

# Split household and smoking behavior of rural migrants in China

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## Research article

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# Abstract

**Background:** With Hukou constraints, a large proportion of rural migrants have to leave part of their family members stay at hometown, the split household may induce smoking behavior among rural migrants in destination cities.

**Objective:** This study aims to address association between split household and smoking behavior, while the main discussion is to explore the differences between the three forms of split households—involving sole migration, couple migration, and family migration.

**Method:** A unique and comprehensive database named Rural Urban Migration in China (RUMiC-2009) is applied to explore the association between split household and the smoking behavior; Analyses are conducted using the Chi-square tests and Logit regression.

**Results:** The prevalence of smoking among family migrants (23.54%) is less than those sole migrants (25.46%) and couple migrants (35.13%). The family migrants (OR= 0.7445; 95% CI= 0.5955, 0.930) and couple migrants (OR= 0.8785; 95% CI= 0.6939, 1.1121) are less prone to smoke than the sole migrants counterparts. The family migrants (Coefficient= -0.0787; CI= -0.1229,-0.0346) and couple migrants (Coefficient= -0.0726; CI= -0.1188,-0.0264) show lower level of depression compared with the sole migration groups.

**Conclusions:** Split household is positively associated with the smoking behavior of rural migrants. While the depression may play as the potential transmission channel linked the split household and smoking prevalence.

## Background

China is a high-burden tobacco-use country, where nearly one-third (28.1%) of the population smokes, including 52.9% of men and 2.4% of women[1], which has been linked to the chronic and often fatal diseases of the respiratory tract[2]. With rapid urbanization, about 288 million migrants move from rural to urban in 2018 [3], and they have become an indispensable force for China's industrialization and modernization [4]. However, a large part of them are highly susceptible to smoking [5-7]. A rich array of studies has explored the determinants of rural migrants' smoking prevalence [8]. Most previous researches have consistently concluded that life and work stress are main determinants for the smoking prevalence of rural migrants[9,10], where the life and work stress include but not are limited to low-quality employment, poor living conditions, unequal public service, maladaptation to urban life and so on [9,10,12-14]. The rural migrants with high stress are more prone to trigger and aggravate smoking to obtain temporarily release [7]. Beyond that, there is also a consistent conclusion that the rural migrants' smoking prevalence is associated with age, gender, education attainments, income, occupation and migration durations[6-7,15].

However, the existing studies neglect a fact that Hukou system remains a fundamental institutional constraint in the process of migration integration in China. Without local urban Hukou, rural migrants can move to a new place but are not easy to share the same public services and welfare as local urban citizens [14, 18]. Thus, the rural-urban migration is not a one way street, and most of rural migrants are temporary or circular [16-17]. Most of them have to split their households between their rural origins and urban work locations, as some of the family members live in rural areas, whereas others have moved to cities looking for a job [19-22]. The household split including sole migration and couple migration has become an important social issue in China's urbanization process [29].

Split household usually is co-occurred with rural migrants mental health status, such as the work stress, psychological distress, depressive symptoms [23; 30]. Moreover, previous studies also reported a positive association between depression / anxiety and smoking behavior [31][32]. Smoking was generally used as a common way of alleviating stress, and thus the split household may cause smoking behavior. Nevertheless, previous studies pay little attention to the association between split household and smoking behavior. Chen et al. (2004) found a negative correlation between living with relatives and the smoking prevalence [7], but their conclusion was drawn only through Pearson chi-square tests, without regression applied to conduct more robust results.

The present study aims to fill those gaps by using a unique survey named RUMiC to extend the discussion of association between split household and smoking behavior among rural migrants in China. Three issues are addressed as follows:

- (1) Does the split household induce to smoking behavior?
- (2) Are there any differential effect among three split-household forms?
- (3) What is the potential mechanism linking the split household and smoking behavior?

This research contributes to the literature in three distinct ways. First, the present study emphasizes the association between split-household and the rural migrants' smoking behavior in China context, and it presents new evidence to understand the nexus between the smoking abuse and solitude due to household split. Second, a unique and comprehensive database named RUMiC is used to explore the relationship between split household and smoking prevalence. Third, the potential transmission channels linking the split household and smoking behavior are discussed by estimating the association between split household and depression.

## Method

### Data and sample

This study used data from Rural Urban Migration in China (RUMiC), which is initiated by a group of researchers at the Australian National University, the University of Queensland and the Beijing Normal University and supported by IZA Institute of Labor Economics. RUMiC consists of three independent

surveys: the Urban Household Survey (UHS), the Rural Household Survey (RHS) and the Migrant Household Survey (MHS). The data we applied in the present study is derived from MHS, which collects rich information on household roster and personal characteristics, education and training backgrounds, employment situation, household income and expenditure during migration period. RUMiC covers 15 cities within nine-largest provinces sending and receiving migrants in China, namely, Bengbu, Chengdu, Chongqing, Dongguan, Guangzhou, Hefei, Hangzhou, Luoyang, Nanjing, Ningbo, Shanghai, Shenzhen, Wuhan, Wuxi, and Zhengzhou (See Figure1).

About 5000 migrant households were collected in each wave, and the sampling frame of MHS was conducted by RUMiC team to overcome the problem of under-coverage [24]. RUMiC established a list of 550,000 migrant workers, from which 5,000 samples were randomly selected. The sampling frame was established on workplaces (rather than residences), all businesses—including street vendors—in randomly selected enumeration areas within defined city boundaries were included. For each city, a sample of migrant workers was randomly selected within each workplace, based on their birth month. The enumerators subsequently conducted face-to-face interviews with migrant workers and their families [25].

RUMiC was launched in 2008, and three waves RUMiC-2008, RUMiC-2009 are available to apply from the IZA Institute of Labor Economics. But only the wave of 2009 collects smoking-related information.

RUMiC-2009 only provide the information of the household members who was living with the respondent, sharing incomes and expenditures at the time of interview, the data on the family members left behind especially the grandparents was not collected. Thus, present study is limited to the nuclear family only with married-couple and their young unmarried children,, which is only defined as a single family nucleus with married-couple and their young children(age $\leq$ 16). We also drop the incomplete nuclear family samples such as single parent family to ensure the specific split scenario portrayed as split between spouses as well as split between spouse and their children [22]. After deleting the missing samples and outliers, this study obtains 3738 valid migrant samples, which includes about 1995 males and 1743 females in 15 cities (the sample coverage as shown in Table 1)

## **Ethnics Statement**

This study is a secondary analysis based on the data from the from the RUMiC conducted by a group of researchers at the Australian National University, the University of Queensland and the Beijing Normal University and was supported by the Institute for the Study of Labor (IZA) all of which were subject to multiple stages of reviews by experts to address methodological, ethical and legal issues related to data collection. Final approvals of all RUMiC surveys were required from the Research Ethics Committee of National Bureau of Statistics of China to ensure that the data collection complied with ethical requirement according to the Statistics Act.

## **Measures**

In the RUMiC, rural migrants are defined as rural laborers who move from rural areas to urban destinations within China. Internal migrants currently work in the surveyed cities but lack a local urban Hukou. The focal variable used in present study is split household, which are defined as the migrants' household arrangements between origin village and urban destination, includes three forms: sole migration, couple migration and family migration. Following Fan (2001) [22], we define the sole migration as the rural migrants who migrate solely, while both their spouse and children are left behind their hometown. Couple migration refers to migrants who migrate and reside together with their spouse but have no children resided together. Family migration is the household with the couple and all the children reside together at the same destination.

The variable of average cigarettes consumed per day is directly collected from the questionnaire item "How many cigarettes on average do you smoke per day now?". Daily smoking amount is measured by pack of cigarettes consumed per day, which was calculated by the average cigarettes consumed per day / 20. The smoking prevalence is defined as a dummy variable, which is set equal to 1 if migrants smoke at least 1 cigarette per day and 0 otherwise.

According to previous studies, controlled variables incorporate age (ref= age<25), gender (ref=female), educational attainment (ref= junior middle school or less), monthly income (ref= income<1500), duration (ref=duration<5), industry (ref= others), job status (ref= others), work overtime(ref= no), life satisfaction (ref= dissatisfied ).

## **Modeling strategy**

All the analyses are conducted using the Stata 15.0. The Pearson chi-square tests are applied to examine the association between split household, controls and smoking prevalence.

Logit regression analyses are performed to explore the relationship between split household and smoking prevalence, while the demographic variables, employment traits as well as the life satisfaction and city dummies are incorporated as the controls. Tobit estimation on the Daily smoking amount was conducted to give a robust check. OLS regression is applied to discuss the potential transmitted channel linking split household and the smoking prevalence.

# **Results**

## **Baseline characteristics**

Table 1 presents the descriptive statistics, most of the rural migrants are young males, of the 3738 participants, 2624 are less than the 40 years old, and 53.37% of them are males. Most of them(N=2915) have educational achievement at junior middle school or less, only 2.94% (N=110) of them completed education at the level of college or above. Over half (N=2104) of respondents are low-income employees, their monthly income (Yuan) were less than 2000. As for the migration duration, 55.67% of them (N=2081) have stayed in the local city for more than five years. Nearly half of the participants (N=1852)

work in the retail and hotel industry, whereas 18.96% (N=593) and 8.72% (N=326) of them engage in manufacture and construction. 38.09% (N=1424) of them are self-employed, and 32.32% of them experienced overtime. Of the 3738 participants, 255 are dissatisfied with the present life, while 1904 are satisfied with the current life.

**Table 1** Baseline characteristics

	Full sample	Smokers	Prevalence (%)	X2	p
<b>Household arrangement</b>				45.29	0.000
Family migration	1678	395	23.54		
Couple migration	1041	265	25.46		
Sole migration	1019	358	35.13		
<b>Age (years)</b>				11.09	0.026
age<25	126	21	16.67		
25≤age<30	621	164	26.41		
30≤age<35	867	224	25.84		
35≤age<40	1010	281	27.82		
40≤age	1114	328	29.44		
<b>Gender</b>				1.1e+03	0.000
Female	1743	28	1.61		
Male	1995	990	49.62		
<b>Educational attainment</b>				5.418	0.067
Junior middle school or less	2915	774	26.55		
Senior middle school	713	218	30.58		
College or more	110	26	23.64		
<b>Monthly income (Yuan)</b>				27.88	0.00
income<1500	1307	292	22.34		
1500≤income<2000	797	248	31.12		
2000≤income<3000	1110	311	28.02		
3000≤Income	524	167	31.87		
<b>Duration (years)</b>				5.12	0.077
duration<5	1657	431	26.01		
5≤duration<10	1109	330	29.76		
10≤duration	972	257	26.44		
<b>Industry</b>				101.2	0.000
Construction	326	165	50.61		
Manufacture	593	152	25.63		
Retail	1299	321	24.71		
Hotel	553	125	22.60		
Others	967	255	26.37		
<b>Job status</b>				0.7983	0.372
Others	2314	342	14.78		
Self-employed	1424	376	26.40		
<b>Over-time</b>				8.92	0.000
No	2530	651	25.73		
Yes	1208	367	30.38		
<b>Life satisfaction</b>				5.47	0.065
Dissatisfied	255	81	31.76		
Neutral	1579	446	28.25		
satisfied	1904	491	25.79		

<sup>b</sup> P-value were calculated using Pearson chi-square tests

\*significant (p≤0.05)

## Univariate analysis

As show in Table 2, 27.23% of the migrants are smoker. The Chi-square tests indicate that the prevalence of smoking among sole migrants (35.13%) are higher than those couple migrants (25.46%) and family migrants (23.54%). Males are more likely to smoke than females (49.62% vs 1.61%). The migrants serve at the construction industry have higher likelihood to smoke than other sectors (50.61%). The respondents involving in overtime job are more likely to smoking (30.38% vs 25.73%) and the dissatisfied migrants have higher likelihood to smoking than counterparts (31.76% vs 28.25% vs 25.79%)

**Table 2** Sample Coverage

City	N	%
Guangzhou	273	7.3
Dongguan	178	4.76
Shenzhen	117	3.13
Zhengzhou	302	8.08
Luoyang	155	4.15
Hefei	272	7.28
Bengbu	209	5.59
Chongqing	392	10.49
Shanghai	439	11.74
Nanjing	218	5.83
Wuxi	126	3.37
Hangzhou	339	9.07
Ningbo	157	4.2
Wuhan	279	7.46
Chengdu	282	7.54
Total	3,738	100

## Multivariate analysis

Multivariate analysis with Logit regression model is applied to identify independent variables associated with smoking prevalence, from which odd ratios (OR) and 95% confidence intervals (CI) are calculated.

**Table 3** Multiple regression analysis

	Model 1 (Prevalence of smoking) Logit			Model 2 (Daily smoking amount) Tobit		
	OR	95%,CI	P-value	Partial Effects	(95%,CI)	P-value
<b>Household arrangement</b>						
Sole migration	Reference					
Couple migration	0.8785	0.6939,1.1121	0.2820	-0.0141	-0.0426,0.0144	0.331
Family migration	0.7445	0.5955, 0.9306	0.0100	-0.0334	-0.0605,-0.0063	0.016
<b>Age(years)</b>						
age<25	Reference					
25≤age<30	1.1377	0.6029,2.1468	0.6910	0.0294	-0.0486,0.1074	0.46
30≤age<35	0.8942	0.4794,1.6678	0.7250	0.0044	-0.0725,0.0812	0.912
35≤age<40	1.0111	0.5435,1.8810	0.9720	0.0348	-0.0416,0.1111	0.372
40≤age	1.1137	0.5996,2.0684	0.7330	0.0447	-0.0313,0.1208	0.249
<b>Gender</b>						
Female	Reference					
Male	63.7841	43.1029,94.3882	0.0000	0.4997	0.4580,0.5413	0
<b>Educational attainment</b>						
Junior middle school or less	Reference					
Senior middle school	1.0470	0.8355,1.3120	0.6900	0.0019	-0.0256,0.0294	0.893
College or more	0.7000	0.4246,1.1539	0.1620	-0.0607	-0.1244,0.0031	0.062
<b>Monthly income(Yuan)</b>						
income<1500	Reference					
1500≤income<2000	0.9853	0.7661,1.2672	0.9080	-0.0076	-0.0381,0.0228	0.623
2000≤income<3000	1.0066	0.7892,1.2839	0.9580	-0.0050	-0.0343,0.0242	0.737
3000≤Income	0.9515	0.7079,1.2790	0.7420	-0.0005	-0.0366,0.0355	0.977
<b>Duration (years)</b>						
duration<5	Reference					
5≤duration<10	1.1814	0.9570,1.4585	0.1210	0.0166	-0.0089,0.0422	0.203
10≤duration	1.0835	0.8570,1.3700	0.5030	0.0026	-0.0259,0.0312	0.856
<b>Industry</b>						
Others	Reference					
Construction	1.4297	1.0397,1.9660	0.0280	0.0712	0.0332,0.1092	0
Manufacture	0.6983	0.5209,0.9360	0.0160	-0.0238	-0.0603,0.0128	0.202
Retail	1.0736	0.8246,1.3978	0.5980	0.0260	-0.0061,0.0581	0.113
Hotel	0.9999	0.7351,1.3601	1.0000	0.0089	-0.0287,0.0464	0.644
<b>Job status</b>						
Others	Reference					
Self-employed	1.0220	0.7993,1.3068	0.8620	0.0010	-0.0288,0.0309	0.946
<b>Work overtime</b>						
No	Reference					
Yes	1.2524	1.0225,1.5338	0.0300	0.0172	-0.0073,0.0418	0.169
<b>Life satisfaction</b>						
Dissatisfied	Reference					
Neutral	0.8426	0.5876,1.2082	0.3520	-0.0388	-0.0811,0.0035	0.072
satisfied	0.7170	0.5012,1.0258	0.0690	-0.0581	-0.1002,-0.0160	0.007
<b>Constant</b>	0.0137	0.0058,0.0319	0.000	---	---	---
<b>City Dummies</b>		Control			Control	

As shown in Table 3, the Logit estimations reveal that migrants of female (OR= 63.7841; 95% CI= 43.1029,94.3882) smoke less than counterparts reference group. Rural migrants engaged in the construction sector (OR= 1.4297; 95% CI= 1.0397,1.9660) and overtime jobs (OR= 1.2524; 95% CI= 1.0225,1.5338) are likely to smoke more.

As for the influence of split household, the results show that the family migrants (OR= 0.7445; 95% CI= 0.5955, 0.9306) and couple migrants (OR= 0.8785; 95% CI= 0.6939, 1.1121) are less susceptible to smoke than the sole migrants counterparts, but the coefficient of couple migrants is not significant.

This research also applies Tobit regression to verify the relationship between split household and rural migrants' daily smoking amount, the results are shown in Table 2 model 2. The partial effects of Tobit estimations are robust with the Logit regression (As shown in Table 4). The results demonstrate that the family migrants smoke less than the sole migrant counterparts (Partial Effects= -0.0334; CI= -0.0605,-0.0063). while the that couple migrants are also likely to smoke less than the sole migrants (Partial Effects=-0.0141; CI= -0.0426,0.0144), but the effect is not significant at 95% confidence level.

### **Mechanism analysis**

What is the potential mechanism linking the split household and smoking behavior? The present study claims that mental health such as depression may serve as the potential mechanism linking split household and smoking behavior. That is, split household may be positively related with depression, which will cause smoking behavior. To investigate the transmission channel, we further explore the relationship between split household and depression.

As shown in Table 4, Couple migration (Coefficient = -0.0726; CI= -0.1188,-0.0264) and family migration (Coefficient =-0.0787; CI= -0.1229,-0.0346) produce lower level of depression than the sole migrants.

**Table 4** Transmission channel

	Model 3		
	Coefficient	95%,CI	P-value
<b>Household arrangement</b>			
Sole migration			
Couple migration	-0.0726	-0.1188,-0.0264	0.002
Family migration	-0.0787	-0.1229,-0.0346	0
<b>Age(years)</b>			
age<25			
25≤age<30	-0.0226	-0.1206,0.0753	0.651
30≤age<35	-0.0330	-0.1283,0.0623	0.498
35≤age<40	-0.0743	-0.1698,0.0213	0.127
40≤age	-0.0450	-0.1398, 0.0498	0.352
<b>Gender</b>			
Female			
Male	0.0674	0.0325,0.1022	0
<b>Educational attainment</b>			
Junior middle school or less			
Senior middle school	0.0260	-0.0182, 0.0702	0.249
College or more	0.0664	-0.0238,0.1566	0.149
<b>Monthly income(Yuan)</b>			
income<1500			
1500≤income<2000	0.0300	-0.0174, 0.0775	0.215
2000≤income<3000	0.0002	-0.0448, 0.0453	0.993
3000≤Income	-0.0024	-0.0617, 0.0569	0.937
<b>Duration (years)</b>			
duration<5			
5≤duration<10	-0.0130	-0.0536, 0.0276	0.529
10≤duration	-0.0237	-0.0689, 0.0215	0.303
<b>Industry</b>			
Others			
Construction	0.0311	-0.0384,0.1006	0.38
Manufacture	-0.0274	-0.0841,0.0293	0.344
Retail	-0.0272	-0.0776, 0.0231	0.289
Hotel	-0.0014	-0.0598,0.0571	0.964
<b>Job status</b>			
Others			
Self-employed	0.0891	0.0411,0.1372	0
<b>Work overtime</b>			
No			
Yes	0.0120	-0.0270,0.0510	0.547
<b>Life satisfaction</b>			
Dissatisfied			
Neutral	0.1217	0.0449,0.1986	0.002
satisfied	0.2191	0.1431,0.2950	0
<b>Constant</b>	3.136	3.000,3.272	0
<b>City Dummies</b>		Control	

## Discussion

The estimations from Logit confirm that family migrants have fewer probabilities to smoke than sole migrants, which imply that family migration is beneficial for smoking control. Family migrants showed a 25.55% less likelihood to be current smokers relative to sole migrants counterparts, while the partial effects in the Tobit estimation shows that the predicted value of smoking amounts is 0.0334 packets less for family migrants than for sole migrants. The potential reason may be that sole migration is significantly associated with loneliness[26], that is ,migration with the whole family members together, especially migrated with their children together would boost their well-being[27]. Those would release the work and life stress, which may induce to a decrease of smoking behavior. Another possible reason is that with migrated children in the family, the male smokers would reduce the smoking behavior to maintain a good living environment for their children. The results also confirm that couple migrants are less to smoke, but it is not significant. This may be because the incomplete family migration can partly weaker the smoking behavior, while leaving children stay behind has depressing impact[28], which would induce to smoking behavior to relieve loneliness for couples migrants.

In addition, the estimations also reveal that males are more likely to smoke than females, which is consistent with the previous studies confirming that rural male migrants are more likely to be smoker than females [7, 15]. The migrants engaged in construction sector have more likelihood to smoke than the other sectors. It is consistent with the general conclusion that smoking behavior is more prevalence among the construction rural workers due to its high stress job [8].The migrants engaging in over-time job are at a higher level of risk for cigarette smoking, which implies that over-time work may induce a high level of psychosocial stress and high rates of mental problems for migrant workers, which in turn increase the susceptibility to cigarette smoking.

## Conclusion

### Main findings

This study discusses the association between split household and smoking behavior in China context by using a unique and comprehensive database named RUMiC .The results from Pearson chi-square tests show that males have more probability to smoke than females. The estimations from Logit confirm that family migrants and couple migrants are less likely to smoke than sole migrants, but the latter is not significant. The potential reason may be that family migration and couple migration can alleviate the depression and improve the well-being of migrants which in turn decrease the susceptibility to smoking. .

### Study limitations

Our research has some limitations. Firstly, the present papers mainly focus on exploring the correlations, thus the causality discussion is limited. Secondly, without related information, the regression has no chance to capture the effect of disease, parents and other relative left behind, local social network which are also important determinants for smoking behavior, while the expenditure of smoking is un-discussed. Thirdly, based on single question "How many cigarettes on average do you smoke per day now?", the

derived inference smoking amount may be biased ,so we mainly explored the smoking prevalence instead of smoking amounts.

## **Implications**

This study also sheds insight into current smoking control policy in urban China. Family migration is a valid way to weaken smoking behavior, thus it should be highly highlighted to attach importance to harmony and combination of all kinds of migration policy tools to encourage family migration.

## **Abbreviations**

Rural Urban Migration in China (RUMiC); Odds ratios (OR); Confidence interval (CI)

## **Declarations**

### **Ethics approval and consent to participate**

Not applicable

### **Consent for Publication**

Not applicable.

### **Availability of data and material**

The RUMiC is available from the IZA upon reasonable research request. RUMiC can be requested from the website of IZA: <https://datasets.iza.org/dataset/58/longitudinal-survey-on-rural-urban-migration-in-china>

### **Competing interests**

The authors declare that they have no competing interests.

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### **Authors' contributions**

Zicheng Wang took leadership and responsibility for the research activity planning and made substantial contributions to the conception and design of the Programme. Jiachun Liu worked on the statistical analysis of the data. Juan Ming drafted the concept of the paper as well as participated in finalizing the manuscript. All authors read and approved the final manuscript.

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# Figures



**Figure 1**

Sampling map. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.