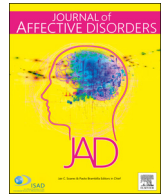




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Research paper

Depression, anxiety and stress in different subgroups of first-year university students from 4-year cohort data

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ABSTRACT

Background: Limited studies have been conducted to investigate the mental health status of subgroups of university students. This study hypothesized that there would be differences among student subgroups in the prevalence of depression, anxiety and stress; and association of age, gender, academic performance and mental health status.**Methods:** This was a cross-sectional survey study. Since 2014, first-year university students in a university in Hong Kong were invited to complete the Depression Anxiety Stress Scale (DASS-21) before the commencement of their study. These DASS data were then merged with objectively measured data from university records. 9,479 students completed the DASS survey, this being 56.5% of the total student population in the records. Kruskal-Wallis Tests were applied to compare the differences among student subgroups.**Results:** Community college transfer (CCT) students were the highest-risk group for depression, anxiety and stress, and their study load was the highest as well. Unexpectedly, mainstream students ranked after the CCT students in the prevalence and levels of depression, anxiety and stress. Student athletes had the highest prevalence of depression. Although there were declining trends for depression, anxiety and stress, it was only a slight drop. Overall, age, gender, study load and academic performance were associated with the mental health profile ($p < 0.05$).**Limitations:** After admission, students' mental health conditions could have changed. Further studies are needed to measure mental health during their study.**Conclusions:** Mental health problems were not distributed evenly across different student subgroups, psychological support should be designed according to the needs of each student subgroup.

1. Introduction

Mental health is a public health issue, particularly for first-year university students. They are vulnerable to mental health problems because they are experiencing a double transition: a developmental transition from adolescence to adulthood, and a life transition from one institution (such as high school, or community college) to another which is often very different, university (Beiter et al., 2015;

Bruffaerts et al., 2018; Liu et al., 2017; Mehr and Daltry, 2016; Pereira et al., 2019). In general, a university is composed of different subgroups of students, which suggests a wide range of mental health states, but this composition has not been studied well. Mainstream students are the largest group; usually they enter university immediately after their secondary school graduation. They are also called freshmen entrants, native students (Archambault, 2015; Mehr and Daltry, 2016), or direct-entry from secondary school students (DEfSS)

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(Acai and Newton, 2015). Some mainstream students are admitted to university after a gap year(s) following their graduation from secondary schools or other institutions, but they still start from first year. In this paper, we will use “not DEFSS” to denote this group of students. The second group is community college transfer (CCT) students, who enter university with prior college credits accumulated from other institutions (Archambault, 2015; Mehr and Daltry, 2016). With this recognition of prior credits, CCT students might have completed most of the junior-year curriculum; thus, they will usually complete their university study over two or three years (Ching et al., 2020). The other student groups consist of international students, student athletes, and others. Each student group is likely to undergo its own unique transition. Current mental health research on university students has mostly examined the gender (Liu et al., 2017; Pereira et al., 2019), academic (Beiter et al., 2015; Bruffaerts et al., 2018; Mehr and Daltry, 2016), accommodation (Cuttilan et al., 2016), academic year (Puthran et al., 2016) and geographical (Tung et al., 2018) differences. Our review found that the research on university students' mental health has focused mainly on mainstream students, if analyses were done of subgroups of students at all (Beiter et al., 2015; Bruffaerts et al., 2018; Liu et al., 2017; Mehr and Daltry, 2016). Only limited studies have examined the differences in mental health between CCT and non-CCT students (Beiter et al., 2015; Mehr and Daltry, 2016), or local and international students (Pereira et al., 2019). Each subgroup faces different challenges in the “new” learning environment of the university; hence, there is a need to investigate their mental health.

1.1. Mainstream students

As mentioned above, first-year university students experience uncertainties in the process of transition, especially with the pressure in their study. In Belgium, 34.9% of university freshmen had mental health problems, and these problems reduced academic performance (Bruffaerts et al., 2018). In Portugal, 32.1% of university students had emotional disorders, which was higher than in the general population. 14.5% and 6.4% of them had anxiety disorders and depression respectively (Sarmiento, 2015). It is difficult to compare the study results because different measurement instruments have been used. There is evidence to suggest that university students in different countries might encounter different levels of challenges, which lead to different levels of mental health problems (Quek et al., 2019; Shamsuddin et al., 2013; Wong et al., 2006). Findings about the role of gender in mental health have been inconsistent. In Hong Kong, female students were found to have significantly higher anxiety and stress scores than male students, while male students had higher depression scores than females did (Wong et al., 2006). However, in Malaysia, gender did not make any difference (Shamsuddin et al., 2013). A recent meta-analysis of data from different countries showed that there was no significant difference in the prevalence of anxiety in university students based on gender (Quek et al., 2019). As well, most studies of university students have not specified the types of students participating; thus, the mental health problems within the student subgroups are not known.

1.2. CCT students

Like mainstream students, CCT students are also new to the university learning environment. Transfer shock (Hills, 1965), campus culture shock (Archambault, 2015; Mehr and Daltry, 2016), and the feeling of being freshmen again (Townsend, 2008) are some of the challenges faced by these students. In the United States (US), some studies have found that transfer students have more mental health problems than other student groups. Compared with non-transfer students, transfer students had statistically significantly higher scores for depression, social anxiety, academic distress, family distress, and part-time jobs, but less involvement in athletic and campus social activities (Mehr and Daltry, 2016). Beiter et al. (2015) also found that transfer

students were statistically significantly more anxious than non-transfer students. The results of heavy study loads due to the insufficient recognition of prior credits earned from community colleges (Mehr and Daltry, 2016) might affect their mental health (Thuraiselvam and Thang, 2015). Furthermore, these US studies did not specify the types of students in the transfer and non-transfer student groups. Nevertheless, these results raise concerns about mental health issues in student subgroups, particularly transfer students.

1.3. International students

Accompanied by globalization, there are increasing populations of international students in different universities. Being new to the learning environment and sometimes experiencing culture shock (Ward et al., 2001), international students also experience different mental health issues. Based on qualitative interviews, Forbes-Mewett and Sawyer (2011) identified three factors that could heighten the stresses and anxieties experienced by international students in Australia. These were the unfamiliar academic environment, knowledge and practical skills needed to manage everyday life, and the tendency to delay seeking professional help for mental health problems. Furthermore, Auerbach et al. (2018) identified the prevalence of mental health issues in international students in eight countries, five in the global north and three in the global south. They found that 35% of the students had been suffering from at least one lifetime mental disorder; female and older students had positive correlations with lifetime mental disorders. Back in Asia, Takeuchi and Sakagami (2018) found that international students in Japan had higher perceived stigmas if they had insufficient knowledge about depression (odd ratio: 0.31 [95% confidence interval (CI), 0.10 – 0.94]). They further suggested launching an anti-stigma education campaign to raise their awareness about seeking help from professionals.

1.4. Chinese students

Like other international students, Chinese students studying in overseas universities experience challenges, not only in adapting to new living and academic environments, but also facing culture shock. Han et al. (2013) surveyed the Chinese international students in Yale University and found that 45% and 29% of them had depression and anxiety symptoms respectively. These percentages were much higher than those of the overall university students in the US. Likewise, Lu et al. (2014) found a similar tendency in Chinese international students in Australia. They found that 54% of the respondents reported having high levels of psychological distress, but that only 9% of those with high levels of psychological distress had sought help from mental health professionals. Furthermore, Chinese international students were found to be more reliant on informal social support networks, such as families and friends, to handle mental health issues (Han et al., 2018). This might have explained why a low percentage of Chinese international students seek assistance from mental health professional services.

1.5. Student athletes

Student athletes represent a unique group of university students. On top of challenges similar to those faced by most students, they need to maintain excellent physical and mental fitness levels to perform high standards in their fields (Moreland et al., 2018). These huge demands push the student athletes to be perfectionists (Garinger et al., 2018), and this puts them at potential risk of mental health issues (Moreland et al., 2018; van Slingerland et al., 2018). In exploring the prevalence of depressive symptoms in student athletes in the US National Collegiate Athletic Association, Wolanin et al. (2016) found that 23.7% of the respondents had depressive symptoms, with 6.3% reporting having moderate to severe levels of depressive symptoms. In their review, Moreland et al. (2018) found that student athletes in the US were

susceptible not only to depression and anxiety, but also to sleep disturbances, eating disorders, substance abuse, and even suicide. These mental health problems were related to the demand to balance their roles of students and athletes (van Slingerland et al., 2018). Although it is natural for someone with mental health problems to seek help from mental health services, Ryan et al. (2018) found that student athletes did not utilize university mental health services effectively. They identified that the fear of negative attitudes from the coach and administrative body, self-stigma and public stigma, and the lack of knowledge about mental health symptoms all contributed to the underutilization of mental health services.

Recent studies evaluating the mental health issues of university students only focused on one single-group, two-subgroups or one mixed-group sample. In addition, most studies utilized cross-sectional study designs that may have overlooked the cohort differences (Beiter et al., 2015; Mehr and Daltry, 2016; Wong et al., 2006). Further studies should examine the mental health issues of different subgroups of students, using cohort data and their associated factors from official university records to identify the at-risk groups needing primary, secondary or tertiary prevention. Our study addressed this gap.

1.6. Objectives and hypotheses

The purpose of the study was to examine the levels of depression, anxiety and stress in six subgroups of university students (i.e., DEfSS, not DEfSS, CCT, international, mainland Chinese students and student athletes). The research questions were: (1) What are the levels of depression, anxiety, and stress in different subgroups of university students? (2) What are the associations between demographic variables, study load, academic performance, and mental health problems in different groups of university students? The hypothesis was that there would be differences among the student groups in (1) the prevalence of depression, anxiety and stress; and (2) the association of age, gender, academic performance and mental health status.

2. Method

2.1. Research design

This was a cross-sectional survey study. Mental health status, using DASS, was measured through a cross-sectional survey, then the survey data were merged with objectively measured data from university records. Student data from the university registrar's databases were de-identified with pseudonymous identifiers, such as 1, 2, 3 to replace the participants' identities. Ethical approval and approval from the Data Access Committee were obtained (HSEARS20180104005-02).

2.2. Sample

The study was conducted in a government-funded university in Hong Kong. The university offers multi-disciplinary programmes covering applied science, business, construction and environment, engineering, health and social science, humanities, design, and hotel and tourism management. Since 2014, all local DEfSS (including student athletes), and local not DEfSS students were invited to complete the DASS online, while the CCT students and non-local DEfSS (including both international and mainland Chinese) were invited to complete it during class orientation in August, before the commencement of the school year.

2.3. Measures

The students' levels of depression, anxiety and stress were assessed by a widely used 21-item Chinese version of the Depression Anxiety Stress Scale (DASS-21) (Chan et al., 2010; Chan et al., 2012; Oei et al., 2013), originally developed by Lovibond and Lovibond (1995). There

are subscales with 7 items each (depression, anxiety and stress). Each item is scored on a 4-point Likert scale (0 = did not apply to me at all and 3 = applied to me very much, or most of the time), with a higher score indicating more severe levels of distress. The summation of each scale, then multiplied by two to convert to full scale scores, was used for the data analysis. Each score ranged from 0 to 42. Participants with cut-off scores of ≥ 10 for the depression dimension (≥ 10 as "mild depression", ≥ 14 as "moderate", ≥ 21 as "severe", and ≥ 28 as "extremely severe"), ≥ 8 in anxiety (≥ 8 as "mild anxiety", ≥ 10 as "moderate", ≥ 15 as "severe", and ≥ 20 as "extremely severe"), ≥ 15 in stress (≥ 15 as "mild anxiety", ≥ 19 as "moderate", ≥ 26 as "severe", and ≥ 34 as "extremely severe") were considered to have these disorders (Lovibond and Lovibond, 1995). The Chinese version has been shown to have good test-retest reliability, internal consistency and convergent validity with the Chinese Beck Depression Inventory and Chinese State-Anxiety Inventory in the general population and in people with diagnosed mental illnesses (Chan et al., 2012; Oei et al., 2013). Both the Chinese and English versions were used in the data collection because some students, such as international students, might not have been able to read Chinese. The DASS was validated in populations who mainly use English and Chinese (e.g. Singaporeans) (Ho et al., 2019; Quek et al., 2018). In our study, the internal consistency coefficients (Cronbach's α) for depression, anxiety and stress scales were 0.841, 0.798, and 0.849, respectively, with 0.929 for the overall scale. Our results were comparable to those found by Oei et al. (2013). The University in which the study was conducted has adopted DASS-21 to assess students' psychological health when they are admitted. Student counsellors then contact students with severe or extremely severe depression, anxiety or stress for further assessment, and appropriate counselling is provided. This serves as a university-wide strategy to have early identification of and early intervention for students with mental health concerns.

2.4. Data collection procedure

Student data from the academic year 2014 to 2017 were gathered from the university registrar (UR) in 2019 with the university Administration's consent, in accordance with the university's Data Governance Framework. Individual students could not be identified from these data and pseudonyms were used. The data were organized by the UR and the information technology office (ITO), to allow for linking across tables and datasets. The process of requesting approval, gathering, and curating the data took about eight months to complete.

The data included four years of student records of the undergraduate degree programmes from all Faculties/Schools. This included, but was not limited to, students' academic records and demographic information. The academic records consisted of the student's grade point average (GPA, maximum score: 4.0), including semester GPA [sGPA], cumulative GPA [cGPA], and award GPA [aGPA]; the programme duration, and the number of credits the student was required to complete for graduation. The student's study load was defined as the average annual number of credits to be taken. The demographic information consisted of student-level information on gender, age, and the students' types.

The pseudo student IDs generated by the ITO were used to merge data obtained from various departments. The current DASS survey dataset was obtained from the counselling office (CO). Since the CO started the DASS survey in 2014, the data for this study were restricted to students who had enrolled in the university between 2014 and 2017, inclusive (N = 17,476). Exchange students, those admitted through university quotas or the advanced standing scheme, and those with disabilities were excluded from the dataset. In total, the dataset consisted of 16,766 valid student records, from which 9,479 students had completed the DASS survey. The response rate was 56.5%.

Overall, 75.5% of the students in the dataset with DASS records had first enrolled as DEfSS, 14.8% were CCT students, and the remaining

Table 1
Characteristics of students' groups and their mental health profiles from the 2014 to 2017 academic years.

	All Groups	CCT Students	Mainstream: DEfSS	Mainstream: not DEfSS	Student Athletes	Mainland Chinese Students	International Students
Total DASS (N)	9479	1406	7156	224	19	523	151
Total students	16766	5726	7865	1334	124	1063	654
Response rate (%)	(56.5)	(24.6)	(91.0)	(16.8)	(15.3)	(49.2)	(23.1)
Age at entry							
mean age \pm SD	18.9 \pm 1.5	21.1 \pm 1.7	18.5 \pm 0.9	20.4 \pm 1.6	19.5 \pm 1.5	18.1 \pm 0.6	18.7 \pm 0.9
median (range)	19 (15-51)	21 (19-51)	18 (16-36)	20 (17-27)	19 (18-22)	18 (15-21)	19 (17-23)
Gender (N, %)							
Male	4519 (47.7)	620 (44.1)	3471 (48.5)	86 (38.4)	–	266 (50.9)	65 (43.0)
Female	4960 (52.3)	786 (55.9)	3685 (51.5)	138 (61.6)	–	257 (49.1)	86 (57.0)
Study load (N)	9479	1406	7156	224	19	523	151
mean credit \pm SD	32.47 \pm 2.13	35.17 \pm 3.37	32.04 \pm 1.35	31.38 \pm 1.73	32.12 \pm 1.68	31.73 \pm 1.16	31.70 \pm 1.22
median (range)	32.3 (25.0-52.5)	34.5 (30.0-52.5)	32.0 (30.0-36.3)	31.0 (25.0-36.3)	31.5 (30.0-36.5)	31.5 (30.0-35.3)	31.5 (29.0-34.0)
Semester GPA (N)	9449	1403	7135	220	19	522	150
mean GPA \pm SD	3.00 \pm 0.48	3.12 \pm 0.41	2.95 \pm 0.48	3.12 \pm 0.56	2.67 \pm 0.44	3.22 \pm 0.47	3.01 \pm 0.54
median (range)	3.07 (0.20-4.00)	3.17 (0.77-4.00)	3.00 (0.20-4.00)	3.19 (0.83-4.00)	2.80 (1.83-3.38)	3.30 (0.75-4.00)	3.10 (0.96-4.00)
Cumulative GPA (N)	9454	1403	7137	222	19	523	150
mean GPA \pm SD	2.99 \pm 0.44	3.09 \pm 0.37	2.96 \pm 0.45	3.09 \pm 0.48	2.55 \pm 0.55	3.17 \pm 0.45	3.07 \pm 0.51
median (range)	3.04 (0.16-4.00)	3.14 (0.77-4.00)	3.00 (0.16-4.00)	3.14 (1.67-4.00)	2.76 (1.27-3.23)	3.24 (1.20-4.00)	3.17 (0.41-3.91)
Award GPA (N)	2668	923	1452	134	–	117	38
mean GPA \pm SD	3.18 \pm 0.32	3.16 \pm 0.30	3.17 \pm 0.31	3.20 \pm 0.29	2.86 \pm 0.37	3.49 \pm 0.34	3.21 \pm 0.30
median (range)	3.19 (2.11-4.00)	3.18 (2.17-4.00)	3.18 (2.11-4.00)	3.23 (2.49-3.98)	2.84 (2.44-3.32)	3.55 (2.25-4.00)	3.22 (2.55-3.89)
Depression (N) mean score	9442	1399	7129	224	19	521	150
\pm SD	5.43 \pm 6.18	6.06 \pm 6.64	5.56 \pm 6.20	5.38 \pm 6.45	4.74 \pm 8.28	2.70 \pm 3.72	2.89 \pm 3.85
median (range)	4 (0-42)	4 (0-42)	4 (0-42)	4 (0-30)	0 (0-30)	2 (0-26)	2 (0-22)
Anxiety (N) mean score \pm SD	9398	1401	7093	224	18	514	148
median (range)	6.82 \pm 6.17 6 (0-40)	7.14 \pm 6.72 6 (0-38)	6.95 \pm 6.11 6 (0-40)	6.38 \pm 6.54 4 (0-32)	4.44 \pm 7.31 1 (0-28)	4.84 \pm 5.12 4 (0-32)	5.32 \pm 4.73 4 (0-22)
Stress (N) mean score \pm SD	9359	1394	7062	224	17	517	145
median (range)	8.82 \pm 7.27 8 (0-42)	9.75 \pm 8.20 8 (0-42)	8.90 \pm 7.10 8 (0-40)	9.06 \pm 7.70 8 (0-34)	4.71 \pm 6.48 2 (0-20)	6.17 \pm 6.20 4 (0-36)	5.81 \pm 5.56 4 (0-26)

Note: – the gender distribution and the number of participants in award GPA for sportsmen are not shown, to avoid identification of students due to the small number in this category

Study load: number of total credits for graduation divided by programme duration.

Semester GPA: first semester GPA of the survey year

Cumulative GPA: cumulative GPA of the survey year

9.7% were admitted either as not DEfSS, student athletes, mainland Chinese or international students. Table 1 shows the response rate for each student subgroup, which ranged from 15.3% to 91.0%. The sample size of student athletes was small; to avoid identification of the student, the actual number of some data would not be presented in the results section.

3. Data Analysis

To test Hypothesis One, regarding the differences among the student groups in the prevalence of depression, anxiety and stress, univariate analysis was used to derive mean values, standard deviations (SD), frequencies (n) and proportion percentages (%) from the categorical and continuous variables. Chi-square tests were used for bivariate analysis. Normality tests indicated that most of the study variables are not normally distributed. Non-parametric Kruskal-Wallis Tests, followed by post-hoc comparisons using the Dwass-Steel-Critchlow-Fligner Method (DSCF), were applied to compare the medians of the different student subgroups' mental health profiles, study loads, and academic performances. To test Hypothesis Two, the strengths of the associations between age, gender, academic performance and mental health status, were analysed with Spearman correlations for the different student populations. Linear trend tests for the DASS scores were performed to track the changes in scores over the cohort years. All tests were two-tailed, with the level of statistical significance defined as $p < 0.05$. SAS Software Version 9.4 for the Windows platform (SAS Institute

Inc., Cary, NC, USA) was used for the analyses.

4. Results

4.1. Characteristics of the student groups and their mental health prevalence

There were more females than males, except in the mainland Chinese student group. Across all six subgroups, the CCT students were older, required to fulfil the highest number of credits, and suffered from the highest level of depression, anxiety and stress (i.e., with the highest DASS scores). Despite this, their GPAs were either higher or comparable to those in the other student groups. The student athletes had the lowest GPAs. Furthermore, the non-local students (i.e., mainland Chinese and international students) obtained good GPAs and good mental health indicators, with the lowest level of depression scores (Tables 1, and Figure 1).

In decreasing order, the prevalence of depression (in the category of moderate or above) was in student athletes (21.1%), CCT students (15.1%), DEfSS (14.3%), not DEfSS (12.0%), mainland Chinese students (3.3%), and international students (2.7%). The overall prevalence of depression was 11.9%. For the prevalence of anxiety (moderate or above), the order was mainstream: CCT students (30.9%), DEfSS (29.7%), not DEfSS (27.7%), international students (21.6%), mainland Chinese students (18.9%), and student athletes (16.7%). The overall prevalence of anxiety was 29.1%. For the prevalence of stress (moderate or above), the order was CCT students (13.6%), DEfSS (11.2%), not

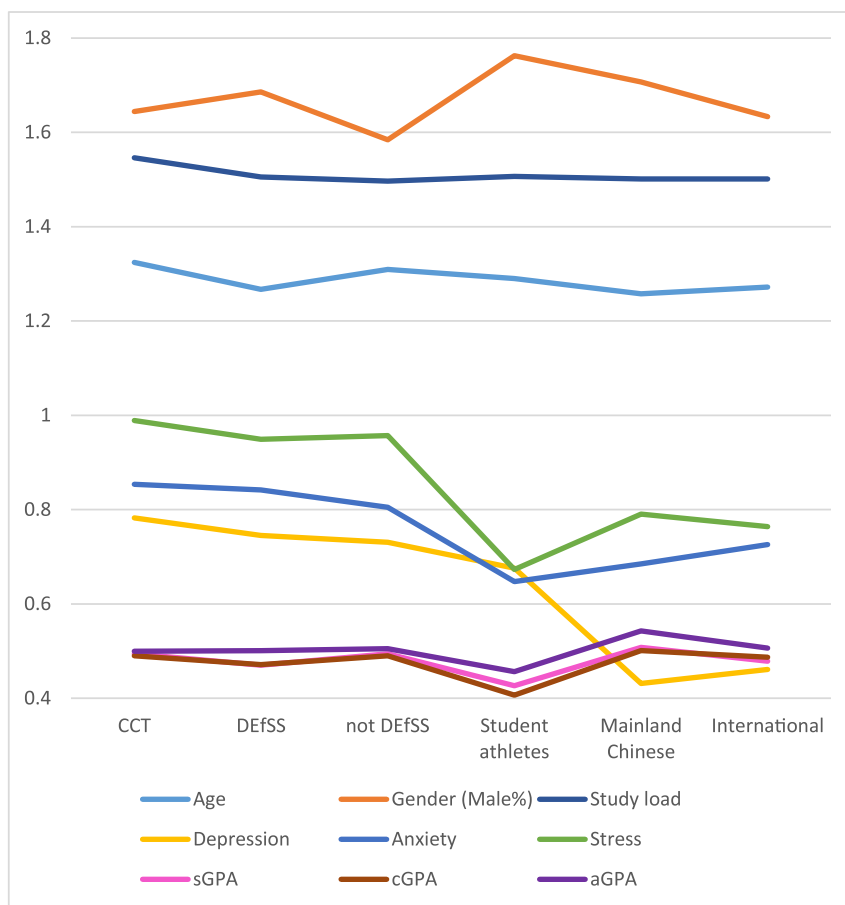


Figure 1. Comparisons of age, gender, study load, mental health profiles and academic performances among the six student groups.

Note: y-axis value in logarithmic scale

Top panel: Gender, study load, age

Middle panel: DASS score

Bottom panel: GPAs

DEfSS (8.2%), student athletes, mainland Chinese students (4.1%), and international students (2.8%). The overall prevalence of stress was 8.8%. For all three categories, the proportion of students in each group with anxiety was higher than the proportions of those with depression or stress, except for the student athletes. The Chi-square analyses indicated that the CCT students were more likely to have depression than the DEfSS, mainland Chinese and international students. Furthermore, in general, the mainland Chinese and international students were less likely than the other four groups of students to have depression, anxiety or stress ($p < 0.01$).

Differences between the median values of the students' mental health profiles, study loads and academic performances were analyzed by the Kruskal-Wallis non-parametric test. Statistically significant differences were found for all the variables: study load ($\chi^2(5) = 1611.97$, $p < 0.0001$); sGPA ($\chi^2(5) = 332.25$, $p < 0.0001$); cGPA ($\chi^2(5) = 270.74$, $p < 0.0001$); aGPA ($\chi^2(5) = 101.15$, $p < 0.0001$); depression ($\chi^2(5) = 169.13$, $p < 0.0001$); anxiety ($\chi^2(5) = 88.63$, $p < 0.0001$); and stress ($\chi^2(5) = 123.91$, $p < 0.0001$).

The Dwass-Steel-Critchlow-Fligner (DSCF) test for multiple comparisons indicated that the CCT students had the heaviest study load (median [m] = 34.5) of the student groups: mainstream: DEfSS (m = 32.0) (Wilcoxon rank sum test statistic [Z] = 38.557, $p < 0.0001$, effect size [r] = 0.42); mainstream not DEfSS (m = 31.0) (Z = 18.013, $p < 0.0001$, r = 0.45); student athletes (m = 31.5) (Z = 4.678, $p < 0.0001$, r = 0.12); mainland Chinese students (m = 31.5) (Z = 24.554, $p < 0.0001$, r = 0.56); and international students (m = 31.5) (Z = 14.887, $p < 0.0001$, r = 0.38). The local

students (CCT, mainstream DEfSS or mainstream not DEfSS) had higher depression and stress scores than the mainland Chinese and international students ($p < 0.0001$). The rest of the comparison results were not inclusive.

4.2. Association of age, gender, study load, academic performance and mental health status

Table 2 shows that, for DEfSS and also for the overall groups, study load was related positively to depression, while GPA was related negatively to this score. Age had a positive significant relationship with all three mental health scores. For CCT students, sGPA and cGPA were related negatively to depression score. For international students, study load was correlated positively to anxiety score.

In terms of gender, males had higher depression scores than females for DEfSS and for the overall student groups ($p < 0.001$). The relationships among depression, anxiety and stress were high, ranging from 0.576 to 0.903 ($p < 0.0001$) overall and for all student groups (data not shown).

4.3. Trends in depression, anxiety, and stress from 2014 to 2017

Figures 2a, 2b and 2c show that slightly decreasing trends of scores were found for both DEfSS and the CCT students, as well as the overall groups. The negative slope (-0.15) [with the maximum of 1 ranging from -1 to 1] for depression in the overall groups suggested that the score value reduced by year, indicating that the students' mental health

Table 2
Relationship between mental health profile and age, study load, and GPAs with Spearman coefficients.

	All Groups	CCT Students	Mainstream: DEfSS	Mainstream: not DEfSS	Student Athletes	Mainland Chinese Students	International Students
Spearman r							
Depression vs:							
Age	0.087***	-0.020	0.086***	-0.038	-0.126	-0.001	-0.083
Study load	0.032**	-0.028	0.028*	-0.102	0.023	0.030	0.099
sGPA	-0.045***	-0.078**	-0.034**	-0.030	0.253	0.028	0.046
cGPA	-0.038***	-0.060*	-0.029*	-0.036	0.226	0.049	0.024
aGPA	-0.050*	-0.047	-0.029	-0.127	—	0.149	-0.125
Anxiety vs:							
Age	0.028*	0.001	0.026*	-0.009	-0.067	0.033	-0.086
Study load	0.001	-0.052	-0.001	-0.060	-0.095	-0.002	0.214**
sGPA	-0.007	-0.034	0.009	-0.024	0.147	-0.012	0.013
cGPA	-0.003	-0.023	0.011	-0.044	0.200	0.005	0.003
aGPA	-0.040*	-0.023	-0.027	-0.088	—	0.095	-0.316
Stress vs:							
Age	0.064***	-0.015	0.037**	-0.013	0.107	0.057	0.029
Study load	0.020*	-0.068*	0.010	-0.046	0.102	0.011	0.156
sGPA	0.004	-0.027	0.012	-0.013	0.186	0.004	0.002
cGPA	0.005	-0.022	0.012	0.027	0.211	0.019	-0.002
aGPA	-0.039*	-0.040	-0.016	-0.059	—	0.007	-0.018

* p < 0.05,
** p < 0.01,
*** p < 0.001.

Note: – the correlations with award GPA for student athletes are not shown to avoid identification of the students, due to small numbers in this category.

conditions improved over the cohorts. Only depression was found to have a significant decreasing trend for not DEfSS.

5. Discussion

To our best knowledge, this has been the first study to examine the mental health profiles of different subgroups of undergraduate students. Depression, anxiety and stress levels, dichotomy (normal, moderate or above), trend analyses, and their associations with age, gender, study load, and academic performance were employed to evaluate the issue. This study has implications for university and government policy and

resource allocation. Of these six student subgroups, the CCT students emerged as the highest-risk group because they had the highest levels of depression, anxiety and stress, and their study load was the highest as well. Unexpectedly, DEfSS and not DEfSS ranked after the CCT students for depression, anxiety and stress levels and their prevalence. On the other hand, the student athletes had the greatest proportion of depression (moderate or above). Although there were declining trends for depression, anxiety and stress from 2014 to 2017, it was only a slight drop. Even though not statistically significant, the trends for anxiety and stress in international students increased. Furthermore, age, gender, study load and academic performance were associated with the

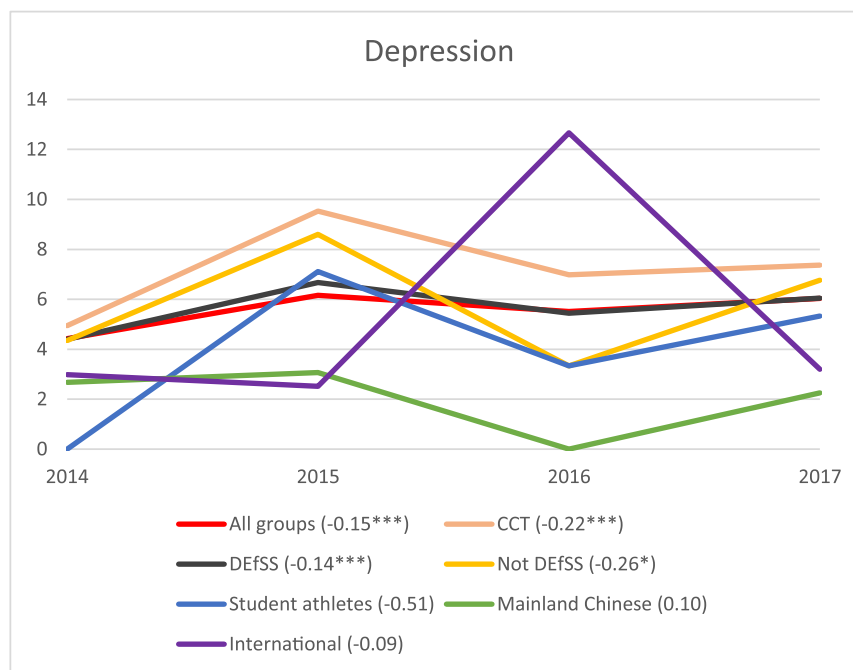


Figure 2. a. Trend of depression from 2014 to 2017 for overall groups and among student groups

b. Trend of anxiety from 2014 to 2017 for overall groups and among student groups

c. Trend of stress from 2014 to 2017 for overall groups and among student groups

Note: The brackets showed the trend (*p < 0.05, ***p < 0.001); n = 0 for mainland Chinese in 2016.

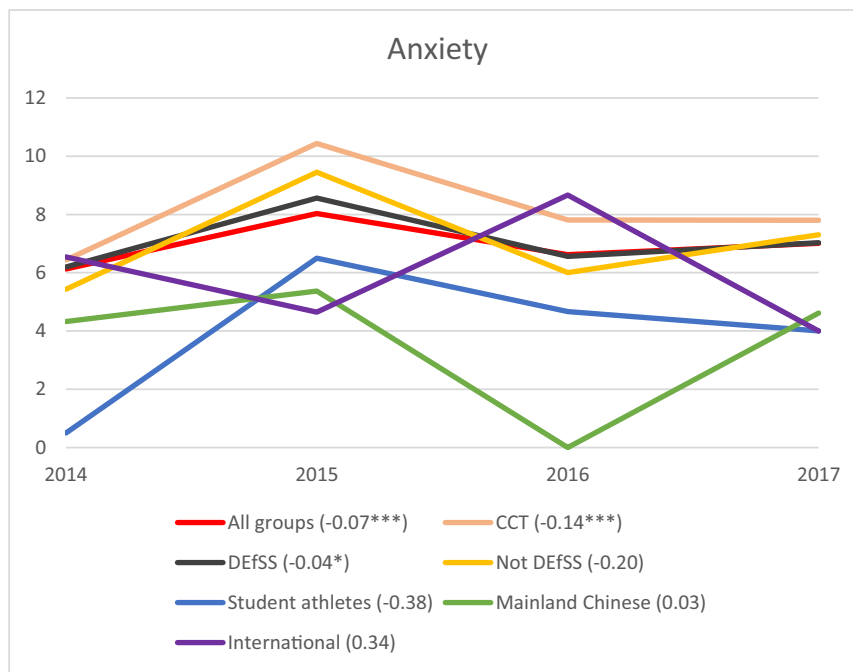


Figure 2. (continued)

mental health profile.

5.1. The prevalence of depression, anxiety and stress

It is challenging to compare the study results in the literature because the data were collected using different measurement instruments and at different times. Our study adopted the widely used DASS instrument and our results can be compared with those of two earlier studies (Shamsuddin et al., 2013; Wong et al., 2006). Our overall groups and sub-group results for depression, anxiety and stress were lower than those in these two studies. The times of data collection

might explain the discrepancy. The Malaysian study (with 37.2% depression, 63.0% anxiety and 23.7% stress) (Shamsuddin et al., 2013) did not provide information about when the data were collected but, from the results, it can be inferred that the study sample might have involved students from different years of study. In addition, it is not clear if the questionnaire was distributed during or close to an examination period. In the Hong Kong study (Wong et al., 2006), the data were collected from first-year students in October 2003, one month after the commencement of their university studies. In Wong's research, 21.0%, 41.0% and 27.0% of first-year university students had moderate or above levels of depression, anxiety and stress respectively

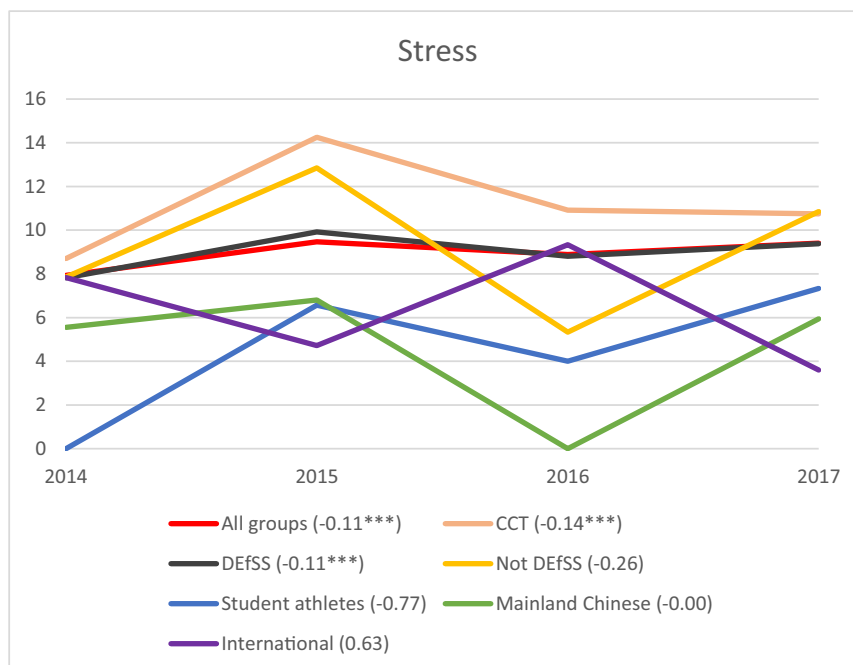


Figure 2. (continued)

(Wong et al., 2006), while our results were 11.9%, 29.1%, and 8.8% respectively. These discrepancies could be because our study data were collected in August, before the commencement of the school year. Our findings, therefore, actually reflected the mental health status before university study. Other studies have found that students tended to worry about the new academic environment, fitting into the university culture, learning resources, making friends, social support and social interaction before studying in a university (Flaga, 2006; Owens, 2010). Based on our study and the two earlier ones (Shamsuddin et al., 2013; Wong et al., 2006), it is easy to recognize the trend of increasing proportions of students with depression, anxiety and stress from prior to starting their university to different times during the study. This comparison also suggests the need to conduct longitudinal studies to identify the time and risk groups for resource allocation to support students' mental health.

A further review of the results in subgroup students revealed three high-risk groups: CCT, student athletes, and international students. The CCT students are the most high-risk group (Table 1). Our results are consistent with those of Mehr and Daltry (2016), that transfer students have significantly higher scores for depression, social anxiety, and academic distress. Furthermore, the prevalence of anxiety (moderate or above) in 30.9% of this group was comparable to those students (41.0%) in 2003 (Wong et al., 2006). In our study, CCT students were slightly older, but with heavier study loads than the DefSS students. These differences will be discussed further in the next section. Another possible at-risk group is student athletes – the 21.1% of this group showing depression (moderate or above) was similar to the 21.0% of students in 2003 (Wong et al., 2006). Although such conclusions should be made with caution due to the small sample size and low response rate, this result is consistent with US findings that 23.7% of student athletes had depressive symptoms (Wolanin et al., 2016). The third possible high-risk group is international students (Table 1). Although their levels of depression, anxiety and stress were relatively low, attention should be paid to the increasing trend in this group (Figure 1); the increase was not statistically significant, however, which could be due to the small sample size and low response rate). Pereira et al. (2019) found that international students were less likely to report their mental health problems and seek help. In this international student group, those from Asian countries were found to be significantly less likely to report psychological issues for which they felt they needed professional help (Pereira et al., 2019). Some authors have commented that most university resources are for mainstream students (local DefSS and not DefSS students) (Blaylock and Bresciani, 2010), and our study results suggest that the resources allocated to mainstream students were needed because the local DefSS and not DefSS students ranked after the CCT for depression, anxiety and stress scores and their prevalence. However, our results further suggest to allocate resources to other subgroups. In addition, our findings can be used to raise university counsellors' awareness about the specific needs of CCT students, student athletes, and international students when designing campus-based mental health promotion programmes or interventions. Our study also found that the relationships among depression, anxiety and stress were high, ranging from 0.576 to 0.903 ($p < 0.0001$). This suggests that counsellors providing support to students with anxiety should also assess their depression and stress levels. Furthermore, to ease students' worries or concerns before the commencement of school, studies could be conducted to assess the needs of each subgroup so that appropriate strategies can be implemented to address their unique needs. For instance, for CCT students, their learning environment in the community college and the university might be different, academic rigor might be less emphasized in the community college (Carlan and Byxbe, 2000). Flaga (2006) and Owens (2010) suggested orientation programmes, campus visits, bridging programmes and transfer checklists to facilitate successful transfer.

5.2. Mental health, age, gender, study load and academic performance

Although our study results found that older students overall and in the DefSS category (Table 2) tended to have higher depression, anxiety and stress levels, the correlation coefficients were not clinically meaningful. The significant results could have been due to the large sample size. Shamsuddin et al. (2013) found, in Malaysia, that older female university students had significantly higher levels of stress. In terms of gender, males had higher depression scores than females overall and in the DefSS group ($p < 0.001$). This result concurs with those of studies conducted by Liu et al. (2017) in China and Wong et al. (2006) in Hong Kong. On the other hand, we found no significant gender differences for anxiety or stress scores. This seems contradictory to earlier findings, that female university students in general were at risk of mental health problems in Hong Kong (Ma and Lai, 2018; Wong et al., 2006), in Malaysia (Shamsuddin et al., 2013), and in Jordan (Hamaideh, 2018). More studies should be conducted to further investigate age and gender differences among student subgroups with a larger sample. Future research can also explore student subgroups' knowledge about their mental health profiles, mental health in general, and effective and ineffective help-seeking behaviors. Strategies for improving mental health literacy specific to student subgroups are warranted.

Our results (Table 2) found that, in DefSS students and the overall groups, study load was related positively to the depression score but GPA (sGPA and cGPA) was related negatively. For CCT students, sGPA and cGPA were related negatively to the depression score. For international students, study load was correlated positively to anxiety score. Numerous studies (Beiter et al., 2015; Bruffaerts et al., 2018; Mehr and Daltry, 2016) have found negative impacts of mental health problems on academic performance. Heavy study loads might induce mental health problems (Thuraiselvam and Thang, 2015). In our study, the CCT students had the heaviest study load of the six subgroups; this, most likely, is the result of poor recognition of prior credits earned from the community college. Unexpectedly, our results did not find a significant relationship between study load and mental health in the transfer students, even though the correlation coefficients were negative. One possible explanation is the lack of variations in the variables, because most CCT students experienced high study loads and low mental health scores. Cheung et al. (2015) found that CCT students, in general, have heavy study loads. On the other hand, their academic results were relatively high. Consistent with other findings, they might have experienced transfer shock (which can result in a GPA drop in the first semester) but they were prepared to work hard to improve their academic performances (Archambault, 2015; Flaga, 2006). It was interesting to find that the student athletes were relatively mentally stable. This might be explained by their engagement in physical activity. Ma and Lai (2018) found that mentally healthy university students were more physically active and engaged less in unhealthy behaviors (such as smoking or substance abuse). Further studies can be conducted to explore the factors contributing to poor mental health, particularly in different student subgroups.

5.3. Implications

In view of our study results, it is important to build up a safety net for early identification of and early intervention for students with high risk factors for mental health problems. A collaborative approach, involving various parties of the campus community, especially those who interact frequently with students, such as teachers, academic advisors and peers, is highly important as they can identify students with high risk factors at an early stage for prevention purpose. Three levels of evidence-based interventions (universal, selective and indicated) are recommended by the World Health Organization (2018). The universal intervention strategy refers to universal wellness promotion and educational strategies targeting all students of the university (e.g. an on-

campus mental health awareness programme). The selective interventions target high-risk groups, such as CCT, student athletes, and non-local students. The indicated interventions focus on students with high risk factors such as those under academic probation and those facing de-registration, or those who are in crisis (e.g. those suffering mental or emotional breakdowns). A recent systematic review and meta-analysis of the effects of mental health interventions for university students found internet-based interventions to be promising (Winzer et al., 2018). Cognitive behavioral therapy (CBT) is largely a psychosocial intervention that has been shown to be efficacious and cost-effective to be delivered online or by smartphones (Zhang et al., 2015; Zhang and Ho, 2017). Online psychoeducation has also been found to improve suicide literacy (Han et al., 2018). Mobile health should be explored further to increase the awareness and knowledge of mental health literacy and thus to de-stigmatize mental health problems in the university setting.

5.4. Limitations

This study had several limitations. First, although the sample size of 9479 was large, the study was conducted in just one university, which limited its generalizability to the other local universities. Furthermore, the limited number of students in some of the sub-groups, such as student athletes and international students, makes it difficult to draw conclusions about the mental health problems of these groups. Our study results will provide a foundation for further studies. Second, the different invitation methods for different groups of students to complete the questionnaire also led to an uneven response rate, which further reduced the numbers of students in the specific sub-groups. The results of the current sample were dominated by the mainstream DefSS students (75.5%), as this group comprised the largest population and the highest response rate. Third, although academic results could be collected from the university records, teaching-learning processes, and non-academic information, such as co-curricular activities, were not collected, even though they are potential factors associated with mental health. Fourth, DASS data were collected before the start of the university study, but the students' mental health conditions could have changed during their study. Last, recall bias was inherent in the self-reported DASS data. Survey data of self-reports may underestimate true levels of mental health conditions (Gaddis et al., 2018).

6. Conclusions

Our study results suggest that university resources and research should focus not only on the mental health of DefSS and not DefSS students, but also particularly on CCT students, student athletes and international students. Of the student subgroups considered in this study, the CCT students were at the highest risk for mental health issues. In addition, age, gender, study load and academic performance were factors associated with mental health conditions. The trend analysis of the student groups showed improvements in mental health conditions over the duration of their study.

The representative results from a massive group of college students in Hong Kong can be generalized to Asian young college students. It may be necessary to re-design mental health services according to the features of various groups. The transition process of becoming a university student should receive more attention as a turning point of young adult development. Consideration should also be given to continual monitoring of students' mental health by massive surveying through the study period. The mechanism underlying the association between academic workload, academic performance and mental health needs to be investigated further with longitudinal studies. Mobile health can be used to promote mental health literacy in the university community. Furthermore, the mental health of university students depends not only on personal characteristics, but also on contextual characteristics of the university environment (teaching-learning

processes) that should be evaluated in greater depth in the future.

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Ethical Approval

Ethical approval was obtained from the Human Subjects Ethics Subcommittee of the Hong Kong Polytechnic University (HSEARS20180104005-02).

Declaration of Competing Interest

The Authors declare no conflicts of interest.

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Contributors

Kin Cheung: Planned the study, coordinated the study, and revised the manuscript.

Kin Yuen Tam: Drafted the introduction and discussion sections, and revised the manuscript.

Hilda Tsang: Conducted data analysis, drafted the results section, and revised the manuscript.

Lillian Weiwei Zhang: Drafted abstract, conclusion, and revised the manuscript.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jad.2020.05.041](https://doi.org/10.1016/j.jad.2020.05.041).

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