Contextual Influences on Deliberate Self-harm Among Chinese University Undergraduates: A Representative Nationwide Study

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Abstract

Background: Numerous studies have identified factors associated with deliberate self-harm (DSH), but environmental influences have been largely neglected. This study explored regional and university contextual factors impacting DSH among undergraduate students in China.

Methods: In this observational cross-sectional study, subjects were 5,016 undergraduate students, who were identified through multistage survey sampling in 22 Chinese universities. Individual-level data were obtained through a self-administered questionnaire, and environmental variables were extracted from the National Bureau of Statistics database. Multilevel logistic regression models were used to examine regional correlates of DSH.

Results: The overall prevalence of self-reported DSH in the study sample was 7.5% (95% CI: 4.1%, 10.9%). The full multilevel logistic model showed university rank and city size were inversely associated with DSH prevalence (OR: 0.24 and 0.55). Regional unemployment rates were positively associated with DSH prevalence (OR: 1.98).

Conclusion: Results yield important insights on the role of context in DSH among Chinese undergraduates, and indicate the need to consider environmental factors in order to ameliorate the problem.

Background

Deliberate self-harm (DSH) is defined as the deliberate, direct destruction or alteration of body tissue without conscious suicidal intent and suicidal behavior [1]; alternatively described as nonsuicidal self-injury. Research has confirmed that DSH is not only identified frequently among patients with psychiatric diagnoses, but also occurs in nonclinical populations, especially adolescents and young adults[2, 3]. In addition to causing physical pain, DSH impacts affect, interpersonal relationships, and academic performance[4]. DSH has emerged as a major social and public health issue among young adults. Many studies have reported characteristics associated with DSH, including sociodemographics, behavioral and mental problems, and social support [5–7]. These studies, however, mainly focused on individual-level factors. Although some studies discerned environmental variation in the prevalence of DSH, they were confined to a very small number of relevant predictors [8–10]. No studies have examined how both individual and environmental factors contribute to DSH variation. The current study examined the independent influence of environmental factors on DSH, especially regional factors. More specifically, it identified variables related to DSH among Chinese undergraduate students, and assessed the extent to which DSH was affected by contextual factors independent of personal characteristics. According to the ‘breeder hypothesis,’ exposure to environmental factors and physical, social, and behavioral factors may directly or indirectly impact personal health [11, 12].

Hypotheses

Several studies associated individual socioeconomic status with DSH [13, 14], but no previous research has examined the association between regional socioeconomic status and DSH. In this study, we evaluated the hypothesis that both individual-level and regional socioeconomic status were associated with DSH among Chinese undergraduates. We also explored the independent influence of city size and university rank upon DSH among this group. Large cities generally have richer social resources and better technology and public facilities than do smaller ones and more geographically remote cities or smaller communities in China [15]. We measured city size by absolute population rather than by population density or areally. It is plausible that students residing in highly populous and generally opportunity-rich cities endure less stress than do other students, which in turn could translate into a lower prevalence of DSH. Similar to large cities, high-rank universities feature more social and financial resources, better provision for knowledge and skills acquisition, and more employment opportunities than do low-rank universities. Students attending such institutions may therefore experience lower stress levels, and hence engage in less DSH than counterparts in other universities. We hypothesized that both city size and university rank were positively associated with DSH.

Unemployment was another contextual variable examined in this study. Many studies have reported an association between personal psychological stress and DSH [5, 16], and a study by Morgan and colleagues found personal unemployment was also associated [17]. However, these studies excluded regional factors. An unemployment designation requires not only that a person is without work but is also actively seeking it [18]. High unemployment reflects discontinuities in economic growth and structure, a confluence of forces that may stress residents. One study found an association between regional unemployment and violence among women [19]. In concert, the aforementioned findings indicate that high unemployment may be a determinant of DSH.

Methods

Procedure, subjects and data source

This was an observational cross-sectional, multilevel study with a multi-staged sampling design. Subjects comprised 5,016 undergraduate students, who came from 22 universities across China. This study reports individual data from the Global Health Professions Student Survey (GHPSS) on Tobacco Control in China GHPSS (Extended version). Compared to the original survey, the extended version included extra health, mental stress, and behavioral items. A detailed description of study methods is reported by Yang et al [20]. The individual-level variables were augmented by regional variables, which were extracted from the National Bureau of Statistics database [15, 21].

Measures

Dependent variable

Deliberate self-harm (DSH): Survey respondents were asked “In the past year have you ever intentionally harmed yourself without suicidal intent and behavior?” Affirmative answers were classified as DSH [22–

25].

Individual-level independent variables

All respondents provided the following sociodemographic information: age, sex, race/ethnicity, grade, major, parental occupation, annual household income, and family residence. Mental stress was measured using the Chinese version of the Perceived Stress Scale (CPSS) [25, 26]. This scale comprises 14 items that address perceptions of stress during the month prior to the survey. Items were rated on a 5-point Likert-type scale, and ranged from 0 (never) to 4 (very often). We summed item scores to yield a total stress score, with higher scores indicating higher perceived levels of stress. Severe stress was operationalized as a score greater than 25, following prior practice [25, 26].

Contextual independent variables

University rank was distinguished using the China University Ranking System (“high,” “medium,” and “low”), as established by the National Ministry of Education [27]. Differential levels implied variable resources, opportunities, and learning environments. There were several independent variables that reflected potential regional variation. The first was degree of economic development, as measured by Gross Domestic Product (GDP) per capita in Yuan. Also included in our analyses were GDP per capita in the province of origin (home province GDP), and GDP per capita in the city where the students resided (university city GDP). Additional contextual variables were the population of the city in which the university was located, and the unemployment rate expressed as the number of unemployed persons per one million population. We extracted the preceding data from the National Bureau of Statistics [16, 22].

Data Analysis

All data were entered into a database using Microsoft Excel. The dataset was then imported into SAS (9.3 version) for the statistical analyses. Our descriptive outcome measure was prevalence of DSH. A logistic model was utilized to assess associations between the independent variables and the outcome, self-reported self-harm versus no harm. Both unadjusted and adjusted multivariable analyses were presented. SAS survey logistic procedures were applied in the unadjusted analysis. Associations were confirmed through application of a multilevel logistic regression model using the SAS GLIMMIX procedure [27]. All analyses accounted for a within-clustering correlation employing the university as the clustering unit. Series models were built for each primary predictor, with adjustment for potentially confounding socio-demographics. We started with the Null Model, a three-level (individual, university, and city) model with random intercepts, in building the DSH multilevel logistic regression model. To the null base, we added individual, university, regional variables as fixed main effects to form the “individual model,” “university model,” and “region model” for evaluating environmental impact on DSH. For this analysis, we operationalized the variable “DSH” as a binary response (no = 1, yes = 2). The first category enumerated for each variable served as the referent in the logistic regression analysis. We assessed the significance of the random parameter variance estimates using the Wald joint *t* test statistic [28].

All statistical analyses were weighted. Weights comprised (1) sampling weights, as the inverse of the probability of selection, calculated at the university level, and (2) post-stratification weights, calculated relative to sex, based on estimated distributions from a national survey [29]. The final overall weights were computed as the product of the preceding weights [28]. We did not consider using a non-response weight since non-response rates were very low. Unadjusted logistic regression analyses were weighted using the overall participant-level weights, and multilevel analysis was weighted using sampling in regional level, subject-level weights were used post-stratification weights, respectively [28].

Results

Valid questionnaires were completed by 97.7% of targeted students, resulting in a sample of 5,016 subjects representing 22 universities. Of the sample, 12% were younger than 20 years of age, 38% were 20 or 21, and the remainder 22 years or older. Forty-one percent were male. The majority of subjects (68%) were freshmen and sophomores, and 32% juniors or seniors. Ninety-one percent were Han Chinese (Table 1).

Table 1

Sample demographic characteristics and prevalence of deliberate self-harm in Chinese undergraduates

Group	n	% of sample	Prevalence (%)	Unadjusted Odds Ratio
Age (years)				
< 20	1054	12.1	7.6	1.00
20	977	18.2	8.2	1.01 (0.78, 1.57)
21	735	20.4	10.0	2.04 (0.79, 5.24)
22	656	21.4	5.5	2.11 (0.44, 10.02)
23+	971	26.7	6.5	1.43 (0.49, 4.17)
Gender				
Male	1617	41.1	8.4	1.00
Female	3399	58.9	6.9	0.81 (0.45, 1.43)
Race/ethnicity				
Han	4548	90.5	7.1	1.00
Minority	436	9.5	11.5	1.63 (0.90, 2.93)
Grade				
1–2	2688	67.9	8.7	1.00
3–4	2188	30.8	4.9	0.58 (0.34, 0.97)*
5+	142	1.3	4.4	0.48 (0.29, 0.81)*
Major				
Medical	4446	24.5	7.4	1.00
Others	570	75.5	7.5	1.02 (0.56, 1.85)
Paternal occupation				
Worker/farmer/merchant	4092	71.1	8.3	1.00
Administrator/clerk	631	15.8	7.1	0.92 (0.64, 1.32)
Technical personnel/educator	293	13.1	3.6	0.42 (0.06, 2.69)
Maternal occupation				
Worker/farmer/merchant	4148	68.0	7.8	1.00
Administrator/clerk	545	15.5	4.2	0.58 (0.19, 1.78)

Group	n	% of sample	Prevalence (%)	Unadjusted Odds Ratio
Technical personnel/educator	292	16.5	9.2	1.27 (0.76, 2.12)
Annual household income per capita				
< 10,000 yuan	1181	34.3	7.2	1.00
10,000	1273	21.7	6.1	0.82 (0.44, 1.52)
20,000+	1932	44.0	8.5	1.17 (0.82, 1.69)
Student monthly expenditure				
< 1,000 yuan	347	5.4	6.0	1.00
1,000–1,499	2717	47.9	7.0	1.17 (0.56, 2.45)
1,500-1,999	1532	32.4	8.5	1.40 (0.67, 2.93)
2,000+	420	14.3	7.5	1.31 (0.43, 4.02)
Mental stress				
No	2590	62.3	5.4	1.00
Yes	2424	33.6	10.9	2.01 (1.36, 2.94)**
Smoking				
No	4563	86.3	6.5	1.00
Yes	452	13.7	14.0	2.34 (1.56, 3.51)**
Family residence				
Rural	3350	59.6	8.5	1.00
City county	768	17.2	5.6	0.68 (0.25, 1.86)
City	898	23.2	6.3	0.78 (0.48, 1.26)
University variable				
Rank				
Low	698	8.1	20.3	1.00
Medium	2497	35.8	8.9	0.54(0.37,0.47)**
High	182	53.4	4.7	0.19(0.16,0.21)**
Regional variables				
Origin region GDP per capita				

Group	n	% of sample	Prevalence (%)	Unadjusted Odds Ratio
< 50,000 yuan	3367	76.3	8.0	1.00
50,000–99,999	798	12.0	5.6	0.63 (0.31, 1.26)
100,000	851	11.7	6.1	0.88 (0.49, 1.59)
University GDP per capita				
< 50,000 yuan	1382	20.3	8.4	1.00
50,000–99,999	3103	74.6	7.4	0.95 (0.47, 1.90)
100,000	531	5.1	5.7	0.69 (0.38, 1.26)
City population(millions)				
< 1	2644	35.5	11.4	1.00
1–3	1398	15.0	7.6	0.64 (0.33, 1.26)
4+	974	49.6	4.6	0.41 (0.24, 0.70)**
Unemployment rate (per million)				
< 100	2086	63.5	5.9	1.00
100–199	1477	21.8	7.4	1.25 (0.72, 2.19)
200+	968	7.1	19.7	4.08 (2.89, 5.99)**

Of students completing the survey, 7.5% reported DSH behaviors (95% CI: 4.1–10.9%). The unadjusted logistic analysis showed grade level, mental stress, smoking, university rank, city size, and unemployment rate were associated with self-reported DSH. The full multilevel logistic model showed that individual grade level, mental stress, and smoking rates were associated with DSH. Turning to the contextual variables, undergraduates residing in cities with fewer than one million people manifested a 1.81 times higher likelihood of reporting DSH than counterparts residing in cities of four million or more. Undergraduates at low-rank universities had 4.14 times the likelihood of reporting DSH than did students in high-rank institutions. Undergraduates residing in regions with a high unemployment rate had approximately twice the self-reported prevalence of DSH as counterparts residing in areas with a low rate (Table 2).

Table 2

Odds ratios and associated 95% confidence intervals for an outcome of deliberate self-harm versus no harm in Chinese undergraduates

	Null Model	Model 1 (Individual)	Model 2 (University)	Model 3 (Regional)
Group		OR (95% CI)	OR (95% CI)	OR (95% CI)
Grade				
1–2		1.00	1.00	1.00
3–4		0.64 (0.41,0.98)*	0.69 (0.40, 1.21)	0.67 (0.40, 1.12)
5+		0.61 (0.40,0.93)*	0.83 (0.76, 0.97)*	0.58 (0.42, 0.81)**
Mental stress				
No		1.00	1.00	1.00
Yes		2.17 (1.49,2.70)**	1.56 (1.19, 2.04)**	1.67 (1.30, 2.12)**
Smoking				
No		1.00	1.00	1.00
Yes		2.49 (1.52,3.12)**	2.17 (1.39, 3.37)**	2.21 (1.43, 3.42)**
University ranking				
Low			1.00	
Medium			0.55(0.40,0.76)**	
High			0.24(0.21,0.27)**	
City population (millions)				
< 1				1.00
1–3				0.87 (0.54, 1.40)
4+				0.55 (0.42, 0.72)**
Unemployment rate (per million)				
< 100				1.00
100–199				0.96 (0.63, 1.47)

	Null Model	Model 1 (Individual)	Model 2 (University)	Model 3 (Regional)
200+				1.98 (1.48, 2.65)**
Fixed parameters	9.55**	7.44**	7.22**	6.77**
Random parameters between universities	2.31*	2.28*	2.05*	1.56
Random parameters between university cities	5.04**	4.67*	4.17*	1.87

Discussion

Approximately 8% of university undergraduates in this study reported DSH, a lower prevalence than found in other Chinese studies [30, 31] but similar to that reported in more economically developed countries [32, 33]. Further research is necessary to enlighten our finding. We found DSH prevalence varied widely among cities and universities across China, variation that may partially be accounted for by environmental and other contextual variables.

Addressing a gap in the literature, we also found that several contextual variables were associated with self-reported DSH. University undergraduates, who resided in cities of less than one million, approached an almost two-fold higher likelihood of reporting DSH than counterparts in cities of four million or more. Large Chinese cities usually have more social and financial resources than do midsize and small cities [16]. Thus, as consequence, it seems plausible undergraduates in large cities have less stress, and in turn the smallest prevalence of DSH. Similarly, undergraduates studying at low-rank universities showed 4-fold higher likelihood of reporting DSH than did students in high-rank institutions. Low-rank universities usually have less government financial support, and fewer quality courses and student opportunities [27]. Higher stress experienced by students in response to these deficient living and learning environments may in turn induce more DSH [6, 17]. Neither regional socioeconomic status nor personal income was associated with DSH. However, university rank and city size showed inverse associations, pointing to the importance of social and economic resources as determinants of DSH [34, 35]. These resources are inequitably distributed across China. The more elite universities concentrate in large cities, particularly along the eastern coast. Our research results argue for the need to augment resources for undergraduates in lower rank universities, and contract intercity differences resources in order to reduce DSH.

Undergraduates residing in high unemployment regions approached twice the self-reported prevalence of DSH as counterparts residing in low unemployment regions. Regional unemployment rates are inversely associated with level of economic development, labor absorption capacity, and social stability. Characteristics associated with unemployment, including lack of jobs, low pay, and excess frustration and hopelessness about future employment prospects [36], likely foster a stressful environment for undergraduates. We also found high personal mental stress was associated with self-reported DSH,

affirming findings from other studies that examined individual-level determinants [6, 17]. Parenthetically, we report a significant interaction between individual mental stress and regional employment status (Estimate: 0.2141, SE: 0.0889), World Chi-Square: 5.80, p: 0.0160).

Study limitations

Study limitations included the cross-sectional design, which precluded us from assessing causation between individual and regional variables, on the one hand, and DSH, on the other. Serving as mitigating forces, we employed a large sample and our findings met several criteria for inferring causality, including the strength of some associations, their consistency, and plausibility of effect. Future studies need to compile longitudinal surveillance data on DSH. Our subjects were confined to university undergraduates, thus inhibiting generalizability of results to the wider student population and to the Chinese population.

Conclusion

Contextual disparities appear to contribute to DSH among Chinese undergraduates. Study results point to the need to consider environmental factors in DSH prevention and reduction. Preventive initiatives must focus on redressing imbalances in the allocation of social and economic resources across universities and regions, but include teaching undergraduates how to reduce and manage their mental stress.

Abbreviations

DSH: Deliberate self-harm

GHPSS: Global Health Professions Student Survey

CPSS: Perceived Stress Scale

GDP: Gross Domestic Product

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee at the Medical Center, Zhejiang University, and verbal consent was obtained from all participants prior to data collection.

Consent for publication

The authors listed the manuscript participated in the work and have agreed to publish this manuscript.

Availability of data and material

Data sharing not applicable to this article because the datasets we used belongs to our Centre for Tobacco Control Research Zhejiang University School of Medicine. Please contact corresponding author for data requests.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Tingzhong Yang conceived the study design, conceptualized the ideas, and supervised the data management and analyses. Sihui Peng and Weifang Zhang organized the data collection, processed and managed the project. TY wrote the initial manuscript. RC and IR provided the revision of the manuscript. All authors reviewed previous drafts. All authors read and approved the final manuscript.

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