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Tobacco and alcohol use among drug users receiving methadone maintenance treatment: a cross-sectional study in a rural prefecture of Yunnan Province, Southwest China

Song Duan,[1] Ziyi Jin,[2,3] Xing Liu,[2] Yuecheng Yang,[1] Runhua Ye,[1] Renhai Tang,[1] Meiyang Gao,[2] Yingying Ding,[2] Na He[2,3]

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SD, ZJ and XL contributed equally.

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For numbered affiliations see end of article.

Correspondence to
Dr Na He; nhe@fudan.edu.cn

ABSTRACT

Objective: To estimate the prevalence of ever, current and heavy tobacco and alcohol use and their correlates among patients undergoing methadone maintenance treatment (MMT).

Design: Cross-sectional study.

Setting: The study was conducted in all of the 5 MMT clinics in Dehong Prefecture, China.

Participants: 2121 (81.6%) eligible MMT participants were included in the study population.

Analysis: Ordinal logistic regression was used to estimate the ORs and their 95% CIs.

Results: The overall prevalence of ever, current and heavy smoking was 98.6%, 97.8% and 66.3%, respectively; while that of ever, current and hazardous alcohol drinking was 86.6%, 58.6% and 16.6%, respectively. Among HIV-infected participants, the proportions of those experiencing harmful effects of tobacco and alcohol on AIDS were 53.6% and 72.5%, respectively, and 16.9% and 49.3% had ever tried to quit after diagnosis with HIV. After adjusting for potential confounders, heavier smokers and more hazardous drinkers were more likely to be men, older and less educated. Ethnic minorities were less likely to heavily smoke, but more likely to engage in hazardous drinking. In addition, hazardous drinking was negatively associated with longer years of MMT and HIV infection. Moreover, heavier smoking ($OR_{\geq 2}$=2.08, 95% CI 1.16 to 3.73) and more hazardous drinking ($OR_{\geq 2}$=2.46, 95% CI 1.53 to 3.97) were positively associated with having multiple sexual partners, and both were positively associated with each other.

Conclusions: The prevalence of tobacco and alcohol consumption was extraordinarily high among MMT participants in China, suggesting the urgent need of enhancing MMT patients' awareness of the harmful effects of tobacco and alcohol consumption and implementing comprehensive education and effective intervention programmes.

Strengths and limitations of this study

- This is the first study specifically examining tobacco and alcohol use and their correlates among drug users receiving methadone maintenance treatment (MMT), with a large sample size in China.
- The results provide a better understanding of the prevalence and severity of current tobacco and alcohol consumption among MMT patients, particularly among those infected with HIV, helping to target population at higher risk for tobacco/alcohol-related diseases in the MMT population.
- This cross-sectional study is unable to make causal inferences between associated factors and tobacco and alcohol use.
- Self-reported data were used for risk behaviours, so information bias may exist.
- Participants were recruited from Dehong Prefecture; the findings might not be generalisable to MMT patients in other areas.

INTRODUCTION

China's methadone maintenance treatment (MMT) programme started with eight pilot sites in five provinces in March 2004, scaled up nationwide in June 2006 and has become one of the largest opioid-substitution treatment and care systems in the world.[1 2] By the end of 2012, a total of 756 community-based MMT clinics had been established in 28 provinces and had provided treatment for 384 479 drug users (DUs).[3] At the end of 2015, 167 600 DUs were receiving treatment in 785 MMT clinics located in 29 provinces. Owing to successful implementation during the past decade, the MMT programme in China has drastically reduced drug use and related morbidity and mortality, improved quality of life as well as the social and family well-being of DUs.[1 2 4] As MMT patients live longer because of the effectiveness of MMT, unhealthy lifestyles such as smoking and alcohol drinking have been suggested to be major causes of excess mortality for DUs.[5]

Furthermore, more than 10% and 60% of MMT patients are living with HIV and HCV, respectively, and are therefore at even higher risk of onset and rapid progression of comorbidities associated with tobacco and alcohol use.[6–10]

Tobacco and alcoholic beverages are highly addictive substances and widely consumed throughout the world, especially in China.[11 12] Tobacco and alcohol consumption have serious effects on public health and are regarded as the most common modifiable and preventable risk factors for major non-communicable diseases.[13 14] They contain well-established group I carcinogens and are causally associated with development of certain cancers,[15] and further contribute to the increasing health burden among persons living with HIV/AIDS (PLWHA).[16] Globally, a much higher prevalence of smoking (79–93%) has been reported in active DUs and MMT patients than in the general population,[17–24] whereas the prevalence of alcohol drinking was reported to be varying from 13% to 49%, depending on definitions of alcohol consumption and study area.[25–33]

However, no study has been designed to specifically examine tobacco and alcohol use among DUs receiving MMT, particularly those living with HIV in China. To fill this gap, we conducted a cross-sectional study to specifically examine tobacco and alcohol use and their correlates, and further to explore by gender and by HIV infection status among a large sample of DUs receiving MMT in Dehong Prefecture of Yunnan Province at China's southwest border, where the first China's indigenous HIV outbreak was reported in 146 infected heroin users in 1989, and injection drug use had been the predominant mode of HIV transmission through the early 2000s and continues to be an important source of HIV infection.[34 35]

METHODS

Study design, setting and participants

Details of the study design have been described in a previous publication, which showed that the prevalence of illicit drug use was 10.4%, 12.9% and 9.2% for morphine, methamphetamine and both of them, respectively, in the study population.[36] In brief, a cross-sectional survey was conducted from June to July in 2014 in Dehong Prefecture in Yunnan Province, China. The participants were identified from all of the five MMT clinics in Dehong Prefecture and were former opioid users, aged 20 years or older, had registered as local residents for at least 6 months where the clinic was located and were capable of completing civil liability (eg, of age and sound mind).[1 2]

Data collection

All participants had to read and sign the informed consent form prior to participating in the survey.

Trained public health professionals within the local clinics collected epidemiological data through face-to-face interviews using a structured questionnaire at a private location. The questionnaire had been tested in an early study.[37 38] The epidemiological data included basic demographic characteristics (gender, age, ethnicity, marital status and level of education), tobacco smoking (age at starting smoking, type of cigarettes, smoking frequency, smoking intensity and number of cigarettes smoked per day (CPD) in the past month), alcohol drinking (age at starting drinking, types of alcoholic beverage, drinking frequency and quantity of drinking in the past month), tobacco smoking and alcohol drinking status during MMT, knowledge and quitting behaviour for HIV-infected individuals and sexual behaviours (number of sexual partners in the last year). Information on age at starting drug use, length of taking MMT, daily methadone dosage and HIV and HCV infection status were obtained from the MMT Data System.

Measures

Ever smokers were defined as having smoked at least 100 cigarettes in their lifetime,[39] while ever alcohol drinkers were defined as having drunk at least once per month for more than 1 year.[37] Current smokers and current drinkers were defined as those who smoke or drank in the month prior to the interview. Current smokers were further asked about cigarette type (manufactured only, hand-rolled only or combination of the two), smoking frequency (none, sometimes or daily) and number of CPD in the past month. We summed absolute numbers of both types of cigarette, then defined heavy smoking as smoking at least 20 CPD, moderate smoking as 10–19 CPD and light smoking as 0–9 CPD.[39] As distilled spirits and beer were the mostly common consumed alcoholic beverage, alcohol type was classified into three categories in the analysis: distilled spirits only, beer only or combination of the two. Current drinkers were further asked about frequency of drinking (none, occasionally (1–3 times/month), often (1–3 times/week), almost daily (at least 4 times/week) or daily) and quantity of alcohol consumed in the past month. Weekly consumption of pure ethanol (g/week) on average were calculated with the standard of ethanol content of 4% for beer and 40% for distilled spirits, and a conversion factor of 0.79.[40] According to the US National Institute on Alcohol Abuse and Alcoholism (NIAAA) guidelines for physicians, the definition of standard drinks was 14 g of pure alcohol per drink. And we defined hazardous level as having more than 14 drinks/week (196 g of alcohol) for men and more than 7 drinks/week (98 g) for women, and moderate level as drinking ethanol below hazardous levels.[41] The frequency of drinking was dichotomised into 'often or daily' versus 'none or occasionally' in the analysis.

Statistical analysis

SAS V.9.2 package (SAS Institute) was used to clean and analyse the data. The distribution of participants'

sociodemographic characteristics, information on taking MMT, and tobacco and alcohol consumption by gender and by HIV infection status were described and compared using the χ^2 test or Fisher's exact test, where appropriate. Univariate ordinal logistic regressions were used to estimate ORs and their 95% CIs to examine the associations between smoking/drinking behaviours and related factors. In multiple regression, ordinal logistic regression models were performed with 'forced entry' of all variables selected based on prior knowledge and confounding assessment, for intensity of smoking and levels of alcohol drinking in the past month, respectively. These included gender (women/men), age (years, 18–29/30–39/40–49/50–79), ethnicity (Han/Jingpo/Dai/others), marital status (never married/in marriage/divorced or widowed), education level (illiteracy or primary/middle/high or above), age at first drug use (years,<25/≥25), length of MMT (years, <1/1–5/>5), daily methadone dose (mL, ≤30/31–60/61–99/≥100), number of sexual partners in the last year (0/1/≥2), HIV infection(no/yes), HCV infection(no/yes), alcohol use in the past month (none/moderate/hazardous, except for alcohol use) and smoking intensity in the past month (low/moderate/high, except for smoking).

RESULTS

Sociodemographic characteristics and status of HIV/HCV infection

Characteristics of MMT participants overall and by gender are summarised in table 1. During the study period, a total of 2600 DUs were receiving MMT. However, 269 participants could not complete the questionnaire due to intoxication, disability (eg, deaf-mute) or severe mental disorders. These conditions were determined by clinical judgements of the trained public health professionals conducting the face-to-face interviews. In addition, 197 did not appear at MMT sites and 13 participants were excluded because of excessive missing data. Finally, 2121 (81.6%) eligible MMT participants were included in the final analysis. Of the 2121 participants, 2041 (96.2%) were men; the mean age was 40.8 years (SD=10.0). Jingpo (42.9%) and Han (41.7%) were the largest two ethnic groups. Seventy per cent of the participants were married, and 1063 (50.1%) were illiterate or only had a primary school education. For HIV/HCV infection status, 451 (21.3%) had western blot confirmed HIV infection, while 786 (37.1%) were positive for serum HCV antibody. Male and female participants were significantly different in age, ethnicity and level of education.

Drug use, MMT and sexual behaviour

Among the study participants, 1199 (56.5%) started using heroin before they were 25 years. System data showed that 1754 (82.7%) had received MMT for more than 1 year and 669 (31.5%) for more than 5 years and 411 (20.2%) had daily methadone dosage >100 mL. For sexual behaviour, 75 (3.5%) reported having had 2 or more sex partners in the last year. No statistically significant difference was observed between men and women in these behaviours.

Tobacco use

The overall characteristics of tobacco smoking among MMT participants are presented in table 2, and were compared by gender and further by HIV infection status. Among all participants, 2091 (98.6%) were ever smokers, 2075 (97.8%) self-reported as current smokers and 1276 (61.0%) started smoking before they were 18 years; 1313 (62.8%) had smoked for more than 20 years and 2079 (98.0%) still smoked during MMT. Among current smokers, 1406 (66.3%) smoked more than 20 cigarettes/day and were defined as heavy smokers in this study. Almost all smokers preferred manufactured cigarettes. Smoking patterns were all significantly different by gender, since men were more likely to smoke (99.2% vs 83.8%, p<0.001), were more likely to start smoking before the age of 18 (61.8% vs 38.8%, p<0.001), had a longer duration of smoking (proportion of those who smoked for more than 20 years: 64.2% vs 20.9%, p<0.001), had a higher frequency of smoking (proportion of those smoking daily: 93.4% vs 66.3%, p<0.001) and higher intensity (heavy smoking: 68.1% vs 20.0%, p<0.001). When stratified by gender, HIV-positive individuals were more likely to start smoking before 18 in men (74.1% vs 58.4%, p<0.001) and women (63.2% vs 29.2%, p=0.010), and to prefer manufactured cigarettes (95.8% vs 86.8%, p<0.001) compared with HIV-negative participants in men. Among the HIV-infected individuals, 231 (53.6%) thought smoking has harmful effect on AIDS disease progression, while only 73 (16.9%) ever tried to quit smoking after being diagnosed with HIV, with no statistically significant difference by gender.

The prevalence of light, moderate and heavy smoking and associated factors of tobacco smoking intensity among MMT patients are presented and examined by ordinal logistic regression models in table 3. After adjusting for potential confounding factors, heavier smoking in the preceding month was positively associated with men (OR=13.10, 95% CI 8.22 to 20.88), having more sexual partners in the past month ($OR_{\geq 2}$=2.08, 95% CI 1.16 to 3.73) and engaging in hazardous drinking (OR=1.57, 95% CI 1.18 to 2.10), and negatively associated with being an ethnic minority (OR_{Jingpo}=0.63, 95% CI 0.51 to 0.79) and having received higher education ($OR_{high\ or\ above}$=0.72, 95% CI 0.53 to 1.00). Smoking intensity was not significantly associated with age, marital status, age at starting drug use, duration of taking MMT, daily methadone dose, or HIV or HCV infection.

Alcohol use

The characteristics of alcohol drinking among MMT participants are shown in table 4. Of all participants,

Table 1 Characteristics of study participants

Variables*	Total (N=2121)	Male (N=2041)	Female (N=80)
Age (years) (p=0.024)			
18–29	251 (11.8)	243 (11.9)	8 (10.0)
30–39	811 (38.2)	769 (37.7)	42 (52.5)
40–49	653 (30.8)	639 (31.3)	14 (17.5)
50–79	406 (19.1)	390 (19.1)	16 (20.0)
Ethnicity (p=0.023)			
Han	885 (41.7)	854 (41.8)	31 (38.8)
Jingpo	909 (42.9)	880 (43.1)	29 (36.3)
Dai	249 (11.7)	231 (11.3)	18 (22.5)
Others	78 (3.7)	76 (3.7)	2 (2.5)
Marital status (p=0.156)			
Never married	378 (17.8)	368 (18.0)	10 (12.5)
Current married	1495 (70.5)	1439 (70.5)	56 (70.0)
Divorced or widowed	248 (11.7)	234 (11.5)	14 (17.5)
Education level (p=0.001)			
Illiteracy or primary	1063 (50.1)	1038 (50.9)	25 (31.3)
Middle	816 (38.5)	777 (38.1)	39 (48.8)
High or above	242 (11.4)	226 (11.1)	16 (20.0)
Age at first drug use (years) (p=0.778)			
<25	1199 (56.5)	1155 (56.6)	44 (55.0)
≥25	922 (43.5)	886 (43.4)	36 (45.0)
Length of MMT (years) (p=0.086)			
<1	367 (17.3)	360 (17.6)	7 (8.8)
1–5	1085 (51.2)	1043 (51.1)	42 (52.5)
>5	669 (31.5)	638 (31.3)	31 (38.8)
Daily methadone dose (mL) (p=0.444)			
≤30	335 (16.4)	327 (16.7)	8 (10.1)
31–60	765 (37.5)	732 (37.3)	33 (41.8)
61–99	528 (25.9)	508 (25.9)	20 (25.3)
≥100	411 (20.2)	393 (20.1)	18 (22.8)
Number of sexual partners in the past year (p=0.357)			
0	601 (28.4)	581 (28.5)	20 (25.0)
1	1441 (68.1)	1386 (68.0)	55 (68.8)
≥2	75 (3.5)	70 (3.4)	5 (6.3)
HIV infection (p=0.405)			
No	1670 (78.7)	1610 (78.9)	60 (75.0)
Yes	451 (21.3)	431 (21.1)	20 (25.0)
HCV infection (p=0.698)			
No	1335 (62.9)	1283 (62.9)	52 (65.0)
Yes	786 (37.1)	758 (37.1)	28 (35.0)

*p Value obtained from χ^2 tests.

1837 (86.6%) were ever drinkers, 953 (51.9%) started drinking before they were 18 years old, 1092 (59.4%) had consumed alcohol for more than 20 years and 1555 (73.3%) were still drinking during MMT and also in the past month prior to interview. The prevalence of current drinking, drinking often or daily and drinking at hazardous level were 58.6%, 24.5% and 16.6%, respectively. Men had significantly different alcohol drinking patterns than women. Men were more likely to drink, had a longer duration of drinking, drank more distilled spirits, drank more and had a higher drinking frequency. In men, compared with HIV-uninfected individuals, HIV-infected cases had a lower prevalence of drinking during MMT (66.8% vs 76.5%, p<0.001), smaller frequency of drinking in the past month (proportion of drinking often and daily: 17.6% vs 27.3%, p<0.001), less distilled spirits use (68.7% vs 72.5%, p<0.001) and fewer had a hazardous level of drinking (9.3% vs 19.1%, p<0.001). No significant difference was seen in women when comparing by HIV status. Among those HIV cases, 266 (72.5%) thought alcohol was harmful for AIDS disease progression, and 181 (49.3%) had ever tried to quit drinking after diagnosed with HIV, with no significant difference between men and women.

The prevalence of none, moderate and hazardous alcohol drinking and associated factors among MMT patients were examined and shown in table 5. After adjusting for potential confounding factors, higher levels of alcohol drinking in the preceding month were

Table 2 Characteristics of tobacco smoking among study participants†

Variables	Total (N=2121)	Male (N=2041)	Female (N=80)	Male		Female	
				HIV+ (N=431)	HIV− (N=1610)	HIV+ (N=20)	HIV− (N=60)
Ever smoking		***					
No	30 (1.4)	17 (0.8)	13 (16.3)	2 (0.5)	15 (0.9)	1 (5.0)	12 (20.0)
Yes	2091 (98.6)	2024 (99.2)	67 (83.8)	429 (99.5)	1595 (99.1)	19 (95.0)	48 (80.0)
Smoking initiation age (years)		***		***		*	
≥18	815 (39.0)	774 (38.2)	41 (61.2)	111 (25.9)	663 (41.6)	7 (36.8)	34 (70.8)
<18	1276 (61.0)	1250 (61.8)	26 (38.8)	318 (74.1)	932 (58.4)	12 (63.2)	14 (29.2)
Smoking years		***					
<20	778 (37.2)	725 (35.8)	53 (79.1)	149 (34.7)	576 (36.1)	13 (68.4)	40 (83.3)
≥20	1313 (62.8)	1299 (64.2)	14 (20.9)	280 (65.3)	1019 (63.9)	6 (31.6)	8 (16.7)
Smoking during MMT		***					
No	42 (2.0)	22 (1.1)	20 (25.0)	4 (0.9)	18 (1.1)	2 (10.0)	18 (30.0)
Yes	2079 (98.0)	2019 (98.9)	60 (75.0)	427 (99.1)	1592 (98.9)	18 (90.0)	42 (70.0)
Smoking frequency in the past month		***					
None	46 (2.2)	25 (1.2)	21 (26.3)	3 (0.7)	22 (1.4)	2 (10.0)	19 (31.7)
Sometimes	116 (5.5)	110 (5.4)	6 (7.5)	15 (3.5)	95 (5.9)	3 (15.0)	3 (5.0)
Daily	1959 (92.4)	1906 (93.4)	53 (66.3)	413 (95.8)	1493 (92.7)	15 (75.0)	38 (63.3)
Smoking types		***		***			
Manufactured only	1845 (88.9)	1788 (88.7)	57 (96.6)	410 (95.8)	1378 (86.8)	18 (100.0)	39 (95.1)
Hand-rolled only	43 (2.1)	42 (2.1)	1 (1.7)	4 (0.9)	38 (2.4)	0 (0.0)	1 (2.4)
Both above	187 (9.0)	186 (9.2)	1 (1.7)	14 (3.3)	172 (10.8)	0 (0.0)	1 (2.4)
Smoking intensity in the past month		***					
Low	226 (10.7)	177 (8.7)	49 (61.3)	42 (9.7)	135 (8.4)	11 (55.0)	38 (63.3)
Moderate	489 (23.1)	474 (23.2)	15 (18.8)	96 (22.3)	378 (23.5)	4 (20.0)	11 (18.3)
Heavy	1406 (66.3)	1390 (68.1)	16 (20.0)	293 (68.0)	1097 (68.1)	5 (25.0)	11 (18.3)
Attitude to effect of smoking on AIDS							
Good	6 (1.4)	6 (1.5)	0 (0.0)	6 (1.5)	–	0 (0.0)	–
Harmful	231 (53.6)	219 (53.0)	12 (66.7)	219 (53.0)	–	12 (66.7)	–
No effect	194 (45.0)	188 (45.5)	6 (33.3)	188 (45.5)	–	6 (33.3)	–
Ever tried to quit smoking after diagnosed with HIV							
Yes	73 (16.9)	69 (16.7)	4 (22.2)	69 (16.7)	–	4 (22.2)	–
No	358 (83.1)	344 (83.3)	14 (77.8)	344 (83.3)	–	14 (77.8)	–

* p<0.05; *** p<0.001.
†p Value obtained from χ^2 tests or Fisher's exact tests.

Table 3 Prevalence and associated factors of tobacco smoking intensity among study participants

Variables	Low (N=226)	Moderate (N=489)	High (N=1406)	Crude OR (95% CI)	Adjusted OR (95% CI)†
Gender					
Female	49 (61.3)	15 (18.8)	16 (20.0)	1.00	1.00
Male	177 (8.7)	474 (23.2)	1390 (68.1)	14.04 (8.96 to 22.01)***	13.10 (8.22 to 20.88)***
Age (years)					
18–29	33 (13.1)	61 (24.3)	157 (62.5)	1.00	1.00
30–39	89 (11.0)	197 (24.3)	525 (64.7)	1.12 (0.84 to 1.49)	1.20 (0.88 to 1.64)
40–49	62 (9.5)	142 (21.7)	449 (68.8)	1.34 (0.99 to 1.80)	1.30 (0.92 to 1.84)
50–79	42 (10.3)	89 (21.9)	275 (67.7)	1.27 (0.92 to 1.75)	1.34 (0.90 to 2.00)
Ethnicity					
Han	79 (8.9)	194 (21.9)	612 (69.2)	1.00	1.00
Jingpo	106 (11.7)	224 (24.6)	579 (63.7)	0.78 (0.64 to 0.94)*	0.63 (0.51 to 0.79)***
Dai	28 (11.2)	56 (22.5)	165 (66.3)	0.86 (0.64 to 1.16)	0.77 (0.56 to 1.06)
Others	13 (16.7)	15 (19.2)	50 (64.1)	0.73 (0.46 to 1.17)	0.64 (0.39 to 1.03)
Marital status					
Never married	46 (12.2)	97 (25.7)	235 (62.2)	1.00	1.00
Current married	152 (10.2)	336 (22.5)	1007 (67.4)	1.25 (0.99 to 1.57)	1.18 (0.87 to 1.60)
Divorced or widowed	28 (11.3)	56 (22.6)	164 (66.1)	1.17 (0.84 to 1.63)	1.21 (0.85 to 1.72)
Education level					
Illiteracy or primary	112 (10.5)	221 (20.8)	730 (68.7)	1.00	1.00
Middle	81 (9.9)	207 (25.4)	528 (64.7)	0.86 (0.71 to 1.05)	0.86 (0.69 to 1.07)
High or above	33 (13.6)	61 (25.2)	148 (61.2)	0.72 (0.54 to 0.95)*	0.72 (0.53 to 1.00)*
Age at first drug use (years)					
<25	122 (10.2)	285 (23.8)	792 (66.1)	1.00	1.00
≥25	104 (11.3)	204 (22.1)	614 (66.6)	1.00 (0.84 to 1.20)	0.90 (0.72 to 1.13)
Length of MMT (years)					
<1	32 (8.7)	86 (23.4)	249 (67.8)	1.00	1.00
1–5	114 (10.5)	240 (22.1)	731 (67.4)	0.96 (0.75 to 1.23)	0.97 (0.75 to 1.26)
>5	80 (12.0)	163 (24.4)	426 (63.7)	0.81 (0.62 to 1.06)	0.81 (0.61 to 1.09)
Daily methadone dose (mL)					
≤30	36 (10.7)	78 (23.3)	221 (66.0)	1.00	1.00
31–60	85 (11.1)	182 (23.8)	498 (65.1)	1.02 (0.80 to 1.30)	1.02 (0.80 to 1.32)
61–99	50 (9.5)	115 (21.8)	363 (68.8)	1.20 (0.92 to 1.57)	1.29 (0.97 to 1.70)
≥100	51 (12.4)	82 (20.0)	278 (67.6)	1.10 (0.83 to 1.46)	1.25 (0.92 to 1.70)
Number of sexual partners in the last year					
0	76 (12.6)	140 (23.3)	385 (64.1)	1.00	1.00
1	143 (9.9)	337 (23.4)	961 (66.7)	1.31 (1.08 to 1.58)**	1.15 (0.88 to 1.51)
≥2	7 (9.3)	11 (14.7)	57 (76.0)	1.55 (1.27 to 1.89)***	2.08 (1.16 to 3.73)*
Alcohol use in the past month					
None	129 (14.7)	203 (23.1)	547 (62.2)	1.00	1.00
Moderate	63 (7.1)	227 (25.5)	599 (67.4)	1.36 (1.12 to 1.64)**	1.19 (0.97 to 1.47)
Hazardous	34 (9.6)	59 (16.7)	260 (73.7)	1.71 (1.31 to 2.24)***	1.57 (1.18 to 2.10)**
HIV infection					
No	173 (10.4)	389 (23.3)	1108 (66.3)	1.00	1.00
Yes	53 (11.8)	100 (22.2)	298 (66.1)	0.97 (0.78 to 1.20)	1.00 (0.77 to 1.29)
HCV infection					
No	141 (10.6)	309 (23.1)	885 (66.3)	1.00	1.00
Yes	85 (10.8)	180 (22.9)	521 (66.3)	1.00 (0.83 to 1.20)	0.99 (0.81 to 1.22)

*p<0.05; **p<0.01; ***p<0.001.
†Adjusted for potential confounding variables listed in the table by multivariate ordinal logistic regression analysis.

positively associated with being a man (OR=7.20, 95% CI 3.83 to 13.54), at an older age ($OR_{40–49}$=1.70, 95% CI 1.23 to 2.35; $OR_{50–79}$=1.76, 95% CI 1.22 to 2.53), being an ethnic minority (OR_{Jingpo}=2.58, 95% CI 2.11 to 3.16; OR_{Dai}=3.08, 95% CI 2.31 to 4.11), having two or more sexual partners in the last year ($OR_{\geq 2}$=2.46, 95% CI 1.53 to 3.97) and being a heavy smoker (OR_{high}=1.39, 95% CI 1.03 to 1.88). Heavier drinking was negatively associated with having received higher education (OR_{middle}=0.76, 95% CI 0.63 to 0.93; $OR_{high\ or\ above}$=0.65, 95% CI 0.48 to 0.89), having a longer duration of MMT ($OR_{>5}$=0.77, 95% CI 0.59 to 1.00) and being HIV infected (OR=0.53, 95% CI 0.42 to 0.68). Quantity of alcohol consumption was not significantly associated

Table 4 Characteristics of alcohol drinking among study participants

Variables	Total (N=2121)	Male (N=2041)	Female (N=80)	Male		Female	
				HIV+ (N=431)	HIV− (N=1610)	HIV+ (N=20)	HIV− (N=60)
Ever alcohol drinking		***					
No	284 (13.4)	257 (12.6)	27 (33.8)	60 (13.9)	197 (12.2)	6 (30.0)	21 (35.0)
Yes	1837 (86.6)	1784 (87.4)	53 (66.3)	371 (86.1)	1413 (87.8)	14 (70.0)	39 (65.0)
Drinking initiation age (years)				**			
≥18	884 (48.1)	854 (47.9)	30 (56.6)	149 (40.2)	705 (49.9)	5 (35.7)	25 (64.1)
<18	953 (51.9)	930 (52.1)	23 (43.4)	222 (59.8)	708 (50.1)	9 (64.3)	14 (35.9)
Drinking years		***					
<20	745 (40.6)	708 (39.7)	37 (69.8)	155 (41.8)	553 (39.1)	11 (78.6)	26 (66.7)
≥20	1092 (59.4)	1076 (60.3)	16 (30.2)	216 (58.2)	860 (60.9)	3 (21.4)	13 (33.3)
Drinking during MMT		***		***			
No	566 (26.7)	521 (25.5)	45 (56.3)	143 (33.2)	378 (23.5)	10 (50.0)	35 (58.3)
Yes	1555 (73.3)	1520 (74.5)	35 (43.8)	288 (66.8)	1232 (76.5)	10 (50.0)	25 (41.7)
Drinking frequency in the past month		***		***			
None and occasionally	1602 (75.5)	1526 (74.8)	76 (95.0)	355 (82.4)	1171 (72.7)	19 (95.0)	57 (95.0)
Often and daily	519 (24.5)	515 (25.2)	4 (5.0)	76 (17.6)	439 (27.3)	1 (5.0)	3 (5.0)
Drinking types		***		***			
Distilled spirits only	563 (45.3)	560 (45.6)	3 (23.1)	90 (44.8)	470 (45.7)	0 (0.0)	3 (30.0)
Beer only	355 (28.6)	346 (28.2)	9 (69.2)	63 (31.3)	283 (27.5)	2 (66.7)	7 (70.0)
Both of the above	324 (26.1)	323 (26.3)	1 (7.7)	48 (23.9)	275 (26.8)	1 (33.3)	0 (0.0)
Alcohol use in the past month		***		***			
None	879 (41.4)	812 (39.8)	67 (83.8)	230 (53.4)	582 (36.1)	17 (85.0)	50 (83.3)
Moderate	889 (41.9)	881 (43.2)	8 (10.0)	161 (37.4)	720 (44.7)	1 (5.0)	7 (11.7)
Hazardous	353 (16.6)	348 (17.1)	5 (6.3)	40 (9.3)	308 (19.1)	2 (10.0)	3 (5.0)
Attitude to effect of drinking on AIDS							
Good	8 (2.2)	8 (2.3)	0 (0.0)	8 (2.3)	–	0 (0.0)	–
Harmful	266 (72.5)	255 (72.2)	11 (78.6)	255 (72.2)	–	11 (78.6)	–
No effect	93 (25.3)	90 (25.5)	3 (21.4)	90 (25.5)	–	3 (21.4)	–
Ever tried to quit drinking after diagnosed with HIV							
Yes	181 (49.3)	174 (49.3)	7 (50.0)	174 (49.3)	–	7 (50.0)	–
No	186 (50.7)	179 (50.7)	7 (50.0)	179 (50.7)	–	7 (50.0)	–

**p<0.01; ***p<0.001.
†p Value obtained from χ^2 tests or Fisher's exact tests.

Table 5 Prevalence and associated factors of alcohol drinking quantity among study participants

Variables	None (N=879)	Moderate (N=889)	Hazardous (N=353)	Crude OR (95% CI)	Adjusted OR (95% CI)†
Gender					
Female	67 (83.8)	8 (10.0)	5 (6.3)	1.00	1.00
Male	812 (39.8)	881 (43.2)	348 (17.1)	7.43 (4.12 to 13.42)***	7.20 (3.83 to 13.54)***
Age (years)					
18–29	107 (42.6)	114 (45.4)	30 (12.0)	1.00	1.00
30–39	375 (46.2)	338 (41.7)	98 (12.1)	0.90 (0.69 to 1.18)	1.22 (0.91 to 1.64)
40–49	258 (39.5)	272 (41.7)	123 (18.8)	1.26 (0.96 to 1.66)	1.70 (1.23 to 2.35)**
50–79	139 (34.2)	165 (40.6)	102 (25.1)	1.69 (1.26 to 2.28)**	1.76 (1.22 to 2.53)**
Ethnicity					
Han	498 (56.3)	297 (33.6)	90 (10.2)	1.00	1.00
Jingpo	267 (29.4)	452 (49.7)	190 (20.9)	2.85 (2.38 to 3.42)***	2.58 (2.11 to 3.16)***
Dai	74 (29.7)	118 (47.4)	57 (22.9)	2.97 (2.27 to 3.88)***	3.08 (2.31 to 4.11)***
Others	40 (51.3)	22 (28.2)	16 (20.5)	1.45 (0.93 to 2.25)	1.56 (0.99 to 2.47)
Marital status					
Never married	184 (48.7)	147 (38.9)	47 (12.4)	1.00	1.00
Currently married	590 (39.5)	639 (42.7)	266 (17.8)	1.47 (1.19 to 1.82)**	0.93 (0.70 to 1.24)
Divorced or widowed	105 (42.3)	103 (41.5)	40 (16.1)	1.31 (0.96 to 1.77)	1.17 (0.85 to 1.63)
Education level					
Illiteracy or primary	345 (32.5)	487 (45.8)	231 (21.7)	1.00	1.00
Middle	398 (48.8)	318 (39.0)	100 (12.3)	0.50 (0.42 to 0.60)***	0.76 (0.63 to 0.93)**
High or above	136 (56.2)	84 (34.7)	22 (9.1)	0.37 (0.28 to 0.49)***	0.65 (0.48 to 0.89)**
Age at first drug use (years)					
<25	544 (45.4)	472 (39.4)	183 (15.3)	1.00	1.00
≥25	335 (36.3)	417 (45.2)	170 (18.4)	1.39 (1.18 to 1.64)***	0.89 (0.73 to 1.09)
Length of MMT (years)					
<1	115 (31.3)	203 (55.3)	49 (13.4)	1.00	1.00
1–5	417 (38.4)	484 (44.6)	184 (17.0)	0.89 (0.71 to 1.11)	0.92 (0.73 to 1.16)
>5	347 (51.9)	202 (30.2)	120 (17.9)	0.60 (0.47 to 0.76)***	0.77 (0.59 to 1.00)*
Daily methadone dose (mL)					
≤30	133 (39.7)	150 (44.8)	52 (15.5)	1.00	1.00
31–60	281 (36.7)	327 (42.7)	157 (20.5)	1.17 (0.93 to 1.46)	1.29 (1.02 to 1.63)*
61–99	228 (43.2)	217 (41.1)	83 (15.7)	0.87 (0.68 to 1.11)	1.04 (0.81 to 1.35)
≥100	213 (51.8)	146 (35.5)	52 (12.7)	0.63 (0.48 to 0.81)**	0.97 (0.73 to 1.29)
Number of sexual partners in the last year					
0	286 (47.6)	226 (37.6)	89 (14.8)	1.00	1.00
1	568 (39.4)	625 (43.4)	248 (17.2)	1.35 (1.13 to 1.61)**	1.34 (1.04 to 1.73)*
≥2	23 (30.7)	36 (48.0)	16 (21.3)	1.88 (1.20 to 2.94)**	2.46 (1.53 to 3.97)**
Smoking intensity in the past month					
Low	129 (57.1)	63 (27.9)	34 (15.0)	1.00	1.00
Moderate	203 (41.5)	227 (46.4)	59 (12.1)	1.56 (1.15 to 2.11)**	1.11 (0.80 to 1.55)
High	547 (38.9)	599 (42.6)	260 (18.5)	1.92 (1.46 to 2.52)***	1.39 (1.03 to 1.88)*
HIV infection					
No	632 (37.8)	727 (43.5)	311 (18.6)	1.00	1.00
Yes	247 (54.8)	162 (35.9)	42 (9.3)	0.49 (0.40 to 0.60)***	0.53 (0.42 to 0.68)***
HCV infection					
No	504 (37.8)	598 (44.8)	233 (17.5)	1.00	1.00
Yes	375 (47.7)	291 (37.0)	120 (15.3)	0.71 (0.60 to 0.84)***	0.86 (0.71 to 1.04)

*p<0.05; **p<0.01; ***p<0.001.
†Adjusted for potential confounding variables listed in the table by multivariate ordinal logistic regression analysis.

with marital status, age of first drug use, daily methadone dose or HCV infection.

DISCUSSION

In this cross-sectional study with 2121 MMT participants from western China, we observed the overall prevalence of ever, current and heavy/hazardous for smoking was 98.6%, 97.8% and 66.3%, respectively; and the prevalence for alcohol drinking was 86.6%, 58.6% and 16.6%, respectively. We also found significantly different patterns of tobacco and alcohol consumption when comparing men and women, or HIV-positive and negative participants. Moreover, we reported that gender, age,

ethnicity, level of education and sexual activity were associated with smoking and drinking behaviours, while length of MMT and HIV infection were negatively associated with heavier drinking. Smoking and drinking were also correlated with each other in the models.

MMT patients in the survey showed an overall prevalence of current smoking of 97.8%, which was more than three times that of 28.3% in Chinese general adults. When looking by gender, the prevalence of current smoking was about twice and 30 times than that of Chinese men and women in the general population, respectively (men: 98.8% vs 53.3%, women: 73.7% vs 2.5%).[42] Among MMT patients in western counties, the overall prevalence of smoking was observed from 78.5% to 93.0%;[17–20] while there have been only two previous studies reported current smoking prevalence (91.4% and 92.9%, respectively) among Chinese MMT patients.[23 24] Previous studies' sample sizes were <600, but consistent with our results, high prevalence of smoking was uniformly observed among MMT patients.

To the best of our knowledge, no previous study had reported the prevalence of heavy smoking among MMT patients in China. There was only one study measuring heavy smoking using the same method as ours; however, it only recruited 32 MMT participants from Los Angeles and reported 11 heavy smokers.[43] Of all participants in our analysis, the prevalence of overall heavy smoking was 66.3%, 68.1% men and 20.0% women, which were extremely high compared with the general Chinese population aged 15 years and above (overall: 10.1%, men: 22.8% and women: 0.6%),[44] and were higher than those of 2.6% and 7.2% of adults in California and the remaining USA in 2007, respectively.[39] As almost all MMT patients are smokers, smoking intensity may be a better exposure measure when examining the seriousness of smoking effects on health. Meanwhile, the published literature suggested that interventions among MMT patients have been largely unsuccessful in achieving sustained smoking abstinence.[45] Therefore, implementation of innovative smoking cessation programmes is urgent and smoking reduction may be the primary and more important intervention among heavy smokers.

The overall prevalence of current alcohol drinking in the study population was 58.6%, which was twice that of Chinese general adults (28.8%).[46] This prevalence was higher than that (30.3%) in central China,[32] and also higher than that (44.0% and 49.0%) among MMT patients of the Beth Israel Medical Center (BIMC) in the USA.[26 27] The prevalence (16.6%) of participating in hazardous alcohol drinking among all study participants was lower than those (22–35%) reported in BIMC with the same criterion of hazardous alcohol level.[25–27] We observed that the proportion declined by 28.0% from ever drinking to current drinking, especially for women (by 50.1%), suggesting that alcohol consumption was negatively affected during the course of MMT, although a systematic review found no change when patients had been on MMT (three studies supported an increase, three supported a decrease and nine supported no change in alcohol use).[29]

It was not surprising to find that heavier smoking and higher level alcohol drinking in the preceding month were positively associated with men, which was observed in the Chinese general population.[47 48] Meanwhile, results showed that those who were older and had little education were more likely to be heavier smokers and hazardous drinkers, which was not consistent with previous results.[31] Ethnic minorities were more likely than ethnic Han to engage in high level of alcohol consumption, which was consistent with the finding among HIV-infected patients who were also from Dehong Prefecture.[37] But ethnic minorities showed less heavier smoking, which might be due to different ethnic cultures.[49] This suggested that tobacco and alcohol cessation programmes in future should be mindfully conducted according to different demographic characteristics in target populations.

As mentioned above, patients in MMT were more likely to drink less, and hazardous drinking was further found to be negatively associated with the length of receiving MMT. In addition, of PLWHA in our study, a large proportion (72.5%) have realised the harmful effects of alcohol on AIDS, and half of them ever tried to quit drinking. Therefore, it was not surprising that hazardous drinking was observed to be negatively associated with HIV infection, whereas no difference of ever drinking was observed between HIV-infected individuals and HIV-uninfected individuals. Meanwhile, a relatively small percentage were aware of tobacco's harmful effects and less than a quarter ever tried to quit smoking, resulting in a null association between heavier smoking and HIV infection. It will be of great value to enhance MMT patients' awareness of harmful effects of tobacco and alcohol consumption by carrying out health education programmes.

Furthermore, risky behaviours of heavier smoking and more hazardous drinking were positively associated with each other, and both were positively associated with more sexual partners in this study. This might probably explain or be due to the fact that DUs worldwide are likely to engage in high levels of risky sexual behaviours[50 51] and often have coexisted with illegal substance use behaviours.[52] Consistent with our results, previous studies have shown that alcohol drinking was positively associated with a number of sexual risk behaviours including multiple sexual partners.[25 27 53]

Limitations

This study has certain limitations. First, similar to all cross-sectional studies, causal inferences cannot be made. Rather, we are reporting the subgroups of participants with even higher prevalence of use to target the population who are at higher risk for alcohol and tobacco-related health problems for focused intervention. Second, self-reported data were used for health-related risk behaviours and behaviours in the

past. There might be under-reporting of health-related risk behaviours such as number of sexual partners in the last year. And it could be more difficult to recall the memory after a long time on details such as age at first drug use, smoking/drinking initiation age, etc. So information bias may exist in our study. However, the primary variables asked about in the preceding month prior to interviews were asked by well-trained public health professional in a private setting that will minimise recall bias and deliberate concealment of sensitive personal topics. Third, the sample size of female MMT patients in the study was only 80 (3.8%), and substantial differences were not found significant when comparing by HIV status in women. A study with larger sample size of women is needed to better explore the association between characteristics and behaviours with alcohol and tobacco use in female DUs receiving MMT. Fourth, all participants were recruited from Dehong, the observed results of tobacco smoking and alcohol drinking in our study might not be generalisable to MMT patients in other areas, and may not be generalisable to those DUs who do not attend MMT clinic. Fifth, the validity and reliability of questions measuring tobacco and alcohol use should be specifically verified among MMT patients in future research, although these questions were previously used for HIV-infected people including HIV-infected DUs in the same study area.[37 38]

CONCLUSIONS

The present study suggested high prevalence of current tobacco smoking, current alcohol drinking, heavy smoking and hazardous drinking among MMT patients in China. It is vital to implement comprehensive education and effective intervention programmes to reduce the harmful use of tobacco and alcohol among MMT patients. Furthermore, the comparative risk assessment of disease burden attributable to tobacco and alcohol consumption, and the evidence for the effectiveness and cost-effectiveness of interventions to prevent and reduce tobacco and alcohol-related harm are needed in the further studies. In addition, confirmation of associated factors, changing trends in the prevalence and comorbid mental health conditions of tobacco and alcohol use among MMT patients warrant further longitudinal cohort studies.

Author affiliations
[1]Dehong Prefecture Center for Disease Control and Prevention, Mangshi, Yunnan Province, China
[2]Department of Epidemiology at School of Public Health and The Key Laboratory of Public Health Safety of Ministry of Education, Fudan University, Shanghai, China
[3]Collaborative Innovation Center of Social Risks Governance in Health, Fudan University, Shanghai, China

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