



## Research article

## Psychological distress among first-year health science students in Taiwan

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## HIGHLIGHTS

- Some first-year health science students are at risk of psychological distress.
- Anxiety and self-harm are common among first-year health science students.
- Students in four-year programs are more likely to experience mental health challenges.

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## ABSTRACT

**Background:** Most first-year college/university students are adolescents or young adults and therefore are at high risk of developing psychological distress symptoms. Little is known about psychological distress among first-year university students in Taiwan, especially those studying health science-related fields.

**Objective:** To understand the prevalence of psychological distress and its five dimensions (depression and anxiety, self-harm, impulsivity, and psychiatric disturbance) and explore the relationship between student-specific variables (enrollment year, age, sex, program duration, and college) and psychological distress.

**Methods:** A secondary analysis design was adopted. We enrolled 4,212 first-year university students throughout 2016, 2017, and 2018. Health screening data were obtained using the Mental Health Scale for Undergraduate-Screening Assessment (MHSU-SA) for first-year health science students at a private technical-vocational university in northern Taiwan.

**Results:** Many first-year university students were at-risk for depression (4.2%), anxiety (8.2%), self-harm (5.2%), impulsivity (2.6%), psychiatric disturbance (4.4%), and overall psychological distress (4.2%). Students in a four-year program were more than twice as likely to demonstrate psychological distress symptoms compared to their two-year (night) program counterparts (odds ratio = 2.05, 95% confidence interval = 1.20–3.49,  $p < 0.01$ ).

**Conclusion:** Some first-year health science university students showed psychological distress, including anxiety, self-harm, psychiatric disturbance, depression, and impulsivity. Students in four-year programs were twice as likely to show symptoms of psychological distress than those in two-year (night) programs. Therefore, mental health screenings are recommended to facilitate early detection and timely intervention for at-risk students.

## 1. Introduction

Psychological distress is positively correlated with the development of mental disorders (Eleftheriades et al., 2020). It can include emotional changes, maladjustments, or adverse experiences arising from poor stress management or unmet needs (Drapeau et al., 2012). Symptoms of psychological distress often begin in early adulthood (adolescence to

twenties) (Auerbach et al., 2018; Bantjes et al., 2019). Approximately 20% of adolescents experience mental health problems, affecting interpersonal relationships, academic achievement, or job performance. Severe cases may lead to suicide or other maladaptive behaviors (WHO, 2019). Because college/university students are young adults (Torres et al., 2017), first-year university students may be at risk for psychological distress and require mental health support (Wadman et al., 2019).

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Among first-year students, 31.4% experienced at least one mental health problem during the preceding year; most exhibited symptoms before starting university (Auerbach et al., 2018; Bantjes et al., 2019), implying the general importance of addressing mental health issues in first-year university students. Therefore, mental health assessments should be conducted early to provide the necessary support (Auerbach et al., 2018; Pereira et al., 2019).

Mental health problems can co-occur; hence, multiple dimensions are needed to assess mental health status (Bruffaerts et al., 2018). These psychological assessments measure internalizing (e.g., depression, anxiety, self-harm/injury) and externalizing (e.g., hyperactivity, impulsivity) behaviors (Bantjes et al., 2019; Bruffaerts et al., 2018). Methodological differences can produce different estimates of psychological distress among undergraduate students (9–64.7%) (Eleftheriades et al., 2020). Unfortunately, few studies have explicitly focused on first-year university students (Liang et al., 2020). Psychological distress is a non-specific mental health problem characterized by depression, anxiety, and psychiatric disturbance (Drapeau et al., 2012). Individuals prone to self-harm/injury and impulsivity may endanger their own lives or others. This is an area of concern particularly for first-year university students (Bruffaerts et al., 2018). This study focused on the psychological distress symptoms of depression, anxiety, self-harm/injury, impulsivity, and psychiatric disturbance (Huang and Wang, 2008).

The extent to which variables like age, sex, the field of study, and program duration correspond to increased risk of psychological distress among first-year university students remains inconclusive. One study found the prevalence of psychological distress gradually increases after age 17, peaks at 20, then attenuates (Pereira et al., 2019). Other studies showed that age was negatively (Bhat et al., 2018) or non-significantly correlated (Saias et al., 2014). Females may have a higher prevalence of psychological distress (Bantjes et al., 2019; Pereira et al., 2019; Tesfahunegn and Gebremariam, 2019); however, such findings are not ubiquitous (Demenech et al., 2021).

Selecting a college/university (Ilgan et al., 2018; Islam and Shoron, 2020) and field of study (Durdyev and Ihtiyar, 2019; Schuller et al., 2018) is an important decision that may reflect similarly shared background characteristics. Upon completing grades 1–9, Taiwanese adolescents attend a three-year regular or vocational senior high school or five-year junior college. Graduates apply to college/university through multiple tracks based on their entrance examinations. In 2016, 97.1% of applicants were admitted to higher education institutions (Chien et al., 2013; Huang et al., 2018), with programs lasting for two or four years, according to each student's background (Huang and Zhan, 2017; Huang et al., 2018). The field of study appears to be linked to psychological distress. Students' decisions to major in health science often stem from a desire to help others or career aspirations (Bhat et al., 2018) such as medical, nursing, paramedical, dental, pharmacy, applied medical sciences, or health services administration, among others (AlFaris et al., 2016; Bhat et al., 2018; Eleftheriades et al., 2020; Schuller et al., 2018). Some studies found that students in the medical and other health sciences exhibited more mental health problems (Eleftheriades et al., 2020; Lei et al., 2016); however, another study did not (Bhat et al., 2018).

While interest in student mental health has increased, most studies originate in the United States (Hernández-Torran et al., 2020). Investigations in other countries are needed since ethnic and cultural variables may influence psychological distress (Bantjes et al., 2019; Eskin et al., 2016). Although there is a large body of survey research on the mental health of first-year students in Taiwan (Chang et al., 2009; Ho, 2014; Hsu, 2008; Huang and Tsau, 2009; Lee et al., 2008; Li et al., 2002; Shih, 2004; Yang and Chang, 2015; Yang and Shiu, 2014), most based their findings on outdated data, with little focus on students in health science-related fields. We sought to (1) understand the prevalence of psychological distress and its five dimensions (depression, anxiety, self-harm, impulsivity, and psychiatric disturbance) and (2) explore the relationship between student-specific variables (enrollment year, age, sex, program duration, and college) and psychological distress. We

hypothesized that some first-year health science university students demonstrate risk factors regarding psychological distress and its five dimensions; we also hypothesized that risk would correlate with student-specific variables.

## 2. Materials and methods

### 2.1. Data sources and students

All data were collected from a private technical-vocational university in Northern Taiwan that trains healthcare professionals and has approximately 5,000 students. In addition, the Office of Student Affairs is equipped with a Student Counseling Center that performs mental health assessments on all incoming first-year students to screen for mental health problems and increase the likelihood that mental health services can be provided at the earliest possible time. Each year, the school pays the questionnaire publisher for use of the questionnaire and subsequent analytic services.

This secondary data analysis was conducted after securing approval from the Institutional Review Board of Chang Gung Medical Foundation (IRB No: 201801038B0). This study obtained full ethical approval, and all the student respondents provided written informed consent before completing the questionnaire. After obtaining approval from the Chang Gung University of Science and Technology Research Ethics Committee, the counseling center provided the researchers with deidentified mental health screening assessments data obtained from first-year university students in 2016, 2017, and 2018. All data provided by the Counseling Center were deidentified.

We used data obtained from first-year university students admitted in 2016, 2017, and 2018. The complete mental health assessment questionnaire included 10 items that assessed response validity. Scoring greater than 85% of the norm indicated the student's responses were non-valid (Huang and Wang, 2008). To improve the accuracy of our results, we excluded all responses from students with missing data or whose responses were deemed non-valid.

There were 4,911 first-year students enrolled across the three academic years; 4,831 completed the mental health screening questionnaire (98.4%). After excluding 300 (missing data) and 319 students (validity index  $\geq 85\%$ ), we analyzed the data of 4,212 students (87.2% of the initial student pool). There were no significant between-group differences for enrollment year, sex, program duration, and department between those included and not included in the final analysis ( $p > 0.05$ ). Despite our efforts to obtain a representative sample, students included in the final analysis were significantly younger than the general student population ( $p < 0.01$ ).

### 2.2. Measurements

The self-administered Mental Health Scale for Undergraduate-Screening Assessment (MHSU-SA) consists of two parts. The first part provides student-specific variables. The second part consists of 110 questions (10 items assess response validity and 100 items on the five dimensions: depression, anxiety, self-harm, impulsivity, and psychiatric disturbance). Student-specific variables included enrollment year, age, sex, program duration, and department. The program duration was divided into two-year (night), two-year (day), and four-year tracks. Students in the two-year track were graduates of five-year junior colleges from similar departments. Most students in the two-year (night) track are full-time or part-time, whereas students in the two-year (day) track are full-time students. The four-year track graduates are graduates of three-year regular or vocational senior high schools and full-time day students. First-year students in the two-year (day) and four-year tracks must live in university accommodation. There are five departments in this university that are combined into two colleges. The College of Nursing includes two departments: (1) nursing and (2) gerontology and health care management. The College of Human Ecology includes three

departments: (1) childcare and education, (2) nutrition and health sciences, and (3) cosmetic science.

The MHSU-SA was developed based on the diathesis-stress model (Huang and Wang, 2008) and has been previously used in Taiwan (Ho, 2014; Yang and Chang, 2015; Yang and Shiu, 2014). It consists of 100 items and includes five dimensions: depression, anxiety, self-harm, impulsivity, and psychiatric disturbance. Depression refers to feelings of emotional depression and unhappiness. Anxiety is characterized by feeling tense and restless. Self-harm can encompass world-weariness, despair, or actual attempts to harm oneself. Impulsivity refers to the degree of impulsive regret and frequent disputes with people. Psychiatric disturbance is the extent to which some unusual thoughts or behaviors (e.g., hallucinations, delusions) interfere with daily life activities. The depression, anxiety and psychiatric disturbance dimensions illustrate their corresponding symptoms; however, this analysis does not comprise a formal clinical diagnosis of depressive, anxiety or psychiatric disorders. Each dimension comprises 20 items used to assess the cognitive, emotional, behavioral, and physiological characteristics of that dimension. The items were rated using a 4-point Likert scale (1 = completely disagree, 2 = disagree, 3 = agree, 4 = completely agree), and the six negatively worded items were reverse-scored, with higher scores indicating more distress. The total score of the five dimensions represented the overall level of psychological distress.

To establish the national norm standard of the MHSU-SA, Huang and Wang (2008) divided the country into four regions (north, middle, south, east); they randomly selected colleges/universities from each region according to the proportion (4:2:3:1), and then randomly selected a class for each grade in each school. The final sample consisted of 1,960 students, and the valid response rate was 91.2%. The national normative percentile rankings for the five subscales and the overall scale were separately established by sex and academic years. The students' raw MHSU-SA scores (subscales and overall scale) were compared to national standard scores of first-year students to obtain normative percentile ranks by sex. Those scoring  $\geq 85\%$  of the norm (national normative percentile ranks) were considered at-risk students for each dimension or for overall psychological distress (Huang and Wang, 2008).

The MHSU-SA subscales showed split-half reliabilities of 0.85–0.91 (overall scale: 0.95), and the Cronbach's  $\alpha$  coefficient for internal consistency was 0.86–0.93 (overall scale: 0.98); the three-week test-retest

reliability is 0.62–0.84 (overall scale: 0.89). Five tests or practice experts reviewed the scale structure and the content of each item; the subscale pass rate was 73–100% (overall scale: 92%). Comparing the degree of psychological distress of college students with or without counseling or past exposure to psychiatric services, the independent t-test analysis showed significant between-group differences in subscales and the overall scale ( $p < 0.001$ ), indicating adequate discriminant group difference validity. Huang and Wang (2008) conducted an exploratory factor analysis of the five subscales since the scale structure was consistent with the theory and had good expert content validity. Factor analysis revealed three extracted factors (hopelessness, losing interest, sadness, and the urge to cry) in the depression dimension, with a total explained variance of 52.7%; three extracted factors (restlessness, nervousness, fear of losing control) in the anxiety dimension, with a total explained variance of 49.8%; three extracted factors (suicide, self-abandon, self-injury) in the self-harm dimension, with a total explained variance of 59.3%; four extracted factors (uncontrollable aggression, impatience, hyperactivity, rage) in the impulsivity dimension, with a total explained variance of 51.1%; and three extracted factors (persecutory delusions, hallucinations, emotional indifference) in the psychiatric disturbance dimension, with a total explained variance of 50.8% (Huang and Wang, 2008) (Table 1). When the Taiwanese Depression Questionnaire (TDQ) and Basic Personality Inventory (BPI) were used as the external criteria, the correlation coefficient with the TDQ was 0.46–0.64, and with BPI was 0.20–0.68,  $p < 0.01$  (Huang and Wang, 2008; Yang and Chang, 2015).

### 2.3. Data collection

The questionnaire was administered to each class by the Counseling Center staff during the first-year orientation period. After instructions were given, the questionnaires and computerized answer sheets were distributed and completed in about 20 min. Students absent from orientation were tested individually at the center following identical procedures. The computerized answer sheets were sent to the MHSU-SA questionnaire publisher for collective analysis. After analysis, each student's summary scores and percentile ranks (relative to the national norm) on the subscales and overall scale were returned to the counseling center in an electronic format. The center provided each student with a sealed copy of their assessment results and interpretations. In addition,

**Table 1.** Reliability and validity of the Mental Health Scale for Undergraduate-Screening Assessment (MHSU-SA).

Subscales	No. of items	Reliability			Validity		
		Split-half (correlation coefficient)	Internal consistency (Cronbach's $\alpha$ )	Test-retest (correlation coefficient)	Expert agreement (%)	Factors (No. of items)	Explained variance (%)
Response	10				95		
Depression	20	0.85	0.91	0.84	100	hopelessness (8) lose interest (7) urge to cry (5)	38.35 7.63 6.69
Anxiety	20	0.89	0.92	0.83	97	restlessness (8) nervousness (7) fear of losing control (5)	34.48 6.23 5.13
Self-harm	20	0.91	0.93	0.84	73	suicide (7) self-abandon (8) self-injury (5)	45.69 8.28 5.30
Impulsivity	20	0.86	0.86	0.80	100	uncontrollable aggression (10) impatience (5) hyperactivity (4) rage (1)	28.75 8.74 7.22 6.43
Psychiatric disturbance	20	0.87	0.91	0.62	93	persecutory delusions (12) hallucinations (4) emotional indifference (4)	36.91 8.46 5.39
Overall	110	0.95	0.98	0.89	92		

Note: No. = Number; Results from Huang and Wang (2008).

the Counseling Center and class mentors offered follow-up discussions and counseling sessions to at-risk populations. The entire process was completed before November during each of the three years (2016, 2017, 2018). The same assessment instrument and data collection processes were implemented for all three academic years (2016, 2017, 2018).

#### 2.4. Data analysis

Statistical analysis was performed using SPSS (version 23.0; IBM Corporation, USA). Initially, the released data were checked for unreasonable values. Categorical variables are presented as counts and percentages. Continuous variables were non-normally distributed based on the Kolmogorov-Smirnov test ( $p < 0.05$ ) and are presented as medians and interquartile ranges (IQRs). The prevalence estimates for five dimensions and overall psychological distress in at-risk students are expressed using percentages and 95% confidence intervals (CIs).

Given the similarity between the information provided by the students' departments and colleges, the independent variables included only enrollment year, age, sex, program duration, and college; the dependent variables included the percentages of students at-risk for psychological distress symptoms like depression, anxiety, self-harm, impulsivity, psychiatric disturbance, and overall psychological distress. Variables deemed significant ( $p < 0.05$ ) after the initial, simple analysis were entered into multiple logistic regression analyses. The relationship between student-specific variables and psychological distress was expressed using odds ratios (OR) and 95% confidence intervals (CI). Most of the students in this study were female; therefore, we also analyzed the subgroups by gender. All tests were two-tailed, and statistical significance was set at  $p < 0.05$ .

#### 2.5. Controlled for potential bias

To ensure data validity and reduce potential bias, we selected a good data source. The questionnaire operation manual standardized the data collection process. The computer answer sheet was handed over to the questionnaire publisher for collective analysis to reduce possible errors in the coding and analysis process. To reduce reporting bias, we analyzed 87.2% of the subjects in the data pool, excluding missing values and responses where the validity index was  $\geq 85\%$ . We entered all student-specific variables into a multiple logistic regression analysis to reduce the likelihood of type I error. Finally, we performed subgroup analyses by sex to control for potential sex bias affecting the study results.

### 3. Results

A total of 4,212 students were included in the analysis, with 51.2% > 20 years (median 20.1; IQR 18.6–20.7), 91.7% female, 46.8% on the four-year track, 69.5% in the nursing department, and nearly 75% studying at the College of Nursing. Among the five dimensions of depression, anxiety, self-harm, impulsivity, and psychiatric disturbance, 13.6% were at risk ( $\geq 85\%$  of the norm) for at least one dimension (Table 2). We generated prevalence estimates for depression (4.2%), anxiety (8.2%), self-harm (5.2%), impulsivity (2.6%), psychiatric disturbance (4.4%), and overall psychological distress (4.2%). The prevalence of students at risk for overall psychological distress was 3.7% in 2016 and 4.7% in 2018 (Table 3).

Simple logistic regression showed that certain student-specific variables were significantly related to mental health problems. Enrollment year has a significant relationship with self-harm risk. Older students had a lower risk of depression, anxiety, self-harm, psychiatric disturbance, and overall psychological distress. Females exhibited less impulsivity. Students on the four-year track, and those in the College of Human Ecology, had a higher risk of depression, anxiety, impulsivity, psychiatric disturbance, and overall psychological distress (Table 4, Model 1).

We considered that enrollment year, age, sex, program duration, and college were significantly related to depression, anxiety, self-harm,

**Table 2.** Student-specific variables.

Variable	n	%
<b>Enrollment year</b>		
2016	1426	33.9
2017	1394	33.1
2018	1392	33
<b>Age (year)<sup>a</sup></b>		
$\leq 20$	1991	47.3
>20	2155	51.2
Missing	66	1.6
<b>Sex</b>		
Female	3863	91.7
Male	349	8.3
<b>Program duration</b>		
Two-year (night)	930	22.1
Two-year (day)	1309	31.1
Four-year	1973	46.8
<b>Department</b>		
Nursing	2927	69.5
Gerontology and Health Care Management	218	5.2
Child Care and Education	455	10.8
Nutrition and Health Sciences	234	5.5
Cosmetic Science	378	9.0
<b>College</b>		
Nursing	3145	74.7
Human ecology	1067	25.3
<b>Psychological distress<sup>a</sup></b>		
Depression <sup>a</sup>	31	24–38
Anxiety <sup>a</sup>	40	31–47
Self-harm <sup>a</sup>	26	22–32
Impulsivity <sup>a</sup>	34	29–40
Psychiatric disturbance	28	23–35
<b>Numbers of at-risk dimensions</b>		
0	3641	86.4
1	316	7.5
2	118	2.8
3	78	1.9
4	44	1.0
5	15	0.4

<sup>a</sup> indicates expression as the median and interquartile range.

impulsivity, psychiatric disturbance, and/or overall psychological distress ( $p < 0.05$ ). The variance inflation factors for enrollment year, age, sex, program duration, and college were all  $< 1.5$ , satisfying the assumption of no multicollinearity. We entered the enrollment year, age, sex, program duration, and college independent variables separately into each multiple regression model to obtain a more conservative and robust relationship. The multiple logistic regression analysis used depression, anxiety, self-harm, impulsivity, psychiatric disturbance, and overall psychological distress as dependent variables. The Hosmer-Lemeshow test of the regression model indicated a good fit in all cases (all  $p > 0.05$ ). After adjustment, the risk of self-harm among students enrolled in 2017 and 2018 was approximately 1.5 higher than those enrolled in 2016 (OR = 1.47 in 2017; OR = 1.48 in 2018, both  $p < 0.05$ ). Compared to students enrolled in the two-year (night) track, those in the four-year track showed ORs for depression 2.04 (95% CI = 1.16–3.57), anxiety 2.48 (95% CI = 1.62–3.80), self-harm 1.64 (95% CI = 1.05–2.56), psychiatric disturbance 5.27 (95% CI = 2.68–10.36), and overall psychological distress 2.05 (95% CI = 1.20–3.49) (all  $p < 0.05$ ). Compared to students in the College of Nursing, those in the College of Human Ecology were more likely to be depressed (OR = 1.41, 95% CI = 1.01–1.96) or

**Table 3.** Prevalence of at-risk ( $\geq 85\%$  of norm) in psychological distress and five dimensions.

Variable	Depression		Anxiety		Self-harm		Impulsivity		Psychiatric disturbance		Psychological distress	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Total	175	4.2 (3.6–4.8)	345	8.2 (7.4–9.0)	221	5.2 (4.5–5.9)	109	2.6 (2.1–3.1)	187	4.4 (3.8–5.0)	176	4.2 (3.6–4.8)
Enrollment year												
2016	52	3.6 (2.6–4.6)	123	8.6 (7.1–10.0)	59	4.1 (3.1–5.1)	39	2.7 (1.9–3.5)	56	3.9 (2.9–4.9)	53	3.7 (2.7–4.7)
2017	57	4.1 (3.1–5.1)	99	7.1 (5.8–8.4)	81	5.8 (4.6–7.0)	40	2.9 (2.0–3.8)	63	4.5 (3.4–5.6)	58	4.2 (3.1–5.3)
2018	66	4.7 (3.6–5.8)	123	8.8 (7.3–10.0)	81	5.8 (4.6–7.0)	30	2.2 (1.4–3.0)	68	4.9 (3.8–6.0)	65	4.7 (3.6–5.8)
Age												
$\leq 20$	114	5.7 (4.7–6.7)	227	11.4 (10.1–12.8)	140	7.0 (5.9–8.1)	75	3.8 (3.0–4.6)	146	7.3 (6.2–8.4)	122	6.1 (5.0–7.2)
$> 20$	58	2.7 (2.0–3.4)	113	5.2 (4.3–6.1)	78	3.6 (2.8–4.4)	33	1.5 (1.0–2.0)	37	1.7 (1.1–2.3)	51	2.4 (1.7–3.1)
Sex												
Female	162	4.2 (3.6–4.8)	318	8.2 (7.3–9.1)	206	5.3 (4.6–6.0)	94	2.4 (1.9–2.9)	165	4.3 (3.7–4.9)	159	4.1 (3.5–4.7)
Male	13	3.7 (1.7–5.7)	27	7.7 (4.9–10.0)	15	4.3 (2.2–6.4)	15	4.3 (2.2–6.4)	22	6.3 (3.8–8.8)	17	4.9 (2.6–7.2)
Program duration												
Two-year (night)	23	2.5 (1.5–3.5)	40	4.3 (3.0–5.6)	40	4.3 (3.0–5.6)	20	2.2 (1.3–3.1)	16	1.7 (0.9–2.5)	27	2.9 (1.8–4.0)
Two-year (day)	35	2.7 (1.8–3.6)	78	6.0 (4.7–7.3)	39	3.0 (2.1–3.9)	16	1.2 (0.6–1.8)	21	1.6 (0.9–2.3)	26	2.0 (1.2–2.8)
Four-year	117	5.9 (4.9–6.9)	227	11.5 (10.0–13.0)	142	7.2 (6.1–8.3)	73	3.7 (2.9–4.5)	150	7.6 (6.4–8.8)	123	6.2 (5.1–7.3)
Department												
Nursing	112	3.8 (3.1–4.5)	219	7.5 (6.5–8.5)	154	5.3 (4.1–6.1)	62	2.1 (1.6–2.6)	120	4.1 (3.4–4.8)	112	3.8 (3.1–4.5)
Gerontology	4	1.8 (0.0–3.6)	14	6.4 (3.2–9.6)	8	3.7 (1.2–6.2)	3	1.4 (0.0–3.0)	4	1.8 (0.0–3.6)	6	2.8 (0.6–5.0)
Child Care	27	5.9 (3.7–8.1)	44	9.7 (7.0–12.0)	21	4.6 (2.7–6.5)	16	3.5 (1.8–5.2)	28	6.2 (4.0–8.4)	24	5.3 (3.2–7.4)
Nutrition	12	5.1 (2.3–7.9)	26	11.1 (7.1–15.0)	17	7.3 (4.0–11.0)	12	5.1 (2.3–7.9)	19	8.1 (4.6–12.0)	15	6.4 (3.3–9.5)
Cosmetic	20	5.3 (3.0–7.6)	42	11.1 (7.9–14.0)	21	5.6 (3.3–7.9)	16	4.2 (2.2–6.2)	16	4.2 (2.2–6.2)	19	5.0 (2.8–7.2)
College												
Nursing	116	3.7 (3.0–4.4)	233	7.4 (6.5–8.3)	162	5.2 (4.4–6.0)	65	2.1 (1.6–2.6)	124	3.9 (3.2–4.6)	118	3.8 (3.1–4.6)
Human ecology	59	5.5 (4.1–6.9)	112	10.5 (8.7–12.3)	59	5.5 (4.1–6.9)	44	4.1 (2.9–5.3)	63	5.9 (4.5–7.3)	58	5.4 (4.0–6.8)

Note: CI = confidence interval.

**Table 4.** Relationships between student-specific variables affecting psychological distress and five dimensions by logistic regression.

Model and variables	Depression	Anxiety	Self-harm	Impulsivity	Psychiatric disturbance	Psychological distress
<b>Model 1 (unadjusted)</b>						
Enrollment year, ref = 2016						
2017	1.13 (0.77–1.65)	0.81 (0.62–1.07)	1.43 (1.01–2.02) *	1.05 (0.67–1.64)	1.16 (0.80–1.67)	1.13 (0.77–1.65)
2018	1.32 (0.91–1.91)	1.03 (0.79–1.33)	1.43 (1.02–2.02) *	0.78 (0.48–1.27)	1.26 (0.88–1.80)	1.27 (0.88–1.84)
Age (years)	0.91 (0.84–0.98) *	0.90 (0.85–0.95) **	0.94 (0.89–1.00) *	0.98 (0.92–1.03)	0.83 (0.75–0.92) **	0.93 (0.86–0.99) *
Sex (female, ref = male)	1.13 (0.64–2.01)	1.07 (0.71–1.61)	1.25 (0.73–2.14)	0.55 (0.32–0.97) *	0.66 (0.42–1.05)	0.84 (0.50–1.40)
Program duration, ref = two-year (night)						
Two-year (day)	1.08 (0.64–1.85)	1.41 (0.95–2.08)	0.68 (0.44–1.07)	0.56 (0.29–1.09)	0.93 (0.48–1.80)	0.68 (0.39–1.17)
Four-year	2.49 (1.58–3.92) **	2.89 (2.05–4.09) **	1.73 (1.20–2.47) **	1.75 (1.06–2.89) *	4.70 (2.79–7.92) **	2.22 (1.46–3.40) **
College (human ecology, ref = nursing)	1.53 (1.11–2.11) *	1.47 (1.16–1.86) **	1.08 (0.79–1.47)	2.04 (1.38–3.01) **	1.53 (1.12–2.09) **	1.48 (1.07–2.04) *
<b>Model 2 (adjusted)</b>						
Enrollment year, ref = 2016						
2017	1.12 (0.76–1.65)	0.78 (0.59–1.04)	1.47 (1.03–2.09) *	1.06 (0.67–1.67)	1.12 (0.77–1.64)	1.12 (0.76–1.64)
2018	1.34 (0.92–1.96)	1.03 (0.79–1.34)	1.48 (1.04–2.10) *	0.79 (0.49–1.28)	1.28 (0.89–1.86)	1.30 (0.89–1.89)
Age (years)	0.98 (0.93–1.04)	0.98 (0.94–1.03)	0.99 (0.94–1.03)	1.01 (0.96–1.06)	1.02 (0.97–1.07)	1.00 (0.95–1.05)
Sex (female, ref = male)	1.32 (0.73–2.36)	1.26 (0.83–1.91)	1.51 (0.88–2.60)	0.61 (0.35–1.08)	0.88 (0.55–1.40)	1.02 (0.60–1.71)
Program duration, ref = two-year (night)						
Two-year (day)	0.93 (0.52–1.65)	1.25 (0.82–1.91)	0.65 (0.40–1.05)	0.53 (0.25–1.09)	1.03 (0.50–2.15)	0.64 (0.36–1.15)
Four-year	2.04 (1.16–3.57) *	2.48 (1.62–3.80) **	1.64 (1.05–2.56) *	1.55 (0.81–2.96)	5.27 (2.68–10.36) **	2.05 (1.20–3.49) **
College (human ecology, ref = nursing)	1.41 (1.01–1.96) *	1.27 (0.99–1.62)	1.01 (0.74–1.39)	2.06 (1.37–3.10) **	1.29 (0.93–1.78)	1.38 (0.98–1.92)

Note: adjusting variables including enrollment year, age, sex, program duration, and college in each model are expressed as odds ratio (95% confidence interval), \* $p < 0.05$ , \*\* $p < 0.01$ .

demonstrate impulsivity (OR = 2.06, 95% CI = 1.37–3.10) (Table 4, Model 2).

We found that the proportion of males was very low. To reduce sex bias, we performed the subgroup analysis of prevalence and correlations in psychological distress and five dimensions by sex (Appendix).

#### 4. Discussion

We analyzed mental health screening data obtained from first-year students enrolled in a university in Northern Taiwan in 2016, 2017, and 2018. Our results indicated that some first-year health science



university students were at risk of psychological distress symptoms; this risk correlated with student-specific variables.

In this study, symptoms of psychological distress were present in 4.2% of students; 13.6% were at risk ( $\geq 85\%$  of the norm) for at least one dimension. A study of more than 5,000 undergraduate students in 12 countries showed the prevalence rate of psychological distress (General Health Questionnaire-12 $\geq 5$ ) in students in China is lower than the overall prevalence rate (21 vs. 33.8%), which depended on the variance of the sociocultural context (Eskin et al., 2016). According to previous studies, the prevalence of psychological distress among undergraduate students is 9–64.7% (Eleftheriades et al., 2020); 31.4% of first-year students experienced at least one mental health problem in the past year (Auerbach et al., 2018). However, it is difficult to compare these findings with our study due to methodological differences. A past study that used the MHSU-SA found that 11.4% of students were at risk for psychological distress (Yang and Shiu, 2014), higher than our results. This discrepancy might be explained by Yang and Shiu's research on students studying commerce, human ecology, design, and engineering. Students in health science-related fields tend to be motivated to help others. The students' motivation to help others (Schuller et al., 2018) may have provided greater mental health support than students in other disciplines (Bhat et al., 2018; Liang et al., 2020; Torres et al., 2017). Second, a previous study (Yang and Shiu, 2014) performed mental health assessments one month after classes amidst mounting academic pressure. We screened students during the orientation period before the start of formal classes. These students may have perceived less academic pressure and may have been relishing in the newfound freedom and excitement of university life (Liu, 2012).

As before, anxiety was the most common mental health problem noted among first-year university students (Bantjes et al., 2019; Hussain et al., 2013; Tomsaa et al., 2014). Moreover, about 80% of our students live on-campus. These students must adapt to group living while gaining autonomy and responsibilities. For many adolescents and young adults, "moving away" means leaving home, family, and friends. In addition, the need for inclusion and recognition conveys pressure to make new friends (Demenech et al., 2021; Wadman et al., 2019). These are potential stressors that may elicit greater anxiety among students. Depression, self-harm, and psychiatric disturbance are highly correlated (correlation coefficients: 0.75–0.82) (Yang and Shiu, 2014), potentially resulting in similar prevalence levels for these mental health problems (4.2%–5.2%). Our sample demonstrated low rates of impulsivity (2.6%), potentially attributable to the higher number of female student responses (Kessler et al., 2005).

The risk of psychological distress among students in the four-year track was twice that of students in the two-year (night) track. The risk estimates for depression, anxiety, self-harm, and psychiatric disturbance were 1.64–5.27 times higher among four-year track students. In the Taiwanese education system, first-year students on the four-year track are mainly recent graduates of regular or vocational senior high schools. Thus, they tend to be younger and less independent when starting college/university. In contrast, students on the two-year (night) track tended to be five-year junior college graduates from the same or similar fields of study. Thus, these students tended to be more familiar with their respective fields of study, have gained social experience through internship and/or work, and usually considered the level of economic, work, and/or family support before enrolling; these factors may have contributed to better mental health (Huang and Zhan, 2017).

Deciding on which university (Ilgan et al., 2018; Islam and Shoron, 2020) to attend or field of study (Durdyev and Ihtiyar, 2019; Schuller et al., 2018) to pursue can be influenced by numerous internal and external factors that can affect psychological distress levels. Previous studies have shown that depressive symptoms in nursing students are slightly less prevalent than in students in other science-related fields (dentistry, medicine, applied medical sciences, etc.) (AlFaris et al., 2016). Colleges of Nursing educate students interested in caring for patients and

the elderly. In addition, nursing health science students may enjoy helping others; this altruism tends to receive encouragement and support from teachers, family, and friends (Schuller et al., 2018). These factors specific to first-year students in the College of Nursing may lower their risk of depression or impulsivity.

Age did not significantly impact mental health status in this study, potentially because of the students' similar ages (IRQ 18.6–20.7). Previous studies demonstrated that females are more likely to exhibit elevated levels of anxiety (Demenech et al., 2021; Hsu, 2008; Kessler et al., 2005; Tesfahunegn and Gebremariam, 2019), which is consistent with our results. We also found that men had a slightly higher prevalence of impulsivity, psychiatric disturbance, and overall psychological distress than females in the subgroup analysis. However, the sex difference did not reach statistical significance, likely since females comprised 91.7% of our sample. Moreover, the significantly higher risk of self-harm detected among students in 2017 and 2018 warrants further attention and more in-depth future investigations.

Mental health issues are of increasing importance to students and universities. Training the country's future healthcare professionals is critically important. First-year university students—in addition to facing previous familial or social—campus life would bring new challenges, especially for those living on campus. Along with familial support, institutions of higher learning should integrate resources, promote cooperation in the fields of teacher, school nurse, psychologist, and psychiatry physician, and jointly guarantee and promote student mental health services (Eleftheriades et al., 2020). The timely provision of effective mental healthcare can improve symptoms and prevent or delay disease onset (WHO, 2019). Universities should screen first-year university students for psychological distress symptoms to understand the prevalence of various mental health problems. This will enable the counseling center to identify high-risk populations for professional re-assessment or immediate assistance, particularly given that university mental health resources are typically limited (Auerbach et al., 2018). Furthermore, students in different years may exhibit different mental health statuses (Pereira et al., 2019); we recommend longitudinal mental health assessments for detecting dynamic changes in mental health. A new university-level curriculum and lifestyle may increase anxiety; peer support networks and academic guidance may help students adapt to university life. Although we could not distinguish among self-harm ideation, attempts, or behaviors in this study, self-harm is a risk factor for suicide (Pereira et al., 2019). We suggest prioritizing students at risk for self-harm as candidates for counseling. Schools should consider creating a mentorship system with small groups or classes for students in higher-risk program durations or departments—especially the four-year track composed mainly of senior high school graduates. This will enable mentors to provide more time for care and counseling. Students on the four-year track have a higher risk of psychological distress during the orientation phase before the official start of classes. This suggests that psychological distress symptoms might develop before the student begins classes. We suggest that the national education system strengthen mental health screening, counseling, and other services in regular or vocational senior high schools rather than limiting their focus to helping students explore universities or majors.

This was the first study to use mental health screening data obtained from first-year university students studying health sciences in Taiwan. However, some limitations warrant further consideration. A cross-sectional design was adopted in this study; this cannot and should not be used to infer causal relationships between and among variables. Our secondary data analysis was limited by the retrospective nature of our original data. This means that other factors that may impact mental health status—but not captured by the original dataset—could not be examined. The questionnaire was self-administered and did not specify a timeframe for reporting symptoms; this may have led to recall or reporting bias. Data with missing values and validity indices  $\geq 85\%$  were deleted from our analysis; this may have affected the prevalence estimates for the various mental health problems. Finally, our study cohort

consisted entirely of first-year health science university students in Taiwan; our results cannot be generalized to other regions, universities, or fields of study.

In conclusion, first-year university students' psychological distress was still present even before formal classes. The most common mental health problem was anxiety, especially those on the four-year track. This study provides empirical data on psychological distress among first-year university students in health science-related fields. We are hopeful that our findings will inform future efforts to maximize college/university mental health service systems.

**Declarations**

*Author contribution statement*

Nai-Hung Chen:Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Li-Mei Liu:Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Hsing-Yuan Liu:Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

I-Chang Hsieh:Analyzed and interpreted the data; Wrote the paper.

Ching-Ching Tsai:Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

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*Data availability statement*

Due to the potentially sensitive nature of this data, please contact Ching-Ching Tsai (cctsai@gw.cgust.edu.tw) or Chang Gung University of Science and Technology (<https://english.cgust.edu.tw/>), a representative of the data access committee, for access to the dataset. Data can be made available after review by the CGUST, the organization that approved these restrictions. The data will be stored on institutional data archives.

*Declaration of interests statement*

The authors declare no conflict of interest.

*Additional information*

No additional information is available for this paper.

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**Appendix. Subgroup analysis of prevalence and correlations in psychological distress and five dimensions by sex.**

**Appendix Table 1.** Student-specific variables by sex.

Variable	Female (n = 3863) n (%)	Male (n = 349) n (%)	p-value
Enrollment year <sup>b</sup>			0.66
2016	1311 (33.9)	115 (33.0)	
2017	1283 (33.2)	111 (31.8)	
2018	1269 (32.9)	123 (35.2)	
Age (year) <sup>a</sup>	20.1 (18.6–20.7)	18.8 (18.4–20.3)	<0.001
≤20	1747 (45.2)	244 (69.9)	<0.001
> 20	2056 (53.2)	99 (28.4)	
Missing	60 (1.6)	6 (1.7)	
Program duration <sup>b</sup>			<0.001
Two-year (night)	877 (22.7)	53 (15.2)	
Two-year (day)	1265 (32.7)	44 (12.6)	
Four-year	1721 (44.6)	252 (72.2)	
Department <sup>b</sup>			<0.001
Nursing	2651 (68.6)	276 (79.1)	
Gerontology and Health Care Management	201 (5.2)	17 (4.9)	
Child Care and Education	444 (11.5)	11 (3.2)	
Nutrition and Health Sciences	196 (5.1)	38 (10.9)	
Cosmetic Science	371 (9.6)	7 (2.0)	
College <sup>b</sup>			<0.001
Nursing	2852 (73.8)	293 (84.0)	
Human ecology	1011 (26.2)	56 (16.0)	
Psychological distress <sup>a</sup>	159 (132–192)	164 (132.5–193.5)	0.40
Depression <sup>a</sup>	31 (24–38)	30 (24–38)	0.70
Anxiety <sup>a</sup>	40 (31–47)	39 (30.5–47)	0.59
Self-harm <sup>a</sup>	25 (22–32)	26 (22–33)	0.39
Impulsivity <sup>a</sup>	34 (29–40)	35 (30–41)	0.03
Psychiatric disturbance	28 (23–35)	29 (23–37)	0.07

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**Appendix Table 1 (continued)**

Variable	Female (n = 3863)		Male (n = 349)		p-value
	n	(%)	n	(%)	
Numbers of at-risk dimensions <sup>b</sup>					0.33
0	3341	(86.5)	300	(86.0)	
1	289	(7.5)	27	(7.7)	
2	111	(2.9)	7	(2.0)	
3	67	(1.7)	11	(3.2)	
4	42	(1.1)	2	(0.6)	
5	13	(0.3)	2	(0.6)	

<sup>a</sup> indicates expression as the median (interquartile range), and analysis by Mann-Whitney U test.

<sup>b</sup> analysis by Chi-Square test.

**Appendix Table 2. Prevalence of at-risk (≥85% of norm) in psychological distress and five dimensions among female students.**

Variable	Depression		Anxiety		Self-harm		Impulsivity		Psychiatric disturbance		Psychological distress	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Total	162	4.2 (3.6–4.8)	318	8.2 (7.3–9.1)	206	5.3 (5.0–6.0)	94	2.4 (1.9–2.9)	165	4.3 (3.7–4.9)	159	4.1 (3.5–4.7)
Enrollment year												
2016	49	3.7 (2.7–4.7)	115	8.8 (7.3–10.3)	54	4.1 (3.0–5.2)	35	2.7 (1.8–3.6)	49	3.7 (2.7–4.7)	49	3.7 (2.7–4.7)
2017	54	4.2 (3.1–5.3)	93	7.2 (5.8–8.6)	77	6.0 (4.7–7.3)	35	2.7 (1.8–3.6)	57	4.4 (3.5–5.5)	53	4.1 (3.0–5.2)
2018	59	4.6 (3.5–5.8)	110	8.7 (7.2–10.3)	75	5.9 (4.6–7.2)	24	4.6 (3.5–5.8)	59	4.6 (3.5–5.8)	57	4.5 (3.4–5.6)
Age												
≤20	102	5.8 (4.7–6.9)	202	11.6 (10.1–13.1)	127	7.3 (6.1–8.5)	62	3.5 (2.6–4.4)	125	7.2 (6.0–8.4)	106	6.1 (5.0–7.2)
>20	57	2.8 (2.0–3.6)	111	5.4 (4.3–6.5)	76	3.7 (2.8–4.6)	31	1.5 (0.9–2.1)	36	1.8 (1.2–2.4)	50	2.4 (1.7–3.1)
Program duration												
Two-year (night)	22	2.5 (1.5–3.5)	38	4.3 (3.0–5.6)	38	4.3 (3.0–5.6)	19	2.2 (1.2–3.2)	15	1.7 (0.8–2.6)	26	3.0 (1.9–4.1)
Two-year (day)	35	2.8 (1.9–3.7)	78	6.2 (4.9–7.5)	39	3.1 (2.1–4.1)	15	1.2 (0.6–1.8)	21	1.7 (1.0–2.4)	26	2.1 (1.3–2.9)
Four-year	105	6.1 (5.0–7.2)	202	11.7 (10.2–13.2)	129	7.5 (6.3–8.7)	60	3.5 (2.6–4.4)	129	7.5 (6.3–8.7)	107	5.2 (4.2–6.3)
Department												
Nursing	102	3.8 (3.1–4.5)	196	7.4 (6.4–8.4)	141	5.3 (4.5–6.2)	53	2.0 (1.5–2.5)	100	3.8 (3.1–4.5)	97	3.7 (3.0–4.4)
Gerontology	3	1.5 (-0.2–3.2)	12	6.0 (2.7–9.3)	7	3.5 (1.0–6.0)	2	1.0 (-0.4–2.4)	3	1.5 (-0.2–3.2)	5	2.5 (0.3–4.7)
Child Care	27	6.1 (3.9–8.3)	44	9.9 (7.1–12.7)	21	4.7 (2.7–6.7)	15	3.4 (1.7–5.1)	28	6.3 (4.0–8.6)	24	5.4 (3.3–7.5)
Nutrition	10	5.1 (2.0–8.2)	24	12.2 (7.6–16.8)	16	8.2 (4.4–12.0)	9	4.6 (1.7–7.5)	18	9.2 (5.2–13.2)	14	7.1 (3.5–10.7)
Cosmetic	20	5.4 (3.1–7.7)	42	11.3 (8.1–14.5)	21	5.7 (3.3–8.1)	15	4.0 (2.0–6.0)	16	4.3 (2.2–6.4)	19	5.1 (2.9–7.3)
College												
Nursing	105	3.7 (3.0–4.4)	208	7.3 (6.4–8.3)	148	5.2 (4.4–6.0)	55	1.9 (1.4–2.4)	103	3.6 (3.2–4.6)	102	3.6 (2.9–4.3)
Human ecology	57	5.6 (4.2–7.0)	110	10.9 (9.0–12.8)	58	5.7 (4.7–7.1)	39	3.9 (2.7–5.1)	62	6.1 (4.6–7.6)	57	5.6 (4.2–7.0)

Note: CI = confidence interval.

**Appendix Table 3. Prevalence of at-risk (≥85% of norm) in psychological distress and five dimensions among male students.**

Variable	Depression		Anxiety		Self-harm		Impulsivity		Psychiatric disturbance		Psychological distress	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Total	13	3.7 (1.7–5.7)	27	7.7 (4.9–10.5)	15	4.3 (2.2–6.4)	15	4.3 (2.2–6.4)	22	6.3 (3.8–8.9)	17	4.9 (2.6–7.2)
Enrollment year												
2016	3	2.6 (-0.3–5.5)	8	7.0 (2.3–11.7)	5	4.3 (0.6–8.0)	4	3.5 (0.1–6.9)	7	6.1 (1.7–10.5)	4	3.5 (0.1–6.9)
2017	3	2.7 (-0.3–5.7)	6	5.4 (1.2–9.6)	4	3.6 (0.1–7.1)	5	4.5 (0.6–8.4)	6	5.4 (1.2–9.6)	5	4.5 (0.6–8.4)
2018	7	5.7 (1.6–9.8)	13	10.6 (5.2–16.0)	6	4.9 (1.1–8.7)	6	4.9 (1.1–8.7)	9	7.3 (2.7–11.9)	8	6.5 (2.1–10.9)
Age												
≤20	12	4.9 (2.2–7.6)	25	10.2 (6.4–14)	13	5.3 (2.5–8.1)	13	5.3 (2.5–8.1)	21	8.6 (5.1–12.1)	16	6.6 (3.5–9.7)
>20	1	1.0 (-0.3–2.3)	2	2.0 (0.2–3.8)	2	2.0 (0.2–3.8)	2	2.0 (0.2–3.8)	1	1.0 (-0.3–2.3)	1	1.0 (-0.3–2.3)
Program duration												
Two-year (night)	1	1.9 (-1.8–5.6)	2	3.8 (-1.4–9.0)	2	3.8 (-1.4–9.0)	1	1.9 (-1.8–5.6)	1	1.9 (-1.8–5.6)	1	1.9 (-1.8–5.6)
Two-year (day)	-	-	-	-	-	-	1	2.3 (-2.1–6.7)	-	-	-	-
Four-year	12	4.8 (2.1–7.4)	25	9.9 (6.2–13.6)	13	5.2 (2.5–7.9)	13	5.2 (2.5–7.9)	21	8.3 (4.9–11.7)	16	6.3 (3.3–9.3)
Department												
Nursing	10	3.6 (1.4–5.8)	23	8.3 (5.1–11.6)	13	4.7 (2.2–7.2)	9	3.3 (1.2–5.4)	20	7.2 (4.2–10.2)	15	5.4 (2.7–8.1)

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Appendix Table 3 (continued)

Variable	Depression		Anxiety		Self-harm		Impulsivity		Psychiatric disturbance		Psychological distress	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Gerontology	1	5.9 (-5.3–17.1)	2	11.8 (-3.5–27.1)	1	5.9 (-5.3–17.1)	1	5.9 (-5.3–17.1)	1	5.9 (-5.3–17.1)	1	5.9 (-5.3–17.1)
Child Care	-	-	-	-	-	-	1	9.1 (-7.9–26.1)	-	-	-	-
Nutrition	2	5.3 (-1.8–12.4)	2	5.3 (-1.8–12.4)	1	2.6 (-2.5–7.7)	3	7.9 (-0.7–16.5)	1	2.6 (-2.5–7.7)	1	2.6 (-2.5–7.7)
Cosmetic	-	-	-	-	-	-	-	-	-	-	-	-
College												
Nursing	11	3.8 (1.6–6.0)	25	8.5 (5.3–11.7)	14	4.8 (2.4–7.3)	10	3.4 (1.3–5.5)	21	7.2 (4.2–10.2)	16	5.5 (2.9–8.1)
Human ecology	2	3.6 (-1.3–8.5)	2	3.6 (-1.3–8.5)	1	1.8 (-1.7–5.3)	5	8.9 (1.4–16.4)	1	1.8 (-1.7–5.3)	1	1.8 (-1.7–5.3)

Note: CI = confidence interval.

Appendix Table 4. Logistic regression analysis of the relationships between student-specific variables affecting psychological distress and the five scale dimensions in female students.

Model and variables	Depression	Anxiety	Self-harm	Impulsivity	Psychiatric disturbance	Psychological distress
<b>Model 1 (unadjusted)</b>						
Enrollment year, ref = 2016						
2017	1.13 (0.76–1.68)	0.81 (0.61–1.08)	1.49 (1.04–2.12)*	1.02 (0.64–1.64)	1.20 (0.81–1.77)	1.11 (0.75–1.65)
2018	1.26 (0.85–1.85)	0.99 (0.75–1.30)	1.46 (1.02–2.09)*	0.70 (0.42–1.19)	1.26 (0.85–1.95)	1.21 (0.82–1.79)
Age (years)	0.91 (0.84–0.98)*	0.90 (0.85–0.96)*	0.94 (0.89–1.00)*	0.98 (0.93–1.04)	0.84 (0.76–0.94)*	0.93 (0.87–1.00)*
Program duration, ref = two-year (night)						
Two-year (day)	1.11 (0.64–1.90)	1.45 (0.98–2.16)	0.70 (0.46–1.11)	0.54 (0.27–1.07)	0.97 (0.50–1.89)	0.69 (0.40–1.20)
Four-year	2.53 (1.58–4.03)**	2.94 (0.21–4.20)**	1.79 (1.23–2.59)**	1.63 (0.97–2.75)	4.66 (2.71–8.00)**	2.17 (1.40–3.36)**
College (human ecology, ref = nursing)	1.56 (1.12–2.18)**	1.55 (1.22–1.98)**	1.11 (0.81–1.52)	2.04 (1.35–3.10)**	1.74 (1.26–2.41)**	1.61 (1.61–2.25)**
<b>Model 2 (adjusted)</b>						
Enrollment year, ref = 2016						
2017	1.12 (0.75–1.67)	0.78 (0.59–1.05)	1.53 (1.06–2.20)*	1.03 (0.63–1.66)	1.15 (0.77–1.72)	1.10 (0.73–1.64)
2018	1.28 (0.86–1.89)	0.99 (0.75–1.30)	1.51 (1.05–2.18)*	0.71 (0.42–1.20)	1.28 (0.86–1.90)	1.23 (0.83–1.83)
Age (years)	0.98 (0.92–1.04)	0.98 (0.94–1.03)	0.99 (0.94–1.04)	1.01 (0.96–1.06)	1.02 (0.97–1.08)	0.99 (0.94–1.05)
Program duration, ref = two-year (night)						
Two-year (day)	0.94 (0.53–1.69)	1.27 (0.83–1.96)	0.67 (0.41–1.09)	0.50 (0.24–1.07)	1.05 (0.49–2.24)	0.63 (0.35–1.15)
Four-year	1.98 (1.11–3.54)*	2.43 (1.56–3.77)	1.64 (1.03–2.59)	1.50 (0.76–2.95)	5.09 (2.50–10.38)	1.90 (1.10–3.31)*
College (human ecology, ref = nursing)	1.45 (1.03–2.04)	1.35 (1.05–1.74)	1.06 (0.76–1.46)	2.02 (1.31–3.12)**	1.45 (1.04–2.03)	1.51 (1.07–2.14)*

Note: adjusting variables—including enrollment year, age, program duration, and college—are expressed as odds ratio (95% confidence interval), \**p* < 0.05, \*\**p* < 0.01.

Appendix Table 5. Relationships between student-specific variables affecting psychological distress and five dimensions by logistic regression among male students.

Model and variables	Depression	Anxiety	Self-harm	Impulsivity	Psychiatric disturbance	Psychological distress
<b>Model 1 (unadjusted)</b>						
Enrollment year, ref = 2016						
2017	1.04 (0.21–5.25)	0.76 (0.26–2.28)	0.82 (0.34–3.15)	1.31 (0.34–5.01)	0.88 (0.29–2.71)	1.31 (0.34–5.01)
2018	2.25 (0.57–8.93)	1.58 (0.63–3.97)	1.13 (0.34–3.80)	1.42 (0.39–5.18)	1.22 (0.44–3.39)	1.93 (0.57–6.59)
Age (years)	0.80 (0.47–1.35)	0.69 (0.45–1.05)	0.8 (0.57–1.34)	0.91 (0.62–1.33)	0.74 (0.48–1.15)	0.76 (0.47–1.24)
Program duration, ref = two-year (night)						
Two-year (day)	0.00 (-)	0.00 (-)	0.00 (-)	1.21 (0.07–19.91)	0.00 (-)	0.00 (-)
Four-year	2.60 (0.33–20.44)	2.81 (0.64–12.24)	1.39 (0.30–6.33)	2.83 (0.36–22.10)	4.73 (0.62–35.94)	3.53 (0.46–27.18)
College (human ecology, ref = nursing)	0.95 (0.21–4.41)	0.40 (0.09–1.73)	0.36 (0.05–2.81)	2.78 (0.91–8.45)	0.24 (0.03–1.79)	0.32 (0.04–2.42)
<b>Model 2 (adjusted)</b>						
Enrollment year, ref = 2016						
2017	1.56 (0.23–5.90)	0.85 (0.28–2.56)	0.93 (0.24–3.58)	1.37 (0.35–5.36)	0.97 (0.31–3.02)	1.45 (0.37–5.62)
2018	2.51 (0.63–10.04)	1.76 (0.69–4.49)	1.21 (0.36–4.12)	1.54 (0.42–5.68)	1.35 (0.48–3.83)	2.15 (0.62–7.44)
Age (years)	1.01 (0.80–1.27)	0.97 (0.73–1.29)	0.99 (0.78–1.26)	1.01 (0.81–1.26)	1.02 (0.84–1.25)	1.01 (0.81–1.26)
Program duration, ref = two-year (night)						
Two-year (day)	0.00 (-)	0.00 (-)	0.00 (-)	1.04 (0.06–17.79)	0.00 (-)	0.00 (-)
Four-year	2.98 (0.30–29.3)	3.15 (0.59–6.83)	1.55 (0.28–8.55)	2.37 (0.24–23.65)	6.25 (0.66–58.82)	4.47 (0.47–42.7)
College (human ecology, ref = nursing)	0.79 (0.17–3.75)	0.32 (0.07–1.39)	0.31 (0.04–2.46)	2.48 (0.79–7.77)	0.18 (0.02–1.39)	0.25 (0.03–1.95)

Note: adjusting variables including enrollment year, age, program duration, and college are expressed as odds ratio (95% confidence interval), \**p* < 0.05, \*\**p* < 0.01.

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