Malaysian Journal of Medicine and Health Sciences Vol. 3(2) June 2007 : 17-27

A Case Control Study on Risk Factors Associated with Drug Addiction amongst Malaysian Males

[1]Azhar Md Zain , [2]Sanjay Rampal & [1]Lekhraj Rampal

[1] Faculty of Medicine and Health Sciences, Universiti Putra Malaysia 43400 UPM Serdang, Malaysia

[2] Department of Social and Preventive Medicine, Faculty of Medicine University of Malaya, 50603 Kuala Lumpur

ABSTRACT

Objectives: Drug addiction poses a significant threat to the health, social and economic fabric of families, communities and nations. The aim of this study was to determine factors associated with drug addiction amongst Malaysian males. **Methods**: A population-based case control study was carried out in Johor state. Cases were defined as confirmed male drug dependents aged 15 and above. Controls were defined as those aged 15 and above who had never used illegal drugs in their lifetime. A total of 1016 cases were selected at random from a list obtained from the state anti-drug agency and 1106 controls were sampled from a population-based sampling frame. After obtaining verbal consent, they were interviewed by trained graduates. Multiple logistic regression analysis was performed using StataV8.2. The final model was adjusted for smoking, age, alcohol consumption, importance of religion, ethnicity, education level and self-esteem. **Results:** The final model had good fit (p>0.05) and good discrimination (AUC=0.94). Compared with those aged 15-19 years, the highest risk was amongst the 20–29 years age group (adjusted OR(aOR) 7.2; 95%CI=3.8,13.7) followed by the 30-39 year age group (aOR 5.4; 95%CI=2.9, 10.2) and 40-49 year age groups (aOR 5.0; 95%CI=2.6, 9.8). Being an ever-smoker was highly associated with drug addiction (aOR 98.7; 95%CI=28.7, 339.5). Compared with the Chinese, Malays (aOR 7.4; 95%CI=4.9, 11.2) and Indians (aOR 3.8; 95%CI=2.1,7.0) had a higher risk of drug addiction. Drug addiction was associated with disagreeing "that religion is important as guidance in their life" (aOR 16.2;95%CI=8.3, 31.9), and a history of alcohol consumption (aOR 7.6; 95%CI=5.6, 10.4). **Conclusion**: In conclusion the important risk factors associated with drug addiction is smoking, ethnicity, age, education level, alcohol consumption and not giving importance to religion as guidance in their life. However an increased self-esteem (aOR 0.6; 95%CI=0.4,0.5) is protective against drug addiction.

Keywords: Risk factors, drug addiction, Malaysia, smoking, ethnicity, religion

INTRODUCTION

Drug addiction refers to a situation where drug procurement and administration appear to govern the organism's behaviour, and where the drug seems to dominate the organism's motivational hierarchy.[1] A number of factors such as curiosity, peer pressure or psycho-dynamic processes motivate drug use. The World Health Organisation (WHO) defines the term dependence as the state of needing or depending on something or someone for support or to function or survive.[2] In relation to drugs, the term implies a need for repeated doses of the drug to feel good or to avoid feeling bad. Alternatively, dependence is defined as a cluster of cognitive, behavioural and physiologic symptoms that indicate a person has

impaired control of psycho-active substance use and continues use of the substance despite adverse consequences. Drug addiction among young people is part of a broader vulnerability and results from a complex interaction of risks and protective factors. There is no single pathway to the development of chronic and dependent drug use.[3] WHO reported that psycho-active substance use poses a significant threat to the health, social and economic fabric of families, communities and nations.[4] In 2002, there was an estimated 185 million drug users worldwide.

In Malaysia, the National Drug Authority (NDA) is the regulatory governmental body that is empowered to manage drug addiction. Of the 20,194 new cases confirmed and registered by the NDA in 2003, the majority of cases were dependent on ganja (31.2%), heroin (28.8%), morphine (23.1%) and metamphetamine (11.8%).[5] The 2003 prevalence of drug addiction in Malaysia was 897,624.[6] Malaysia's vision since 1998 is to create a drug-free nation by the year 2023; however, the number of drug users keeps increasing. Currently there is little evidence available locally on the understanding of the relationship between drug addiction and its determinants. It is important to bridge this knowledge vacuum to prevent drug addiction from ever occurring. The aim of this study was to determine risk factors associated with drug addiction amongst Malaysians.

MATERIAL AND METHODS

A population-based case control study design was used to ascertain risk factors associated with drug dependence. The study was conducted in the state of Johor, Malaysia. As most drug addicts in Malaysia are males, we restricted this study to include only males. Cases were defined as confirmed Malaysian drug dependents who were residing in Johor in 2004. Cases (1106 drug addicts) were randomly selected from a list obtained from the state anti-drug agency. These cases had been confirmed to be drug dependents by a positive urine test for drugs. The population-based controls were also selected from the state of Johor. For selection of the population-based controls in this study, sampling was carried out by the Statistics Department of Malaysia using a stratified two-stage cluster sampling design. The state of Johor was divided into artificially created, contiguous geographical areas called Enumeration Blocks (EBs). An EB consisted of 80-120 living quarters and had specified boundaries (either natural or artificial), which did not straddle administrative boundaries. The first stage units of sample selection were the EBs while the second stage units were living quarters (LQs) within the selected EB. The public health officer informed the head of the selected living quarters (households) of the study's objective, date and approximate time of interview. Visits to the living quarters were then made by the interviewer at the appointed date. All respondents aged fifteen years and above in the selected living quarters (households), upon receiving verbal consent, were interviewed. If during the interview, they were found to be drug addicts, they were excluded as controls.

Data Collection

Trained interviewers using a structured pre-tested questionnaire produced in three languages (English, Malay and Chinese) interviewed the study participants. The interviewers obtained verbal consent from the subjects before administrating the interview. Information given

was immediately transcribed onto the questionnaire. Age was computed from the information on date of birth and date of interview.

Statistical Analysis

The data was analysed using Stata version 8.2. Continuous variables were summarised using means and 95% confidence intervals (95% CI) and differences between two means were tested using either *t*-test (normal distribution) or Mann-Whitney *U*-tests (skewed distributions), respectively. Categorical variables were tabulated to show the distribution of risk factors amongst the cases and controls. Any difference between proportions was tested using chi square test, and Fisher's exact test was used when more than 20% of the cells had an expected value of less than 5. Odds-ratios (OR) with their 95% CI was used to measure the associations between drug dependence and risk factors. Initially, we looked at the crude associations from an univariate analysis of drug addiction and the following risk factors; age, ethnicity, educational level, smoking, importance of religion, sex before marriage, age first had sex, ever-consumed alcohol and self-esteem. We used likelihood ratio tests to check for the significance of the covariates and to compare different models. Age was entered as a categorical variable, whereas age first had sex and self-esteem scores were entered as a continuous variable. To increase the interpretability of these two variables, they are presented as *n* unit change from the mean score of the sampled study population. We considered two models for the multivariate logistic regression analysis. The differences between these two models was the variables 'sex before marriage' and 'age first had sex'. These two variables had many missing responses and thus were excluded from the final model so as to improve the model's efficiency. The fit of the final model was tested using the Hosmer Lemeshow goodness-of-fit test. The discrimination of the final model was determined using the logistic regression Receiver Operating Characteristic Curve. All statistical tests were two-sided and a *p*-value of less than 0.05 was considered statistically significant.

RESULTS

Characteristics of Respondents

Table 1 shows the characteristics of respondents by age, ethnicity, educational level, smoking status, importance of religion, history of having sex before marriage and consumption of alcohol. All cases and controls were males. The mean age of the controls was 40.4 (95% CI= 39.4, 41.4) years with a median of 39 years and ranged from 15 to 90 years. The mean age for the cases was 33.8 (95%CI = 33.3, 34.4) years with a median of 33 years and ranged from 16 to 61 years. The difference between the mean age of the cases and controls was statistically significant ($p<0.01$). Malays constituted 79.6% of the cases as compared to 66.6% in controls. However, there were more Chinese (26.0%) in the control group compared to 11.8% in the case group. The percentage of Indians was nearly the same.

Table 1. Socio-demographic characteristics of cases and controls

Characteristics	Controls (%)	Cases (%)	Chi-square test *p*-value
Age groups (years)			< 0.001
15 to 19	156 (14.1)	21 (2.1)	
20 to 29	188 (17.0)	359 (35.3)	
30 to 39	213 (19.3)	357 (35.1)	
40 to 49	208 (18.8)	233 (22.9)	
50 and above	341 (30.8)	46 (4.5)	
Ethnicity			< 0.001
Chinese	288 (26.0)	120 (11.8)	
Malay	736 (66.6)	809 (79.6)	
Indian	77 (7.0)	73 (7.2)	
Others	5 (0.4)	14 (1.4)	
Education level			< 0.001
Tertiary	109 (10.2)	31 (3.2)	
Secondary	647 (60.4)	733 (74.4)	
Primary	315 (29.4)	221 (22.4)	
Smoking status (Ever smoker)			< 0.001
No	426 (38.5)	4 (0.4)	
Yes	680 (61.5)	1012 (99.6)	
Importance of religion			< 0.001
Strongly Agree	515 (46.6)	124 (12.3)	
Agree	511 (46.2)	694 (68.6)	
Uncertain	39 (3.5)	62 (6.1)	
Disagree	41 (3.7)	116 (11.5)	
Strongly Disagree	0 (0.00)	15 (1.5)	
Had sex before marriage			< 0.001
No	628 (76.6)	151 (20.4)	
Yes	192 (23.4)	590 (79.6)	
Ever consumed alcohol			< 0.001
No	670 (60.6)	158 (15.6)	
Yes	436 (39.4)	858 (84.4)	

Crude Associations between Drug Addiction and Socio-demographic and Behavioral Risk Factors

Table 2 shows the crude association between drug addiction and age, ethnicity, educational level, smoking, importance of religion, sex before marriage, age first had sex, alcohol consumption and self-esteem. The results show that the highest risk was faced by those in age group 20 – 29 years and it decreased after the age of 30 years. There is no difference in

Table 2. Crude association between drug addiction and age, ethnicity, highest education attained, smoking status, importance of religion in life, had sex before marriage, age first had sex, ever consumed alcohol, and self-esteem

Determinants	Crude odds-ratio (95% CI)	*p*-value
Age groups (years)		
15 to 19	1.0	
20 to 29	14.2 (8.7, 23.1)	<0.001
30 to 39	12.5 (7.7, 20.2)	<0.001
40 to 49	8.3 (5.1, 13.6)	<0.001
50 and above	1.0 (0.6, 1.7)	0.994
Ethnicity		
Chinese	1.00	
Malay	2.6 (2.1, 3.3)	< 0.001
Indian	2.3 (1.5, 3.3)	< 0.001
Others	6.7 (2.4, 19.1)	< 0.001
Education level		
Tertiary	1.00	
Secondary	4.0 (2.6, 6.0)	<0.001
Primary	2.5 (1.6, 3.8)	<0.001
Smoking status (Ever smoker)		
No	1.00	
Yes	158.5 (58.9, 426.2)	< 0.001
Importance of religion		
Strongly Agree	1.00	
Agree	5.6 (4.5, 7.1)	<0.001
Uncertain	6.6 (4.2, 10.3)	<0.001
Disagree	11.8 (7.8, 17.6)	<0.001
Strongly Disagree	-	N/A
Had sex before marriage		
No	1.00	
Yes	12.8 (10.0, 16.3)	<0.001
Age first had sex		
An increase of 1 year from the mean of 22.8 years	0.8 (0.8, 0.9)	< 0.001
Ever consumed alcohol		
No	1.00	
Yes	8.3 (6.8, 10.3)	< 0.001
Self-esteem		
Score change of +1 from mean	0.8 (0.8, 0.8)	< 0.001
Score change of +4 from mean	0.4 (0.3, 0.4)	< 0.001

risk after the age of 50 years. Compared to the Chinese, Malays (OR=2.6, 95% CI= 2.1, 3.3) had the highest risk followed by the Indians (OR=2.3, 95% CI=1.5, 3.3). Those with secondary education had the highest risk (OR=4.0, 95% CI= 2.6, 6.0) compared with tertiary education. Those who had smoked in their lifetime had a 158 times higher risk than never smokers (OR=158.5, 95% CI= 58.9, 426.2). Sex before marriage was significantly associated with drug addiction (OR=12.8, 95% CI= 10.0, 16.3). Age first had sex was significantly associated with drug addiction; with every increase of 1 year from the mean of 22.8 years, there was a 20% decreased risk of drug addiction (OR=0.8, 95% CI= 0.8, 0.9). Alcohol consumption was also associated with drug addiction (OR=8.3, 95% CI= 6.8, 10.3). An increase in self-esteem was associated with a reduced risk of drug addiction. The results also show that those who disagreed that religion was very important as guidance in their life had a significantly higher risk of drug addiction compared to those who strongly agreed (OR=11.8, 95% CI= 7.8, 17.6).

Multivariate Logistic Regression Analysis Results

Multivariate logistic regression was then carried out and adjusted for age, ethnicity, education level, smoking status, importance of religion, alcohol consumption and self-esteem. This model had a good fit (p=0.75) and had good discrimination (area under the curve of 0.94) (*Fig.1)*. The final model (Table 3) showed that an ever smoker had approximately 99 times higher risk of being a drug addict than a non smoker (aOR= 98.7, 95% CI= 28.7, 339.5). Compared with the Chinese, Malays had 7.4 times higher risk (aOR= 7.4, 95% CI= 4.9, 11.2), and the Indians had 3.8 times higher risk (aOR= 3.8, 95% CI= 2.1, 7.0) of being drug addicts.

Those who disagreed with the statement "that religion is important as guidance in their life" were 16.2 times more likely to be drug addicts compared to those who had strongly agreed (aOR= 16.2, 95% CI= 8.3, 31.9). A person who had consumed alcohol has approximately 8 times higher risk of being a drug addict compared with those who had never consumed alcohol (aOR= 7.6, 95% CI= 5.6, 10.4).

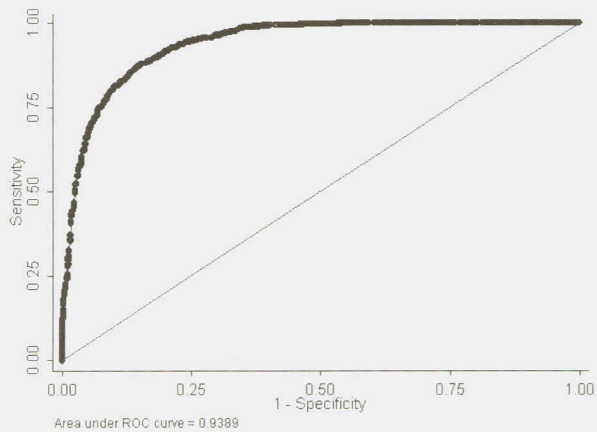

Figure 1. Receiver Operating Characteristics (ROC) curve

Table 3. Association between drug addiction and its risk factors adjusted for age, ethnicity, highest attained education, smoking status, importance of religion, ever consumed alcohol, and self-esteem

Determinants	Adjusted odds-ratio (95% CI)	*p*-value
Age groups (years)		
15 to 19	1.0	
20 to 29	7.2 (3.8, 13.7)	<0.001
30 to 39	5.4 (2.9, 10.2)	<0.001
40 to 49	5.0 (2.6, 9.8)	<0.001
50 and above	0.7 (0.4, 1.6)	0.445
Ethnicity		
Chinese	1.0	
Malay	7.4 (4.9, 11.2)	< 0.001
Indian	3.8 (2.1, 7.0)	< 0.001
Others	15.1 (3.3, 69.2)	< 0.001
Education level		
Tertiary	1.0	
Secondary	1.6 (0.9, 3.0)	0.127
Primary	2.7 (1.4, 5.3)	0.005
Smoking status (Ever smoker)		
No	1.0	
Yes	98.7 (28.7, 339.5)	< 0.001
Importance of religion		
Strongly agree	1.0	
Agree	5.6 (4.0, 7.7)	<0.001
Uncertain	6.4 (3.3, 12.2)	<0.001
Disagree	16.2 (8.3, 31.9)	<0.001
Strongly disagree	-	N/A
Ever consumed alcohol		
No	1.0	
Yes	7.6 (5.6, 10.4)	< 0.001
Self-esteem score		
Score change of +4 from mean	0.4 (0.4, 0.5)	< 0.001

Additional Information on Cases (Drug Addicts)

The case group was asked a few additional questions. Analysis on the cases (drug addicts) showed that the mean age at which the respondent first started injecting drugs was 21.5 (95% CI= 20.7 – 22.2) years with a median of 21 years. Of the 1016 drug addicts, 741 (72.9%) had had sexual intercourse while 590 (79.6%) had had sexual intercourse before marriage. The results show that 87% of those drug addicts who had sex before marriage did not use condom as compared to 81.8% who did not have sex before marriage. However, this difference was not statistically significant (p=0.4). Amongst those who did not use condoms, all (100%) felt that it was expensive and 98% stated that it was available. The majority (57.3%) stated that they did not think condoms were necessary whereas one percent stated that their partner did not like it. Further analysis showed that friends introduced 80% of the drug addicts to drugs. Siblings or parents introduced less than one percent. The common main reasons given for first taking drugs were: " I was curious about the feeling of taking drugs (43.6%); "my friends asked me to try" (23.4%); "to release tension" (15.6%); 5% stated "to try for fun"; and 3% stated that they were depressed. Less than one percent (0.3%) stated, "My parents take, so I started taking drugs too".

Approximately 24% stated that the last time they had injected drugs, they had used a needle or syringe that had previously been used by someone else. Among them, less than 4% had either used bleaching or boiling to clean their used needles/syringes. Eighty percent of the drug addicts knew someone who was infected by HIV/AIDS. A similar proportion (80%) had a HIV test done previously and 80% of these tests were performed routinely. Ninety-five percent knew their results and 17% were positive to HIV/AIDS. A majority (58.5%) of those tested positive were not aware of any services provided for HIV positive cases. Only 21% of these HIV positive cases were aware of care and support programmes provided by Non Government Organisations (NGOs) for people living with HIV/AIDS. Those aware were then asked to list down the NGOS they knew that provided such care and support programme for the people living with HIV/AIDS. Only 15% stated "Pengasih" and only 1% stated the AIDS Foundation.

DISCUSSION

Drug addiction poses a significant threat to the health, social and economic fabric of families, communities and nations. It should not be treated as a failure of will or strength of character, but more as a neurological or psychiatric disorder that may not be curable but can be treated effectively. Those with such problems should not be stigmatised as effective treatments exist, such as the prescription of substitute drugs and psychosocial therapy, which is aimed at changing patients' behaviour. We must try to integrate them into society and provide them with the social support they need. As the cases of drug addiction continue to rise in Malaysia, there is a greater need for community involvement. There is also a need for etiological research which focuses primarily on the likely causes and correlates of drug use, although no single variable or set of variables can explain drug use by an individual. There is a need to understand and discuss the natural history of drug addiction in Malaysia so as to provide some insight into the progress of a disease in an individual over time. It

could provide information from before the onset of disease (stage of susceptibility) until after its resolution (the stage of recovery, disability or death). The risk factors and protective factors in Malaysian adolescents need to be identified. A risk factor is a characteristic that, if present and active, clearly increases the probability of an individual with the factor developing a disease compared with an otherwise similar group of persons who do not.[7] Before a factor is labeled a risk factor, it has to satisfy the following conditions: the risk factor must be statistically associated with the disease; the risk factor must precede the onset of disease; and the observed association must not be spurious. We have to examine the host factors such as individual genotype (genetics), social behaviour, interpersonal contact, psychological state and ability to cope with stress. We also have to examine environmental factors such as social, political, and economic and the home environment of the individual.The interaction of these risk and protective factors contribute to determine the occurrence or otherwise of the disease. One of the limitations of this study is that some of these factors were not examined. Another limitation of the study is that the population-based controls such as urine was not tested for drugs. Some of them may have concealed their status. However, in the Malaysian context, it is not very feasible to ask the general population to undergo a urine test for drugs unless there is a legal requirement.

Boyle *et al*. reported that among adolescents in Ontario, prior tobacco and/or alcohol use was strongly associated with subsequent use of tobacco and /or alcohol and hard drugs.[8] Our study also shows that tobacco and/or alcohol use was significantly associated with drug addiction. Bachman *et al.* reported racial differences in illicit drug use.[9] Their study reported relatively low levels of drug use by most non whites, especially Black Americans and Asian Americans. Our study, however, shows that it is more common among Malays, which is not the minority ethnic group. There is a need to study in detail why Malays are at higher risk compared to the Chinese and Indians. Self-esteem was also significantly associated with drug addiction. This study showed that those who had disagreed "that religion is important as guidance in their life" were significantly more likely to become drug addicts compared to those who had strongly agreed. This study showed that the majority of the drug addicts (case group) were involved in high-risk activities such as sex before marriage and sexual intercourse (after marriage) without the use of condom. Our findings are consistent with Jessor[10] who noted that drug use and other high-risk activities, including delinquent behaviour and precocious sexual intercourse, can serve important social and personal functions for the individual, and they are unlikely to be abandoned in the absence of alternatives that can provide similar satisfaction. Risk behaviours are functional, purposeful, instrumental, and goal-directed and these goals are often central to normal adolescent development. High-risk behaviour change requires promotion of conventional alternative behaviours that can achieve the same goals more safely. Early onset of use, poor academic achievement and learning problems, low religiosity and poor self-esteem have also been correlated with substance abuse.[11,12] Needle[13] reported that there were over ten million injecting drug users and up to three million IDU living with HIV/AIDS. Discussions of HIV control in developing countries usually pay insufficient attention to injecting drug use. Yet half the population of the world now lives in developing countries in a region where HIV infection is dominated by the sharing of injecting equipment.[14] Lau *et al*.[15] reported that needle sharing among IDUs was highly prevalent

(60.6% and 45.3% for male and female respectively) in China and the sharers were often friends, spouses, and acquaintances. Few IDUs sterilised the used needles properly. In our study, 24% stated that they did use a needle or syringe that had previously been used by someone else and less than 4% had either bleached or boiled the syringe. Needle exchange programmes (NEP) have been shown to be effective at reducing HIV risk behaviour and HIV transmission among injection drug users and should be implemented in Malaysia as one of the harm reduction strategies. [16,17]

An integrated community programme involving all the relevant government and non government agencies and the community leaders should be planned and implemented. At state level, it should be headed by the Chief Minister (Menteri Besar) and at the District level by the District Officer himself. Involvement of the religious department, mosques, churches and temples is an important strategy of involving the community, getting families together and helping youth choose not to use drugs. There is definitely a need for a smart partnerships between the researchers, government agencies involved and the community including NGOs to find solutions to the problem. The National Drug Authority should form a smart partnership with Ministry of Education and Ministry of Higher Education, Ministry of Health, Religious Departments, Ministry of Youth, Ministry of Sports, Malaysian Medical Association and other NGOs. Unless, we show leadership and take strong action now, future generations will condemn us for failure to control one of the worst scourges facing our people today.

ACKNOWLEDGEMENTS

We are grateful to the Y.A.B. Dato' Haji Abdul Ghani Othman, Chief Minister Johor State for encouragement and support given throughout the study. We are also grateful to the Y. Bhg. Dato' Haji Hamzah bin Abdullah, Director General, National Drug Agency for permission to carry out the study. Our thanks are also due to Mr. Sukumaran, Mr. Ashok and the staff of National Drug Agency Johor State, for assistance during the data collection. This study was funded by MOSTE IRPA Project Grant No. 06-02-04-0000-PR-0041/05-03.

REFERENCES

[1] Bozarth MA. Drug addiction as a psychobiological process. In: Warburton DM (ed.). Addiction controversies. London: Harwood Academic Publishers, 1990: 112-134.

[2] WHO. WHO Expert Committee on Addiction-Producing Drugs. WHO Tehnical Report Series 1964: 273.

[3] Spooner C. Evidence supporting treatment. ANCD research paper 3. ANCD 2001.

[4] WHO. The Global Burden. World Health Report 2002.

[5] National Drug Authority Ministry of Home Affairs, Malaysia. *Statistik Penagih Dadah Di Malaysia 2003*.

[6] Ministry of Health Malaysia. Estimation of Drug Users in Malaysia. 2005: 23-31.

[7] Jekel JF, Katz DL, Elmore JG. Epidemiology and biostatistics and preventive medicine. W.B. Saunders Co Publ. 2001.

[8] Boyle MH, Offord DR, Racine YA, Szatmari P, Fleming JE, Links PS. Predicting substance use in late adolescence: results from the Ontario child health study follow-up. Am J Psychiatry 1992; 149(6): 761-767.

[9] Bachman JG, Wallace JM, O'Malley PM, Johnston LD, Kurth CL, Neighbors HW. Racial/ ethnic differences in smoking, drinking and illicit drug use among American high school seniors1976-1989. Am J Public Health 1991; 81(3): 372-377.

[10] Jessor R. Risk behavior in adolescence: a psychosocial framework for understanding and action. J Adolesc Health 1991;12: 597- 605.

[11] Kandel DB. Epidemiological and psychological perspectives on adolescent drug use. J Am Acad Child Psychiatry 1982; 21: 328-347.

[12] Newcomb MD, Maddahian E, Bentler PM. Risk factors for drug use among adolescents: concurrent and longitudinal analyses. Am J Public Health 1986; 76: 525-531.

[13] Needle R. Trends in the epidemiology, ethnography and prevention of HIV/AIDS in injecting drug users. Global research network meeting on HIV prevention in drug using populations; Third annual meeting report 2000.

[14] Editorial. HIV in injecting drug users in Asian countries. BMJ 2004; 329: 697-698.

[15] Lau JT, Feng T, Lin X, Wang Q, Tsui HY. Needle sharing and sex-related risk behaviours among drug users in Shenzhen, a city in Guangdong, southern China. AIDS Care. 2005; 17(2): 166-81.

[16] Bluthenthal RN, Kral AH, Gee L, Erringer EA, Edlin BR. The effect of syringe exchange use on high-risk injection drug users: a cohort study. AIDS 2000, 14: 605-611.

[17] Des Jarlais DC, Marmor M, Paone D *et al*. HIV incidence among injecting drug users in New York City syringe-exchange programmes. Lancet 1996; 348: 987-991.