

**A 3-phase survey, training, and inter-disciplinary combined  
on-line/offline, theory-based and evidence-based  
intervention for prevention of psychoactive substance use  
among adolescents who are case-work clients of social  
workers (The My Sunny Way Project)**

*Submitted to:*

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## **Introduction**

### *Adolescent drug use*

The significant physical and psychological harms caused by psychoactive substance abuse have been well documented by researchers (Kraner et al., 2001; Shafi et al., 2020). In particular, drug use among adolescents was positively associated with depression and anxiety (Patton et al., 2002; Richert et al., 2020), psychosis (Barkus & Murray, 2010; Bechtold et al., 2016; Marconi et al., 2016), altered bladder function (Mak et al., 2011), impaired neuro-cognitive functioning (Hamidullah et al., 2020; Hanson et al., 2011), and obesity (Huang et al. in young adulthood (Huang et al., 2013). Among substance users, adolescent onset was positively associated with drug dependence (Chen et al., 2005; Chen et al., 2009; Jordan & Andersen, 2017). In China, the lifetime prevalence of club drug use among secondary vocational students was 2.7% (Yu et al., 2021) and 1.70% among people aged 10-24 years (Wang et al., 2017). In Hong Kong, the prevalence of ever use of drugs (mainly psychoactive substances) among secondary school student was 2.5% in 2020/21 (Narcotics Division, 2022).

### *A vulnerable group*

Some special groups of adolescents have higher prevalence of substance use than their counterparts. They are often characterized by aggravated emotional, behavioral, and family problems starting at early childhood. Social workers' case-work clients form a potential vulnerable group. One study conducted among 164 Dutch adolescents under secure residential care found prevalence of substance abuse of 54.9% (Harder et al., 2015). Another Swiss study reported prevalence of life-time substance use disorder of 38% among those served by the juvenile justice system (Seker et al., 2021). A study conducted among non-engaged youths in Hong Kong found that the prevalence of adolescent psychoactive substance use was significantly higher among clients of social workers (37.5%) than those recruited through a population-based telephone survey (13.7%) (Lau, 2013). To design effective interventions, it is important to understand such adolescents' perceptions, problems, and needs.

### *Behavioural theories*

Substance use interventions based on behavioral health theories are more effective than non-theory-based ones (Glanz & Bishop, 2010; Jhanjee, 2014; Lin et al., 2021). The Theory of Planned Behavior (TPB) is a behavioral theory developed by Icek Ajzen in 1985 (Ajzen, 1985). It was modified from the Theory of Reasoned Action (Fishbein & Ajzen, 1975). It proposes that attitudes (positive and negative ones), subjective norm (i.e. how significant others think about their behavior), and perceived behavioral control (i.e. the degree of control over the behavior) determine behavioral intention (i.e. whether thinking about performing the behavior), which in turn determines the actual behavioral practice (Ajzen, 1991) (see Appendix 1). It has been extensively used as a framework to understand substance use research and interventions (Armitage et al., 1999; Arnaud et al., 2012; Bashirian et al., 2012;

Cutrín et al., 2020; Lawental et al., 2018; Lin et al., 2021; McMillan & Conner, 2003). Interventions based on the TPB were highly effective in changing the attitudes, subjective norm, perceived behavioral control, and intention to use drugs (Arnaud et al., 2012; Steinmetz et al., 2016).

Some components of the Social Cognitive Theory (SCT) were also used to design the survey and the intervention of this study. The SCT is a popular behavioral health theory developed in 1986 which evolved from the Social Learning Theory (Bandura, 1986). It postulates that the significance of the environment on shaping health-related behaviors. Thus, individuals acquire and keep performing a behavior in the context of the social environment and previous experiences. Individuals are then expected to regulate their behavior via control and reinforcement. It has six constructs: (1) Reciprocal determination refers to the interactions environmental characteristics, personal characteristics and the behavior. (2) Observational learning refers to modeling of behaviors after observing a behavior performed by others, even without trial and error. (3) Outcome expectation means the anticipated consequences (positive and negative) caused by performance of the behavior. (4) Self-efficacy refers to the level of confidence to perform or not to perform the behavior. The construct was also present in other theories such as the Health Belief Model (Rosenstock et al., 1988). (5) Behavioral capacity refers to the ability to perform the behavior (e.g. knowledge and skills). (6) Reinforcement refers to positive and negative responses to the behavior which can be self-initiated or provided by the environment. In the theory, the constructs were directly related to the behavior, without formation of inter-relationships. The literature has shown that most of the studies using SCT to guide interventions used part but not all of the studies (Huang et al., 2022; Sheeran et al., 2016). In the intervention of the present study, we used some role models that were ex-substance users leading positive living to present narrative video-taped stories that may be appealing to adolescents. We also included the component of outcome expectations (both positive and negative outcomes) as components of the survey and the intervention.

#### *Application of evidence-based intervention methods and approaches*

Apart from application of theories, the intervention of the present study used motivational interviewing (MI), which is an evidence-based approach known to be effective in reducing substance use (Brown et al., 2015; Calomarde-Gómez et al., 2021; D'Amico et al., 2008; Smedslund et al., 2011) and other risk behaviors (e.g. smoking and drinking) (Bernstein et al., 2010; Frost et al., 2018; Lai et al., 2010). It is a client-centered and directive method enhancing readiness for change by helping clients to explore and resolve ambivalence (Hettinga et al., 2005). It helps clients to move along their stages of change and sustain long-term changes. Adaptations of MI have shown to be efficacious in changing behaviors both as a stand-alone treatment and as preludes to other treatments (Hettinga et al., 2005; Rubak et al., 2005). Reviews have shown that brief MI of 15 minutes can effectively change behaviors (Bernstein et al., 2010; D'Amico et al., 2008; Erickson et al., 2005) (see Appendix 2 for details and training about MI). Our team has been experienced in conducting MI interventions. In the present study, the collaborating social workers were trained to implement MI.

As effective substance prevention programs should target both risk and protective factors (Nawi et al., 2021; Sloboda et al., 2012), the present intervention also tried to enhance positive coping strategies. It is warranted to promote awareness that it is normal to have emotions and positive emotional regulation strategies, as negative emotions were strongly associated with substance use among adolescents. In the intervention of the present study, these components were delivered via online narrative and video-based approaches plus offline debriefing and discussion components, which are effective means to modify health-related behaviors (Feng et al., 2021; Hinyard & Kreuter, 2007; Kreuter et al., 2010; Tuong et al., 2014).

This project collaborated with social workers, who have built up rapport with their case-work clients, making it feasible to access hard-to-reach high risk adolescents. Social workers were involved throughout the planning stage and participated in a training workshop, which briefed them about the background of the study, and provided them with training about MI, behavioural theories, and substance use topics. Also, the study took an interdisciplinary and combined online/offline approach.

### **The three phases of the present study**

This project included three parts. *Phase I* (Understanding) included a survey to gain understanding of the situations among adolescent case-work clients of social workers of two major NGOs in Hong Kong, namely, the Hong Kong Playground Association and the Hong Kong Children and Youth Services). *Phase II* (Preparation) included the design of a combined online/offline, interdisciplinary, theory-based, and evidence-based intervention based on the survey results and other information. In *Phase 3* (RCT and evaluation), the most stringent randomized controlled trial (RCT) study design was employed to evaluate the intervention's efficacy in reducing intention of substance use (12 month) or level of psychoactive substance use in the past six month; the control group received a drug prevention pamphlet.

### **Part I: The Phase I Survey**

#### ***Objective***

The aim of the Part I anonymous survey was to investigate risk and protective factors associated with i) psychoactive substance use behaviors [current use (last 30 days), use in the last six months, and ever use of psychoactive substances], and ii) intention of psychoactive substance use (future lifetime and next 12 months) among local adolescents who were case-work clients. Selection of such factors was based on the SCT (e.g. positive/negative outcome expectations and self-efficacy) and the TPB (i.e. attitudes, subjective norm, perceived behavioral control).

#### ***Methods***

Design: An anonymous survey was conducted during March 2019 to May 2019.

Inclusion criteria: 1) Case-work clients of social workers of the collaborating NGOs and 2) adolescents aged 13-18 years.

### Recruitment of participants

The participating social workers were recommended to randomly select eligible case-work clients by using a Kish randomization table and invited the selected clients to join the study. The number of invitation was proportionate to the total number of cases managed by the social worker. An information sheet was provided to the social workers to facilitate their briefing and explanations given to participants. The social workers obtained verbal informed consent from the participants to maintain anonymity after briefing them; the social workers also signed a form pledging that they had explained the background of the study clearly to the participants and obtained their verbal consent. Consent from parents of the adolescents was not feasible due to potential parental worry and conflicts regarding adolescents' possibility of substance use; similar verbal consent procedures have been used in anonymous surveys and RCTs of high-risk behaviors targeting adolescents (Li et al., 2018; Yu et al., 2022). Participants were reminded that they could quit the survey at any time point without being asked about the reasons, and refusals would not affect their right to use any services. The social workers signed a form pledging that he/she had explained the study's background to the participants in detail and obtained verbal informed consent from the participants. The social workers then passed a link to the participants to access an online structured questionnaire. With the help of the research workers when needed, all the consented participants then filled out an online structured questionnaire, which took about 20 minutes to complete. A coupon of value about HKD30 was given to the participants completing the study. Ethics approval was obtained from the Chinese University of Hong Kong (reference number: SBRE-18-435).

### Measures:

#### ***Background socio-demographic variables***

Such variables included sex, age, any deceased parent(s), and father's and mother's education level.

#### ***Variables related to use of psychoactive substance***

Participants were asked if they had used any one of the psychoactive substances listed in Appendix 1 in a) lifetime, b) the last 30 days, and c) the last six months. Participants were also asked about their intention to use psychoactive substances in the next 12 months and in future lifetime (4-point scale from absolutely not to absolutely yes). In addition, current users (who had ever used drugs in the past 30 days) were asked whether they would stop using psychoactive substance in the next 12 months.

#### ***TPB related factors***

1) A 4-item and a 2-item scale were used to assess positive and negative attitudes toward psychoactive substance use, respectively [sample items: "taking psychoactive substances is a

hobby like smoking” and “taking psychoactive drugs is harmful to health” (1 = extremely disagree to 4 = extremely agree); Cronbach’s alpha: 0.96 and 0.88].

2) A 4-item scale was constructed to assess subjective norm (i.e., support toward drug use given by significant others]. A sample item was “my significant others would not accept my using psychoactive drugs” (1 = extremely disagree to 4 = extremely agree). The Cronbach’s alpha was 0.77].

3) A 3-item behavioural control scale was constructed. A sample item is “I can control psychoactive substances taking habits to make substance use not addictive” (1 = extremely disagree to 4 = extremely agree; Cronbach’s alpha=0.92).

### ***SCT-related factors***

1) Environmental factors: i) A question asked about the number of good friends using psychoactive substance in the last year (0, 1-5, 6-10, >10). ii) A question asked whether knowing someone who are intensive psychoactive substance users (yes/no). iii) Easiness to obtain psychoactive substances was assessed by a question (very easy/easy versus don’t know/very difficult/difficult). iv) Two questions were asked if any peers (classmates and friends) have offered psychoactive substances to the participants (yes/no).

2) The Positive Outcome Expectancy scale (POE) and the Negative Outcome Expectancy (NOE) scale of psychoactive substance use: Item generation was based on literature search. A 7-item scale POE and a 11-item NOE scale were created (4-point responses from extremely agree to extremely disagree). The Cronbach’s alpha values were 0.96 and 0.97, respectively.

3) Self-efficacy for refusal: The 14-item Psychoactive Substance Use Refusal Self-efficacy Scale was modified from the Cannabis Refusal Self-efficacy Questionnaire (Young et al., 2012), with the word cannabis replaced by psychoactive substance. The items covered a number of situations in which people may find themselves vulnerable to psychoactive substance use, such as “when I want to feel more confident” and “when I feel restless” (1 = I am not very sure I could NOT resist substance use to 6 = I am very sure I could resist substance use). Its Cronbach’s alpha was 0.99.

### ***Personal psychosocial factors***

1) Self-esteem: The Chinese version of the 10-item Rosenberg self-esteem scale was used. Sample items included “on the whole, I am satisfied with myself” and “at times I think I am no good at all” (1= strongly agree to 5 = strongly disagree). Cronbach’s alpha was 0.77.

2) Gratitude: The Chinese version of the Gratitude Questionnaire-Six Item Form was used. A sample item is “I have so much in life to be thankful for” (1 = strongly disagree to 7 = strongly agree). Cronbach’s alpha was 0.60.

3) Dissatisfactory parental relationship: Two items were constructed: “Some adolescents’ parents don’t really understand them” and “Some adolescents’ parents are not willing to listen to their problems” (1 = extremely not similar to my situation to 4 = extremely similar to my situation). Cronbach’s alpha was 0.80.

### Data analysis

The key dependent variables were the use of psychoactive substance (current use in the last 30 days, use in the last six months, and ever use) and intention (perceived likelihood) to use psychoactive substances in future lifetime and in the next 12 months. Descriptive statistics were presented in this report. Univariate and multivariate logistic regression analysis were conducted. Further analyses adjusted for socio-demographic factors. Crude odds ratios (ORc) and adjusted odds ratios (ORa) and their 95% confidence intervals (CI) were reported. Statistical significance was taken as  $p < .05$ . SPSS was used for data analysis.

### Sample size planning

A sample of 301 participants was recruited. The sample size limits the widths of the confidence intervals within  $\pm 5\%$ . Based on our previous study and discussion with social workers, we estimated the prevalence of ever use of psychoactive substances or having an intention to do so in the next 12 months to be 20-50% in the reference group (no intention and no psychoactive substance use in the last six months). The sample size yields the smallest odds ratio (OR) of about 2, with alpha of .05, and power of .8 (2-sided hypothesis).

### Test-retest reliability

A pilot of 20 participants was conducted with test-retest reliability of the key measure established. Two scales showed low intra-class correlation (positive attitude and perceived behavioural control ( $< .30$ ) while the others were acceptable. The sample size of 20 was, however, very small and it should only be used as a reference.

## **Results**

### Descriptive statistics

Of all the participants, the mean age was 17.3 (SD = 2.4; range = 13-21) years; 62.8% were males; 6.6% had at least one deceased parent; 11.3% and 10.0% of the participants' father and mother had attained an educational level of college or above, respectively. (Table 1)

The prevalence of psychoactive substance use in the past 30 days, the past six months, and lifetime was 7.6%, 12.0%, and 20.9%, respectively. The prevalence of intention of psychoactive substance use in the next 12 months and lifetime was 8.6% and 9.6%, respectively. Among those who had ever used psychoactive substances ( $n = 60$ ), 88.3% intended that they would quit in the next 12 months. Of the participants, 33.9% found it easy/very easy to obtain psychoactive substances; 47% knew some psychoactive substance users; 21.6% offered drugs by their peers; 32.9% and 10.0% had had 1-5 and  $>5$  good friends using substances. The mean (SD; range) scores of TPB variables, SCT variables, and personal psychosocial factors are presented in Table 2.

Table 1 Descriptive statistics of the categorical variables ( $n = 301$ )

	n	%
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**Socio-demographics**

Sex		
Female	112	37.2
Male	189	62.8
Any deceased parent(s)		
No	281	93.4
Yes	20	6.6
Father's educational level		
Primary school or below	55	18.3
Junior/senior secondary school	128	42.5
College or above	34	11.3
Missing data	84	27.9
Mother's educational level		
Primary school or below	53	17.6
Junior/senior secondary school	141	46.8
College or above	30	10.0
Missing data	77	25.6

**Dependent variables**

Psychoactive substance use in the past 30 days		
No	278	92.4
Yes	23	7.6
Psychoactive substance use in the past six months		
No	265	88.0
Yes	36	12.0
Ever used psychoactive substances (lifetime)		
No	238	79.1
Yes	63	20.9
Intention of psychoactive substance use in the next 12 months		
No	275	91.4
Yes	26	8.6
Intention of psychoactive substance use in the future lifetime		
No	272	90.4
Yes	29	9.6
Intention to stop psychoactive substance use among current users (n = 60)		
No	7	11.7
Yes	53	88.3

**Categorical independent variables**

Easiness to obtain psychoactive substances		
Don't know/very difficult/difficult	199	66.1
Very easy/easy	102	33.9
Knew someone who are intensive psychoactive substance users		
No	159	53.0
Yes	141	47.0
Ever offered psychoactive substances by peers		
No	236	78.4
Yes	65	21.6
Number of good friends who are psychoactive substance users		
Nil	172	57.1
1-5	99	32.9



>5

30

10.0

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Table 2 Descriptive statistics of the continuous variables

	Range	Mean	SD
<b>Socio-demographics</b>			
Age	13-21	17.3	2.4
<b>TPB variables</b>			
Attitude toward psychoactive substance use			
Positive attitude	4-16	7.3	3.0
Negative attitude	2-8	6.2	2.0
Subjective norm	4-16	7.2	3.1
Perceived behavioral control	4-16	8.4	4.0
<b>SCT variables</b>			
Outcome expectancies of psychoactive substance use			
Positive outcome expectancies	7-28	13.5	6.0
Negative outcome expectancies	11-44	35.7	8.8
Refusal self-efficacy	14-84	62.2	23.3
<b>Personal psychosocial factors</b>			
Self-esteem	11-40	27.3	4.8
Gratitude	6-24	16.6	2.7
Dissatisfactory parental relationship	2-8	5.0	1.7

*Background factors of psychoactive substance use behaviors and intention*

In Table 3, older age (ORc = 1.23 and 1.43, respectively) and having a deceased father or mother (ORc = 4.68 and 2.74, respectively) were positively associated with psychoactive substance use in the past six months and in lifetime. Sex and father's and mother's education level were not significantly associated with these two dependent variables of psychoactive substance use. Regarding psychoactive substance use in the past 30 days, no significant background factors were found.

Table 3 Background factors of psychoactive substance use behaviors

	DV1 = Psychoactive substance use in the past 30 days	DV2 = Psychoactive substance use in the past six months	DV3 = Ever used psychoactive substances (lifetime)
	ORc (95% CI)	ORc (95% CI)	ORc (95% CI)
Age	1.19 (0.99, 1.44) <sup>†</sup>	1.23 (1.05, 1.44)*	1.43(1.24,1.64)***
Sex			
Female	Ref = 1.0	Ref = 1.0	Ref = 1.0
Male	1.39 (0.55, 3.48)	1.21 (0.58, 2.53)	1.36 (0.75, 2.45)
Any deceased parent(s)			
No	Ref = 1.0	Ref = 1.0	Ref = 1.0
Yes	2.30 (0.62, 8.53)	4.68(1.73,12.67)**	2.74 (1.07, 7.03)*
Father's educational level			
Primary school or below	Ref = 1.0	Ref = 1.0	Ref = 1.0
Junior/senior secondary school	1.16 (0.30, 4.53)	0.55 (0.21, 1.46)	0.58 (0.28, 1.23)
College or above	2.99 (0.67, 13.42)	1.52 (0.50, 4.67)	1.11 (0.43, 2.86)
Missing data	1.58 (0.39, 6.37)	0.79 (0.29, 2.16)	0.58 (0.26, 1.31)
Mother's educational level			
Primary school or below	Ref = 1.0	Ref = 1.0	Ref = 1.0
Junior/senior secondary school	1.95 (0.41, 9.19)	1.14 (0.39, 3.32)	0.63 (0.29, 1.36)
College or above	2.83 (0.45, 18.00)	1.92 (0.51, 7.26)	1.32 (0.49, 3.59)
Missing data	2.96 (0.60, 14.52)	1.60 (0.52, 4.91)	0.87 (0.38, 1.99)

Note. †, 0.05 < p < 0.10; \*, p < 0.05; \*\*, p < 0.01; \*\*\*, p < 0.001.

In Table 4, older age (ORc = 1.33 and 1.36, respectively), male sex (ORc = 2.68 and 3.11, respectively), having deceased parent(s) (ORc = 2.94 and 3.57, respectively), and mother's college or above education (ORc = 5.10 and 4.17, respectively) were significantly or marginally (.05 < p < .1) associated with intention of psychoactive substance use in the next 12 months and lifetime. Father's education was not a significant factor of the two intention variables (p > .05). In addition, lifetime use of psychoactive substances was significantly and strongly associated with the two intention outcomes (ORc = 45.04 and 38.49, respectively). Among ever-users and never users, the prevalence of future lifetime use was 39.7% and 1.7%, respectively.

Table 4 Background factors of psychoactive substance use intention

	DV4 = Intention of psychoactive substance use in the next 12 months	DV5 = Intention of psychoactive substance use in future lifetime
	ORc (95% CI)	ORc (95% CI)
<b>Socio-demographics</b>		
Age	1.33(1.10, 1.61)**	1.36(1.13, 1.64)**
Sex		
Female	Ref = 1.0	Ref = 1.0
Male	2.68 (0.98, 7.31)†	3.11 (1.15, 8.41)*
Any deceased parent(s)		
No	Ref = 1.0	Ref = 1.0
Yes	2.94 (0.91, 9.57)†	3.57 (1.19, 10.67)*
Father's educational level		
Primary school or below	Ref = 1.0	Ref = 1.0
Junior/senior secondary school	0.67 (0.21, 2.14)	0.46 (0.16, 1.33)
College or above	1.72 (0.46, 6.46)	1.47 (0.45, 4.81)
Missing data	1.05 (0.33, 3.40)	0.72 (0.25, 2.12)
Mother's educational level		
Primary school or below	Ref = 1.0	Ref = 1.0
Junior/senior secondary school	2.37 (0.51, 10.97)	1.69 (0.46, 6.19)
College or above	5.10 (0.92, 28.15)†	4.17 (0.96, 18.10)†
Missing data	2.55 (0.51, 12.79)	1.67 (0.41, 6.76)
Ever used psychoactive substances		
No	Ref = 1.0	Ref = 1.0
Yes	45.04 (12.92, 157.05)***	38.49 (12.69, 116.75)***

Note. †,  $0.05 < p < 0.10$ ; \*,  $p < 0.05$ ; \*\*,  $p < 0.01$ ; \*\*\*,  $p < 0.001$ .

#### *Factors of psychoactive substance use behaviors*

The results are presented in Table 5. Regarding the TPB variables, positive attitude ( $OR_a = 1.19, 1.28, \text{ and } 1.34$ , respectively), subjective norm ( $OR_a = 1.17, 1.16, \text{ and } 1.12$ , respectively), and perceived behavioral control ( $OR_a = 1.21, 1.19, \text{ and } 1.20$ , respectively) were significantly associated with psychoactive substance use in the past 30 days, in the past 6 months, and in the lifetime, after adjusted for background factors. Negative attitude toward psychoactive substance use was significantly associated with psychoactive substance use in the past 30 days, but not with the two other dependent variables of psychoactive substance use behaviour (in the last six months and in lifetime).

Regarding the SCT variables (Table 5), a) the positive outcome expectancies ( $OR_a = 1.16, 1.21, \text{ and } 1.21$ , respectively) and negative outcome expectancies ( $OR_a = 0.93, 0.93, \text{ and } 0.94$ , respectively), b) the environmental factors of knowing someone who were intensive psychoactive substance users ( $OR_a = 26.16, 44.51, \text{ and } 9.70$ , respectively), having 1-5 good friends using psychoactive substances ( $OR_a = 23.61, 40.33, \text{ and } 8.17$ , respectively), having >5 good friends using psychoactive substances ( $OR_a = 59.25, 328.29, \text{ and } 124.35$ , respectively), easiness to obtain psychoactive substances ( $OR_a = 12.12, 14.45, \text{ and } 11.34$ , respectively), and having been offered psychoactive substances by peers ( $OR_a = 53.04, 42.65, \text{ and } 47.00$ , respectively), and c) refusal self-efficacy (all  $OR_a = 0.98$ ) were all significantly associated with all the three behavioral outcomes.

Regarding the personal psychoactive factors, self-esteem, gratitude, and unsatisfactory family relationship, their associations with the three behavioral substance use variables were all statistically non-significant.

Table 5 Factors of psychoactive substance use behaviors

	DV1 = Psychoactive substance use in the past 30 days ORa (95% CI)	DV2 = Psychoactive substance use in the past six months ORa (95% CI)	DV3 = Ever used psychoactive substances (lifetime) ORa (95% CI)
<b>TPB variables</b>			
Attitude toward psychoactive substance use			
Positive attitude	1.19 (1.04, 1.37)*	1.28(1.13,1.45)***	1.34(1.21,1.50)***
Negative attitude	0.80 (0.65, 0.99)*	0.87 (0.73, 1.05)	0.91 (0.78, 1.07)
Subjective norm	1.17 (1.01, 1.34)*	1.16 (1.03, 1.31)*	1.12 (1.01, 1.23)*
Perceived behavioral control	1.21(1.08, 1.36)**	1.19(1.09,1.31)***	1.20(1.11,1.29)***
<b>SCT variables</b>			
Outcome expectancies of psychoactive substance use			
Positive outcome expectancies	1.16 (1.06,1.25)**	1.21(1.12,1.31)***	1.21(1.14,1.29)***
Negative outcome expectancies	0.93(0.89, 0.98)**	0.93 (0.90,0.97)**	0.94(0.90,0.97)***
Environmental factors			
Number of good friends using psychoactive substances			
Nil	Ref = 1	Ref = 1	Ref = 1
1-5	23.61 (2.93, 189.95)**	40.33 (5.03, 323.31)***	8.17 (3.38, 19.72)***
>5	59.25 (9.77, 815.20)***	328.29 (34.82, 3095.31)***	124.35 (31.66, 488.45)***
Knew someone who are intensive psychoactive substance users			
No	Ref = 1	Ref = 1	Ref = 1
Yes	26.16 (3.38, 202.83)**	44.51 (5.89, 336.55)***	9.70 (4.28, 21.96)***
Easiness to obtain psychoactive substances			
Don't know/very difficult/difficult	Ref = 1	Ref = 1	Ref = 1
Very easy/easy	12.12 (3.66, 40.08)***	14.45 (5.23, 39.91)***	11.34 (5.48, 23.47)***
Ever offered psychoactive substances by peers			
No	Ref = 1	Ref = 1	Ref = 1
Yes	53.04 (12.87, 218.71)***	42.65 (14.30, 127.28)***	47.00 (19.78, 111.69)***
Refusal self-efficacy	0.98 (0.96, 1.00)*	0.98 (0.96, 0.99)**	0.98 (0.97, 1.00)*
<b>Personal psychosocial factors</b>			
Self-esteem	0.96 (0.87, 1.06)	0.99 (0.91, 1.07)	0.99 (0.93, 1.06)
Gratitude	0.89 (0.75, 1.07)	0.91 (0.78, 1.06)	0.93 (0.83, 1.05)
Unsatisfactory parental relationship	1.01 (0.78, 1.32)	1.09 (0.87, 1.37)	1.02 (0.85, 1.22)

Note. †, 0.05 < p < 0.10; \*, p < 0.05; \*\*, p < 0.01; \*\*\*, p < 0.001. The models were adjusted for the listed socio-demographics.

*Factors of psychoactive substance use intention*

The results are presented in Table 6. Regarding the TPB variables, a) positive attitude toward psychoactive substance use (ORa = 1.28 and 1.29, respectively), b) negative attitude toward psychoactive substance use (ORa = 0.78 and 0.79, respectively), c) subjective norms (ORa = 1.15 and 1.14, respectively), and perceived behavioral control (ORa = 1.32 and 1.28, respectively) were significantly or marginally significantly (.05 < p < .10) associated with the intention of psychoactive substance use in the next 12 months and future lifetime, after adjusted for background factors.

Regarding the SCT variables, a) both positive outcome expectancies (ORa = 1.23 and 1.22, respectively) and negative outcome expectancies (ORa = 0.91 and 0.90, respectively), b) environmental factors of knowing someone who are intensive psychoactive substance users (ORa = 13.80 and 16.77, respectively), having 1-5 good friends using psychoactive substances (ORa = 11.18 and 13.98, respectively), having >5 friends using psychoactive substances (ORa = 28.49 and 27.63, respectively), easiness to get psychoactive substances (ORa = 7.29 and 9.42, respectively), and having been offered psychoactive substances by peers (ORa = 71.85 and 56.77, respectively), and c) refusal self-efficacy (both ORa = 0.97) were all significantly associated with the two intention outcomes.

Regarding the personal psychosocial factors, self-esteem (ORa = 0.92 and 0.90, respectively) were significantly or marginally significantly associated with the two intention outcomes. Gratitude (ORa = 0.85) was marginally significant with only intention to use psychoactive substance in future lifetime, but not with intention to use psychoactive substance in the next 12 months. Unsatisfactory parental relationship was not significantly associated with the two intention outcomes.

Table 6 Factors of psychoactive substance use intention

	DV4 = Intention of psychoactive substance use in the next 12 months	DV5 = Intention of psychoactive substance use in future lifetime
	ORa (95% CI)	ORa (95% CI)
<b>TPB variables</b>		
Attitude toward psychoactive substance use		
Positive attitude	1.28(1.11, 1.48)**	1.29(1.12, 1.49)***
Negative attitude	0.78 (0.64, 0.97)*	0.79 (0.65, 0.97)*
Subjective norm	1.15 (0.99, 1.32)†	1.14 (0.99, 1.31)†
Perceived behavioral control	1.32(1.16,1.50)***	1.28(1.14,1.44)***
<b>SCT variables</b>		
Outcome expectancies of psychoactive substance use		
Positive outcome expectancies	1.23(1.12,1.35)***	1.22(1.12,1.33)***
Negative outcome expectancies	0.91(0.86,0.95)***	0.90(0.86,0.95)***
Environmental factors		

Number of good friends using psychoactive substances		
Nil	Ref = 1	Ref = 1
1-5	11.18 (2.43, 51.47)**	13.98 (3.07, 63.80)**
>5	28.49 (5.25, 154.66)***	27.63 (5.06, 151.00)***
Knew someone who are intensive psychoactive substance users		
No	Ref = 1.0	Ref = 1.0
Yes	13.80 (3.08, 61.89)**	16.77 (3.68, 76.44)***
Easiness to obtain psychoactive substances		
Don't know/very difficult/difficult	Ref = 1	Ref = 1
Very easy/easy	7.29 (2.57, 20.68)***	9.42 (3.29, 26.99)***
Ever offered psychoactive substances by peers		
No	Ref = 1	Ref = 1
Yes	71.85 (15.17, 340.24)***	56.77 (14.45, 223.01)***
Refusal self-efficacy	0.97 (0.95, 0.99)**	0.97 (0.96, 0.99)**
<b>Personal factors</b>		
Self-esteem	0.92 (0.84, 1.02)†	0.90 (0.82, 0.98)*
Gratitude	0.91 (0.79, 1.06)	0.85 (0.71, 1.02)†
Unsatisfactory parental relationship	1.03 (0.79, 1.34)	1.04 (0.80, 1.35)

Note. †,  $0.05 < p < 0.10$ ; \*,  $p < 0.05$ ; \*\*,  $p < 0.01$ ; \*\*\*,  $p < 0.001$ . The models were adjusted for the listed socio-demographics.

### **Discussion (Phase I survey)**

As expected, the prevalence of ever use of psychoactive substance use was quite high, as compared to the local figure of 2.5% among secondary school students in Hong Kong (Narcotics Division, 2022) and 1.7% among people aged 10-24 years in mainland China (Wang et al., 2017). The intention of use in the future lifetime was close to 10%, as expected, the prevalence was much higher among ever-users than never-users, which was 39.7% versus 1.7%, respectively (ORc = 38.49). The population of clients of social workers, especially those who are ever-users, hence requires attention and interventions. Although some ever-users indicated that they had not used substances in the last 30 days or the last six months, their likelihood to use substances in the future lifetime was high. Yet, there might be a promising level of willingness to participate in cessation programs as many of them intended to stop using substances in the next six months. The adolescents may both feel likely to use substances but prefer stop using such; the apparent paradox has no contradiction in real life.

Corroborating with literature (Chen et al., 2005; Chen et al., 2009; Jordan & Andersen, 2017), the prevalence of psychoactive substance use behaviour and intention both increased with age. It is known that developmental challenges such as those related to academic stress and interpersonal relationships increase with age among adolescents (Kiuru et al., 2020). Having a deceased father and/or a deceased mother also increased the risk of substance use behaviour and intention. This is also consistent with the literature (Templeton et al., 2016). It is inferred that single parenthood would also be associated with psychoactive substance

use behaviour but it is a limitation of the study that such information was not collected in the survey.

In contrast to the literature reporting high prevalence of psychoactive substance use among males than females (McHugh et al., 2018), there was no observed sex difference in the prevalence of psychoactive substance use behaviour in the present study. However, males were more likely than females to intend to use psychoactive substances in the future. Furthermore, despite the findings of previous studies that participants of families of higher socio-economic status (SES) reported lower prevalence of substance use (Andrabi et al., 2017), this study found that parental education levels, which is a strong indicator of SES, were not significantly associated with psychoactive substance use behaviour and intention. Notably, this population was different from the general adolescent population (e.g. student population). While sex and parental educational level predict high risk behaviour in the general population, such factors might not be significant in a selective high-risk population. It seems that the parental education level was much lower than that of the general adult population, as only about 10% had received tertiary education, as compared to 35.2% in the Hong Kong general population in 2021 (Census and Statistics Department, 2021). As the participants were clients of social workers, they tend to have some behavioral and/or emotional problems, which were likely to be associated with SES. In other words, this group tended to be of lower SES than the general population, and within a lower SES group, the effect of parental education or other SES indicators might have been less salient than the effect of the SES on substance use in the general adolescent population. Interventions may thus need to target all members of this high risk population, irrespective of sex and SES.

The findings show that the participants were exposed to a high-risk environment, as about half of them knew some intensive psychoactive substance users and about 43% had good friends who were psychoactive substance users while about 10% had more than five good friends being substance users. Supporting the SCT, the factors of acquaintance with psychoactive substance users hint at potential role modelling effects, as such factors were significantly and positively associated with substance use behaviour and intention. The odds ratios were indeed very large. A problem is that adolescents might find psychoactive substances quite available, as 33.9% reported that it was easy or very easy to obtain psychoactive substances. The easiness to obtain psychoactive substances was positively associated with psychoactive substance use behavior and intention. Furthermore, 21.6% of the participants had been offered psychoactive substances by their peers; the variable was also significantly and positively associated with substance use behavior and intention. Interventions to increase refusal skills are essential and was given an attempt in the intervention, as self-efficacy for refusing psychoactive substances was negatively associated with psychoactive substance use in the present survey. Overall, some components of the SCT, such as the importance of the environment and potential model effect seem to be supported by the data of this study.

Although some previous research found that psychosocial factors such as self-esteem (Lee et al., 2018), gratitude (Leung & Tong, 2017), and dissatisfactory relationship with parents (Van Ryzin et al., 2012) were significantly associated with adolescent substance use behaviour



and intention, such associations were consistently non-significant in the present study. It is thus an interesting plausibility that the risk factors of substance use commonly found in the general adolescent populations (e.g. students) and positive attribute of gratitude might be less relevant (non-significant) in high risk populations. Again, it is speculated that the high-risk groups might have relatively high and relatively homogeneous level of psychological risk factors (e.g. poor relationships with parents); the variations of such psychosocial factors within the high-risk groups are not large enough to distinguish between substance users and non-users. Statistically, the analogy is that the association between some psychological risk/protective factors and psychoactive substance use might be less significant after controlled for some other psychological and behavioural problems. However, self-esteem was significantly associated with intention of future lifetime substance use. The reasons of significance in this case of intention but not in substance use behaviour is difficult to explain. The findings confirm that the intervention in Phase III should focus on inter-personal influences such as role modelling and subjective norm, and cognitive components (e.g. outcome expectancies, attitudes, and self-efficacy), and behavioral capacity (e.g. refusal skill) as prescribed by the SCT and TPB. As psychoactive substance use has often been used under negative moods, the component of emotional awareness and emotional regulation were also added to the intervention.

## Part II Phase II (Preparation and design)

### *Formation of a panel*

A research panel was formed, consisting of academic researchers, social workers, external advisers (e.g. experts of NGOs working on psychoactive substance use prevention) and participants meeting the project's inclusion criteria. The panel reviewed the findings of the survey and designed the combined online/off-line intervention.

### *Focus groups*

A focus group was conducted with five participants<sup>1</sup> meeting inclusion criteria of the Phase III RCT to seek advice about the intervention; the participants were briefed about the purpose and encouraged to share their views. Audio-taping was conducted. Informed consent was obtained from the participants. Recruitments were assisted by the social workers. A coupon of HKD100 was given as a token of appreciation after their completion of the focus group interview. Some suggestions were given by the participants. 1) The videos should not emphasize on the dark side as it would turn people away. 2) Persuasion would not work and a serious approach may be better than a humorous or fear appeal approach. 3) Actors should be good looking and young and easily be identified with. 4) The stories do not necessarily involve good endings. 5) Peer influences are important. 6) Romance story may create good responses. 7) Temptations such as peers' requests to use drugs exist. 8) Joy and

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<sup>1</sup> The number is one less than the range of 6-8 stated in the proposal, as it took place during the COVID-19 pandemic period and it was very difficult to recruit participants. This would not affect the process as unlike quantitative studies, the discussion does not strictly require a sample size and the discussion flow was more important.

escape are reasons to use drugs; no happy scenes when using drugs should be played. 9) Young people don't think about consequences. 10) It is hard to quit. These suggestions were considered when preparing the videos. Another focus group of five participants were conducted later, asking for opinions to refine the interventions.

### *Training workshop*

Social workers participating in the project joined a 3-day workshop which involves briefing and Q&A about the project. They were also trained by an experienced and accredited trainer in how to conduct MI (see Appendix 2).

### *Creation of intervention materials*

A professional production company (G Proto) was contracted to create the three intervention videos. A number of planning meetings were held. A number of versions have been prepared and edited to create the final versions.

## **Phase III: RCT study evaluating the intervention efficacy**

### Objective

The RCT evaluated the efficacy of the combined online/offline theory-based intervention in reducing psychoactive substance use (last 12 months), drug use intention (future lifetime and in the next six months), the risk level of psychoactive substance use among the participants. It was intended to evaluate the intervention's effect on intention to stop using substances among those who had used psychoactive substance. However, the sample size of substance users in the past six months was too small. This part of the analysis was hence not performed.<sup>2</sup>

### Study design:

A 2-arm RCT was conducted during July 2021 to June 2022. RCT yields the highest level of evidence among all study designs (Spieth et al., 2016). Participants were randomly allocated into the control and the intervention groups. Since this is a behavioural study, blinding of the participants and investigators was not feasible.

Inclusion and exclusion criteria: The criteria were the same as those used in the Phase I survey. Additional criteria included access to the Internet for receiving the online intervention and willingness to join the RCT and be followed up by phone six months after the completion of the intervention.

### Recruitment

Following similar procedures of the Phase I study, the social workers firstly briefed their clients about: a) the purpose of the study (to help him/her understand more about potential harms of substance use), b) recruitment (random selection among his/her clients for invitations), c) the logistics and procedures (randomization into the intervention and control

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<sup>2</sup> Evaluation of the intervention's effect on intention to stop using substances among those who had used psychoactive substance is not a planned analysis in the proposal.

arms, voluntary and anonymous nature of the study, the right to refuse or quit participation without being questioned and no consequence on the right to use services, and the follow-up surveys), and d) contents of the intervention group (videos , short brief online feedback exercises, and discussion about the video with the social worker afterwards) and information about the control group (online messages). The sample of the Phase III intervention was different from that of the Phase I study. Participants received an information sheet, a card showing the website link, an introduction to the program from the social worker. The briefing and consent procedures, and ethics approval from the ethics committee were similar to those of the Phase I survey. The first five digits of the participant's phone number were recorded for the purpose of matching between the baseline and follow-up questionnaires.

#### Random allocation and completion of the baseline questionnaire

The block randomization method of size of four participants was used to allocate participants in the intervention and the control groups. With verbal informed consent, the social worker opened a sealed envelope which contained an assignment code generated by a computer program. The participants were then informed that about the result of the randomization, i.e., they were randomly allocated to the control group or the intervention group. Upon completion of the randomization, the social worker passed a link to the participants to access the online baseline questionnaire to the participants that took about 10 minutes to complete. The participants self-administered the online baseline questionnaire on site. Support from research staff was available when needed.

#### The control group

A printed pamphlet for prevention of psychoactive substance use was provided to the participants who are assigned to the control group. The contents discussed briefly about harms of psychoactive substance use.

#### The Intervention group

The intervention group was exposed to the following additional intervention components on top of those received by the control group.

- 1) **Interactions with social workers:** With an appointment with the client and during a counselling session, the social worker gave a very brief introduction about the themes of videos to the participant prior to his watching. After the participant had viewed the video, there was also a 20-30 minute sharing (i.e., debriefing) between all participants and their social worker about the participants' thoughts on a range of topics (e.g., whether he/she understood the theme of the video, whether he/she agreed with the theme, how he/she felt about the video, any common features between the video's content and the participant's life, what impact the video on the clients' intention to use substances, and discussion about the participant's thoughts about the video and advised him/her how the participant could improve his/her life through making some cognitive/behavioral changes suggested by the video's themes). In addition, for 69 participants self-reported having used psychoactive substances in the past six months or those who showed having a chance of future psychoactive substance use (about 15% of the intervention group), a 20-30 minute brief MI was provided to such adolescents. MI is an evidence-based technique to induce behavioral change through emergence of mental conflict between the desired situation versus the current situation. With empathy and creation of

“change talk” (responses indicating potential changes), the participants were oriented to find their resources and plans for change.

2) **Online intervention:**

**Overview:** Overall, the participants were requested to complete three sessions of online interventions within 1-2 months.

These sessions included a video session of about 10 minutes involving some narrative stories presented by some purposively selected presenters. The presentations took a positive framing approach that were more likely to be acceptable to adolescents. The second part was a brief self-help activity. At least five reminders were automatically sent to the participants about the next session upon completion of a session.

**Session 1:** This session focused on the observational learning component of the SCT. Two videos were created, based on narrative approaches to tell stories of two real persons (role models) who were psychoactive substance ex-users. They tried to raise and address some issues regarding perceived positive and negative outcomes of psychoactive substance use, and how they made changes to quit psychoactive substance use successfully. Each video was about five minutes in length. The participants were asked to complete a short 5-minute self-help tutorial in a multiple choice format. Answers were given after the participants entered their data. Participants were asked to indicate their understanding about actual harm caused by substance used and suggestions on how to prevent substance use. A riddle was integrated into the self-help sessions for fun.

**Session 2:** This session focused on behavioural control, self-efficacy, refusal skills, and subjective norms. A narrative video was made to foster positive peer influences. It also discussed about practical skills to refuse temptations in order to increase behavioural control/self-efficacy. The video was about 15 minutes in length. Similarly, participants were requested to complete a 5-minute self-help tutorial, which attempt to reinforce clues about how to resist temptations to use psychoactive substances. To be interactive, participants were invited to send us some innovative ways to refuse temptations of drug use optionally in the form of slogans, posters, or photos. A prize was given to the ‘best’ submission.

**Session 3:** This part also used narrative and video approaches. The 7-minute video focused on protective emotional factors such as awareness of emotions and positive emotional regulation, which are related to use psychoactive substance behaviors and intention. The story described a young man who was under stress in a romance relationship and in work and developed negative emotions that might result in maladaptive coping in terms of psychoactive substance use. He resolved the risk by making some cognitive changes and enhanced support given by his girlfriend. The self-tutorial tries to reinforce the understanding various potential stressors, ways to calm down when negative emotion surge, and that experience of negative emotions are quite common. in multiple choice format.

**Considerations of contamination:** To minimize contamination, the access to the online intervention was password protected, and the materials could not be

downloaded. The password was provided to the participants by the social worker. Participants were requested not to distribute the password to others. Each password could only be used three times; people who needed extra access could contact the research team. We also asked about the control group whether they had been exposed to this intervention (e.g. videos and discussion with social workers); no such contamination was found. As the participants watched the online videos with the social workers, non-compliance was not an issue.

## Outcomes

### *Psychoactive substance use outcomes*

Such outcomes included: a) use of psychoactive substance according to a list (see Methods and Appendix 1) including current use in the last 30 days and usage in the last six months, b) intention to use psychoactive substances in the next 12 months and future lifetime, c) level of risk of psychoactive substance use as measured by the 29-item validated vulnerability scale predicting intention/behaviour of psychoactive substance use among teenagers, which was developed by the research team (BDF101018; Appendix 3). The primary outcome was intention to use psychoactive substance in the next 12 months or having used psychoactive substances in the last six months.

### *Cognitive outcomes*

Cognitive secondary outcomes included positive and negative outcome expectancy (POE and NOE) of psychoactive substance use, behavioural control, and self-efficacy for refusal. Such scales had been used in the Phase I survey.

### *Potential confounders*

Background factors were treated as potential confounders; significant ones were adjusted for in data analysis.

## Post-program evaluation

At the completion of the intervention, a post-intervention telephone survey was administered by the research worker. Another 6-month post-intervention evaluation through telephone survey was administered. The procedures and the questionnaires were similar to the baseline survey. Those who completed all three surveys will be given a cafe coupon of HKD100 in value. Some questions were also asked about process evaluation (convenience, interest, recommendation to others etc.) in the post-program evaluation survey.

## Informed consent of RCT

Verbal informed consent was obtained from the participants and were confirmed by signatures of both the social workers and the research assistant. The procedures were similar to those of Phase I, except that participants were briefed about the interventions and the follow-up surveys. Ethics approval was obtained from the Chinese University of Hong Kong (Reference number: SBRE-18-435).

### Sample size planning

The target effective sample size of the RCT was 120 per group. The sample size would allow us to detect effect size of between-group differences of about 14.3% at completion of the intervention for the constructed outcome for the primary outcome of actual use in the last six months or intention to use drugs in the next 12 months, assuming that 35% of the control group would have at least one of such unfavorable outcomes (alpha=.05, one-sided hypothesis, power=.8). Assuming about 20% loss to follow-up, the planned sample size would be 300 or 150 per group. The actual response rate was 70%, i.e., while 150 and 150 participants were recruited for the intervention and control groups at baseline; 113 and 97 of them had been followed up at Month 6, respectively.

### Data analysis

The intention-to-treat analysis was performed. Absolute and relative risk ratios, as well as number to treat were estimated, comparing the two evaluation surveys' measures; 95% confidence intervals (CI) were constructed. Baseline between-group analysis were conducted. The baseline background factors were adjusted for when comparing the between-group key outcomes to reduce confounding bias. Subgroup analysis was conducted for those who were current users (last 30 days). The analysis had not been performed for the subgroup of psychoactive substance users (last 30 days) due to the small sample size (n = 23).

### Results

#### *Baseline comparisons*

At the baseline, the intervention group and the control group were not statistically different ( $p>.05$ ) in any of the background variables and outcome variables ( $p>.05$ ; see Table 1).

Table 1 Baseline characteristics by intervention group status

	All (n = 300)	Intervention group (n = 150)	Control group (n = 150)	<i>p</i> of $\chi^2$
	%	%	%	
<b>Background factors</b>				
Age (years) (Mean, SD)	17.7, 2.4	17.8, 2.6	17.7, 2.3	0.621
Sex				1.000
Male	63.3	63.3	63.3	
Female	36.7	36.7	36.7	
Housing				0.092
Public housing	62.7	55.3	70.0	
Home ownership	9.3	10.0	8.7	
scheme housing				
Private housing	16.3	20.0	12.7	
Temporary housing	2.0	2.0	2.0	
Other types of housing	9.7	12.7	6.7	
Living with both parents				0.696
Yes	63.0	65.3	60.7	

No	35.0	32.7	37.3	
Missing data	2.0	2.0	2.0	
Decreased parent(s)				1.000
No	91.3	91.3	91.3	
Yes	8.7	8.7	8.7	
Father's educational level				0.437
Primary school or below	14.3	13.3	15.3	
Junior/senior secondary school	40.7	45.3	36.0	
College or above	13.7	12.7	14.7	
Missing data	31.3	28.7	34.0	
Mother's educational level				0.783
Primary school or below	20.7	20.7	20.7	
Junior/senior secondary school	39.3	42.0	36.7	
College or above	10.0	9.3	10.7	
Missing data	30.0	28.0	32.0	
<b>Behavioral outcomes</b>				
a) Psychoactive substance use in the past 30 days	7.7	8.7	6.7	0.665
b) Psychoactive substance use in the past six months	10.7	12.0	9.3	0.575
c) Intention of psychoactive substance use in the next 12 months	12.7	13.3	12.0	0.862
d) Intention of psychoactive substance use in the future lifetime	12.3	14.0	10.7	0.483
e) High risk of psychoactive substance use	38.0	36.0	40.0	0.552
Any of a), b), or c)	15.3	15.3	15.3	1.000
Any of a), b), c) or e)	43.7	40.0	47.3	0.244

Note. Risk of psychoactive substance use was calculated by the formula of the Secondary Prevention Screening Index; those scoring above the cut-off of 0.017 are classified as high-risk cases, or vice versa as low-risk cases.

### Outcomes

In Table 2 involving all the participants, none of the between-group differences (intervention versus control) in the outcomes in psychoactive substance use in the past 30 days and in the past six months, intention of psychoactive substance use (next 12 months and future lifetime), and the risk level of psychoactive substance use were statistically significant at the completion of intervention and at 6-month follow-up time. The same was true for the analysis for the subgroup of non-users (i.e., those who had not used psychoactive substance in the last 30 days at baseline ( $p > .05$ )) in Table 3.

Table 2 Comparing efficacies of interventions among all participants (between-group differences in behavioral outcomes)

	Intervention group	Control group	Intervention versus Control			
	%	%	OR (95% CI)	<i>p</i>	ARR	NNT
<b><i>Post-intervention (n= 224)</i></b>						
a) Psychoactive substance use in the past 30 days	5.2	4.6	1.12 (0.33, 3.79)	0.851	0.01	100
b) Psychoactive substance use in the past six months*	7.8	6.5	1.21 (0.44, 3.38)	0.711	0.01	100
c) Intention of psychoactive substance use in the next 12 months*	9.5	3.7	2.72 (0.84, 8.83)	0.095	0.06	17
d) Intention of psychoactive substance use in the future	11.2	4.6	2.60 (0.90, 7.56)	0.079	0.07	15
e) High risk of psychoactive substance use	33.6	35.2	0.93 (0.54, 1.62)	0.805	-0.02	-50
Any of a), b), or c)	11.2	7.4	1.58 (0.63, 3.97)	0.333		
Any of a), b), c), or e)	37.1	37.0	1.00 (0.58, 1.72)	0.996		
<b><i>At Month-6 Follow-up (n = 186)</i></b>						
a) Psychoactive substance use in the past 30 days	3.0	3.5	0.84 (0.16, 4.26)	0.830	-0.01	-100
b) Psychoactive substance use in the past six months*	10.9	10.6	1.03 (0.41, 2.62)	0.947	0.01	100
c) Intention of psychoactive substance use in the next 12 months*	5.9	4.7	1.28 (0.35, 4.69)	0.711	0.01	100
d) Intention of psychoactive substance use in the future	8.9	4.7	1.98 (0.59, 6.68)	0.270	0.04	25
e) High risk of psychoactive substance use	26.7	28.2	0.93 (0.49, 1.77)	0.819	-0.02	-50
Any of a), b), or c)	12.9	14.1	0.90 (0.39, 2.09)	0.804		
Any of a), b), c), or e)	32.7	34.1	0.94 (0.51, 1.73)	0.835		

Note. \*, Key outcomes. OR = Odds ratio; CI = Confidence interval; ARR = Absolute risk reduction; NNT = Number needed to treat. Risk of psychoactive substance use was calculated by the formula of the Secondary Prevention Screening Index; those scoring above the cut-off of 0.017 are classified as high-risk cases, or vice versa as low-risk cases.

Table 3 Comparing efficacies of interventions in the subgroup of those who were not current substance users (between-group differences in behavioral outcomes)

	Intervention group	Control group	Intervention versus Control			
	%	%	OR (95% CI)	<i>p</i>	ARR	NNT
<b>Among non-current users at baseline</b>						
<b><i>Post-intervention (n = 209)</i></b>						



a) Psychoactive substance use in the past six months*	2.8	2.9	0.95 (0.19, 4.83)	0.953	-0.01	-100
b) Intention of psychoactive substance use in the next 12 months*	6.5	2.0	3.50 (0.71, 17.26)	0.124	0.04	25
c) Intention of psychoactive substance use in the future	7.5	2.9	2.67 (0.69, 10.35)	0.156	0.05	20
d) High risk of psychoactive substance use	32.7	34.3	0.93 (0.52, 1.65)	0.806	-0.01	-50
a) or b)	6.5	3.9	1.72 (0.49, 6.04)	0.401		
Any of a), b) or d)	33.6	35.3	0.93 (0.53, 1.65)	0.802		

***At Month-6 Follow-up (n = 173)***

a) Psychoactive substance use in the past six months*	4.3	5.0	0.85 (0.21, 3.53)	0.827	-0.01	-100
b) Intention of psychoactive substance use in the next 12 months*	3.2	3.8	0.86 (0.17, 4.36)	0.851	-0.01	-100
c) Intention of psychoactive substance use in the future	6.5	3.8	1.77 (0.43, 7.32)	0.430	0.03	34
d) High risk of psychoactive substance use	25.8	25.0	1.04 (0.53, 2.07)	0.903	0.01	100
a) or b)	6.5	8.8	0.72 (0.23, 2.24)	0.569		
Any of a), b) or d)	28.0	30.0	0.91 (0.47, 1.75)	0.768		

Note. \*, Key outcomes. OR = Odds ratio; CI = Confidence interval; ARR = Absolute risk reduction; NNT = Number needed to treat. Risk of psychoactive substance use was calculated by the formula of the Secondary Prevention Screening Index; those scoring above the cut-off of 0.017 are classified as high-risk cases, or vice versa as low-risk cases.

*Cognitive secondary outcomes*

The results are shown in Table 4. The cognitive outcomes (secondary outcomes) of POE, NOE and refusal self-efficacy were not of statistical significance ( $p > .05$ ), both among all the participants and among the subsample of non-current users at the baseline (in the last 30 days). The exception was that the intervention group showed a level of perceived behavioural control than the control group among all participants ( $p = .034$  in t-test and  $p = .039$  in ANCOVA test; Cohen's  $d = 0.26$ ); such a difference was statistically non-significant but was close to statistical significance in the subgroup of having used psychoactive substances in the last 30 days ( $p = .066$  in t-test and  $p = .056$  in ANCOVA test).

Table 4 Comparing efficacies of interventions (between-group differences cognitive outcomes)

	Intervention group	Control group	$p$ of t-test*	$p$ of ANCOVA*
	Mean, SD	Mean, SD		
<b>Among all participants</b>				
Positive outcome expectation				
Baseline	13.2, 6.2	14.0, 6.1	0.243	0.188

Post-intervention	12.9, 5.8	12.8, 5.9	0.586	0.558
Month 6	14.1, 5.9	12.8, 5.6	0.937	0.965
Negative outcome expectation				
Baseline	35.2, 10.3	35.9, 9.1	0.556	0.299
Post-intervention	35.6, 10.3	35.7, 9.9	0.536	0.616
Month 6	36.3, 8.3	37.6, 7.6	0.866	0.139
Perceived behavioral control				
Baseline	8.7, 4.4	9.7, 4.5	0.068	0.067
Post-intervention	9.0, 4.6	9.0, 4.2	0.494	0.474
Month 6	9.1, 4.2	8.0, 4.2	<b>0.034</b>	<b>0.039</b>
Refusal self-efficacy (RSE)				
Baseline	61.7, 24.3	60.2, 23.4	0.594	0.899
Post-intervention	63.0, 23.5	60.1, 23.7	0.181	0.200
Month 6	63.9, 24.1	64.1, 22.6	0.526	0.573
<b>Among non-current users at baseline</b>				
Positive outcome expectation				
Baseline	12.5, 6.0	13.5, 6.0	0.164	0.175
Post-intervention	12.7, 5.7	12.4, 5.8	0.651	0.676
Month 6	13.7, 5.9	12.3, 5.4	0.938	0.979
Negative outcome expectation				
Baseline	36.0, 10.1	36.6, 8.8	0.643	0.315
Post-intervention	36.6, 9.9	35.9, 10.0	0.307	0.516
Month 6	36.8, 8.3	37.7, 7.8	0.762	0.801
Perceived behavioral control				
Baseline	8.4, 4.4	9.5, 4.5	<b>0.047</b>	<b>0.043</b>
Post-intervention	8.7, 4.6	8.9, 4.3	0.621	0.539
Month 6	8.8, 4.2	7.8, 4.2	0.066	0.056
Refusal self-efficacy (RSE)				
Baseline	63.3, 24.5	61.5, 23.9	0.534	0.965
Post-intervention	64.6, 23.2	61.0, 24.0	0.139	0.225
Month 6	65.0, 24.1	65.5, 22.5	0.545	0.585

Note. \*, two-tailed p of t-test for baseline data and one-tailed p of t-test for post-intervention and six-month follow-up data. ANCOVA analysis was adjusted for background factors, including age, sex, housing, living with both parents, deceased parents, father's and mother's educational level.

#### *Process evaluation*

The results are shown in Table 5. More than half of the participants of the intervention group found the intervention helpful or very helpful in promoting knowledge about harms of psychoactive substance use (55.3%), increasing their confidence in refusing psychoactive substance use (57.1%), and satisfactory or very satisfactory (55.6%); 73.8% would be likely or definitely to recommend the project to his/her peers. The levels of negative perception (unhelpful and dissatisfaction) ranged from 11.2% to 14.1%.

Table 5 Post-intervention evaluation (n = 142)

	n	%
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Level of help in increasing knowledge about harms of psychoactive substance use		
Totally unhelpful	10	7.0
Unhelpful	6	4.2
Average	46	32.4
Helpful	56	39.4
Very helpful	24	16.9
Level of help in increasing confidence of psychoactive substance refusal		
Totally unhelpful	8	5.6
Unhelpful	11	7.7
Average	42	29.6
Helpful	43	30.3
Very helpful	38	26.8
Overall satisfaction with this project		
Very dissatisfied	12	8.5
Dissatisfied	8	5.6
Neutral	43	30.3
Satisfied	53	37.3
Very satisfied	26	18.3
Recommendation of this project		
Definitely not	17	12.0
Likely not	23	16.2
Likely yes	80	56.3
Definitely yes	22	15.5

## Discussion

The intervention group showed better perceived behavioral control at Month 6 than the control group. Behavioral control is a construct of the TPB, which is an important determinant of addictive behavior in general (Ajzen, 1991), and adolescent psychoactive substance use in particular. The variable was also significantly associated with substance use behavior and intention in the Phase I survey; thus, the effect is potentially useful in reducing substance use.

It is, however, disappointing that the intervention was unable to reduce substance use behavior in the past 30 days and intention of future use. One of the plausible reasons is that the prevalence of psychoactive substance use in the last six months and the intention to use psychoactive substances in the next 12 months was lower than expected, although such prevalence still indicated a relatively high level that requires attention, especially among those who were ever-users. As most of the social workers viewed the videos with the participants, compliance for video watching may not be the cause of the non-significant treatment effect. The low level of dissatisfaction about the intervention also suggests that the intervention had been delivered properly.

The follow-up period of six months was relatively short, and it is unknown whether the results would or would not be significant for a shorter follow-up period. Also, the present study was conducted during the COVID-19 period. Social distancing was commonly

exercised. It is uncertain whether the prevalence of psychoactive substance use was lowered because of social distancing and the possibility of having lower chances to interact with peers who are psychoactive substance users. We have seen in the Phase I study that the intention to use drugs among substance users was very high. It is plausible that the intervention might have a stronger effect in this group, but the sample size was inadequate for a subgroup analysis.

The cognitions of POE and NOE about psychoactive substance use also did not differ statistically between the intervention group and the control group. As seen from the Phase I survey, POE was significantly associated with psychoactive substance use behavior and intention. The inability to reduce positive outcome and increase negative outcome may also account for the non-significant intervention effect on substance use behavior and intention. The non-significant findings may imply that some participants of this population have deep-rooted misperceptions about perceived benefits of psychoactive substance use and underestimated its harms. Health promotion approaches might not be strong enough to modify their perceptions.

From another angle, it is a limitation of this study that while we tried to change the participants' response to environmental influences, we were, however, unable to change the environment, such as peer influences, easy contacts with psychoactive substance user, and availability of psychoactive substance. Such changes are hard to accomplish. Peer influences are known to have very strong effect on adolescent psychoactive substance use (Pandina et al., 2010).

Overall, the target population is a hard-to-reach and potential risk group that frequently encounter academic, family, relationship, psychological, and behavior problems. All such problems are risk factors of psychoactive substance use. It is possible that psychoactive substance use is not a stand-alone problem but is possibly one of the clusters of interrelated problems. Health promotion approaches, although carefully designed and corresponds to theories and empirical research, might not be adequate to stop the psychoactive substance use problems in this population. The high prevalence of intention to use among ever-users found in Phase I requires attention. In literature, cognitive behavioral therapy has been effective in reducing substance use (McHugh et al., 2010), but such program is intensive and not easily available. Furthermore, adolescent psychoactive substance users need to be motivated to seek help and to use such services. The conditions might be difficult to meet. To conclude, it seems that we need to shift from treatment to early prevention among secondary school students, to provide them with resilience, stress reduction, and secondary interventions before they develop intention and behaviors related to psychoactive substance use.

## Reference

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Andrabi, N., Khoddam, R., & Leventhal, A. M. (2017). Socioeconomic disparities in adolescent substance use: Role of enjoyable alternative substance-free activities. *Social Science and Medicine*, 176, 175-182.
- Armitage, C. J., Armitage, C. J., Conner, M., Loach, J., & Willetts, D. (1999). Different Perceptions of Control: Applying an Extended Theory of Planned Behavior to Legal and Illegal Drug Use. *Basic and Applied Social Psychology*, 21(4), 301-316.  
[https://doi.org/10.1207/S15324834BASP2104\\_4](https://doi.org/10.1207/S15324834BASP2104_4)
- Arnaud, N., Broning, S., Drechsel, M., Thomasius, R., & Baldus, C. (2012). Web-based screening and brief intervention for poly-drug use among teenagers: study protocol of a multicentre two-arm randomized controlled trial. *BMC Public Health*, 12, 826.  
<https://doi.org/10.1186/1471-2458-12-826>
- Bandura, A. (1999). A Sociocognitive Analysis of Substance Abuse: An Agentic Perspective. *Psychological Science*, 10(3), 214-217. <https://doi.org/10.1111/1467-9280.00138>
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52(1), 1-26.
- Barkus, E., & Murray, R. M. (2010). Substance Use in Adolescence and Psychosis: Clarifying the Relationship. *Annual Review of Clinical Psychology*, 6(1), 365-389.  
<https://doi.org/doi:10.1146/annurev.clinpsy.121208.131220>
- Bashirian, S., Hidarnia, A., Allahverdipour, H., & Hajizadeh, E. (2012). Application of the theory of planned behavior to predict drug abuse related behaviors among adolescents. *J Res Health Sci*, 12(1), 54-60.
- Bechtold, J., Hipwell, A., Lewis, D. A., Loeber, R., & Pardini, D. (2016). Concurrent and Sustained Cumulative Effects of Adolescent Marijuana Use on Subclinical Psychotic Symptoms. *Am J Psychiatry*, 173(8), 781-789.  
<https://doi.org/10.1176/appi.ajp.2016.15070878>
- Bernstein, J., Heeren, T., Edward, E., Dorfman, D., Bliss, C., Winter, M., & Bernstein, E. (2010). A brief motivational interview in a pediatric emergency department, plus 10-day telephone follow-up, increases attempts to quit drinking among youth and young adults who screen positive for problematic drinking. *Acad Emerg Med*, 17(8), 890-902. <https://doi.org/10.1111/j.1553-2712.2010.00818.x>
- Brown, R. A., Abrantes, A. M., Minami, H., Prince, M. A., Bloom, E. L., Apodaca, T. R., Strong, D. R., Picotte, D. M., Monti, P. M., MacPherson, L., Matsko, S. V., & Hunt, J. I. (2015). Motivational Interviewing to Reduce Substance Use in Adolescents with Psychiatric Comorbidity. *J Subst Abuse Treat*, 59, 20-29.  
<https://doi.org/10.1016/j.jsat.2015.06.016>
- Calomarde-Gómez, C., Jiménez-Fernández, B., Balcells-Oliveró, M., Gual, A., & López-Pelayo, H. (2021). Motivational Interviewing for Cannabis Use Disorders: A Systematic Review and Meta-Analysis. *Eur Addict Res*, 27(6), 413-427.  
<https://doi.org/10.1159/000515667>
- Census and Statistics Department, H. K. S. A. R., , . (2021). 2021 Population Census. Available at: [https://www.census2021.gov.hk/en/main\\_tables.html](https://www.census2021.gov.hk/en/main_tables.html). Accessed on April 26, 2023.
- Chen, C.-Y., O'Brien, M. S., & Anthony, J. C. (2005). Who becomes cannabis dependent soon after onset of use? Epidemiological evidence from the United States: 2000–2001. *Drug and Alcohol Dependence*, 79(1), 11-22.  
<https://doi.org/http://dx.doi.org/10.1016/j.drugalcdep.2004.11.014>

- Chen, C.-Y., Storr, C. L., & Anthony, J. C. (2009). Early-onset drug use and risk for drug dependence problems. *Addictive Behaviors, 34*(3), 319-322.  
<https://doi.org/http://dx.doi.org/10.1016/j.addbeh.2008.10.021>
- Cutrín, O., Mac Fadden, I., Ayers, S. L., Kulis, S. S., Gómez-Fraguela, J. A., & Marsiglia, F. F. (2020). Applicability of the Theory of Planned Behavior for Predicting Alcohol Use in Spanish Early Adolescents. *Int J Environ Res Public Health, 17*(22).  
<https://doi.org/10.3390/ijerph17228539>
- D'Amico, E. J., Miles, J. N., Stern, S. A., & Meredith, L. S. (2008). Brief motivational interviewing for teens at risk of substance use consequences: a randomized pilot study in a primary care clinic. *J Subst Abuse Treat, 35*(1), 53-61.  
<https://doi.org/10.1016/j.jsat.2007.08.008>
- Erickson, S. J., Gerstle, M., & Feldstein, S. W. (2005). Brief interventions and motivational interviewing with children, adolescents, and their parents in pediatric health care settings: a review. *Arch Pediatr Adolesc Med, 159*(12), 1173-1180.  
<https://doi.org/10.1001/archpedi.159.12.1173>
- Feng, B., Malloch, Y. Z., Kravitz, R. L., Verba, S., Iosif, A.-M., Slavik, G., & Henry, S. G. (2021). Assessing the effectiveness of a narrative-based patient education video for promoting opioid tapering. *Patient Education and Counseling, 104*(2), 329-336.  
<https://doi.org/https://doi.org/10.1016/j.pec.2020.08.019>
- Frost, H., Campbell, P., Maxwell, M., O'Carroll, R. E., Dombrowski, S. U., Williams, B., Cheyne, H., Coles, E., & Pollock, A. (2018). Effectiveness of Motivational Interviewing on adult behaviour change in health and social care settings: A systematic review of reviews. *PLoS One, 13*(10), e0204890. <https://doi.org/10.1371/journal.pone.0204890>
- Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annu Rev Public Health, 31*, 399-418.  
<https://doi.org/10.1146/annurev.publhealth.012809.103604>
- Hamidullah, S., Thorpe, H. H. A., Frie, J. A., McCurdy, R. D., & Khokhar, J. Y. (2020). Adolescent Substance Use and the Brain: Behavioral, Cognitive and Neuroimaging Correlates. *Front Hum Neurosci, 14*, 298.  
<https://doi.org/10.3389/fnhum.2020.00298>
- Hanson, K. L., Medina, K. L., Padula, C. B., Tapert, S. F., & Brown, S. A. (2011). Impact of Adolescent Alcohol and Drug Use on Neuropsychological Functioning in Young Adulthood: 10-Year Outcomes. *Journal of Child and Adolescent Substance Abuse, 20*(2), 135-154.
- Harder, A. T., Knorth, E. J., & Kalverboer, M. E. (2015). Risky or Needy? Dynamic Risk Factors and Delinquent Behavior of Adolescents in Secure Residential Youth Care. *International Journal of Offender Therapy and Comparative Criminology, 59*(10), 1047-1065. <https://doi.org/doi:10.1177/0306624X14531036>
- Hettema, J., Steele, J., & Miller, W. R. (2005). Motivational interviewing. *Annu Rev Clin Psychol, 1*, 91-111. <https://doi.org/10.1146/annurev.clinpsy.1.102803.143833>
- Hinyard, L. J., & Kreuter, M. W. (2007). Using Narrative Communication as a Tool for Health Behavior Change: A Conceptual, Theoretical, and Empirical Overview. *Health Education and Behavior, 34*(5), 777-792.  
<https://doi.org/10.1177/1090198106291963>
- Huang, D. Y. C., Lanza, H. I., & Anglin, M. D. (2013). Association between adolescent substance use and obesity in young adulthood: A group-based dual trajectory analysis. *Addictive Behaviors, 38*(11), 2653-2660.  
<https://doi.org/http://dx.doi.org/10.1016/j.addbeh.2013.06.024>
- Jhanjee, S. (2014). Evidence based psychosocial interventions in substance use. *Indian J Psychol Med, 36*(2), 112-118. <https://doi.org/10.4103/0253-7176.130960>

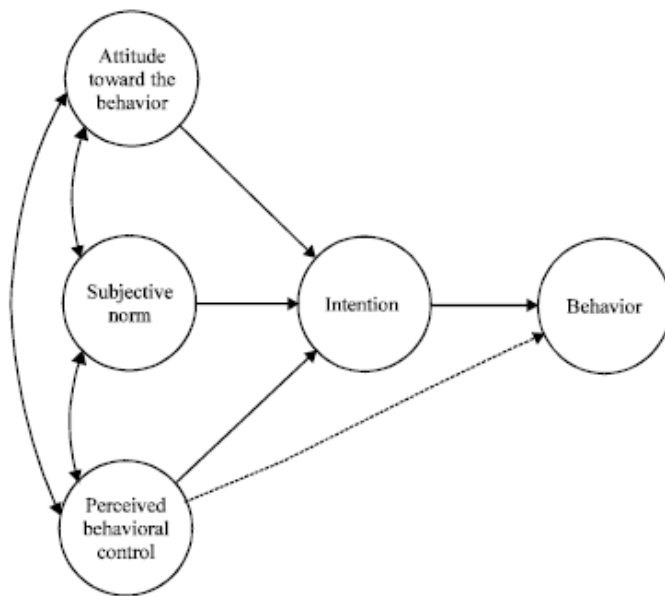
- Jordan, C. J., & Andersen, S. L. (2017). Sensitive periods of substance abuse: Early risk for the transition to dependence. *Developmental Cognitive Neuroscience*, 25, 29-44.  
<https://doi.org/https://doi.org/10.1016/j.dcn.2016.10.004>
- Kiuru, N., Wang, M.-T., Salmela-Aro, K., Kannas, L., Ahonen, T., & Hirvonen, R. (2020). Associations between adolescents' interpersonal relationships, school well-being, and academic achievement during educational transitions. *Journal of youth and adolescence*, 49(5), 1057-1072.
- Kraner, J. C., McCoy, D. J., Evans, M. A., Evans, L. E., & Sweeney, B. J. (2001). Fatalities caused by the MDMA-related drug paramethoxyamphetamine (PMA). *Journal of Analytical Toxicology*, 25(7), 645-648.
- Kreuter, M. W., Holmes, K., Alcaraz, K., Kalesan, B., Rath, S., Richert, M., McQueen, A., Caito, N., Robinson, L., & Clark, E. M. (2010). Comparing narrative and informational videos to increase mammography in low-income African American women. *Patient Education and Counseling*, 81, Supplement 1(0), S6-S14.  
<https://doi.org/http://dx.doi.org/10.1016/j.pec.2010.09.008>
- Lai, D. T., Cahill, K., Qin, Y., & Tang, J. L. (2010). Motivational interviewing for smoking cessation. *Cochrane Database Syst Rev*(1), Cd006936.  
<https://doi.org/10.1002/14651858.CD006936.pub2>
- Lau, J. T. F. (2013). Study on Drug Abuse Situation and Service Needs of Non-engaged Youths in Hong Kong.
- Lawental, M., Kipnis, A., & Rigg, K. (2018). Binge drinking among young adults in Israel: application of the theory of planned behavior. *Psychol Health Med*, 23(9), 1060-1068. <https://doi.org/10.1080/13548506.2018.1467025>
- Lee, C. G., Seo, D. C., Torabi, M. R., Lohrmann, D. K., & Song, T. M. (2018). Longitudinal trajectory of the relationship between self-esteem and substance use from adolescence to young adulthood. *Journal of School Health*, 88(1), 9-14.
- Leung, C.-C., & Tong, E. M. (2017). Gratitude and drug misuse: Role of coping as mediator. *Substance Use and Misuse*, 52(14), 1832-1839.
- Li, J. B., Mo, P. K. H., Lau, J. T. F., Su, X. F., Zhang, X., Wu, A. M. S., Mai, J. C., & Chen, Y. X. (2018). Online social networking addiction and depression: The results from a large-scale prospective cohort study in Chinese adolescents. *Journal of behavioral addictions*, 7(3), 686-696.
- Lin, L.-C., Huang, C.-M., Hsu, H.-P., Liao, J.-Y., Lin, C.-Y., & Guo, J.-L. (2021). Integrating health literacy into a theory-based drug-use prevention program: a quasi-experimental study among junior high students in Taiwan. *BMC Public Health*, 21(1), 1768.  
<https://doi.org/10.1186/s12889-021-11830-5>
- Mak, S. K., Chan, M. T. Y., Bower, W. F., Yip, S. K. H., Hou, S. S. M., Wu, B. B. B., & Man, C. Y. (2011). Lower Urinary Tract Changes in Young Adults Using Ketamine. *The Journal of Urology*, 186(2), 610-614.  
<https://doi.org/http://dx.doi.org/10.1016/j.juro.2011.03.108>
- Marconi, A., Di Forti, M., Lewis, C. M., Murray, R. M., & Vassos, E. (2016). Meta-analysis of the Association Between the Level of Cannabis Use and Risk of Psychosis. *Schizophr Bull*, 42(5), 1262-1269. <https://doi.org/10.1093/schbul/sbw003>
- McHugh, R. K., Hearon, B. A., & Otto, M. W. (2010). Cognitive behavioral therapy for substance use disorders. *Psychiatric Clinics*, 33(3), 511-525.
- McHugh, R. K., Votaw, V. R., Sugarman, D. E., & Greenfield, S. F. (2018). Sex and gender differences in substance use disorders. *Clinical Psychology Review*, 66, 12-23.
- McMillan, B., & Conner, M. (2003). Using the theory of planned behaviour to understand alcohol and tobacco use in students. *Psychology, Health & Medicine*, 8(3), 317-328.  
<https://doi.org/10.1080/1354850031000135759>

- Narcotics Division. (2022). 2020/21 Survey of Drug Use among Students. [https://www.nd.gov.hk/en/survey\\_of\\_drug\\_use\\_20-21.html](https://www.nd.gov.hk/en/survey_of_drug_use_20-21.html)
- Nawi, A. M., Ismail, R., Ibrahim, F., Hassan, M. R., Manaf, M. R. A., Amit, N., Ibrahim, N., & Shafurdin, N. S. (2021). Risk and protective factors of drug abuse among adolescents: a systematic review. *BMC Public Health*, 21(1), 2088. <https://doi.org/10.1186/s12889-021-11906-2>
- Nelson, L. F., Weitzman, E. R., & Levy, S. (2022). Prevention of Substance Use Disorders. *Med Clin North Am*, 106(1), 153-168. <https://doi.org/10.1016/j.mcna.2021.08.005>
- Pandina, R. J., Johnson, V. L., & White, H. R. (2010). Peer influences on substance use during adolescence and emerging adulthood.
- Patton, G. C., Coffey, C., Carlin, J. B., Degenhardt, L., Lynskey, M., & Hall, W. (2002). Cannabis use and mental health in young people: cohort study. *BMJ*, 325(7374), 1195-1198. <https://doi.org/10.1136/bmj.325.7374.1195>
- Richert, T., Anderberg, M., & Dahlberg, M. (2020). Mental health problems among young people in substance abuse treatment in Sweden. *Substance Abuse Treatment, Prevention, and Policy*, 15(1), 43. <https://doi.org/10.1186/s13011-020-00282-6>
- Rubak, S., Sandbæk, A., Lauritzen, T., & Christensen, B. (2005). Motivational interviewing: a systematic review and meta-analysis. *The British Journal of General Practice*, 55(513), 305-312. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1463134/>
- Seker, S., Habersaat, S., Boonmann, C., Palix, J., Jenkel, N., Fischer, S., Fegert, J. M., Kölch, M., Schmeck, K., & Schmid, M. (2021). Substance-use disorders among child welfare and juvenile justice adolescents in residential care: The role of childhood adversities and impulsive behavior. *Children and Youth Services Review*, 121, 105825. <https://doi.org/https://doi.org/10.1016/j.chilyouth.2020.105825>
- Shafi, A., Berry, A. J., Sumnall, H., Wood, D. M., & Tracy, D. K. (2020). New psychoactive substances: a review and updates. *Ther Adv Psychopharmacol*, 10, 2045125320967197. <https://doi.org/10.1177/2045125320967197>
- Sloboda, Z., Glantz, M. D., & Tarter, R. E. (2012). Revisiting the Concepts of Risk and Protective Factors for Understanding the Etiology and Development of Substance Use and Substance Use Disorders: Implications for Prevention. *Substance Use & Misuse*, 47(8-9), 944-962. <https://doi.org/doi:10.3109/10826084.2012.663280>
- Smedslund, G., Berg, R. C., Hammerstrom, K. T., Steiro, A., Leiknes, K. A., Dahl, H. M., & Karlsen, K. (2011). Motivational interviewing for substance abuse. *Cochrane Database Syst Rev*(5), Cd008063. <https://doi.org/10.1002/14651858.CD008063.pub2>
- Spieth, P. M., Kubasch, A. S., Penzlin, A. I., Illigens, B. M.-W., Barlinn, K., & Siepmann, T. (2016). Randomized controlled trials – a matter of design. *Neuropsychiatr Dis Treat*, 12, 1341-1349. <https://doi.org/10.2147/NDT.S101938>
- Steinmetz, H., Knappstein, M., Ajzen, I., Schmidt, P., & Kabst, R. (2016). How Effective are Behavior Change Interventions Based on the Theory of Planned Behavior?: A Three-Level Meta-Analysis. *Zeitschrift für Psychologie*, 224, 216-233. <https://doi.org/10.1027/2151-2604/a000255>
- Templeton, L., Ford, A., McKell, J., Valentine, C., Walter, T., Velleman, R., Bauld, L., Hay, G., & Hollywood, J. (2016). Bereavement through substance use: Findings from an interview study with adults in England and Scotland. *Addiction Research & Theory*, 24(5), 341-354.
- Thomas Roger, E., Lorenzetti, D., & Spragins, W. (2011). Mentoring adolescents to prevent drug and alcohol use. *Cochrane Database of Systematic Reviews*(11). <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007381.pub2/abstract>



- Tuong, W., Larsen, E. R., & Armstrong, A. W. (2014). Videos to influence: a systematic review of effectiveness of video-based education in modifying health behaviors. *J Behav Med*, 37(2), 218-233. <https://doi.org/10.1007/s10865-012-9480-7>
- Van Ryzin, M. J., Fosco, G. M., & Dishion, T. J. (2012). Family and peer predictors of substance use from early adolescence to early adulthood: An 11-year prospective analysis. *Addictive Behaviors*, 37(12), 1314-1324.
- Wang, R. J., Wang, T. Y., Ma, J., Liu, M. X., Su, M. F., Lian, Z., Shi, J., Lu, L., & Bao, Y. P. (2017). Substance use among young people in China: a systematic review and meta-analysis. *The Lancet*, 390, S14. [https://doi.org/https://doi.org/10.1016/S0140-6736\(17\)33152-5](https://doi.org/https://doi.org/10.1016/S0140-6736(17)33152-5)
- Young, R. M., Gullo, M. J., Feeney, G. F., & Connor, J. P. (2012). Development and validation of the Cannabis Refusal Self-Efficacy Questionnaire (CRSEQ) in adult cannabis users in treatment. *Drug And Alcohol Dependence*, 125(3), 244-251.
- Yu, J., Wu, Q., Wu, Y., Li, J., Wu, Q., Cao, H., & Wang, Z. (2021). Prevalence of and Factors Associated with Club Drug Use among Secondary Vocational Students in China. *Int J Environ Res Public Health*, 18(19). <https://doi.org/10.3390/ijerph181910408>
- Yu, Y., Mo, P. K., Zhang, J., Li, J., & Lau, J. T. (2022). Maladaptive cognitions, loneliness, and social anxiety as potential moderators of the association between Internet gaming time and Internet gaming disorder among adolescent Internet gamers in China. *Addictive Behaviors*, 107239.

**Appendix 1: Theoretical framework of the Theory of Planned Behavior**



## **Appendix 2: Details and training about MI**

### Background of Motivational Interviewing

Motivational Interviewing (MI) is first developed based on the clinical experience of alcoholism treatment described by Miller (1983) and it is a client-centered counseling technique (1). Miller and Rollnick (2002) defined MI as client-centred, directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence (2). The focus of MI is on eliciting the person's intrinsic motivation for change. Counsellors focus on the concerns and perspectives of the individual, exploring ambivalence, and selectively response to speech in a way that resolves ambivalence and moves the person toward change.

### Practice of MI

MI is ways of being with people. Four fundamental spirits lie in understanding and experiencing the human nature in the process of MI (2).

*Collaboration.* Counselling involves a partnership that honors the client's expertise and perspectives. The counsellor provides an atmosphere that is conducive rather than coercive to change (2,3).

*Evocation.* The resources and motivation for change are presumed to reside within the client. Intrinsic motivation for change is enhanced by drawing on the client's own perceptions, goals and values (2).

*Acceptance.* The counsellor accepts what the client brings but not necessarily approved of the client's actions or acquiesce to the status quo. Acceptance in here includes four aspects, 1) absolute worth, 2) affirmation, 3) autonomy, and 4) accurate empathy. The counsellor affirms the client's right and capacity for self-direction and facilitates informed choice. Because MI assumes that the clients have what they need for change, counsellor respects client's autonomy to choose whether, when and how to change (2).

*Compassion.* MI practice is more than just skills but also not to pursuit self-interest whilst drawing out the client's motivation to change. Therefore, MI requires counsellor to have their heart in the right place so that the trust the counsellor engender will be deserved (2).

Under these general spirits, four principles guide counsellors toward greater specificity of the practice of MI (2).

*Express empathy.* Clients' ambivalence is normal. Counsellors' acceptance facilitates clients' changes. Skilful reflective listening is fundamental technique to express empathy (2).

*Develop Discrepancy.* The client rather than the counsellor should present the arguments for change. Change is motivated by a perceived discrepancy between present behavior and important personal goals or values (2). Counsellor evokes a "change talk"- expressions of the client's desire, ability, reasons and need for change- and give periodic reflective summary to the clients which creates discrepancy between patient's present behaviours and their important current/future goals. As suggested by the Bem's self-perception theory (4), clients' commitment to the changes will be strengthened when they hear their self-statement of changes in the "change talk" and the reflective summary from counsellors.

*Roll with resistance.* The client is a primary resource in finding answers and solutions. Counsellor avoids arguing for client's change. Client's resistance is a signal for counsellor to respond differently. So, client's resistance to change is not directly opposed. Instead of directly oppose or impose, counsellor invites client for new perspectives (2).

*Support self-efficacy.* A person's belief in the possibility of change is an important motivator. The client, not the counsellor, is responsible for choosing and carrying out change. The counsellor own belief in the person's ability to change becomes a self-fulfilling prophecy (2).

The process of MI can be conceptualized as two phases, with somewhat different, albeit overlapping. Phase 1 involves resolve ambivalence and building intrinsic motivation for change; phase 2 involves strengthening commitment to change and develop a plan to accomplish it. In phase 1, common MI techniques include asking open-end questions, reflective listening, affirmation, summary statement and eliciting change talk. The counsellor can make transition from phase 1 to phase 2 through recapitulation of phase 1, asking key questions, giving information and advice. In phase 2, the counsellor can help client to set goal, consider change options, arrive at a plan, and elicit his/ her commitment (2).

### Clinical Application of MI

MI is especially effective to two different types of clients: less motivated clients and oppositional/angry clients (5). MI invites the less motivated clients to contemplate their current situation and lead them to prepared for changes. In clinical practice, resistance is common especially when therapists provide a clear direction of changes to oppositional/angry clients. However, MI emphasizes the self-efficacy of the clients and provides them room to make decision and plan for their changes. Thus, it would lower their resistance.

MI has been found effective to reduce illicit drug use, alcohol consumption, and tobacco use (2, 5-7). Applications of MI to health behavior have been expanding rapidly, with trials showing effects in improving health outcomes (5). MI has been showed useful in promoting physical health including improvement on body mass index, promotion of physical exercise

and healthy diet, reduction in blood pressure and cholesterol, changing diet behavior, adherence to medical treatment and medication, as well as risky sexual behaviors (8-17).

### Brief Adaptation of Motivational Interviewing

Adaptation of MI is efficacious, both as stand-alone treatments and as preludes to other treatments, in studies of addictive behaviours, health behaviours and treatment adherence (2, 5). There are many studies documenting that MI of about 15 minutes have shown to be effective in change health-related behaviors such as smoking, drinking (8, 18-19). Adapted MI through phone has been used successful to promote health lifestyle and treatment engagement (20, 21).

The goals of brief adaptation of MI include demonstrating respect, communicating risk, and providing information to initiate a behaviour change sequence. The interviewing styles are sometimes empathic, confrontational or challenging. This style is appropriate for active expert counsellor to passive client. In brief adaptation of MI, provide advice (often about risk) is the most essential skill. Counsellors may ask open-ended questions, affirm, ask permission, encourage recipient choice and responsibility in decision making in the practice of brief MI. Summaries, reflective listening statement, elicit change talk, roll with resistance and articulate deeply held values are less essential in a brief adaptation.

#### Reference:

1. Miller, W.R. (1983). Motivational interviewing with problem drinkers. *Behavioural Psychotherapy*, 11: 147-172.
2. Miller, W. R., & Rollnick, S. R. (2013). *Motivational Interviewing: Helping People Change (3<sup>rd</sup> Ed)*. The Guilford Press, New York
3. Britt, E., Hudson, S.M., Blampied, N.M. (2004). Motivational interviewing in health settings: a review. *Patient Education and Counseling*, 53, 147-155.
4. Bem, D.J. Self-perception theory. In: Berkowitz, L., editor. *Advances in experimental social psychology*. Vol. Vol. 6. New York: Academic Press; 1972. p. 1-62.
5. Hettema, J., Steele, J., Miller, W.R. (2005). Motivational interviewing. *Annual Review Clinical Psychology*, 1:91-111.
6. Lundahl, B., Burke, B. R. (2009). The effectiveness and applicability of motivational interviewing: practice-friendly review of four meta-analyses. *Journal of Clinical Psychology*, 65 (11), 1232-1245.
7. Gilder DA. Luna JA. Calac D. Moore RS. Monti PM. Ehlers CL. Acceptability of the use of motivational interviewing to reduce underage drinking in a Native American community. *Substance Use & Misuse*. 46(6):836-42, 2011.
8. Rubak, S., Sandbak, A., Lauritzen, T., Christensen, B. (2005). Motivational interviewing: a systematic review and meta-analysis. *British Journal of General Practice*, 55: 305-312.
9. Macdonell K. Brogan K. Naar-King S. Ellis D. Marshall S. A pilot study of motivational interviewing targeting weight-related behaviors in overweight or obese African American adolescents. *Journal of Adolescent Health*. 50(2):201-3, 2012 Feb.
10. Miller ST. Marolen KN. Beech BM. Perceptions of physical activity and motivational interviewing among rural African-American women with type 2 diabetes. *Womens Health Issues*. 20(1):43-9, 2010 Jan-Feb.
11. Bennett JA. Lyons KS. Winters-Stone K. Nail LM. Scherer J. Motivational interviewing to increase physical activity in long-term cancer survivors: a randomized controlled trial. *Nursing Research*. 56(1):18-27, 2007 Jan-Feb.

12. Olsen S. Smith SS. Oei TP. Douglas J. Motivational interviewing (MINT) improves continuous positive airway pressure (CPAP) acceptance and adherence: a randomized controlled trial. *Journal of Consulting & Clinical Psychology*. 80(1):151-63, 2012 Feb.
13. Laakso LJ. Motivational interviewing: addressing ambivalence to improve medication adherence in patients with bipolar disorder. *Issues in Mental Health Nursing*. 33(1):8-14, 2012 Jan.
14. Bredie SJ. Fouwels AJ. Wollersheim H. Schippers GM. Effectiveness of Nurse Based Motivational Interviewing for smoking cessation in high risk cardiovascular outpatients: a randomized trial. *European Journal of Cardiovascular Nursing*. 10(3):174-9, 2011 Sep.
15. Harris KJ. Catley D. Good GE. Cronk NJ. Harrar S. Williams KB. Motivational interviewing for smoking cessation in college students: a group randomized controlled trial. *Preventive Medicine*. 51(5):387-93, 2010 Nov.
16. Hides LM. Elkins KS. Scaffidi A. Cotton SM. Carroll S. Lubman DI. Does the addition of integrated cognitive behaviour therapy and motivational interviewing improve the outcomes of standard care for young people with comorbid depression and substance misuse? *Medical Journal of Australia*. 195(3):S31-7, 2011 Aug 1.
17. Petersen R. Albright J. Garrett JM. Curtis KM. Pregnancy and STD prevention counseling using an adaptation of motivational interviewing: a randomized controlled trial. *Perspectives on Sexual & Reproductive Health*. 39(1):21-8, 2007 Mar.
18. D'Amico EJ. Miles JN. Stern SA. Meredith LS. Brief motivational interviewing for teens at risk of substance use consequences: a randomized pilot study in a primary care clinic. *Journal of Substance Abuse Treatment*. 35(1):53-61, 2008 Jul.
19. Bernstein J. Heeren T. Edward E. Dorfman D. Bliss C. Winter M. Bernstein E. A brief motivational interview in a pediatric emergency department, plus 10-day telephone follow-up, increases attempts to quit drinking among youth and young adults who screen positive for problematic drinking. *Academic Emergency Medicine*. 17(8):890-902, 2010 Aug
20. Keulen HM, Mesters I, Ausems M, Breukelen G, Campbell M et al. Tailored print communication and telephone motivational interviewing are equally successful in improving multiple lifestyle behaviours in a randomized controlled trial. *Ann Behav Med*. 2011; 41: 104-118
21. Seal KH, Abadjian L, McCamish N, Shi Y, Tarasovsky G et al. A randomized controlled trial of telephone motivational interviewing to enhance mental health treatment engagement in Iraq and Afghanistan veterans. *Gen Hosp Psychiat*. 2012; 34(5): 450-459

### Appendix 3: Background and application of the Secondary Prevention Screening Index (SPSI)

#### Introduction

SPSI is a screening tool which can be used to identify high-risk secondary students who have ever used psychoactive substances or intend to do so in the future. It was based on the information obtained from literature review and a large-scale survey conducted among secondary school students, whose information can be imputed into a statistical formula to derive a SPSI score. The information involves 29 variables, including demographic factors (e.g. age, housing type), other risk behaviors (e.g. whether smoke or drink alcohol currently), perception of using psychoactive substances (e.g. perceived benefits of psychoactive substances), behavioral problems (e.g. ever being bullied by classmate etc.), peer influence, support from parents, and academic aspiration (see Table 1). Students scoring above the cut-off of 0.017 are classified as a high-risk case for substance use, or vice versa as a low-risk case. The screening tool can be used to recruit participations to join secondary intervention programs for prevention of psychoactive substance use among high risk secondary school students.

The items for calculation of the SPSI score are listed in Table 1. The formula for calculation of SPSI score is as below:

$$SPSI\ score = \frac{1}{1 + e^{-(-7.7857 + q1 + q2 + \dots + q29)}}$$

The formula is based on the predicted conditional probability for an event to occur, which was obtained by a multiple logistic regression model, given characteristics based on students' answers to the question items involved (Rosner, 2005). The figures shown in the denominators are determined by choosing the appropriate coefficient of the logistic regression model for specific item responses given by students.

In our case, there are 29 question items involved (q1 to q29) and they are listed in Table 1. The values for these 29 question items for imputation are also listed in Table 1. The values vary from students to students, depending on their answers given to the 29 questions. Examples for imputation are given in the footnotes of Table 1.

Table 1 Values for imputation into the formula to obtain SPSI score

Question item	Description and response categories	Value to be selected for imputation into statistical formula according to the student's characteristics†
<u>Socio-demographic backgrounds</u>		
q1	<u>Participant's age</u>	
	below 12	0
	12-12.9	4.6180
	13-13.9	4.4795
	14-14.9	4.0521
	15-15.9	4.0777
	16-16.9	3.5901
	17-17.9	4.3901
	18-18.9	4.2816
19 or above	0.4444	
q2	<u>Housing</u>	
	Public Housing	0
	Home ownership scheme housing	-0.0581
	Private housing	0.2028
	Temporary housing	-0.3544
	Other types of housing	0.4266
q3	<u>Living arrangement</u>	
	Living with both parents	0
	Living with either father or mother	0.3131
	Living with neither father nor mother	-1.0767
q4	<u>Either father or mother was deceased</u>	
	No	0
	Yes	0.3840
q5	<u>Alcohol consumption in the past 30 days</u>	
	No	0
	Yes	-0.3225
q6	<u>Smoking in the past 30 days</u>	
	No	0
	Yes	0.7679
q7	<u>Friend(s) often use psychoactive substances</u>	
	No	0
	Yes	0.6667
q8	<u>Family members/Relatives often use psychoactive substances</u>	
	No	0
	Yes	-0.5264
q9	<u>Perception of "people taking psychoactive substances occasionally"</u>	
	Absolutely disapprove	0



Table 1 Values for imputation into the formula to obtain SPSI score

Question item	Description and response categories	Value to be selected for imputation into statistical formula according to the student's characteristics†
	Slightly disapprove	0.5998
	Slightly approve	1.0039
	Absolutely approve	0.8316
q10	<u>Perception of "people taking psychoactive substances regularly"</u>	
	Absolutely disapprove	0
	Slightly disapprove	0.4095
	Slightly approve	-0.2249
	Absolutely approve	0.7218
q11	<u>Perceived accessibility of psychoactive substances</u>	
	Never think of getting psychoactive substances	0
	Very difficult	1.9714
	Difficult	1.7590
	Easy	1.2555
	Very easy	1.1109
q12	<u>Taking psychoactive substances is harmful to health</u>	
	Agree	0
	Disagree	1.1370
q13	<u>Psychoactive substances-abuse destroys one's future</u>	
	Agree	0
	Disagree	0.1454
q14	<u>Current anti-psychoactive substances publicity can prevent drug use</u>	
	Agree	0
	Disagree	0.1843
q15	<u>Young people should try different things</u>	
	Agree	0
	Disagree	-0.8082
q16	<u>It is fine to get along with those who are abusing psychoactive substances</u>	
	Agree	0
	Disagree	0.0494
q17	<u>Taking psychoactive substances is a hobby like smoking</u>	
	Agree	0
	Disagree	0.5693
q18	<u>He/she can control psychoactive substances taking habit to make substance use not addictive</u>	

Table 1 Values for imputation into the formula to obtain SPSI score

Question item	Description and response categories	Value to be selected for imputation into statistical formula according to the student's characteristics†
	Agree	0
	Disagree	-0.4732
q19	<u>Ever being bullied by schoolmates/classmates</u>	
	No	0
	Yes	-0.1529
q20	<u>Ever involved in Triad society</u>	
	No	0
	Yes	0.6552
q21	<u>Ever playing truant</u>	
	No	0
	Yes	0.2195
q22	<u>Do not have any behavioural problems</u>	
	No	0
	Yes	-0.2325
q23	<u>Perceived peer influence</u>	
	Very small	0
	Small	-0.6663
	Medium	-0.2780
	Large	-0.1847
	Very large	-0.1609
q24	<u>Their parents don't really understand them</u>	
	Disagree	0
	Slightly disagree	0.3109
	Slightly agree	0.4703
	Agree	0.4952
q25	<u>Their parents are not willing to listen to their problems</u>	
	Disagree	0
	Slightly disagree	-0.3342
	Slightly agree	-0.2107
	Agree	-0.1242
q26	<u>Their parents value them very much</u>	
	Disagree	0
	Slightly disagree	-0.5451
	Slightly agree	-0.7843
	Agree	-0.7587
q27	<u>Their parents are satisfied with the way they are</u>	
	Disagree	0
	Slightly disagree	-0.1522

Table 1 Values for imputation into the formula to obtain SPSI score

Question item	Description and response categories	Value to be selected for imputation into statistical formula according to the student's characteristics†
	Slightly agree	-0.1334
	Agree	0.3017

Perceived benefits of substances use

<i>q28</i>	<p><u>Perceived benefits of substances use scoring</u>  Mean score of the following items (Range: 1-4):</p> <p>(1) <i>Taking psychoactive substances makes me happy</i></p> <p>(2) <i>Taking psychoactive substances releases my pressure</i></p> <p>(3) <i>Taking psychoactive substances makes me and my friends closer</i></p> <p>(4) <i>I can get rid of unhappy feelings when taking psychoactive substances</i></p>	0.3757 * mean score‡
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Academic aspiration

<i>q29</i>	<p><u>Academic aspiration scoring</u>  Mean score of the following items (Range: 1-4):</p> <p>(1) <i>I am interested in attending more school</i></p> <p>(2) <i>I am willing to work hard in order to get more education</i></p> <p>(3) <i>One of my most important goals is to get more education</i></p> <p>(4) <i>I would put effort into a school if it would lead to a good job</i></p>	-0.4296 * mean score‡
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† For example, if a student aged 12.5 and lived in public housing, the value of *q1* and *q2* will be assigned as 4.6180 and 0 respectively

‡ Take *q28* as an example, if the mean score is  $(1+1+2+2)/4 = 1.5$ , the value of *q28* will be  $0.3757 * 1.5 = 0.56355$

Reference:

Rosner, B (2005). Fundamentals of Biostatistics (6<sup>th</sup> edition). Wadsworth Publishing Co Inc