Suicidality Among Young Adolescents in Secondary Schools in Hong Kong

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Abstract

Background:

Despite concerted effort in suicide research and prevention across countries, youth suicide remains a significant public health concern in Hong Kong and nationwide. This study examined the prevalence and correlates of suicidality among secondary school students in Hong Kong.

Methods:

Data were derived from the 2016 Youth Sexuality Survey initiated by the Family Planning Association of Hong Kong using a stratified random sample of 3,672 secondary school students aged 12 to 18 years in Hong Kong. Suicidality was measured in four progressive levels (suicidal ideation, suicidal plan, suicidal attempts and suicidal attempts requiring medical attention). Multivariable cumulative logit model analysis was used to identify significant risk factors of suicidality.

Results:

Female students reported more suicidality than their male counterparts (28.0% versus 17.0%, respectively). Multivariable cumulative logit model analysis showed that female gender, age, unhappy school life, disharmony with classmates, unhappy family life, living with mother, acceptance of mothers' discipline, not sleeping for more than 9 hours on weekdays, alcohol consumption, non-suicidal self-injury, and dissatisfaction with life were significantly associated with suicidality.

Limitations:

Due to cross-sectional design, causality between suicidality, individual psychosocial and psychological characteristics cannot be established.

Conclusions:

Suicidal behaviour among Chinese young adolescents remains prevalent in Hong Kong. Family disintegration, school-related problems, and life satisfaction are significant predictors of suicidal behaviour in this study. There is a pressing need to restore optimal mental health among youth adolescents via interdisciplinary collaboration among schools, healthcare providers, stakeholders and mental health experts. The involvement of stakeholders in the community in suicide research and prevention is pivotal in mental health promotion for young adolescents.

1. Background

In 2019, the population of Hong Kong was 7.49 million, which ranks 104th in the world and was one of most densely population society with more than 10,000 living in an area of 1 square kilometre (1). The overall suicide rate in Hong Kong has reduced from its historical high of 18.6 per 100,000 in 2003 to 12.4

per 100,000 in 2016. However, the suicide rate among youth aged 15 and 24 years has shown an increase from 8.3% in 2012 to 9.5% in 2016 (2).

Youth suicide and non-suicidal self-injury (NSSI) are major public health problems in adolescents, with rates of NSSI being high in the teenage years and suicide being the second-most common cause of death in young people nationwide (3, 4). NSSI behaviours refer to intentional self-poisoning or self-injury, irrespective of the type of motive or the extent of suicidal intent (5). Although variation exists in international studies, findings from many community-based studies show that approximately 10% of adolescents report having self-harmed, some of whom will report a degree of suicidal intent underpinning their self-injury (6).

Poor family relationships, poor peer relationships, and poor boy-girl relationships, along with poor academic performance, are the most common risk factors for youth suicide (7). Critical negative life events (e.g., parental divorce/separation, child abuse) and life stressors (e.g., loss of a parent, bereavement, critical illnesses), family disintegration and adversity, and presence of psychopathology (e.g., substance use disorder, mood disorders, major depressive disorder) within the family also contribute to higher risks of suicidality among youth adolescents (8). Childhood adversity is a risk factor for suicide in adolescence and young adulthood (9) and is denoted by a range of indicators, such as parental separation or divorce, single parenthood, substance abuse, childhood poverty, and parental psychopathology (10). Exposure to childhood adversity was positively associated with the risk of NSSI in young adulthood (11).

Suicide is a complex phenomenon and is multi-faceted. Suicidal behaviours can be conceptualized as a spectrum of self-destructive behaviours. In this study, suicidal ideation and behaviour were conceptualized in four progressive levels—having suicidal ideation, making plans for a suicide attempt, having attempted suicide, and having made an injurious attempt that required medical attention (12).

This paper reports the prevalence of suicidal behaviour in a territory-wide sample of secondary school students in Hong Kong. Ideators and attempters were also asked to explain the reasons for their suicidal behaviour so that we can corroborate our quantitative findings with participants' narrative perspectives towards suicidality.

2. Method

2.1. Data

In 2016, the Family Planning Association of Hong Kong conducted the Youth Sexuality Survey (YSS), which included four questions on suicidal behaviours. A random stratified sample of all Form 1 to Form 6 students enrolled in day school (equivalent to grades 7 to 12 in the U.S. education system) was used. School class was used as the sampling unit, and the sample was stratified by school type and education level. The sample was representative of the Form 1 to Form 6 student population in Hong Kong.

2.2 Ethics and Consent to Participate

Consent was sought from schools before students participated in this study. The Family Planning Association of Hong Kong assisted in the operation of the study and thus, ethics approval was waived by the Human Research Ethics Committee of the University of Hong Kong, Hong Kong. All students were informed about the objectives of this study, and participation was voluntary. Students were assured of the anonymity and confidentiality of this study. Data collection spanned from October 2016 to December 2016.

A total of 3,672 students participated in this study, which yielded a valid response of 98.6% (2,035 boys and 1,587 girls); the mean age was 15.26 years (SD: 1.92).

2.3 Measures

Participants were invited to complete a questionnaire written in Chinese in the classrooms, with minimal interference from the teacher.

Suicidality. Suicidality was measured by four progressive levels: 1) suicidal ideation, 2) suicidal plans, 3) suicidal attempts, and 4) injurious attempts that required medical attention.

Questions were constructed as follows:

1.
During the past 12 months, did you seriously consider suicide?
2.
During the past 12 months, did you make a plan about how you would attempt suicide?
3.
During the past 12 months, how many times did you actually attempt suicide?
4.
During the past 12 months, did you make any suicidal attempt that resulted in an injury that required treatment by medical personnel?

2.4 Individual factors

Sociodemographic data were obtained, including gender, age, educational level, academic performance, relationship with classmates, satisfaction with school life and some lifestyle questions, including weekly frequency of having breakfast and dinner with family, physical activity and sleep duration on weekdays and weekends. For breakfast and dinner practices with family, responses were categorized as 1) eating 0 days; 2) not eating daily; and 3) eating daily. Physical activity was measured on weekdays and weekends and was categorized as 1) no activity, 2) > 1 hour, and 3) < 1 hour. Sleep duration was also measured on weekdays and weekends and was categorized as 1) 6–8 hours daily, 2) $\leq$ 5 hours, and 3) $\geq$ 9 hours daily.

2.5 Family factors

Information was collected on students' living circumstances, relationships with parents, attitudes towards parents' discipline and satisfaction towards family life, as well as on parents' marital status and educational background.

2.6 Substance use

Students were asked whether (yes or no) and how often (1: no smoking; 2: smoking daily) they smoked cigarettes or e-cigarettes. They were also asked about alcohol consumption (1: no alcohol consumption; 2: daily to a few times a week; 3: once a week) and the inhalation or ingestion of illicit drugs or substances (yes/no) in the past month.

2.7 Social support

Students were asked how many best friends they had with whom they could talk about their thoughts when necessary.

2.8 Life Satisfaction Scale

A five-item statement was used to measure global cognitive judgements of students' life satisfaction on a 7-point Likert scale, ranging from 1 "strongly disagree" to 7 "strongly agree". The total score of life satisfaction was the sum of the scores on all five items. The cut-off points for this scale were as follows: 5–9 as "very dissatisfied", 10–14 as "dissatisfied", 15–19 as "slightly dissatisfied", 20 as "average", 21–25 as "slightly satisfied", 26–30 as "satisfied", and 31–35 as "very satisfied". The life satisfaction score was coded as 'satisfied' and 'not satisfied' before it was entered into the univariate analysis. The Life Satisfaction Scale has excellent internal consistency (Cronbach's alpha = 0.93).

The items in the Life Satisfaction Scale were as follows:

- 1: I am largely satisfied with my life
- 2: I am very satisfied with my life
- 3: I am satisfied with my life
- 4: Thus far, I have what I want in my life
- 5: If I were to start my life again, I don't have any changes I want to pursue

3. Statistical Analysis

To identify the associated risk factors for ideators and attempters, multivariable logistic regression was used. Specifically, students who reported suicidal ideation and/or those who had planned suicide were classified as ideators. Regardless of those reporting ideation, those who had attempted and/or had received medical attention were classified as attempters. The four groups were collapsed into two categories in the logistic regression using the backward elimination method. The effects of the significant

risk factors were reported as odds ratios. Cumulative logit modelling was then used to identify the risk factors that were associated with an increased risk of suicidality. The cumulative logit model utilized parsimony and power (13). The four questions on suicide described the severity continuum of suicidal behaviour on adolescents, and thus, instead of collapsing different responses from the four questions on suicide, the cumulative logit model utilized all the information yielded from the four questions on suicide.

4. Results

4.2 Prevalence rate of suicidality among young adolescents in secondary schools in Hong Kong

The prevalence rates of suicidal ideation and behaviour among secondary school students in this study were 16.1% (considered), 0.1% (planned), 5.0% (attempted suicide) and 0.6% (attempted once or more, requiring medical attention) in 2016. Among female students, the prevalence rates were 19.8%, 0.1%, 7.3%, and 0.8%, respectively. Among male students, the prevalence rates were 13.2%, 0.1%, 3.4%, and 0.3%, respectively. Table 1 reports the prevalence rate of suicidality with mutually exclusive categories. Twenty-two percent (95% CI = 0.20, 0.23) had some levels of suicidal ideation or behaviour. More female students reported suicidal ideation and attempted suicide. Male and female students were equally likely to have a suicidal plan.

Table 1
Prevalence Rate of Suicidality (%) Among F3–F7 Students by Gender–Mutually Exclusive

	Male n = 2,035	Female n = 1,587	Total n = 3,622
1. No suicidal tendency	83.0	72.0	78.2
2. Suicidal ideation	13.2	19.8	16.1
3. Made a plan about how to attempt suicide	0.1	0.1	0.1
4. Attempted suicide	3.4	7.3	5.0
5. Made at least one injurious attempt that required medical attention	0.3	0.8	0.6
6. Had any suicidal ideation or attempt (categories 2–5 above)	17.0	28.0	21.8
Note: The categories are mutually exclusive. Cases are assigned according to the highest level of suicidal behaviour reported.			

4.3 Multivariable Logistic Regression

As previously mentioned, ideators were defined as those who had considered and/or made a plan or attempted suicide in the last 12 months (categories 2 and 3 in Table 1), and attempters were defined as

those who had ever made an attempt in the last 12 months (categories 4 and 5 in Table 1). Using the backward elimination method, four sets of significant risk factors were identified: attempters versus ideators; ideators versus the non-suicidal group; attempters versus the non-suicidal group; and suicidal ideators or attempters versus the non-suicidal group. The Nagelkerke R square was 27%, 33%, 51% and 40%, respectively (Table 2).

Table 2 shows that there were more significant associations between individual factors and suicidal ideation (Column 2) and fewer risk factors associated with suicide attempts (Column 3). The results in Table 2 suggest that there were some overlaps in the profile of ideators and attempters. Compared with the non-suicidal group, both groups were likely to be male, have unhappy relationships with classmates, drink alcohol daily to a few times a week or once a week, have non-suicidal injury and be dissatisfied with life. Nevertheless, there were also some differences in the profiles of ideators and attempters. Attempters were more likely to have bad relationships with parents, especially with mothers. These factors, however, did not significant correlate with ideation. Being younger in age (particularly between ages 13 and 15), having mothers who were less educated, having non-accepting attitudes towards mothers' discipline, and sleeping for less than 5 hours on weekdays and weekends were significant correlated with suicidal ideation.

By examining the risk factors distinguishing attempters and ideators, as shown in Column 1 of Table 2, attempters were likely to be junior secondary school students (in particular, those in Forms 1 and 2 were at higher risk than those in Form 3 or above; OR = 3.45, CI = 1.64, 7.44 and OR = 2.92, CI = 1.39, 6.25, respectively), have an unhappy school life (OR = 1.08, CI = 0.58, 1.98), have 1 or 2 best friends (OR = 1.09, CI = 0.54, 2.18 and OR = 1.19, CI = 0.67, 2.10 respectively) and not have breakfast with their family daily (OR = 0.49, CI = 0.27, 0.86) or not have breakfast at all (OR = 0.98, CI = 0.64, 1.48).

Table 2. Significant Risk Factors Among Hong Kong Students with Suicidal Ideation, Suicide Attempts, and Suicidal Ideation and/or Attempts

	Attempts vs. ideation	Ideation vs. none	Attempts vs. none	Ideation or attempts vs. none
Male ^a	0.67 (0.45, 0.99)	0.51(0.42, 0.63)	0.41 (0.27, 0.59)	0.49 (0.40, 0.59)
Age ^b				
12 or below		1.97 (1.16, 3.33)		2.04 (1.28, 3.25)
13		2.49 (1.55, 4.02)		2.70 (1.77, 4.12)
14		2.44 (1.62, 3.71)		2.28 (1.56, 3.35)
15		1.99 (1.32, 3.03)		2.00 (1.37, 2.95)
16		1.87 (1.26, 2.81)		1.82 (1.27, 2.65)
17		1.87 (1.25, 2.83)		1.90 (1.30, 2.78)
Education level ^c				
Form 5	1.46 (0.74, 2.95)			1.35 (0.67, 2.71)
Form 4	1.59 (0.80, 3.24)			1.53 (0.77, 3.10)
Form 3	1.37 (0.67, 2.84)			1.32 (0.66, 2.71)
Form 2	2.92 (1.39, 6.25)			2.67 (1.30, 5.58)
Form 1	3.45 (1.64, 7.44)			2.27 (1.11, 4.75)
School life ^d				

Remarks: All odds ratios have a p-value < 0.05. Odds ratios (95% CI) estimated from a multivariate binary logistic model using backward elimination. ^a Male; ^b 18 or above; ^c Form 6; ^d Fair; ^e Fair; ^f ≥ 5 best friends; ^g Tertiary; ^h Average; ⁱ Average; ^j Neutral; ^k Not daily; ^l 6–8 hours; ^m No alcohol consumption; ⁿ Satisfied with life.

Table 2. Significant Risk Factors Among Hong Kong Students with Suicidal Ideation, Suicide Attempts, and Suicidal Ideation and/or Attempts				
Happy	0.59 (0.39, 0.89)			
Unhappy	1.08 (0.58, 1.98)			
Relationship with classmates ^e				
Happy		0.70 (0.56, 0.89)	0.48 (0.32, 0.73)	0.67 (0.54, 0.82)
Unhappy		1.88 (0.99, 3.52)	1.73 (0.67, 4.20)	1.97 (1.11, 3.49)
No. of best friends ^f				
1	1.09 (0.54, 2.18)			
2	1.19 (0.67, 2.10)			
3	1.05 (0.59, 1.88)			
4	0.75 (0.36, 1.49)			
Mother's educational level ^g				
Not educated	0.94 (0.12, 5.01)	0.49 (0.17, 1.27)		
Primary	2.28 (1.05, 5.18)	0.82 (0.56, 1.21)		
Secondary	2.08 (1.07, 4.29)	0.74 (0.54, 1.01)		
Unknown	1.12 (0.51, 2.55)	0.69 (0.48, 0.99)		
Relationship with parents ^h				
Good			1.38 (0.85, 2.27)	
Remarks: All odds ratios have a p-value < 0.05. Odds ratios (95% CI) estimated from a multivariate binary logistic model using backward elimination. ^a Male; ^b 18 or above; ^c Form 6; ^d Fair; ^e Fair; ^f ≥ 5 best friends; ^g Tertiary; ^h Average; ⁱ Average; ^j Neutral; ^k Not daily; ^l 6–8 hours; ^m No alcohol consumption; ⁿ Satisfied with life.				

Table 2. Significant Risk Factors Among Hong Kong Students with Suicidal Ideation, Suicide Attempts, and Suicidal Ideation and/or Attempts			
Bad		2.04 (1.12, 3.67)	
Relationship with mother ⁱ			
Good		0.82 (0.50, 1.34)	
Bad		2.98 (1.34, 6.51)	
Acceptance of mother’s discipline ^j			
Accept	0.60 (0.48, 0.76)	1.32 (0.96, 1.82)	
Not accept	1.40 (0.99, 1.97)	0.62 (0.50, 0.77)	
Breakfast with family ^k			
Daily	0.49 (0.27, 0.86)		
None	0.98 (0.64, 1.48)		
Sleep duration on weekdays ^l			
≤ 5 hours daily	1.47 (1.08, 1.99)		
≥ 9 hours daily	0.69 (0.47, 0.98)		
Sleep duration on weekends ^l			
≤ 5 hours daily	2.96 (1.52, 5.82)	0.42 (0.24, 0.70)	
≥ 9 hours daily	0.87 (0.58, 1.31)	0.94 (0.75, 1.17)	

Remarks: All odds ratios have a p-value < 0.05. Odds ratios (95% CI) estimated from a multivariate binary logistic model using backward elimination. ^a Male; ^b 18 or above; ^c Form 6; ^d Fair; ^e Fair; ^f ≥ 5 best friends; ^g Tertiary; ^h Average; ⁱ Average; ^j Neutral; ^k Not daily; ^l 6–8 hours; ^m No alcohol consumption; ⁿ Satisfied with life.

Table 2. Significant Risk Factors Among Hong Kong Students with Suicidal Ideation, Suicide Attempts, and Suicidal Ideation and/or Attempts				
Alcohol consumption ^m				
Daily to a few times a week		1.42 (0.88, 2.23)	4.17 (2.24, 7.65)	1.71 (1.15, 2.51)
Once a week		1.73 (1.39, 2.16)	1.63 (1.07, 2.48)	1.76 (1.44, 2.16)
Non-suicidal injury ⁿ				
Yes	4.74 (3.25, 6.97)	4.65 (3.46, 6.24)	18.87 (12.76, 28.11)	6.83 (5.29, 8.86)
Satisfaction with life score ^o		0.94 (0.92, 0.95)	0.91 (0.88, 0.94)	0.93 (0.92, 0.95)
Nagelkerke R ²	27%	33%	51%	40%
Remarks: All odds ratios have a p-value < 0.05. Odds ratios (95% CI) estimated from a multivariate binary logistic model using backward elimination. ^a Male; ^b 18 or above; ^c Form 6; ^d Fair; ^e Fair; ^f ≥ 5 best friends; ^g Tertiary; ^h Average; ⁱ Average; ^j Neutral; ^k Not daily; ^l 6–8 hours; ^m No alcohol consumption; ⁿ Satisfied with life.				

4.4 Cumulative Logit Modelling

Cumulative logit modelling was used to examine the risk factors associated with increasing levels of suicidality.

4.4.1 Univariate analysis

A univariate cumulative logit model was used to examine the individual variables associated with suicidality. As previously mentioned, suicidality was measured at five progressive levels: During the last 12 months, the respondent had 1) no suicidal tendency; 2) considered suicide; 3) made plan(s) about how to attempt suicide; (4) attempted suicide; and (5) made an injurious attempt that required medical attention.

Table 3 reports the unadjusted odds ratios estimated from the univariate analysis. Age below 13 and 17 years old, educational level, living with fathers/stepmothers/others, parents' educational level, physical activity for more than 1 hour on weekdays and weekends, and sleep duration on the weekends were insignificant in relation to suicidality. Students who were female, who were between 14–16 years old, who had an unhappy school life, who had poor relationships with classmates, who had less than 4 best friends, and who were dissatisfied with their academic performance. Family dynamic factors (including living with a single parent or mother and stepfather), having a poor relationship with parents, having an unhappy family life, not accepting parents' discipline, not having breakfast or dinner daily or having none

at all, having no physical activity on weekends, sleeping for less than 5 hours on weekdays, smoking daily with alcohol consumption, engaging in substance use, engaging in non-suicidal self-injury and being dissatisfied with life were significantly associated with increasing levels of suicidality.

Table 3. Unadjusted Odds Ratios Estimated from the Cumulative Logit Modelling of Individual Risk Factors with Suicidality

Variables	OR (95% CI)
Male ^a	0.52 (0.45,0.61)***
Age group ^b	
12 or below	1.28 (0.93, 1.76)
13	1.31 (0.97, 1.79)
14	1.43(1.05, 1.98)*
15	1.50 (1.10, 2.06)**
16	1.53 (1.09, 2.16)**
17	1.10 (0.75, 1.60)
Education ^c	
Form 5	1.08 (0.83, 1.41)
Form 4	1.18 (0.85, 1.48)
Form 3	1.10 (0.84, 1.45)
Form 2	1.25 (0.92, 1.69)
Form 1	0.99 (0.72, 1.35)
School life ^d	
Happy	0.47 (0.40, 0.56)***
Unhappy	2.20 (1.62, 2.98)***
Relationship with classmates ^e	
Happy	0.45 (0.38, 0.53)***
Unhappy	1.94 (1.26, 2.96)**
Number of best friends ^f	
1 best friend	1.81(1.34, 2.43)***
2 best friends	1.80 (1.43, 2.27)***
4 best friends	1.30 (1.00, 1.70)*

^a Female; ^b 18 or above; ^c Form 6; ^d Fair; ^e Average; ^f 5 or more best friends; ^g Neutral; ^h Not having daily; ⁱ Parents; ^j Tertiary; ^k Average; ^l Fair; ^m Average; ⁿ Neutral; ^o Not having daily; ^p 1 hour or less; ^q 6–8 hours; ^r No smoking; ^s No alcohol consumption; ^t No; ^v Satisfied with life. *p < 0.05; **p < 0.01; ***p < 0.001. CI: confidence interval.

Variables	OR (95% CI)
3 best friends	1.32 (1.05, 1.66)*
None	2.05 (1.47, 2.84)***
Academic performance ^g	
Not satisfied	1.93 (1.61, 2.31)***
Satisfied	0.83 (0.66, 1.04)
Parents' status ^h	
Divorced/separated	1.58 (1.30, 1.93)***
One or both parents passed away	1.39 (0.94, 2.02)
Living circumstances ⁱ	
Father only	1.73 (1.21, 2.42)**
Mother only	1.49 (1.19, 1.85)***
Father and stepmother	1.41 (0.75, 2.47)
Mother and stepfather	1.80 (1.14, 2.76)**
Others	1.38 (0.96, 1.95)
Father's education ^j	
Not educated	0.42 (0.10, 1.21)
Primary	1.20 (0.89, 1.61)
Secondary	1.12 (0.89, 1.41)
Unknown	1.01 (0.77, 1.32)
Mother's education ^j	
Not educated	1.18 (0.52, 2.44)
Primary	1.30 (0.96, 1.77)
Secondary	1.27 (0.99, 1.64)
Unknown	1.11 (0.83, 1.49)

^a Female; ^b 18 or above; ^c Form 6; ^d Fair; ^e Average; ^f 5 or more best friends; ^g Neutral; ^h Not having daily; ⁱ Parents; ^j Tertiary; ^k Average; ^l Fair; ^m Average; ⁿ Neutral; ^o Not having daily; ^p 1 hour or less; ^q 6–8 hours; ^r No smoking; ^s No alcohol consumption; ^t No; ^v Satisfied with life. *p < 0.05; **p < 0.01; ***p < 0.001. CI: confidence interval.

Variables	OR (95% CI)
Relationship between parents ^k	
Good	0.64 (0.53, 0.76)***
Bad	2.29 (1.77, 2.97)***
Family life ^l	
Happy	0.42 (0.35, 0.50)***
Unhappy	2.85 (2.17, 3.73)***
Relationship with father ^m	
Good	0.58 (0.48, 0.69)***
Bad	2.05 (1.53, 2.74)***
Relationship with mother ^m	
Good	0.53 (0.44, 0.64)***
Bad	3.13 (2.16, 4.52)***
Discipline by father ⁿ	
Accepts	0.58 (0.48, 0.69)***
Does not accept	1.69 (1.31, 2.18)***
Discipline by mother ⁿ	
Accepts	0.49 (0.41, 0.58)***
Does not accept	1.91 (1.47, 2.47)***
Breakfast with family ^o	
Daily per week	0.75 (0.60, 0.94)**
None	1.49 (1.25, 1.77)***
Dinner with family ^o	
Daily per week	0.70 (0.60, 0.82)***
None	1.58 (1.06, 2.31)*

^a Female; ^b 18 or above; ^c Form 6; ^d Fair; ^e Average; ^f 5 or more best friends; ^g Neutral; ^h Not having daily; ⁱ Parents; ^j Tertiary; ^k Average; ^l Fair; ^m Average; ⁿ Neutral; ^o Not having daily; ^p 1 hour or less; ^q 6–8 hours; ^r No smoking; ^s No alcohol consumption; ^t No; ^v Satisfied with life. *p < 0.05; **p < 0.01; ***p < 0.001. CI: confidence interval.

Variables	OR (95% CI)
Physical activity on weekdays ^p	
No activity	1.23 (0.97, 1.55)
More than 1 hour	0.86 (0.73, 1.03)
Physical activity on weekends ^p	
No activity	1.37 (1.12, 1.69)**
More than 1 hour	0.86 (0.72, 1.04)
Sleep duration on weekdays ^q	
5 hours or less	1.78 (1.43, 2.20)***
9 hours or more	0.71(0.54, 0.92)**
Sleep duration on weekends ^q	
5 hours or less	1.23 (0.89, 1.67)
9 hours or more	0.90 (0.76, 1.07)
Smoking ^r	
Smoke every day	1.92 (1.06, 3.33)*
Alcohol consumption ^s	
Alcohol consumption daily to a few times a week	3.01 (2.21, 4.06)***
Alcohol consumption once a week	1.91 (1.62, 2.26)***
Drug abuse ^t	1.66 (1.04, 2.58)*
Non-suicidal self-injury ^t	11.67 (9.43, 14.48)***
Satisfaction With Life Scale ^v score	0.91 (0.89, 0.92)***
^a Female; ^b 18 or above; ^c Form 6; ^d Fair; ^e Average; ^f 5 or more best friends; ^g Neutral; ^h Not having daily; ⁱ Parents; ^j Tertiary; ^k Average; ^l Fair; ^m Average; ⁿ Neutral; ^o Not having daily; ^p 1 hour or less; ^q 6–8 hours; ^r No smoking; ^s No alcohol consumption; ^t No; ^v Satisfied with life. *p < 0.05; **p < 0.01; ***p < 0.001. CI: confidence interval.	

4.4.2 Multivariate Cumulative Logit Modelling

Using multivariate cumulative logit modelling, the effects of the various risk factors on levels of suicidality were examined simultaneously—the effect of each factor was examined while controlling for effects of other factors included in the model. Table 4 reports the significant risk factors associated with

suicidality among students in the multivariate model: being female, age between 12–15 years, unhappy school life, poor relationship with classmates, unhappy family life, living with mother only, accepting mother’s discipline, not sleeping for more than 9 hours on weekdays, alcohol consumption, non-suicidal self-injury, and dissatisfaction with life.

Table 4. Adjusted Odds Ratios Estimated from Multivariate Cumulative Logit Model of Risk

Factors with Suicidality

Variables	OR (95% CI)
Gender ^a	
Male	0.55 (0.42, 0.72)***
Age ^b	
12 or below	2.12 (1.07, 4.19)*
13	3.13 (1.72, 5.79)***
14	2.61 (1.51, 4.60)***
15	1.98 (1.15, 3.49)*
16	1.63 (0.96, 2.82)
17	1.60 (0.92, 2.82)
Relationship with classmates ^c	
Happy	0.66 (0.46, 0.93)*
Unhappy	2.20 (0.99, 4.81)*
Living circumstances ^d	
Father only	1.50 (0.67, 3.31)
Mother only	1.84 (0.98, 3.40)*
Father and stepmother	1.64 (0.43, 5.45)
Mother and stepfather	2.36 (0.72, 7.12)
Others	1.25 (0.58, 2.54)
Family life ^e	
Happy	0.98 (0.66, 1.48)
Unhappy	1.93 (1.11, 3.34)*
Discipline by mother ^f	
Unaccepted	0.98 (0.59, 1.61)
Accepted	0.54 (0.36, 0.81)**

^a Female; ^b 18 or above; ^c Fair; ^d Parents; ^e Fair; ^f Neutral; ^g 6–8 hours; ^h No alcohol consumption;

ⁱ No; ^j Satisfied with life. *p < 0.05; **p < 0.01; ***p < 0.001. CI: Confidence interval.

Variables	OR (95% CI)
Sleep duration on weekdays ^g	
5 hours or less	1.24 (0.86, 1.79)
9 hours or more	0.47 (0.27, 0.77)**
Alcohol consumption ^h	
Daily to a few times a week	1.77 (1.02, 3.00)*
Once a week	1.66 (1.23, 2.23)***
Non-suicidal self-injury ⁱ	8.60 (6.07, 12.22)***
Satisfaction With Life Scale score ^j	0.96 (0.94, 0.98)***
^a Female; ^b 18 or above; ^c Fair; ^d Parents; ^e Fair; ^f Neutral; ^g 6–8 hours; ^h No alcohol consumption;	
ⁱ No; ^j Satisfied with life. *p < 0.05; **p < 0.01; ***p < 0.001. CI: Confidence interval.	

Table 5 reports the reasons for suicidal behaviour by gender. The most common reasons cited by students for suicidal behaviour were as follows: 1) emotional problems; 2) school-related problems; 3) family-related problems; and 4) the meaninglessness of life. Interestingly, there is no gender difference in sequential order of the reasons for suicidal behaviour.

Table 5
Reasons for Suicidal Behaviour (%) for Male and Female students

Reasons for suicidal behaviour	Male	Female	Chi-square
	%	%	p
No suicidal tendency	67.3	55.5	< 0.001
1. Illnesses	2.1	2	0.204
2. Emotional problems (e.g., unhappiness, loneliness)	19.4	30.4	0.003
3. Monetary problems	5.4	4.5	0.006
4. Work-related problems	2.6	1.1	< 0.001
5. School-related problems	15.6	24.3	0.009
6. Family related problems	12.1	21.2	< 0.001
7. Relationship problems	8.8	12.5	0.329
8. Friendship problems	6.9	13.7	< 0.001
9. Loss of a loved one	3.8	4.6	0.744
10. Weak character	5.8	7.4	0.948
11. Life is meaningless	10.9	15.3	0.330
12. Others	2.4	1.8	0.022
Remarks: p value significant at 0.05.			

5. Discussion

The prevalence rates among secondary school students in this study were 16.1% (considered), 0.1% (planned), 5.0% (attempted suicide), and 0.6% (attempted suicide requiring medical attention). Female students reported more suicidal ideation and attempted suicide than their male counterparts. Only a very small percentage (0.1%) of both male and female students have made a suicidal plan. Nevertheless, female students were at higher risk of nonfatal suicidal ideation and behaviour, although the gender difference was not pronounced (OR = 0.51, 95% CI 0.42, 0.63). The prevalence rates of female students' attempted suicide (7.3% vs 3.4%, respectively) and attempted suicide requiring medical attention (0.8% vs 0.3%, respectively) were at least two times higher than their male counterparts. We were intrigued by the low prevalence rates for suicidal plans but the high prevalence rates of attempted suicide among female and male students. We were uncertain whether this finding was due to the Chinese translation of the Youth Risk Behaviour Survey (YRBS), which originated in the U.S. (14), or whether this finding was a genuine feature of the student population in Hong Kong (12). The 2017 national school-based Youth Risk Behaviour Survey in the U.S. reported the prevalence rates of suicidal ideation among high school

students as 17.7% (considered), 13.9% (planned) and 7.8% (suicide attempts) (15). Compared with the national data in the U.S., our prevalence rates of suicide planning and attempted suicide seemed less prevalent, but the prevalence rates of suicidal ideation in our sample (16.1%) were very close to those in the U.S. sample.

An epidemiological study (the CASE Study) investigated self-harm in 30,477 adolescents aged between 14 and 17 years old in seven countries—Belgium, England, Hungary, Ireland, the Netherlands and Norway and Australia (16). The results showed that 79.6% reported no self-harm tendencies in the past year. A total of 14.6% had thought about harming themselves, 2.6% had single self-harm episodes and 3.2% had multiple self-harm episodes. Compared with the prevalence rates in the CASE study, the prevalence rates of suicidal ideation and attempted suicide in this study were higher. Similarly, females were more likely to report suicidal ideation in Madge's study (16), which echoed the findings of our study and that of Xiao et al.

5.2 NSSI and Impulsivity

Liu et al. (17) conducted a systematic review of 34 studies using random-effects meta-analysis examining behavioural impulsivity in relation to non-suicidal self-injury (NSSI). The results showed that a small pooled effect size was observed for the association between behavioural impulsivity and NSSI (OR = 1.34, $p < 0.05$). A small-to-medium pooled effect size (OR = 2.23, $p < 0.001$) was found for the association between behavioural impulsivity and suicide attempts. Liu's study has delivered a clear message that behavioural impulsivity is closely linked with NSSI or suicidal attempts.

5.3 NSSI and Social Support

Older research suggests that social withdrawal and loneliness were common reasons among young suicide attempters (18); however, recent research refuted that loneliness did not predict suicide ideation over time or at the cross-sectional level (19). In this study, participants' perceived social support was measured by the number of best friends. The composite scores were initially significant in the univariate analysis but became insignificant in the multivariate cumulative logit model. Nonetheless, emotional problems ranked 1st among all reasons for suicidal behaviour in this study (Table 5) in both male and female students. It clearly indicates that students' NSSI may be triggered by their negative emotions/events that they have encountered in the past 12 months. With a poor perceived social support network, students experiencing negative emotions/life events may confide in themselves and externalize their frustrations by NSSI.

5.4 NSSI and Family Disintegration

Social withdrawal is considered a disengaging and avoidant coping style that is closely linked to depression and externalized behaviour problems (20). Findings from the multivariate logit model suggest that students seem to have family dysfunction, interpersonal relationship problems with peer classmates and difficulty enjoying their school life. Among all the variables pertaining to living circumstances, 'living with mother' is the only significant predictor in the multivariate logit model, and thus, we speculate that

these students live with their single mothers at home. It is highly plausible that the marital status of these students' parents was either divorced, separated or widowed. Parental marital status, including separation/divorce, is a risk factor for youth suicide attempts (16). Due to single motherhood, students may have an increased likelihood of self-stigmatizing or self-defeating behaviour due to not having an intact family. Some research has also indicated that single mothers report more stress, sadness, and fatigue in parenting than partnered mothers do (21). Thus, these single mothers might have the unintentional tendency of enforcing stringent discipline upon their children, possibly due to their psychological stress of occupying the dual role of being a 'mother' and a 'father' in the family.

Due to family disintegration, students may develop low self-esteem, negative emotions and negative attitudes towards their mothers' discipline. This claim may be justified by students' rating of 'family-related problems' as the third-most common reason for their suicidal behaviour (Table 5). Students experiencing family dysfunction may react with unhappiness, social withdrawal or avoidant behaviour in the public sphere. Some may attempt to overcome their emotional turmoil, family disintegration, disharmony with peers and unhappy school life with alcohol consumption (22) or externalize their negative emotions and frustrations with NSSI or suicidal ideations (23). Harmony within a traditional Chinese family is a significant protective factor against negative life events. The impact of family disintegration on secondary school students' suicidality warrants more research in the near future for early intervention.

5.5 NSSI and Lifestyle

Findings from a recent large-scale Youth Risk Behaviour Survey (24), which involved 14,506 high school students aged between 12 and 18 in the U.S., reported that health-promoting behaviour is significantly associated with suicidality among young adolescents. A total of 23.6% of students were engaged in health-promoting behaviour compared with 6.9% with the lowest engagement in health-promoting lifestyles. Those students with the lowest engagement in health-promoting behaviour were 1.5 times more likely to report suicidality than those with healthy lifestyle behaviour (e.g., eating breakfast daily, being physically active, and use computer/TV devices infrequently) (15). Compared with the YRBS findings, our sample seems to have a sedentary lifestyle, with 43% students not eating breakfast daily and 46.4% and 35% having less than 1 hour physical activity throughout the week and on weekends, respectively. Nevertheless, more than two-thirds of students (71.6%) were able to maintain 6–8 hours of sleep on weekdays, but this amount of sleep dropped significantly on the weekends (35.9%). Although physical activity and breakfast habits did not emerge as significant predictors in the multivariate logit model in this study, more research effort is required to investigate the reasons for secondary school students' lack of adherence to healthy lifestyles before the formulation of effective health promotion initiatives by stakeholders and healthcare providers in Hong Kong.

5.6 NSSI and Sleep deprivation

Among all the lifestyle questions, sleep duration was found to be the only significant predictor in the multivariate logit model. Students who did not have 9 hours sleep or more on weekdays were 0.47 times

more likely to report suicidality than those sleeping for more than 9 hours daily in the multivariate logit model. Insufficient sleep may exacerbate higher risks of suicidal behaviour among secondary school students (25). A recent meta-analysis conducted by Chiu et al (26) examined the effects of sleep duration on suicidal behaviour in adolescents. Results showed that suicidal plans were inversely associated with sleep duration for every hour of increase in sleep duration (OR = 0.89, CI: 0.88, 0.90). Adolescents were also less likely to report suicidal ideation and attempts if they could sustain 8–9 hours sleep daily. Our findings were consistent with Chiu et al's.

In our study, students' lack of satisfaction with their academic performance was one of the predictors in the univariate analysis but became insignificant in the multivariate logit model. Students' poor academic performance is inevitably a precursor of stress for themselves and for their parents. It is plausible that students with unsatisfactory academic performance must spend longer hours studying each day throughout the week to catch up with school assignments, resulting in sleep deprivation. Our line of argument is further supported by the fact that students cited 'school-related problems' as the second-most common reason for their suicidal behaviour (Table 5).

Our speculation is confirmed by recent research (27) that examined the associations among sleep time, school performance, energy drink consumption and suicidal attempts in 121,106 adolescents aged 13 and 18 years old using the web-based Youth Risk Behaviour Survey between 2014 and 2015 in Korea. The results showed that higher stress levels, lack of sleep, and low school performance were significantly associated with suicide attempts. Results emerged from our study echoed the findings of a systematic review (28) that there seems to have an inseparable association between sleep disturbances and suicidal risk. Sleep deprivation in adolescents may lead to higher impulsivity, emotional dysregulation, impaired decision making, decreased cognitive inhibition, disruptions in circadian rhythms and thereby increase the risk of NSSI. If sleep disturbance is a strong predictor of youth suicide, a more accurate measurement of sleep duration is warranted in future suicide research as most research relied on subjective psychological instruments which were subject to under/over-reporting bias. The use of polysomnography and validated wearable devices (e.g., actigraph) may be incorporated in sleep medicine research. Somatic complaints of insomnia or sleep disturbances in adolescents should deserve attention in a timely fashion as these can indicate an early signs of stress overload and can further spiral up to anxiety / depression. Thus, early detection and treatment of sleep problems, and promotion of sleep hygiene in the primary care settings may help reducing suicidal behaviour in adolescents.

5.7 NSSI and Substance use

Research has consistently reported that substance use is strongly associated with NSSI and suicidal ideation and/or attempts in children and adolescents (29). A recent cross-sectional survey (30) examined the association between substance use and NSSI and suicide attempts on 2,518 children and adolescents in Turkey. The results showed that cannabis and cocaine use were significant risk factors for suicidal attempts, while polysubstance use was associated with both NSSI and suicidal attempts. Although substance use was a significant predictor in the univariate analysis, it became insignificant in the multivariate logit model. This phenomenon can best be explained by the low rate of substance use in

this sample and surveillance in secondary schools, the concerted efforts of anti-drug campaigns initiated by the Hong Kong government, and the Narcotics Division, Security Bureau, Hong Kong. More importantly, students may be deterred by the serious penalty imposed on taking illicit drugs. Students in this study may have the tendency to under-report or simply not report their drug use for fear of being arrested or identified by school teachers or due to social desirability bias, despite the anonymity and confidentiality of the survey. The reasons for the use of illicit substances require further investigation because students' decisions regarding drug use may have an impact on the prevention of youth suicide.

5.8 NSSI and Alcohol consumption

Alcohol consumption was a significant predictor of suicidality in the multivariate logit model. Caution needs to be taken that these secondary school students exhibited under-age drinking behaviour in this study. In our study, students who drank alcohol daily to a few times per week or once per week were 1.8–1.7 times more likely to report suicidality than non-drinkers were. A large-scale national Youth Risk Behaviour Survey (YRBS) conducted in 2005 (31) included 13,639 high-school students in grades 9–12 in the United States. The results showed that preteen alcohol use was significantly associated with suicidal ideation (adjusted OR = 1.89, 95% CI = 1.46–2.44) and suicide attempts (adjusted OR = 2.71, 95% CI = 1.82–4.02) relative to non-drinkers for both boys and girls. Our odds ratios of alcohol consumption are lower but still comparable to those of the YRBS, which warrants careful monitoring of under-age drinking behaviour to determine whether there will be a parallel increase in suicidal behaviour among young adolescents (12).

5.9 Life satisfaction

Dissatisfaction with life was another significant predictor of suicidality in the multivariate logit model. Students who were dissatisfied with life were 0.96 times more likely to report suicidality than those satisfied with life. Life satisfaction is the subjective perception of an individual's quality of life based on self-defined standards, including general life satisfaction and specific life satisfaction (32). Some researchers found that a low score of life satisfaction was a risk factor for suicidal ideation among college students. A recent cross-sectional study including 5,249 junior and senior school students in China specifically cited that being female, having lower family satisfaction, having lower school satisfaction, and having a poor living environment were significantly associated with elevated risks of suicidal ideation (33). All of the significant predictors in our multivariate logit model incorporated Yao's risk factors, which seemed to play a pivotal role in suicidal behaviour.

To corroborate our statistical findings, students were asked to indicate the reasons for suicidal behaviour as part of the survey (Table 5). A total of 465 students (12.8%) asserted that 'life is meaningless', which ranks as the 4th -highest reason for suicidal behaviour in this study. Approximately 1 in every 8 secondary students in our sample perceived that their lives were meaningless (Table 5). The instilling of hope is of paramount importance in the prevention of youth suicide. School teachers may consider the inclusion of mental health first aid in the curriculum and reinforce positive thinking mindsets with emotional regulation to reduce impulsivity in suicidal behaviour and to identify effective coping mechanisms to

mitigate the negative impact of life stressors on young adolescents. Suicidal prevention among youth and adolescents should consider childhood adversity as one of the predictors of NSSI and/or suicidal behaviour across the life span.

6. Limitations Of The Study

Several limitations need to be addressed in this study. First, the cross-sectional nature of the study cannot establish the causality between suicidality, individual psychosocial and psychological characteristics. Other bio-psycho-social factors, such as depression, physical or sexual abuse, and history of psychopathology from students and/or their parents, may contribute to risk factors of suicidality among young adolescents. Second, samples recruited in this study were derived from in-school student populations, which means our study findings cannot represent students who refused to participate and absentees or school dropouts. Third, students were asked about their suicidality in the past 12 months, which may have been subject to recall bias/under-reporting.

7. Conclusion

Our findings suggest that suicidality is common among Chinese adolescents in Hong Kong. Family disintegration, school-related problems, and life satisfaction are significant predictors of suicidal behaviour in this study. There is a pressing need to restore optimal mental health among youth adolescents via interdisciplinary collaboration among schools, healthcare providers, stakeholders and mental health experts. Effective stress-reduction strategies targeting youth should be initiated by the public health sector. It is recommended that mental health education should preferably commence in primary school settings to reduce the likelihood of cumulative unresolved stressors throughout the transition from young adolescence to adulthood. A population-based approach involving different stakeholders in the community would be critical to promote mental wellbeing among students as they are facing multiple challenges at individual and/or school level.

Abbreviations

CASE

Child & Adolescent Self-harm in Europe

CI

confidence interval

NSSI

non-suicidal self-injury

OR

odds ratio

p

probability

SD

standard deviation
YRBS
Youth Risk Behaviour Survey
YSS
Youth Sexuality Study

Declarations

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Consent for publication

We had obtained written consent from participants in this study and they had been assured that their names had been anonymized and would not be identified in any publications.

Availability of data and materials

The datasets generated and / or analysed during the current study are not publicly available due to vulnerability of the subjects but are available from the corresponding author on reasonable request.

Authors Contributions:

PSFY, DYTF, and SF conceived the initial idea, designed the study and the questionnaire. TC completed the data analyses, interpreted the data, drafted and revised the initial manuscript. PSFY contributed to study conceptualization, data interpretation, and manuscript review and revision. DYTF contributed to the conceptualizations of the study, interpretation of the data, critically reviewed and revised the manuscript. TF contributed to the formatting and reference organizations. All authors contributed to and approved the final manuscript.

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