean age (SD) of current smokers were 15.5 (1.7) years and 56.3% were boys. The mean (SD) number of cigarettes smoked was 5.1 (5.5) in a smoking day, half (50.5%) the students reported morning smoking and 62.1% were exposed to SHS exposure at home. Living with smoking family members was common: parents 57.5%, siblings 37.5% and others 24.3%. Students who were boys, younger, living with smoking family members, having smoking peers and being exposed to SHS outside home were more likely to report SHS exposure at home (all p for $\chi^2<0.01$).

3.2. Family smoking, SHS exposure at home and nicotine addiction

Table 1 shows that smoking in siblings, other family members and peers were significantly associated with morning smoking and heavier smoking, but no significant association was observed for parental smoking. Table 2 shows that compared with non-smoking families without SHS exposure at home, the AORs (95% CI) for morning smoking were 0.99 (0.76 to 1.29) for 0 day, 1.19 (0.95 to1.50) for 1–4 days and 1.76 (1.41 to 2.21) for 5–7 days/week of SHS exposure at home (p for trend<0.001). The corresponding AOR (95% CI) for any days of SHS exposure at home was 1.50 (1.23 to 1.83). Stronger associations were observed excluding students living with smoking parents. Table 2 shows that increasing days of SHS exposure at home also predicted heavier smoking (p for trend<0.01). Significant associations were observed for any days (adjusted $\beta=0.49$, 95% CI: 0.01 to 0.96) and 5–7 days/week (adjusted $\beta=0.88$, 95% CI: 0.31 to 1.45) of SHS

Table 1
Associations of familial and peer smoking with morning smoking and heavier smoking.

	Smoking	Morning smoking	Heavier smoking
		Adjusted† OR (95%CI)	Adjusted† β (95% CI)
Parents	None‡	1	0
	Any	1.10(0.90 to 1.34)	0.03(−0.39 to 0.44)
Siblings	None‡	1	0
	Any	1.68(1.40 to 2.04)***	0.82(0.34 to 1.30)**
Other family members	None‡	1	0
	Any	1.38(1.04 to 1.84)*	0.92(0.43 to 1.41)***
Peers	None‡	1	0
	Any	2.16(1.77 to 2.63)***	2.26(1.81 to 2.71)***

†Adjusting for sex, age, highest parental education, housing types, school clustering effects and smoking of persons shown in the table.
‡None indicates no such persons or none of them smoked.
*$P<0.05$, **$P<0.01$, ***$P<0.001$.