Gender differences in social environmental changes associated with smoking: a cross-sectional study from Chinese internal migrants

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ABSTRACT

Objectives To identify clues for women’s tobacco control, this study analyses the gender differences in social environmental changes associated with smoking and the interaction between the environment and individuals’ social integration.

Design, setting and participants A cross-sectional design and secondary analysis were used among Chinese internal migrants. Data were from the 2012 Migrant Dynamics Monitoring Survey in China with participants aged 15–59 years old (75 416 women and 83 140 men) who resided in cities for more than 1 month.

Primary and secondary outcome measures Social environmental changes were measured by differences in smoking prevalence and women’s empowerment between the migrant-receiving province (MRP) and migrant-sending province (MSP). Social participation and duration of stay (DOS) were adopted as indicators of social integration.

Stratified analysis and binary logistic regression models were used to determine the dependent variable (smoking status) and environmental changes after controlling for age, education, income and happiness.

Results Differences in the smoking prevalence environment (lower in MRP, OR 0.70, 95% CI 0.60 to 0.83; higher in MRP, OR 1.79, 95% CI 1.35 to 2.37) and women’s empowerment (lower rate in MRP, OR 0.80, 95% CI 0.68 to 0.97; higher rate in MRP, OR 1.15, 95% CI 1.00 to 1.33) between MRP and MSP were positively correlated with women’s smoking. In men, however, migrating to an area with lower smoking prevalence could not reduce smoking risk, whereas moving to an area with higher women’s empowerment could. A long DOS was an independent risk factor for smoking in women (ranged from 1.20 to 2.00 in various environmental changes scenarios) but a protective factor for men. An interaction between environmental changes and social integration could not be verified.

Conclusions Tobacco control strategies should consider gender differences, especially women who are experiencing social environmental changes.

INTRODUCTION

Smoking is one of the most preventable causes of death from non-communicable diseases; women’s smoking, especially, has become an important public health issue. Research has revealed that smoking prevalence patterns differ between genders, and that women lag behind men. Although women’s smoking was not socially accepted in the early 1990s, the increase in women’s employment and economic independence in recent years is changing this outlook. There are multiple smoking-related factors associated with women, which differ from those associated with men. Compared with men, women’s smoking is more sensitive to social environmental factors. These factors include wealth, urbanisation and economic determinants, as well as smoking prevalence, its acceptance and empowerment. In addition, when exploring relationships between social environmental factors and individual behaviours, social integration is found to enhance or reduce behaviours by interacting with social environmental factors. For example, in a company with high smoking prevalence among its employees, workers with more friends would have higher odds of smoking; conversely, in a non-smoking company, they would have lower odds. Gendered analyses in social environmental changes could not be verified.
factors related to smoking and their interaction with individuals’ social integration are still limited, especially in low-income and middle-income countries.\textsuperscript{14,20}

As a traditional Asian country, China has a high smoking prevalence among men but very low smoking prevalence among women. This is, in part, related to the traditional social and cultural context of women’s smoking considered unacceptable for a long period.\textsuperscript{31} 21–25} By contrast, male smoking is considered respectable and, indeed, crucial for business and bonding. Although no evidence yet supports the obvious changing tendencies of smoking prevalence among women nationwide, recent years have witnessed a rising trend of smoking among female adolescents\textsuperscript{28}; in addition, smoking prevalence was relatively high in some subpopulations in China, such as female workers in public places\textsuperscript{25} and female migrants.\textsuperscript{26}

Similar movements were observed among the Iranian and Korean female population.\textsuperscript{27,28} Meanwhile, in China, social environmental risk factors for women’s smoking have increased in recent years, such as economic independence, social acceptance of women’s smoking and women’s empowerment.\textsuperscript{26,29,30} Data from waves 1 to 3 (2006–2009) of the International Tobacco Control China Survey reveal that approximately 38% of smokers and 9% of non-smokers admitted to female smoking being acceptable, with women being almost twice as likely to do so as men (67% vs 36% and 11% vs 6%, respectively).\textsuperscript{30} Therefore, additional evidence is needed to explain the associations between social environmental changes and smoking among women, as well as gender differences, especially in low-income and middle-income and traditional Asian countries like China.

China has one particular group—the internal migrants (or migrants) who mostly come from rural areas and inhabit urban areas to find better job opportunities and increase their income. They are experiencing challenges, such as cultural differences, social acceptance of smoking, social integration, as well as women’s empowerment and economic independence between the out-migrant areas and in-migrant areas.\textsuperscript{31} Therefore, study in this population might provide an opportunity to explore the gender differences in the association between environmental changes and smoking, as well as the interaction between the environment and individuals’ social integration.

Using a nationally representative sample of China’s internal migrants, this study analyses the gender differences in social environmental changes associated with smoking and the interaction between the environment and individuals’ social integration in smoking to provide knowledge for the practical application of women’s tobacco control.

METHODS

Data source

A cross-sectional study was designed to test our hypotheses. Data were obtained from the 2012 Migrant Dynamics Monitoring Survey in China, published by the National Health Commission of the People’s Republic of China. Participants were aged 15–59 years old (83,140 men and 75,416 women) and had been residing in their current cities for more than 1 month without local household registration.

The survey sampling methods were introduced in a previous study.\textsuperscript{32} In brief, a three-tier (ie, town/subdistrict, village/community and individual) sampling method was adopted with a probability proportional to size.

Measures

Smoking

We used one question to assess current smoking status: Do you currently smoke tobacco? Those who answered yes (no) were categorised as smokers (non-smokers).

Social environmental changes

The social environmental changes in our study refer to changes in the smoking prevalence environment and women’s empowerment. First, to demonstrate smoking prevalence environmental changes, we used teenagers’ smoking prevalence in various provinces from the Chinese Youth Tobacco Survey Report 2014 as reference,\textsuperscript{33} and calculated the difference in smoking prevalence between the migrant-receiving province (MRP) and migrant-sending province (MSP) for each participant. Provincially representative smoking-related data for adults in China remain rare, though nationally representative data are available. Meanwhile, smoking control among teenagers forms a key point in every country, and their smoking levels indirectly reflect tobacco consumption and the impact of smoking regulations in the area.\textsuperscript{34,35} Thus, the use of smoking prevalence in teenagers to represent provincial smoking data was valid. In the 31 provinces in mainland China, smoking prevalence varied from 1.4% to 21.4% and differences in smoking prevalence (DSP) between two provinces varied from −20% to 20%. The mean value, median and SD of DSP were −0.24 to –1.30 and 3.68, respectively. Data exploration showed a positive linear relationship between DSP and smoking prevalence among women, but a ‘W’ type of curve with increasing DSP values among men with an inflection point around±5. Thus, three categories were formed based on these differences: similar rate (5 to +5), lower rate in the MRP (≤ −5) and higher rate in the MRP (≥ 5).\textsuperscript{32} Second, to demonstrate the environmental changes in women’s empowerment, we used the proportion of women representatives (PWR) among provincial people’s congresses and Chinese People’s Political Consultative Conference\textsuperscript{14,29} in 2012 in China, which varied from 18.1% to 32.2%, and to calculate the difference between the MRP and MSP for each participant, which varied from −14.1% to 14.1%. Data exploration showed a positive relationship between differences and smoking prevalence among women and a mild negative relationship among men. Thus, three categories were formed based on Z scores of the differences in PWR: similar ((m±SD) 1.5±3.5), lower in the MRP (≤ −1.8) and higher in the MRP (≥ 4.8). We
further analysed the interaction of individuals' social integration with environment changes.

Social Integration

Social integration is multidimensional and has various definitions across disciplines; primarily, it refers to the adaptation of migrants to the norm and values of the local ‘mainstream’. On arrival in a new area, migrants may develop ties with the community and create new social networks. Furthermore, participants in activities within the host community may promote access to further economic opportunities as well as information and services. Therefore, in our study, social participation (SP) and duration of stay (DOS) were adopted as indicators to measure social integration. SP was measured using five questions: ‘Do you or your family ever participate in: culture and sports activities, charity activities (such as blood donation, fundraising), the activities of the Family Planning Association, election activities, or community hygiene and health education activities.’ Responses were scored as 0 (no) or 1 (yes). The sum of the scores, ranging from 0 to 5, was defined as the SP status and higher scores indicated better participation. To measure the DOS, we calculated the duration between the year of migration into the current city and the survey year.

Other control variables in the multivariate analysis included age, education, income and happiness. We used the question ‘Compared with the sending area, do you feel happy now?’ (very happy, happy, so-so, unhappy and very unhappy) to evaluate happiness. The first two items were classified as high, the middle item as medium and the last two items as low happiness.

Hypotheses and framework

Based on previous research results, we proposed the following hypotheses to identify gender differences:

1. The association between smoking and environmental changes is more significant in women than in men: (1) the difference in smoking prevalence between the MRP and MSP is positively correlated with women smoking, (2) the difference in women’s empowerment between the MRP and MSP is positively correlated with women smoking and (3) men’s smoking is less related to changes in smoking prevalence and women’s empowerment.

2. Social integration has different effects on smoking behaviour in different scenarios of environmental changes, regardless of gender (Figure 1). In general, the greater the SP and the longer the DOS, the closer the migrants’ smoking levels and attitudes towards women’s empowerment are to those in the MRP. For example, if the proposition that lower smoking prevalence in MRP is associated with lower smoking prevalence among migrants is verified, then among those with a lower rate in the MRP (or migrating to provinces with lower smoking prevalence), SP and DOS would be protective factors of smoking; that is, if SP and DOS increase, the risk of smoking decreases. Conversely, higher smoking prevalence in the MRP are related to a high risk of smoking. In such a scenario, SP and DOS are risk factors; that is, if SP and DOS increase, the risk of smoking also increases. Additionally, we controlled for happiness as a psychological status indicator because it relates to both social integration and smoking. Therefore, we controlled for happiness to explore the direct relationships between social integration and smoking in different scenarios of environmental changes.

Analysis

Statistical analyses were conducted using SPSS software (V.19.0; SPSS). Variable scores were presented as descriptive statistics; percentages and 95% CIs were used for categorical variables, means and SD were used for continuous variables, and a p<0.05 was considered to be statistically significant. χ² tests were performed for the one-way analysis. Stratified analysis and binary logistic regression analysis were used to determine the factors associated with smoking. A two-tailed test was set at $\alpha=0.05$.

Patients and the public involvement

Patients and the public were not involved in the design, conduct, reporting or dissemination plans of our research.

RESULTS

The study included 75416 women; those aged 15–24, 25–44 and 45–60 years old accounted for 20.7%, 71.1% and 8.1%, respectively. Moreover, 69.7% had an education below junior high school, 75.3% had an income below RMB3000 and 66.3% had a DOS of less than 5 years. Table 1 provides a basic description of the study participants.
Crude smoking prevalence according to differences in environmental factors

Women experiencing various environmental changes in smoking prevalence and women’s empowerment had different smoking prevalence. The women in the MRPs with higher smoking prevalence and PWR had significantly higher smoking prevalence. Among men, no significant differences were found between the groups in terms of women’s empowerment changes (Table 2).

Association between smoking prevalence and environmental changes

Among women, compared with their sending province, the smoking rate was lower in the group migrating to provinces with lower smoking prevalence (OR 0.70, 95% CI 0.60 to 0.83) and lower empowerment (OR 0.81, 95% CI 0.68 to 0.97) and higher in the group migrating to provinces with higher smoking prevalence (OR 1.79, 95% CI 1.35 to 2.37) and higher empowerment (OR 1.15, 95% CI 1.06 to 1.24).

Table 1  General characteristics of respondents and smoking rate

| Variables                  | Categories          | Female                        | Male                        |
|----------------------------|---------------------|-------------------------------|-----------------------------|
|                            | Sample size (%)     | Smokers Prevalence (%)        | Sample size (%)              | Smokers Prevalence (%)        |
| Age 15–24                  | 15 642 (20.7)       | 200 1.3***                    | 17 124 (20.6)               | 6437 37.6***                  |
| 25–44                      | 53 649 (71.1)       | 1032 1.9                      | 54 303 (65.3)               | 26 304 48.4                   |
| 45–60                      | 61 24 (8.1)         | 236 3.9                       | 11 712 (14.1)               | 6579 56.2                     |
| Education                  | Senior school and below | 52 579 (69.7)         | 1150 2.2***                 | 54 968 (66.1)               | 27 917 50.8***                  |
|                            | Senior school and above | 22 837 (30.3)     | 318 1.4                     | 28 172 (33.9)               | 11 403 40.5                     |
| Income per month (Yuan)    | 0–2999              | 56 813 (75.3)                 | 986 1.7***                  | 40 758 (49.1)               | 18 614 45.7***                  |
|                            | 3000+               | 18 402 (24.7)                 | 478 2.6                     | 42 176 (50.9)               | 20 622 48.9                     |
| Duration of stay (years)   | <5                  | 50 026 (66.3)                 | 857 1.7***                  | 55 469 (66.7)               | 26 239 47.3                     |
|                            | 5–10                | 16 422 (21.8)                 | 339 2.1                     | 16 714 (20.1)               | 78 56 47.0                     |
|                            | ≥10                 | 89 68 (11.9)                  | 271 3.0                     | 10 957 (13.2)               | 5 225 47.7                     |
| SP                         | 1.32 (±1.43)        | 1.22 (±1.41)                  |                            |                            |                               |
| SP was described as m±SD as a continuous variable. *p<0.05, **p<0.01, ***p<0.001. SP, social participation.

Table 2  Smoking prevalence in various environment changes scenarios

| Variables                  | Categories          | Women | Male                        |
|----------------------------|---------------------|-------|-----------------------------|
|                            | Sample size (%)     | Smokers Prevalence (%)        | Sample size (%)              | Smokers Prevalence (%)        |
| Similar degree             | 61 667 (81.8)       | 1237 2.0***                   | 67 814 (81.6)               | 31 854 47.0***                |
| Environment                | Lower in MRP        | 12 434 (16.5)                 | 172 1.4                     | 13 374 (16.1)               | 6 411 47.9                     |
| Changes of smoking prevalence | Higher in MRP      | 1309 (1.7)                    | 53 4.0                      | 1943 (2.3)                   | 1054 54.2                     |
| Women’s                    | Similar degree      | 55 189 (73.2)                 | 1072 1.9***                 | 61 773 (74.3)               | 29 317 47.5                    |
| Empowerment                | Lower in MRP        | 92 45 (12.3)                  | 142 1.5                     | 10 236 (12.3)               | 48 53 47.4                     |
| Changes                    | Higher in MRP       | 10 982 (14.6)                 | 253 2.3                     | 11 131 (13.4)               | 5 149 46.3                     |
| Total                      | 75 416 (100.0)      | 1467 1.9                      | 83 140 (100.0)             | 39 319 47.3                |                               |

* p<0.05, ** p<0.01, *** p<0.001.
MRP, migrant-receiving provinces.
1.00 to 1.33); this was statistically significant difference after controlling for age, education, income and happiness. By contrast, men’s smoking prevalence was slightly higher in the MRP with either higher or lower smoking prevalence (table 3).

Comparing women’s smoking according to women’s empowerment changes (table 3), their smoking rate was lower in the MRP with lower empowerment and higher in the MRPs with higher empowerment; this was statistically significant difference after controlling for age, education, income and happiness. Considering men, their smoking prevalence was slightly lower in the MRPs with higher empowerment than in the MRP with similar women’s empowerment.

**Effects of SP and DOS on smoking in various environmental changes scenarios**

Based on the possible impacts of SP and DOS in different smoking prevalence and environments with women’s empowerment, we conducted binary logistic regressions on smoking and empowerment environment change stratifications (table 4). After controlling for age, education, income and happiness, women’s SP showed no statistical significance in the smoking rate for the various environmental changes, except in the MRP with higher women’s empowerment; however, DOS was a significant risk factor in most scenarios (OR ranged from 1.20 to 2.00 in various environmental changes scenarios). Men’s SP and DOS were both protective factors but, in some cases, showed no statistical significance. Thus, no different effects of SP and DOS were observed on smoking behaviour after stratification of environmental changes. This result is different from our expectation, suggesting that SP does not play a direct role in smoking, while DOS might play an independent role.

**DISCUSSION**

The results of this study showed that social environmental changes were significantly associated with smoking; however, there were differences in the results between men and women. Women migrating into areas with higher smoking prevalence and higher women’s empowerment were at high smoking risk, while men were at high smoking risk whether migrating into higher or lower smoking prevalence areas. Women migrating to areas with lower smoking prevalence and lower degrees of women’s empowerment were at low smoking risk. In men, however, moving to an area with higher women’s empowerment could reduce the smoking risk. DOS was an independent risk factor for smoking among women, but a protective factor for men. The study could not demonstrate the different effects of SP and DOS on smoking in different scenarios for either women or men and an interaction between environmental changes and social integration could not be verified.

As for our hypothesis 1, the gap in smoking prevalence and women’s empowerment between the MRP and MSP for women were positively correlated with smoking risk; this indicates that environmental changes were significantly correlated with women’s smoking. Existing studies have shown that being in a high smoking prevalence environment is associated with an increased likelihood of smoking. In our study, the data showed that a lower rate in the MRP was not a protective factor for men’s smoking, compared with women; although this clearly suggests that moving to a low smoking prevalence environment would not reduce smoking in men, the reasons still need to be explored. Qualitative research from China found that men’s smoking was considered ‘normal’ or acceptable, which might mean that men who smoke are not as sensitive to environmental changes. Another study on the US military personnel confirmed this point.

The relationship between women’s empowerment and smoking is complex. On the one hand, women’s empowerment means more independence, job participation, decision-making and cultural tolerance leading to a higher risk of smoking. A study across 130 countries showed that along with high gender empowerment, the female-to-male smoking prevalence ratio was higher. On the other hand, once the hazards of smoking were explained to and accepted by women, improving empowerment can be a protective factor for smoking. Our study

| Table 3 Association between smoking prevalence and environmental changes |
| Variables | Women | SE | Wals | OR | 95% CI | Men | SE | Wals | OR | 95% CI |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Environment | Similar | 1.00 | 1.00 | 1.00 | 1.00 |
| Changes of smoking prevalence | Lower in MRP | 0.08 | 1.00 | 0.70*** | 0.60 to 0.83 | 0.02 | 1.00 | 1.05* | 1.01 to 1.09 |
| Higher in MRP | 0.14 | 16.25 | 1.79*** | 1.35 to 2.37 | 0.02 | 26.28 | 1.27*** | 1.16 to 1.39 |
| Women’s empowerment changes | Similar | 1.00 | 1.00 | 1.00 | 1.00 |
| Lower in MRP | 0.10 | 5.46 | 0.81* | 0.68 to 0.97 | 0.02 | 2.02 | 1.00 | 0.96 to 1.05 |
| Higher in MRP | 0.07 | 4.06 | 1.15* | 1.00 to 1.33 | 0.02 | 6.11 | 0.95* | 0.91 to 0.99 |

Controlled for age, education, income and happiness. *p<0.05, **p<0.01, ***p<0.001. MRP, migrant-receiving area; Wals, statistical value.
was consistent with the former statements, which might be related to the women’s tobacco epidemic stages in China,52 (according to the tobacco epidemic stage model, smoking behaviour is believed to begin with people in higher socioeconomic positions (SEPs) and then slowly spread to people in lower SEPs; women lag behind men in their smoking development stages,12 53 as confirmed by the women’s empowerment index adopted in our study. Among men, higher women’s empowerment in the MRP was shown to be associated with a slightly lower smoking risk, reflecting the complexity of women’s attitudes to men’s smoking and tobacco control policies.14

Considering hypothesis 2, our findings differed from our expectation in that SP was not directly related to smoking in any scenario. This is likely because SP does not interact with environmental changes on smoking. The other possible reason is that SP was positively related to happiness14 54; therefore, when happiness was introduced into the model, the association of SP with smoking could not be observed. We also found that social integration positively related to happiness with statistical and practical significance (Spearman’s rank correlation coefficient r=0.372, p<0.001 among women and r=0.371, p<0.001 among men), as well as happiness associated with smoking negatively (compared with higher happiness, smoking prevalence was higher in people with lower happiness OR 1.767, 95% CI 1.286 to 2.427 among women and OR 1.339, 95% CI 1.226 to 1.462 among men). This might mean that SP influenced smoking indirectly through happiness. Our study also demonstrated that DOS is independent of smoking and empowerment environment changes, which are positively associated with smoking among women but negatively associated with smoking among men. It also differed from our hypothesis, and no different (positive and negative) relationship was observed between the various scenarios. This reflects that other risk factors might be enhanced by longer DOS, rather than the two distal social environment factors we studied. The longer the DOS for women in developed cities, the longer women are exposed to social environments with a rich economy, cultural tolerance and women’s independence.7 8 56 All of these factors

### Table 4

Association of social participation and duration of stay with smoking in various environment changes

| Variables                        | Categories   | Women |               |               | Men |               |               |
|----------------------------------|--------------|-------|---------------|---------------|-----|---------------|---------------|
|                                  |              | SE    | Wals          | OR 95% CI     |     | SE            | Wals          | OR 95% CI     |
| Environment changes of smoking prevalence | Lower in MRP | SP    | <5            | 1.00          |     | 0.08          | 1.82          | 1.12          | 0.95 to 1.31  |
|                                  |              |       | 5–10          | 0.18          | 1.16**| 0.50          | 0.45          | 0.97          | 0.89 to 1.06  |
|                                  |              |       | ≥10           | 0.05          | 1.24  | 0.06          | 0.01          | 0.99          | 0.88 to 1.12  |
|                                  |              | DOS   | <5            | 1.00          |     | 0.03          | 3.42          | 0.95          | 0.89 to 1.00  |
|                                  |              |       | 5–10          | 0.07          | 1.03  | 0.02          | 25.76         | 0.90***       | 0.87 to 0.94  |
|                                  |              |       | ≥10           | 0.08          | 1.21  | 0.02          | 34.64         | 0.87***       | 0.83 to 0.91  |
|                                  |              | Similar | SP | <5            | 1.00          |     | 0.15          | 0.01          | 1.01          | 0.75 to 1.36  |
|                                  |              |       | 5–10          | 0.36          | 0.89  | 0.12          | 1.63          | 0.86          | 0.69 to 1.08  |
|                                  |              |       | ≥10           | 0.37          | 0.83  | 0.14          | 2.57          | 0.80          | 0.62 to 1.05  |
|                                  |              | DOS   | <5            | 1.00          |     | 0.03          | 3.57          | 0.94          | 0.89 to 1.00  |
|                                  |              |       | 5–10          | 0.08          | 0.91  | 0.02          | 24.60         | 0.90***       | 0.86 to 0.94  |
|                                  |              |       | ≥10           | 0.09          | 1.24  | 0.03          | 18.87         | 0.89***       | 0.85 to 0.94  |
|                                  |              | Higher in MRP | SP | <5            | 1.00          |     | 0.07          | 0.78          | 1.20**        | 1.06 to 1.36  |
|                                  |              |       | 5–10          | 0.16          | 0.77  | 0.05          | 3.45          | 0.91          | 0.83 to 1.01  |
| Women’s empowerment changes      | Lower in MRP | SP    | <5            | 1.00          |     | 0.17          | 3.93          | 1.39*         | 1.00 to 1.93  |
|                                  |              |       | 5–10          | 0.17          | 1.00  | 0.05          | 21.03         | 0.79***       | 0.71 to 0.87  |
|                                  |              | Similar | SP | <5            | 1.00          |     | 0.08          | 0.49          | 1.06          | 0.91 to 1.23  |
|                                  |              |       | 5–10          | 0.24          | 1.24  | 0.07          | 4.56          | 0.90***       | 0.86 to 0.94  |
|                                  |              |       | ≥10           | 0.26          | 1.24  | 0.03          | 18.87         | 0.89***       | 0.85 to 0.94  |
|                                  |              | DOS   | <5            | 1.00          |     | 0.07          | 3.57          | 0.94          | 0.94 to 1.02  |
|                                  |              |       | 5–10          | 0.16          | 0.77  | 0.05          | 3.45          | 0.91          | 0.83 to 1.01  |
|                                  |              |       | ≥10           | 0.17          | 1.00  | 0.05          | 21.03         | 0.79***       | 0.71 to 0.87  |

Controlled for age, education, income and happiness. *p<0.05, **p<0.01, ***p<0.001.

DOS, duration of stay; MRP, migrant-receiving area; SP, social participation; Wals, statistical value.
lead to smoking in women, and stricter tobacco control policies in developed cities cannot offset these effects. Tobacco companies’ propaganda targeting women in cities may also influence women’s smoking.\textsuperscript{6–8, 37} China officially signed the WHO Framework Convention on Tobacco Control in 2003; however, China’s implementation of its requirements remain limited.\textsuperscript{59} Our study was conducted in 2012, when no clear requirements existed for smoking bans in public places or advertising restrictions on tobacco companies. A study on Chinese catering services and sex workers among women migrants aged 15–30 years found that exposure to women’s cigarette brands increases susceptibility to smoking.\textsuperscript{59} A study from China showed that smoking among girls is believed to be fashionable by some people, indicating that girls’ understanding of smoking has become a key factor in the prevention of smoking among the new generation of Chinese people.\textsuperscript{50} All these reasons might have led to DOS being independently related to smoking in women in this study. The relationship between environmental changes and DOS in terms of smoking differed between men and women. This might be the result of gender differences in emotional control, risk aversion or the cultural stigma of smoking.\textsuperscript{50} As most migrants moved from economically underdeveloped areas to economically developed areas, studies have shown that economic and cultural factors in developed areas inhibit smoking in men,\textsuperscript{53, 62} while they promote smoking in women.\textsuperscript{1, 61, 63}

This study has some limitations. First, in this cross-sectional study, smoking status before migration was unknown and the time points when people started to smoke, and whether or not they quit, were not tracked. Second, there might be bias in self-reported smoking, which may lead to underestimation of actual smoking status, because women’s smoking is generally seen as undesirable in China. Third, migrants usually move from poor to well-off areas and, aside from integration, psychology, smoking and other factors, there might be factors in the living environment that have not yet been analysed, such as access to smoking cessation services and tobacco advertisement exposure. Moreover, this study only focused on the relative risks in smoking, because women’s smoking rate was very low, far lower than that of men, in terms of absolute values. In addition, there was no uniform measurement for empowerment, and some previous studies measured female empowerment totally or partly based on UNDP’s index,\textsuperscript{94} such as the percentage of female administrators and managers, professional and technical workers and seats in parliament.\textsuperscript{14, 29} In our study, we only chose PWR as an instrument for data availability by gender at provincial level in China. Moreover, most of the activities were formal as we measured SP, which might inhibit smoking to some degree, especially among populations migrating to higher smoking prevalence areas. Future studies on women’s smoking should consider a cohort study design and include more social environmental factors.

CONCLUSION

The results of this study showed that social environmental changes were significantly associated with smoking; however, there were differences in the results between men and women. Our findings provide knowledge to support gender-sensitive tobacco control policy-making. Tobacco control strategies should thus consider the impact of social environmental changes on women.

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