

Clustering Analysis of Risk Factors for Non-suicidal Self-injury (NSSI) Behaviors in Adolescents

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Abstract

Background and Objectives: The analysis of clustering characteristics of disease risk factors makes for the formulation of corresponding prevention and control policies, but the risk factors for non-suicidal self-injury (NSSI) behaviors in adolescents is not covered, so this study is intended to explore the clustering characteristics of risk factors for NSSI behaviors in adolescents in the multi-center primary and secondary schools in western China.

Methods: Utilising stratified and cluster sampling methods, a total of 13,784 primary and secondary school students who met the research standards were randomly selected as the survey subjects in year 2020, and the clustering situation of the seven risk factors (depression, anxiety, stress, low social support, tolerance, avoidance, and emotional venting) among the students was analyzed. The characteristics of the respondents with high clustering degree of risk factors for NSSI behaviors were also identified with the hierarchical logistic regression analysis.

Results: 4.2% of the adolescents in western China were detected with NSSI behaviors in the past year; the risk factors were grouped into 4 clusters, ranging from level 0 to level 3, with each level including 7692 (55.8%), 3847 (27.9 %), 1303 (9.5%) and 941 (6.8%) of the survey subjects, respectively. The results of the Cochran-Armitage trend test analysis showed that there existed a linear trend between the clustering degree of risk factors and the detection rate of NSSI behaviors ($P < 0.000$); according to the hierarchical logistic regression analysis, the clustering degree of risk factors for NSSI behaviors was higher in the adolescents whose parents divorced and remarried 1.22 (0.021~0.379) and whose fathers received only primary school education or below 1.23 (0.004~0.403). By contrast, the degree was lower in the adolescents who are male 0.93 (-0.133~-0.003) and had never attended boarding school 0.83 (-0.285~-0.094), whose parents were not divorced 0.80 (-0.367~-0.072), and whose fathers were farmers 0.99 (-0.136~0.123).

Conclusion: The risk factors for NSSI behaviors in adolescents are in clusters. As the risk factors continue to cluster, NSSI behaviors can be detected more easily in adolescents. With respect to the endeavors to prevent and control NSSI behaviors in adolescents, more attention should be focused on the mental health of the adolescents who are female and attend boarding schools, whose parents have broken marriages, and whose fathers have low literacy.

Introduction

Non-suicidal self-injury (NSSI) comprises deliberate and conscious self-injurious acts without the intention to die. These acts can cause immediate physical damage to the body tissue, and include behaviors such as cutting, scratching, biting, burning, and hitting oneself [1]. In most cases, the onset of NSSI behaviors and adolescence march in lockstep and its prevalence rates increase gradually after 14 years old [2,3] and decline slowly in young adulthood. A meta-analysis showed that the lifetime prevalence rate of NSSI among adolescents who are 10 to 17 years old was 17.2% [4] and more than 50%

of the adolescents continued to harm themselves till their adulthood [5]. Apart from being one of the most powerful tools to predict suicide tendency, NSSI attributes mainly to the death of adolescents [6-8], which makes it a globally serious public health issue. Considering the serious harm NSSI inflicts on the adolescents and its high prevalence and protracted course, it is of great clinical significance to understand the risk factors of NSSI before the first onset, so that it can be better prevented and controlled.

The clustering of risk factors means two or more than two risk factors turn up in an individual at the same time. Contemporary studies on the clustering analysis of risk factors displayed that a certain risk factor is often accompanied by another, which indicated that the expected results may be unavailable if research is done on a single risk factor, so the studies concluded that better cost benefits could be obtained should research be expanded to multiple risk factors study instead of focusing on a single risk factor [13.14]. Many scholars have pointed out that negative emotions, such as anxiety and depression, and corresponding emotion-focused coping strategies like avoidance, tolerance, and venting of emotions, are risk factors for NSSI [9-11], and the negative emotions and coping strategies are believed to interact with the predictors of NSSI. Although all the above risk factors indicate an increased risk of NSSI behaviors, previous studies have shown that risk factors are often clustered, and with the increase of associated risk factors in number, the incidence of NSSI increases [12]. If timely interference can be made in some modifiable risk factors in a targeted manner, it is of great significance to prevent the onset of NSSI in adolescents and improve the prognosis. Currently, there is no research on the clustering situation of risk factors for NSSI at home and abroad. The west of China, known for vast agrarian lands, backward industry and weak economy, has a large number of left-behind children [15], whose mental health is faced with severe challenges. Therefore, focused on students from multi-center primary and secondary school in western China, this study, with the aim to analyze the distribution and clustering situation of risk factors for NSSI, aspires to provide guidance on how to prevent and control NSSI in adolescents.

Based on the above information, we put forward the following research hypotheses: 1) the risk factors for NSSI behaviors in adolescents are in clusters and as the risk factors continue to cluster, NSSI behaviors are to be detected more easily in adolescents; (2) relevant factors possibly affecting the clustering degree of risk factors for NSSI behaviors in adolescents are screened out. Incorporating related individual and sociological factors for NSSI in a fully systemic manner, this study is to explore the risk factors for NSSI behaviors and their clustering situation so as to provide research approaches and scientific support for early identification and prevention of self-injury behaviors in adolescents.

1 Respondents And Methods

1.1 Respondents

With the methods of stratified sampling and cluster sampling, primary and secondary school students who met the research standards were randomly selected as survey subjects. Inclusion criterion: 1) students aged from 10 to 17 years old;

Exclusion criteria: 1) students who were unable to participate in the survey due to mental or psychological problems; 2) students who contracted other serious diseases; 3) students, as well as their parents, who refused to attend the survey.

1.2 Research Methods

Under the organization and coordination of Nanchong Municipal Bureau of Education and Sports, the on-site survey was jointly carried out by Psychological Crisis Intervention Working Group of Mental Health Center in the Affiliated Hospital of North Sichuan Medical College, together with the work team. Before the survey, a pilot survey was conducted in a non-selected school, and principles of all selected schools were organized to attend a symposium where the significance, work flow, precautions and quality requirements of this survey were introduced.

The survey process is as follows: upon registering wjx, a platform in China providing functions equivalent to Amazon Mechanical Turk, members of the work team created the preliminary questionnaire and the final one was decided after three rounds of discussion. The link and QR code of the final questionnaire was sent to the principals, through whom the link and code reached the teachers of every school. The link and code were resent to class group by the class teacher and students were able to fill in the questionnaire when their parents clicked the link or scanned the code on We Chat. The questionnaire was required to be completed within a specified time period of ten days. All survey subjects had signed written informed consent form.

The survey was carried out anonymously. Quality review of the questionnaires received was conducted on a day-to-day basis and the questionnaires that failed to meet the requirement were excluded after giving feedback to the working group.

1.3 Research Instrument

The survey was conducted with a self-made questionnaire on general information, depression-anxiety-stress scale (DASS-21) and coping style scale for middle school students (CSSMSS).

The depression-anxiety-stress scale (DASS-21), made up of 3 sub-scales, examines an individual's experience of depression, anxiety and negative emotions resulting from stress, respectively. Each sub-scale contains 7 items which are graded on a 4-level scale, with "not suitable" as 0 point; "sometimes suitable" as 1 point; "often suitable" as 2 points; "always suitable" as 3 points. The sum of the 7-item scores multiplied by 2 makes the total score of the sub-scale, which ranges from 0 to 42 points. A higher total score indicates severer negative emotions of the survey subject [16].

Coping Style Scale for Middle School Students (CSSMSS) consists of two sub-scales. One is "problem-focused coping" sub-scale which includes the three factors of "problem solving", "seeking social support" and "positive and rationalized explanation". The other is "emotion-focused coping" sub-scale which includes the four factors of "tolerance", "avoidance", "venting of emotions" and "denial of fantasy". Each factor is comprised of several items which are scored on a 4-level scale, with "not use" as 1 point, "use

occasionally” as 2 points, “use sometimes” as 3 points and “use frequently” as 4 points. The sum of item scores makes the scores of factors, and the addition of factor scores belonging to the same sub-scale is the score of the sub-scale. Generally the total score of the CSSMSS is not measured [17].

1.4 Indices and Their Definitions

Seven risk factors were designated with reference to previous literature [9-11] and they are depression (defined as depression dimension score > 9 points in DASS-21), anxiety (defined as anxiety dimension score > 7 points in DASS-21), stress (defined as stress dimension score > 14 points in DASS-21), low social support (defined as social support dimension score \leq 12 points in CSSMSS, based on the national norm of 16.48 ± 4.04 points), tolerance (defined as tolerance dimension score \geq 12 points in CSSMSS, based on the national norm of 8.94 ± 2.42 points), avoidance (defined as avoidance dimension score \geq 10 points in CSSMSS, based on the national norm of 7.23 ± 2.36 points), emotional venting (defined as emotional venting dimension score \geq 11 points in CSSMSS, based on the national norm of 7.70 ± 2.50 points) [18]. The clustering of risk factors: according to the number of risk factors, the survey subjects were divided into 4 clusters marked from level 0 to level 3, of which level 0 meant none of the above risk factors was manifested in the subject, and level 3 meant three or more than three risk factors manifested themselves in the subject at the same time [19].

Judgment of NSSI behaviors: a single-item evaluation method was used to judge NSSI behaviors and the defined NSSI behaviors included hitting one’s head against a wall, biting, picking or scratching oneself hard, pulling one’s hair forcefully, cutting or stabbing oneself with a knife or sharp object, binding oneself and others. The adolescents who harm themselves at least once in that way without the intention to die in the past year are considered having NSSI behaviors.

1.5 Quality Control

(1) Project design: a special investigation team was formed whose members were postgraduates majoring in psychiatry and mental health. Subject seminars were held regularly and experts working for the hospital or external institutes were invited to discuss with team members the subject design, questionnaire design and revision, and subject progress. Investigators were trained with questionnaire survey, so that they were informed of the purpose, significance and precautions of the survey. Investigation procedures and methods were also unified. Only after passing the training could the investigators carry out on-site survey.

(2) Data collection: the principals, teachers and students of the selected schools were reached out in advance to obtain their support and cooperation. With class as unit, the survey questionnaires were handed out under the assistance of head teachers. Before filling in the questionnaire, students were informed of the purpose and significance of the survey, completing methods and precautions. They were also told that the survey was conducted anonymously to ensure the veracity and effectiveness of the data.

(3) Data sorting and input: after recovering data, four investigators would review the data in time and enter them into Excel. The questionnaires with missing key information, incomplete or the same answers were abandoned. Missing and abnormal values were carefully checked and dealt with to ensure data accuracy.

1.6 Statistical Analysis

Database was built with Epidata3.1 and data analysis was conducted with SPSS23.0. The measurement data were described with mean \pm standard deviation, the comparison between groups was carried out with student's test, and the comparison of categorical variables was conducted with chi-square test. Cochran-Armitage trend (CAT) test was used to analyze the trend. During multivariate analysis, by virtue of logistic regression, the dependent variable was whether or not NSSI behaviors occurred, stepwise regression analysis was used to select variables, and the results were expressed as OR (95% CI).

2 Research Results

2.1 General Information

A total of 13,784 primary and secondary school students were under investigation. Among them, NSSI behaviors once occurred to 584 students, with the incidence rate being 4.2%. Among all the survey subjects, there were 7128 male students (51.7%), 6655 female students (48.3%), 1904 students (13.8%) being the only child in their families, 8130 students (59.0%) residing in cities, 2379 students (17.3%) attending boarding school and 5023 students (36.4%) being "left-behind" children. There were 11,998 (87.0%) students whose parents never divorced, 1,093 (7.9%) students with one single parent, and 692 (5%) students whose divorced parents remarried. For the students whose parents never divorced, they (11,998, 87.0%) lived with parents, but for those whose parents divorced, 346 (2.5%) of them lived with their fathers, 435 (3.2%) of them lived with their mothers, and 1004 (7.3%) of them lived with their grandparents. In terms of the occupation of students' fathers, 2,256 (16.4%) of them were employees in enterprises or public institutions, 3,248 (23.6%) of them farmers, 116 (0.8%) of them civil servants, 1,285 (9.3%) of them individual businessmen, and 6,878 (49.9%) of them employed in other fields. With regard to the educational background of students' fathers, 2,344 (17.0%) of them attended primary school or below, 8,412 (61.0%) the secondary school, 2,288 (16.6%) high school or specialized secondary school, 739 (5.4%) junior college or above. When it came to the occupation of students' mothers, 2,049 (14.9%) of them were employees in enterprises or public institutions, 3608(26.2%)of them farmers, 47 (0.3%) of them civil servants, 1066 (7.7%) of them individual businesspersons, and 7014 (50.9%) of them employed in other fields. Regarding the educational background of students' mothers, 3785 (27.5%) of them attended primary school or below, 7,794 students (56.5%) of them secondary school, 1,737 (12.6%) of them high school or specialized secondary school, and 467 of them junior college or above (3.4%).

2.2 Analysis of Distribution of Risk Factors for NSSI behaviors in Adolescents

Adolescents with NSSI behaviors obtained significantly higher scores in anxiety, depression, and stress than those without NSSI behaviors, which demonstrates a statistical difference ($P < 0.001$). Adolescents with NSSI behaviors obtained significantly higher scores in emotion-focused coping style which includes avoidance, tolerance, venting of emotions than those without NSSI behaviors ($P < 0.001$), but in terms of the scores in social support, the condition was rather opposite. The difference was statistically significant ($P < 0.001$). The differences showed that depression, anxiety, stress, low social support and coping strategies like tolerance, avoidance, and emotional venting are all risk factors for NSSI behaviors in adolescents in western China. See Table 1 for details.

Table 1

Analysis of Distribution of Risk Factors for NSSI Behaviors in Adolescents

Risk Factors	Without NSSI n=13199	With NSSI n=584	t	P
Depression	2.15±2.82	7.11±5.12	-39.706	0.000
Anxiety	1.95±2.67	6.26±4.56	-36.696	0.000
Stress	2.77±3.20	7.32±4.85	-32.729	0.000
Social Support	17.68±4.64	16.08±4.50	8.394	0.000
Tolerance	8.71±2.69	10.10±2.64	-12.390	0.000
Avoidance	7.25±2.59	8.33±2.60	-9.803	0.000
Emotional Venting	7.18±2.69	8.85±3.09	-14.564	0.000

2.3 Trend Analysis of Detection Rate of NSSI Behaviors in Adolescents as Clustering Degree of Risk Factors Changes

Among all the survey subjects, there were 7692 (55.8%), 3847 (27.9 %), 1303 (9.5 %) and 941 (6.8%) students respectively located in the four clustering levels of risk factors from level 0 to level 3. Cochran-Armitage trend test analysis showed that a linear trend existed between the clustering degree of risk factors and the detection rate of NSSI behaviors ($P < 0.000$), which meant that as clustering degree of the seven risk factors continuously increased, the detection rate of NSSI in adolescents accordingly rose significantly, as shown in Table 2.

Table 2

Trend Analysis of Detection Rate of NSSI Behaviors in Adolescents as Clustering Degree of Risk Factors Changes

Risk Factor Combination(s)	0	1	2	≥3	EXP B	P
Without NSSI	7552 57.2	3694 28.0	1196 9.1	757 5.7	0.044	0.000
With NSSI	140 24.0	153 26.2	107 18.3	184 31.5	2.346	0.000
Aggregate	7692	3847	1303	941		

2.4 Univariate Analysis of Clustering Degree of Risk Factors for NSSI Behaviors in Adolescents

The results of univariate analysis showed that such factors as sex, family residence, boarding or not, “left-behind” children or not, parents’ marital status, with whom the student living with in the long term, parents’ occupations and educational levels all had an impact on the clustering degree of risk factors, and the differences were statistically significant ($P < 0.05$). See Table 3.

Table 3

Univariate Analysis of Clustering Degree of Risk Factors for NSSI Behaviors in Adolescents

2.4 Multivariate Analysis Results of Clustering Degree of Risk Factors

As shown in Table 4, with the hierarchical logistic regression, such factors as whether being the female, whether residing in countryside, whether attending boarding school and whether being the “left-behind” children were taken as references. Studies showed that the clustering degree of risk factors for NSSI behaviors was higher in the adolescents who are females, whose parents divorced and remarried and whose fathers were farmers, whereas that was relatively low in the adolescents who are males, whose parents enjoyed a fair marriage and whose fathers attended only primary school or below.

Table 4

Multivariate Analysis Results of Clustering Degree of Risk Factors for NSSI Behaviors in Adolescents

Factors	Risk Factor Combination(s)				X ²	P
	0	1	2	≥3		
Sex						
Male	4021 56.4)	1997(28.0)	668(9.4)	442(6.2)	9.610	0.022
Female	3714(55.2)	1850(27.8)	635(9.5)	499(7.5)		
Only Child						
Yes	1071 13.9	494 12.8	193 14.8	146 15.5	6.513	0.089
No	6621 86.1	3353 87.2	1110 85.2	795 84.5		
Residence						
Countryside	3043 39.6	1613 41.9	581 44.6	416 44.2	18.901	0.000
City	4649 60.4	2234 58.1	722 55.4	525 55.8		
Boarding						
Yes	1192 15.5	694 18.0	265 20.3	228 24.2	59.036	0.000
No	6500 84.5	3153 82.0	1038 79.7	713 75.8		
"Left-behind" Children						
Yes	2720 35.4	1405 36.5	511 39.2	387 41.1	17.136	0.001
No	4972 64.6	2442 63.5	792 60.8	554 58.9		
Parental Marriage						
Remarried	6819 88.7	3316 86.2	1095 84.0	768 81.6	66.812	0.000
Single parent	326 4.2	197 5.1	85 6.5	84 8.9		
Parents	547 7.1	334 8.7	123 9.4	89 9.5		
With Whom does he/she live?						
Parents	6891 88.7	3316 86.2	1095 84.0	768 81.6	61.855	0.000

Father	164 2.1	102 2.7	49 3.8	31 3.3		
Mother	225 2.9	122 3.2	51 3.9	37 3.9		
Grandparent(s)	484 6.3	307 8.0	108 8.3	105 11.2		
Father's Occupation						
Employee in a(n) enterprise or public institution	1238 16.1	615 16.0	213 16.3	190 20.2	28.679	0.004
Farmer	1883 24.5	894 23.2	296 22.7	175 18.6		
Civil servant	65 0.8	31 0.8	9 0.7	11 1.2		
Individual businessman	731 9.5	339 8.8	131 10.1	84 8.9		
Others	3775 49.1	1968 51.2	654 50.2	484 51.5		
Father's Qualification						
Primary school or below	1187 15.4	686 17.8	254 19.5	217 23.1	51.885	0.000
Secondary school	4733 61.5	2354 61.2	782 60.0	543 57.7		
High school or specialized secondary school	1347 17.5	604 15.7	206 15.8	131 13.9		
Junior college or above	425 5.5	203 5.3	61 4.7	50 5.3		
Mother's Occupation						
Employee in a(n) enterprise or public institution	1103 14.3	572 14.9	200 15.3	174 18.5	26.504	0.009
Farmer	2070 26.9	1006 26.2	334 25.6	197 20.9		
Civil servant	23 0.3	13 0.3	5 0.4	6 0.6		
Individual businessperson	600 7.8	291 7.6	108 8.3	67 7.1		
Others	3896 50.7	1965 51.1	656 50.3	497 52.8		
Mother's Qualification						
Primary school or below	2004 26.1	1082 28.1	408 31.3	291 30.9	29.308	0.001
Secondary school	4397	2180	708	509		

	57.2	56.7	54.3	54.1
High school or specialized secondary school	1022 13.3	455 11.8	153 11.7	107 11.4
Junior college or above	269 3.5	130 3.4	34 2.6	34 3.6

Independent Variable		B value	OR value(95%)	P value
Sex		0.033	0.93 -0.133~-0.003	0.041
Residence in countryside or not		0.040	1.03 -0.048~0.108	0.455
Boarding		0.049	0.83 -0.285~-0.094	0.000
“Left-behind” Children		0.038	0.99 -0.082~0.068	0.859
Parental Marriage	Divorced & single parent			
	Parents	0.075	0.80 -0.367~-0.072	0.003
	Divorced & remarried	0.091	1.22 0.021~0.379	0.028
After parents’ divorce, with whom does he/she live?	Grandparents(s)			
	Father	0.118	1.08 -0.151~0.311	0.496
	Mother	0.112	0.95 -0.267~0.171	0.667
Father’s Occupation	Others			
	Employee in a(n) enterprise or public institution	0.061	1.01 -0.106~.132	0.833
	Farmer	0.068	0.87 -0.273~-0.008	0.038
	Civil servant	0.192	1.06 -0.315~0.437	0.75
	Individual businessman	0.076	0.99 -0.163~0.137	0.862
Father’s Qualification	Junior college or above			
	Primary school or below	0.102	1.23 0.004~0.403	0.045
	Secondary school	0.093	1.01 -0.174~0.192	0.923
	High school or specialized secondary school	0.095	0.94 -0.248~0.123	0.511
Mother’s Occupation	Others			

	Employee in a(n) enterprise or public institution	0.063	1.12 -0.014~0.232	0.081
	Farmer	0.066	0.99 -0.136~0.123	0.919
	Civil servant	0.284	1.48 -0.165~0.946	0.168
	Individual businessperson	0.082	1.06 -0.101~0.221	0.463
Mother's Qualification	Junior college or above			
	Primary school or below	0.117	1.22 -0.033~0.426	0.093
	Secondary school	0.113	1.12 -0.103~0.338	0.297
	High school or specialized secondary school	0.115	1.04 -0.188~0.261	0.75

Discussion

This study is the first to conduct a large-scale clustering analysis of the risk factors for NSSI behaviors in adolescents from several schools in western China, which can make for a deep and detailed exploration of the status quo and feature distribution of NSSI problems in adolescents. This study reveals that the risk factors for NSSI behaviors in adolescents are in clusters and as the clustering degree increases, the risk of NSSI behaviors in adolescents rises accordingly. Moreover, such factors as sex, parents' marital status, father's educational background and occupation are all related to the clustering degree of risk factors for NSSI behaviors in adolescents.

In previous studies, the prevalence rates of NSSI behaviors in adolescents within a year vary enormously from 6–44.3% [20–21]. The prevalence rate in this study is 4.2%, lower than the rates in previous studies, which may be attributed to the discrepancies in the age of the targeted subjects, questionnaires, definitions of indices, social factors [22], as well as early implementation of mental health screening in primary and secondary schools in the west of China.

It is universal that risk factors of most chronic non-communicable diseases cluster. Among the survey subjects of this study, 27.9% of them are burdened with one risk factor, 9.5% of them two risk factors and 6.8% of them three or more than three. A recent survey on the risk factors for adult mental health showed that 19.34%, 24.37%, 18.98% and 27.66% of the respondents were plagued by one, two, three, four or more than four risk factor(s), respectively [23]. Another study on adolescents with NSSI behaviors displayed that 4.15%, 7.82%, 18.15% and 31.10% of the respondents were disturbed by one, two, three, four or more than four risk factor(s), respectively [24]. Previous studies have shown that the clustering degree of risk factors varies among different populations in different regions, and generally the clustering

degree in this study is lower than that in previous studies. Although a huge gap exists between the results of different studies due to diverse risk factors and demographic differences of survey subjects, all the results suggest an obvious clustering tendency of risk factors.

What's more, the study suggests that high clustering degree of risk factors represents high detection rate of NSSI behaviors in adolescents. Among adolescents with NSSI behaviors, 49.8% of them are beset by two or more than two risk factors. Some studies also found that the risk factors, such as smoking, drinking, being bullied at school, heavy learning pressure, among others, for NSSI behaviors in rural high school students cluster and with the increase of clustering degree of risk factors, the risk of NSSI behaviors in them also rises. It's found that when risk factors reach three or over in number, the risk of NSSI behaviors increases by 12.6 times [12]. Scholars also indicated that more risk factors of mental health meant higher risk of psychological distress [25–27]. The collaboration or interaction between multiple risk factors that coexist tends to increase significantly the risk of NSSI behaviors, so the endeavors to screen people with multiple risk factors should be strengthened insomuch that key prevention and control efforts can be carried out smoothly [28.29].

The results of multivariate analysis shows that risk factors for NSSI behaviors in females tend to cluster more significantly than in males. Most studies showed that the incidence of NSSI behaviors in the female in the past or just within the past year was higher than that in the male [28.29], which may be ascribed to the fact that females in puberty are more easily affected by the external environment or negative emotions [30], and they are inclined to adopt negative attitudes, like avoidance, towards the external stress. This study also points out that the risk factors for NSSI behaviors cluster even more in adolescents who attended boarding school, whose parents divorced and remarried, and whose fathers attended only primary school or below. Some studies showed that due to a constant lack of familial comfort and care, many boarding students are more liable to mental health problems since they often suffer from such negative feelings as tension and anxiety, sense of insecurity. With poor interpersonal skills, they tend to feel insecure in society and thus give no trust in it, thereby receiving less social support when they are in need [31]. The lower educational qualification of the fathers indicate their infrequent and negative participation in cultivating the children, which is likely to invite an increased risk of depression, anxiety, hostility towards society, and discomfort in society in children in the future [32]. Meanwhile, the mental health status of middle school students and their family intimacy are positively correlated. The breakdown of family relationships caused by different reasons contributes significantly to the children's psychological problems. Studies revealed that when parents are mutually hostile and aggressive in a family, the child tends to be mentally stressed and confused, thus their perception of external support reduced [33]. Adolescents with a broken family are more prone to emotional problems and coping style problems, so the incidence of NSSI behaviors in them is also higher [34].

Conversely, the clustering degree of risk factors for NSSI behaviors is relatively low in the adolescents who are male, whose parents have a sound marriage and whose fathers are farmers. The relatively low clustering degree of risk factors for NSSI behaviors in adolescents whose fathers are farmers may result from the low academic requirements the families set for the children who, therefore, face less stress and

negative responses related to academic learning. Furthermore, some scholars pointed out that a father's occupation as a farmer represents the weak economic strength and low social status of the family, which directly affect the investment of household income and social capital, as well as parenting effectiveness, so that the children are faced with higher risks of psychological and behavioral disorders [35–37], more liable to psychological problems and behaviors harmful to themselves or others [38]. Possible reasons for this phenomenon are the rises in social status and income of the farmers with the reform and development of China's economy and society.

This study discovers that endeavors to screen people baffled by multiple risk factors should be strengthened and key efforts to prevent and control the risk factors should be emphasized [39,40], which is rather significant for the policy-makers who intend to work out the mental health problems of adolescents. Accordingly, in the midst of efforts to prevent and control NSSI behaviors in adolescents, more attention should be focused on the adolescents who are female, boarding students, whose parents have broken marriages and whose fathers' educational qualifications are in disadvantage. Activities of health education and psychological counseling should also be actively carried out to reduce the occurrence of NSSI behaviors.

This study has its shortcomings. The survey covers a relatively small geographical area and thus unable to cover all the situations since it was only carried out in Nanchong City, Sichuan Province, China, so further investigation can be conducted on a wider geographical area. In addition, this study obtained lifestyle and behavior information through self-report questionnaires, which may be subject to recall bias.

Conclusions

To sum up, the study results suggest that the risk factors for NSSI behaviors cluster clearly in adolescents in Nanchong City, Sichuan Province, China, and as the clustering degree of risk factors increases, the risk of NSSI behaviors rises accordingly. The study also displays that in the midst of efforts to prevent and control NSSI behaviors in the future, key emphasis should be put on the adolescents who are female, boarding students, whose parents have broken marriages and whose fathers have poor literacy.

Declarations

Ethics approval and consent to participate

Approval was obtained from the ethics committee of the school of North Sichuan Medical College. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. A written informed consent was obtained from each participant and their legal guardians.

Consent for publication

Not applicable.

Availability of data and materials

The dataset supporting the conclusions of this article is included within the article and its additional file.

Competing Interest

The authors declare that they have no competing interests

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Authors' contributions

XH and YLZ contributed to the study design. XH, YLZ, JYZ, JL, JLH, QK, LJL contributed to material preparation and data collection. XH, XHL, LY, QK, ZLP, LT contributed to data analysis. XH, NY wrote, and JML revised the manuscript. All authors read and approved the final manuscript.

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References

1. Reinhardt M, Kökönyei G, Rice KG, Drubina B, Urbán R. Functions of nonsuicidal self-injury in a Hungarian community adolescent sample: a psychometric investigation. *BMC Psychiatry*. 2021 Dec 9;21(1):618. <https://doi.org/10.1016/j.puhe.2018.09.010>.
2. Amarendra, Gandhi, Koen, Luyckx, Imke, & Baetens, et al. Age of onset of non-suicidal self-injury in dutch-speaking adolescents and emerging adults: an event history analysis of pooled data. *Comprehensive Psychiatry*. *J Compr Psychiatry*. 2018 Jan;80:170-178. <https://doi.org/10.1016/j.comppsy.2017.10.007>
3. Plener PL, Schumacher TS, Munz LM, Groschwitz RC. The longitudinal course of non-suicidal self-injury and deliberate self-harm: a systematic review of the literature. *Borderline Personal Disord Emot Dysregul*. 2015 Jan 30;2:2. <https://doi.org/10.1186/s40479-014-0024-3>.
4. Swannell SV, Martin GE, Page A, Hasking P, St John NJ. Prevalence of nonsuicidal self-injury in nonclinical samples: systematic review, meta-analysis and meta-regression. *Suicide Life Threat Behav*. 2014 Jun;44(3):273-303. <https://doi.org/10.1111/sltb.12070>.
5. Klonsky ED. Non-suicidal self-injury in United States adults: prevalence, sociodemographics, topography and functions. *Psychol Med*. 2011 Sep;41(9):1981-6. <https://doi.org/10.1017/S0033291710002497>.

6. Asarnow JR, Porta G, Spirito A, Emslie G, Clarke G, Wagner KD, et al. Suicide attempts and nonsuicidal self-injury in the treatment of resistant depression in adolescents: findings from the TORDIA study. *J Am Acad Child Adolesc Psychiatry*. 2011 Aug;50(8):772-81. <https://doi.org/10.1016/j.jaac.2011.04.003>.
7. Klonsky ED, May AM, Glenn CR. The relationship between nonsuicidal selfinjury and attempted suicide: converging evidence from four samples. *J Abnorm Psychol*. 2013;122(1):231–7. <https://doi.org/10.1037/a0030278>.<https://doi.org/10.1037/a0030278>.
8. Prinstein MJ, Nock MK, Simon V, Aikins JW, Cheah CS, Spirito A. Longitudinal trajectories and predictors of adolescent suicidal ideation and attempts following inpatient hospitalization. *J of Consult. and Clin. Psychol*. 2008;76(1):92. <https://doi.org/10.1037/0022-006X.76.1.92>.
9. Trepal HC, Wester KL, Merchant E. A cross-sectional matched sample study of nonsuicidal self-injury among young adults: support for interpersonal and intrapersonal factors, with implications for coping strategies. *Child Adolesc Psychiatry Ment Health*. 2015 Sep 28;9:36. <https://doi.org/10.1186/s13034-015-0070-7>.
10. Tomás CC, Oliveira E, Sousa D, Uba-Chupel M, Furtado G, Rocha C, et al. Proceedings of the 3rd IPLeiria's International Health Congress : Leiria, Portugal. 6-7 May 2016. *BMC Health Serv Res*. 2016 Jul 6;16 Suppl 3(Suppl 3):200.<https://doi.org/10.1186/s12913-016-1423-5>.
11. Fox KR, Franklin JC, Ribeiro JD, Kleiman EM, Bentley KH, Nock MK. Meta-analysis of risk factors for nonsuicidal self-injury. *Clin Psychol Rev*. 2015 Dec;42:156-67. <https://doi.org/10.1016/j.cpr.2015.09.002>.
12. JIANG Xiao-qing, XU Wen-yan, LI Xu-yang, WEN Xiao-tong, XIE Fei, HUANG Qing, et al. Risk factors and cumulative effects of non-suicidal self-injury behaviors among rural high school students in Wuyuan .*Chinese Journal of School Health*, 2018, 39(12):1876-1878.<https://doi.org/10.16835/j.cnki.1000-9817.2018.12.033>.
13. McAloney K, Graham H, Law C, Platt L. A scoping review of statistical approaches to the analysis of multiple health-related behaviours. *Prev Med*. 2013 Jun;56(6):365-71. <https://doi.org/10.1016/j.ypmed.2013.03.002>.
14. Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barron V, Chisholm D. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *Lancet*. 2010 Nov 20;376(9754):1775-1784.[https://doi.org/10.1016/S0140-6736\(10\)61514-0](https://doi.org/10.1016/S0140-6736(10)61514-0).
15. The State Council. (2016). Opinions of the State Council on strengthening the work of caring for the left behind children in rural areas. Retrieved May 20, 2019, from http://www.gov.cn/zhengce/content/2016-02/14/content_5041066.htm.
16. LU Shan , DUAN Xin-yu1, QIU Ming-yue. Longitudinal Measurement Invariance of the Chinese Versions of DASS-21 in College Students. *Chinese Journal of Clinical Psychology* 2020,28(05):950-953.<https://doi.org/10.16128/j.cnki.1005-3611.2020.05.019>.
17. CHEN Shu lin, ZHENG Quan quan, PAN Jian nan, ZHEN Sheng shen. Preliminary Development of Coping Style Scale for Middle School Students. *Chinese Journal of Clinical*

- Psychology ,2000(04):211-214+237.<https://doi.org/10.16128/j.cnki.1005-3611.2000.04.005>.
18. Li J in Xu Yan The Correlations between Anxiety and Coping Styles of Shanghai Songjiang Middle School Students.China Journal of Health Psychology.2013,21(09):1391-1393.<https://doi.org/10.13342/j.cnki.cjhp.2013.09.024>
 19. Ni W, Weng R, Yuan X, Lv D, Song J, Chi H, et al. Clustering of cardiovascular disease biological risk factors among older adults in Shenzhen City, China: a cross-sectional study. *BMJ Open*. 2019 Mar 7;9(3):e024336.<http://dx.doi.org/10.1136/bmjopen-2018-024336>.
 20. Nock MK, Favazza AR. Nonsuicidal self-injury: definition and classification. In: Nock MK, ed. *Understanding nonsuicidal self-injury: origins, assessment and treatment*. Washington (DC): American Psychological Association; 2009. p. 9-18.
 21. Miller, A., Smith, H. Adolescent non-suicidal self-injurious behavior: The latest epidemic to assess and treat. *Applied and Preventive Psychology*, 12, 178-188.<https://doi.org/10.1016/j.appsy.2008.05.003>
 22. Liu Y, Xiao Y, Ran H, He X, Jiang L, Wang T, et al. Association between parenting and non-suicidal self-injury among adolescents in Yunnan, China: a cross-sectional survey. *PeerJ*. 2020 Dec 7;8:e10493.<https://doi.org/10.7717/peerj.10493>.
 23. REN Ji-dong LIAO Yu-jia TIAN Xiao-bing LIU Yue-guang CHEN Si-yu LI Wan-xia.Analysis on aggregation and mental health risk factors of primary and secondary school teachers in Yingshan County of Nanchong City[J]. *Occup and Health*,2022,38(07):903-907+912.<https://doi.org/10.13329/j.cnki.zyyjk.2022.0157>.
 24. Jiang X . Epidemiological characteristics and risk factors of non-suicidal self-injury in rural high school students at Wuyuan County [D].Nanchang University,2019.
 25. Hutchesson MJ, Duncan MJ, Oftedal S, Ashton LM, Oldmeadow C, Kay-Lambkin F, et al. Latent Class Analysis of Multiple Health Risk Behaviors among Australian University Students and Associations with Psychological Distress. *Nutrients*. 2021 Jan 28;13(2):425. <https://doi.org/10.3390/nu13020425>.
 26. Padrón Alicia,Galán Iñaki,Rodríguez-Artalejo Fernando. Behavioral risk factors and mental health: single and cluster associations in Spanish adolescents.[J]. *Journal of developmental and behavioral pediatrics* : *JDBP*,2012,33(9):698-704.<https://doi.org/10.1097/DBP.0b013e31826ba9d9>.
 27. Champion Katrina E,Mather Marius,Spring Bonnie,Kay-Lambkin Frances,Teesson Maree,Newton Nicola C. Clustering of Multiple Risk Behaviors Among a Sample of 18-Year-Old Australians and Associations With Mental Health Outcomes: A Latent Class Analysis. *Frontiers in public health*, 2018 May 7;6:135.<https://doi.org/10.3389/fpubh.2018.00135>.
 28. Brown RC, Plener PL. Non-suicidal Self-Injury in Adolescence. *Curr Psychiatry Rep*. 2017 Mar;19(3):20.<https://doi.org/10.1007/s11920-017-0767-9>.
 29. Barrocas AL, Hankin BL, Young JF, Abela JR. Rates of nonsuicidal self-injury in youth: age, sex, and behavioral methods in a community sample. *Pediatrics*. 2012;130(1):39-45.<https://doi.org/10.1542/peds.2011-2094>.
 30. Tatnell R, Kelada L, Hasking P, Martin G. Longitudinal analysis of adolescent NSSI: the role of intrapersonal and interpersonal factors. *J Abnorm Child Psychol*. 2014 Aug;42(6):885-96.

<https://doi.org/10.1007/s10802-013-9837-6>.

31. Chu Xiaoqing Research on the Rural Boarding School Students of School Adjustment Problems and Strategies [D]Southwest University 2009
32. Anosike C Isah A Igboeli NU. Development and validation of a questionnaire for evaluating knowledge of risk factors for teen depression among health care trainees of a Nigerian university. *Asia Pac Psychiatry* 2020 12 3 e12391. <https://doi.org/10.1111/appy.12391>.
33. Li Y, Putallaz M, Su Y. Interparental Conflict Styles and Parenting Behaviors: Associations With Overt and Relational Aggression Among Chinese Children[J]. *Merrill-Palmer Quarterly*, 2011,57(4): 402-428.<http://www.jstor.org/stable/23098032>
34. GE Hai-yan, LIU Ai-shu. Cumulative familial risk index and adolescent self-harm behaviors[J]. *Chinese Journal of School Health*, 2018, 39(5): 698-701.<https://doi.org/10.16835/j.cnki.1000-9817.2018.05.017>.
35. Wu Z, Hu BY, Wu H, Winsler A, Chen L. Family socioeconomic status and Chinese preschoolers' social skills: Examining underlying family processes. *J Fam Psychol*. 2020 Dec;34(8):969-979. <https://doi.org/10.1037/fam0000674>.
36. Lucasthompson R G, Hostinar C E. Family income and appraisals of parental conflict as predictors of psychological adjustment and diurnal cortisol in emerging adulthood. *Journal of Family Psychology*, 2013, 27(5):784-794.<https://doi.org/10.1037/a0034373>.
37. Ponnet K. Financial stress, parent functioning and adolescent problem behavior: an actor-partner interdependence approach to family stress processes in low-, middle-, and high-income families. *J Youth Adolesc*. 2014 Oct;43(10):1752-69. <https://doi.org/10.1007/s10964-014-0159-y>.
38. Huang Y, Dai M, Deng Z, Huang X, Li H, Bai Y, et al. Clustering of risk factors and the risk of new-onset hypertension defined by the 2017 ACC/AHA Hypertension Guideline. *J Hum Hypertens*. 2020 May;34(5):372-377. <https://doi.org/10.1038/s41371-019-0232-9>.
39. Li X, Yu C, Guo Y, Bian Z, Shen Z, Yang L, et al Association between tea consumption and risk of cancer a prospective cohort study of 0.5 million Chinese adults[J] *Eur J Epidemiol* 2019 34(8) 753-763 <https://doi.org/10.1007/s10654-019-00530-5>.
40. Evans GW Cassells RC. Childhood poverty cumulative risk exposure and mental health in emerging adults. *Clin Psychol Sci* 2014 2 3 287-296.<https://doi.org/10.1177/2167702613501496>