Fear and anxiety about COVID-19 among local and overseas Chinese university students

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Abstract
This study aimed to establish a new COVID-19 Fear (Higher Education) scale to investigate the relationship between fear and generalised anxiety symptoms among Chinese students in mainland China, Hong Kong, and other countries. 219 Chinese university students studying in universities in mainland China (n = 76, 34.7%), Hong Kong (n = 66, 30.1%), and overseas (i.e., outside of China as international students, n = 77, 35.2%) participated in an online study from March 31, 2020 to April 4. Participants completed a newly developed COVID-19 Fear (Higher Education) scale to measure three domains of fear including fear of infection, fear of instability and fear of insecurity related to the COVID-19 pandemic. They also completed the Generalized Anxiety Disorder 7-item scale (GAD-7) on the severity of anxiety symptoms. About 9.6% of the participants could be classified as exhibiting high anxiety level according to the GAD-7. More students studying overseas (about 15%) were classified into the high GAD group when compared to students studying in both mainland China (6.6%) and Hong Kong (6.1%). MANOVA results showed that students studying in Hong Kong and overseas had more concerns related to preventive measures related to COVID-19 than their mainland counterparts did. We concluded that international students studying away from their home country would have higher risk to develop anxiety problems during a collective trauma such as the COVID-19 pandemic. Education institutions should provide support services including online support groups, social media groups for mutual support to alleviate the fear and anxiety of international students.

Keywords
anxiety, COVID-19, fear, international students, university students

What is known about this topic
- COVID-19 has affected communities all over the world.
- Teaching activities of many education institutions were disturbed by COVID-19.
- There are different dimensions of fear (Infection, Instability, and Insecurity) in infectious diseases such as COVID-19.

What this paper adds
- Different groups of students have differential concerns towards COVID-19.
- Fear of COVID-19 can be separated into three domains: infection, instability and insecurity.
- A COVID-19 Fear Scale is established to measure fear of COVID-19.
The outbreak of a new coronavirus (COVID-19) was declared by the World Health Organization as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 (World Health Organization, 2020a). The new coronavirus pneumonia caused by the highly infectious COVID-19 is an acute infectious disease which has led to millions of infected cases and thousands of death (Zhang, 2020). To prevent the spread of the virus, many cities worldwide have implemented preventive measures including quarantine and lockdown. Threats related to the pandemic and its related preventive measures have significant adverse impact on the mental health of individuals. For instance, Huang and Zhao (2020) studied the factors influencing the mental health of the Chinese public during COVID-19. Results showed that younger Chinese generations and people who spent too much time getting updates from the COVID-19 outbreak were prone to developing anxiety symptoms. Uncertainties about the pandemic would cause higher stress level and have higher chance of developing mental disorder symptoms (Huang & Zhao, 2020). Besides, Choi et al. (2020) investigated how COVID affected the Hong Kong population's psychological well-being. The prevalence of anxiety and depression among Hong Kong people was higher during the pandemic than before (Choi et al., 2020).

Because of these measures, university students from different areas are facing various threatening situations. Students studying in China were among the first being affected by the virus outbreak. Chinese students studying in other countries faced similar threats later when the virus spread to their studying areas. Besides, these students might have to expose themselves to a high risk of infection on flights back to China. Zhou et al. (2020) conducted a cross-sectional online survey and reported that the prevalence of a combination of depressive and anxiety symptoms was 31.3% among Chinese high school students during the COVID-19 outbreak. Older students tended to exhibit more anxiety and depressive symptoms. Another study reported that Chinese college students tend to experience more anxiety if someone they know is tested positive for COVID (Cao et al., 2020). In Hong Kong, Li and Leung (2020) reported that one-third of high school students, especially female students experienced more mental distress. Furthermore, senior high school students were more likely to display psychological distress than younger forms due to stress coming from the potential interference of COVID to the upcoming public examination. Besides, Chinese students at universities in Hong Kong were in a more complicated situation where they have been exposed to both the COVID-19 pandemic and the Hong Kong social movement happening in 2019 (Hou & Hall, 2019) in two consecutive years. Being in an uncertain and threatening situation, students’ mental health may be seriously compromised (Hou & Hall, 2019; Ni et al., 2020; Torales et al., 2020).

### 1.1 Fear and anxiety in times of COVID-19

Anxiety is a complex emotional state where people feel anxious, disturbed, worried and annoyed in face of impending danger or threat such as an infectious disease outbreak (Robinson et al., 2013). Stressful life events were found to be positively associated with anxiety and depressive symptoms (Meng et al., 2011). In times of COVID-19, Zhang et al. (2020) revealed that the detection rate of anxiety symptoms was about 15% in medical students from Mongolia medical colleges in mainland China, and 77% of the students had shown distress symptoms in the past 7 days.

Fear is an emotion that is often related to anxiety (Van Bockstaele et al., 2014). While anxiety arises from expectations or concerns about the occurrence of some fearful situation, fear is an affective reaction to actual exposure to threats (Huberty, 2012). In times of virus outbreak, fear is a common response to the threats of the invisible virus. During the SARS outbreak, healthcare workers who need to have close contact with SARS patients were reported to show strong fear towards SARS (Ho et al., 2005). In combating Ebola, fear is an issue to overcome (Vega, 2016). Research on fear and anxiety in young children has found that fear is a significant predictor for later social anxiety symptoms in young children and adolescents (Buss et al., 2013, 2020). Also, generalised anxiety disorders are related to overgeneralised conditioned fear; the association between anxiety symptoms and constant high level of fear has also been reported (Duits et al., 2016; Lissek et al., 2014).

Due to the increase in globalisation of the world, more Chinese students were studying abroad than in 2003 during SARS. Similar to SARS, the COVID-19 outbreak is likely to evoke strong fearful reactions in university students. It is important to establish appropriate tools to measure anxiety-related to COVID-19 among the student populations as well as to investigate risk factors related to anxiety towards COVID-19.

### 1.2 Measurements related to fear of COVID-19

At the start of the COVID-19 pandemic, a 7-item Persian version of the Fear of COVID-19 scale (FCV-19S) was developed among a sample of Iranian participants (Ahorsu et al., 2020), and later adapted to Turkish (Bakioğlu et al., 2020), Russian (Reznik et al., 2020) and Bangla (Sakib et al., 2020) languages. The FCV-19S is a unidimensional scale. The seven items are related to anxiety symptoms (‘My heart races or palpitates when I think about getting coronavirus-19’; ‘My hands become clammy when I think about coronavirus-19’) and traumatic stress responses (‘When watching news and stories about coronavirus-19 on social media, I become nervous or anxious’; ‘I cannot sleep because I’m worried about getting coronavirus-19’). The total score represents the severity of anxiety which is similar to existing anxiety scales such as the Generalized Anxiety Disorder 7-item scale (Löwe et al., 2008). There is a lack of a multidimensional COVID-19 Fear Scale tailored to university students that is more comprehensive in terms of measuring other symptoms of fear. Both SARS and COVID-19 are coronavirus and lead to contagious severe acute respiratory syndrome (Peiris et al., 2003; World Health Organization, 2020b); similar precaution and preventive measures are implemented in both SARS and COVID-19 pandemics (Ho, 2003;
Lin et al., 2020). Accordingly, it is logical to expect that similar dimensions of fear towards SARS could be applied to understand the fear related to COVID-19. Hence, the present study adapted the multidimensional SARS Fear Scale (Ho et al., 2005) developed during the SARS outbreak to measure different domains of fear towards COVID-19 and establish a new COVID-19 Fear scale for university students.

1.3 | The present study

Based on the above review, this study aimed to establish a new scale, named COVID-19 Fear (Higher Education) scale to compared fear and anxiety related to COVID-19 among (a) local mainland Chinese students studying in their home country, (b) mainland Chinese students studying in Hong Kong, which is a special administrative region of People’s Republic of China, and (c) mainland Chinese students studying in other countries outside of China as international students during the COVID-19 pandemic.

This study investigated Chinese university students’ fear and anxiety towards COVID-19. Using the new scale, the associations between fear and generalised anxiety, and risk factors of generalised anxiety disorder in university students were examined. No research has been conducted to compare the fear and anxiety of these three groups of students, to our best knowledge. The findings can inform university administrators, faculty members and mental health professionals in choosing appropriate services for local and international students to help them cope with infectious disease outbreaks and other crises.

2 | METHOD

2.1 | Participants and procedures

219 Chinese university students, 55 males (25.1%) and 164 females (74.9%), with an average age of 23.17 years (SD = 2.66, range = 17–34 years) participated in the study. Due to the seriousness of the outbreak in China and time constraints at that time, we did not extend the data collection period to collect more samples. Statistical power analysis showed that a power of 0.8 was achieved by our current sample size with a medium effect size (Cohen’s $f^2 = 0.15$) and an alpha value of 0.05. All students were born in mainland China, and they were studying at universities in mainland, Hong Kong, or an overseas country. Among the 219 participants, 76 (34.7%) students were from a university in mainland China; 66 (30.1%) were studying in one of the universities in Hong Kong and 77 (35.2%) were international students who were studying in an overseas university. For participants studying in mainland China, 26 (23.8%) were studying in the Northern provinces (Shanxi, Hebei, Tianjin, Beijing, Inner Mongolia, Shaanxi, and Xinjiang), 20 (21.8%) in the Southern provinces (Hunan, Guangdong, Hubei, Henan, Sichuan, Yunnan, and Guizhou) and 30 (30.4%) in the Eastern provinces (Zhejiang, Jiangsu, Anhui, Shandong and Shanghai). None of the students were under psychiatric treatment nor had been diagnosed with COVID-19. None of the students had a family member diagnosed with COVID-19.

Ethical approval was obtained from the Human Subjects Ethics Committee of the Department of Social & Behavioural Sciences, City University of Hong Kong (reference number: B-5790-202003-17). An online study was conducted because of infectious disease control measures. Convenience sampling was used by posting an invitation link to our study site on WeChat, which is a popular social media among Chinese young people, from 31 March to 21 April 2020. A link to the study site with the online questionnaires was included in the invitation. At the study website, informed consent was presented first on the screen. After the participants read the information sheet and gave consent, they were directed to complete the online questionnaires (see below). Participants clicked a button to submit their answers after completion of the questionnaires.

2.2 | Measures

2.2.1 | COVID-19 related fears

Participants’ fears about COVID-19 were measured by the COVID-19 Fear (Higher Education) scale. The scale was adapted from the 18-item SARS Fear Scale (SFS) for healthcare workers (Ho et al., 2005). Each item describes a specific issue related to COVID-19 (e.g., ‘Fear that I will be infected’ and ‘Feel disturbed because of the complex procedure to go back to my country’). Items only relevant to healthcare workers such as ‘feel distressed because the upsurge in workload’, and ‘worry if I will be assigned to SARS wards’ were removed. Items applicable to university students such as ‘fear being quarantine or forced to limit activities’, and ‘fear being quarantine or forced to limit activities’, were added. Participants were asked to rate on a 4-point Likert Scale from 0 (definitely false) to 3 (definitely true) to what extent the issue applies to them. Participants of the present study completed the Chinese version of the COVID-19 Fear (Higher Education) scale, although it should be noted that both English and Chinese versions of the COVID-19 Fear (Higher Education) scale are available.

2.2.2 | Anxiety level

The Chinese version of the General Anxiety Disorder 7-Item (GAD-7) Scale (Zeng et al., 2013) was translated from the original English version of GAD-7 (Löwe et al., 2008; Spitzer et al., 2006) to assess generalised anxiety disorder symptoms over the past 2 weeks on a four-point scale from 0 (never) to 3 (nearly every day). A total score with a range of 0–21 was calculated by summing up scores on each item, with higher total scores indicating higher anxiety severity. A GAD-7 total score of 10 or above is considered to be in the high anxiety range (Johnson et al., 2019; Spitzer et al., 2006). This scale had excellent internal consistency with Cronbach’s $\alpha = 0.92$ according to the sample of the present study.
2.2.3 | Demographic questionnaire

Participants completed a self-developed questionnaire to provide personal information including gender, age, studying location, history of mental health, family history and personal history of COVID-19. A total of 25 locations, including different provinces, autonomous regions and municipalities directly under the Central government in China were collected. Participants who are under psychiatric treatment or have been diagnosed with COVID-19 were excluded from the study. Any family member of the participant diagnosed with COVID-19 was also excluded. There were four mainland students and two overseas students from Hubei.

2.3 | Data analysis

Exploratory factor analysis was conducted to explore the structure of the COVID Fear (Higher Education) scale. We performed independent samples t-tests and one-way ANOVA to investigate the differences in COVID-19 fear and anxiety between males and females and among the three groups of participants (i.e., mainland China, Hong Kong, overseas). Participants were grouped into high versus low anxiety groups according to the cut-off score of GAD-7. Correlations among age, COVID-19 fear and anxiety were also examined for gender and study places, respectively. Multivariate analysis of variances (MANOVA) was conducted with different dimensions of COVID-19 fear as a group dependent variable. Regression analysis was finally conducted to examine the relative association of different dimensions of COVID-19 fear, gender and study places with students’ anxiety level.

3 | RESULT

3.1 | Exploratory factor analysis

Exploratory factor analysis with varimax rotation was performed to identify the factor structure of the 18-item COVID-19 Fear (Higher Education) scale. Nine items were retained based on criteria that their loadings on a factor exceed 0.50 without loading above 0.40 on another factor, and the difference between an item’s loading on two factors should be larger than 0.30 (Ho et al., 2003). The Kaiser-Meyer-Olkin (KMO) measure of sample adequacy was 0.82, indicating that the sample size (n = 219) was adequate for EFA (Kaiser, 1974). A three-factor solution was revealed which accounted for 71.6% of the total variance (Table 1).

The first factor was labelled as Infection (4 items, 23.49% of variance, Cronbach’s α = 0.83) which contained items related to self or family members being infected. The second factor was named Instability (2 items, 19.03% of variance, Cronbach’s α = 0.69), and indicated fear related to changes caused by preventive measures against COVID-19 such as being quarantined. The third factor contained items related to Insecurity (3 items, 19.36% of variance, Cronbach’s α = 0.80) which measured a participant’s fear of death and life out of control. Higher scores on each subscale indicated higher COVID-19 related fear. A Total COVID-19 Fear score was calculated by summing up the three subscale scores (9 items; Cronbach’s α = 0.84).

#### TABLE 1  Factor structure of the COVID-19 fear (higher education) scale (n = 219)

| Fear items | Factor 1 | Factor 2 | Factor 3 |
|------------|----------|----------|----------|
| Factor 1: Infection | | | |
| Item 1 Worry about health problems regarding myself | 0.816 | | |
| Item 2 Worry about health problems regarding my family members | 0.810 | | |
| Item 3 Fear that I will be infected | | 0.724 | |
| Item 6 Worry that my family will be infected | | 0.625 | |
| Factor 2: Instability | | | |
| Item 8 Fear being quarantine or forced to limit activities | 0.761 | | |
| Item 9 Feel concerned about the complicated procedure back to my country | 0.707 | | |
| Factor 3: Insecurity | | | |
| Item 14 Dream about myself-families–colleagues getting infected | 0.806 | | |
|Item 15 Think about death–dying | 0.783 | | |
|Item 16 Feel that I have lost control of life | 0.681 | | |

Note: Factor loadings less than 0.3 are not shown.

3.2 | Descriptive statistics

Independent sample t-tests were performed to examine gender differences in the fear of COVID-19 and anxiety scores. Significant gender differences were obtained for GAD-7, t(219) = 2.72; p = 0.07 and Insecurity, t(217) = 2.13, p = 0.03. Women had higher GAD-7 and Insecurity scores than men, GAD-7: women (M = 4.79, SD = 4.44), men (M = 2.96, SD = 3.86); Insecurity: women (M = 4.85, SD = 1.74), men (M = 4.29, SD = 1.46). No significant gender differences were obtained for Infection, t(216) = 0.20, p = 0.84 (women: M = 9.26, SD = 2.66; men: M = 9.17, SD = 3.15) and Instability, t(127) = 0.47, p = 0.64 (women: M = 3.90, SD = 1.61; men: M = 3.78, SD = 1.37).

3.3 | High versus low anxiety groups

We categorised each participant based on their score on the GAD-7 scale using the usual cut-off of 10 into high and low anxiety groups.
(Spitzer et al., 2006). Chi-squared analysis showed no gender differences in the distribution of GAD high versus low anxiety groups, $\chi^2(1) = 0.46, p = 0.50$. Independent samples t-test revealed no age difference between the two groups too, $t(217) = -1.42, p = 0.16$. Table 2 shows the distribution of GAD high versus low groups. Overall, about one-tenth (9.6%) of the participants were categorised into the high anxiety group. About 15% of students studying overseas were grouped into the GAD high anxiety group. This percentage tended to be higher than both students in mainland China and Hong Kong (6.6% and 6.1%, respectively), although a marginally non-significant result was obtained, $\chi^2(2, N = 219) = 4.94, p = 0.085$, Wilk’s Lambda = 0.042.

### 3.4 | Multivariate analysis of variances

We next conducted a 2 (GAD group: high versus low) × 3 (place of study: Mainland China, Hong Kong, Overseas) MANOVA to examine the effect of interaction between GAD level and study places on COVID-19 related fear. The three dependent variables were Fear of Infection, Fear of Instability and Fear of Insecurity. Gender and age were controlled as covariates. The results showed a significant multivariate effect for the three latent variables as a group in relation to GAD category (high versus low anxiety) (Wilks’ Lambda = 0.93, $F(3, 208) = 5.19, p = 0.002$) and place of study (Mainland China versus Hong Kong versus Overseas) (Wilks’ Lambda = 0.93, $F(6, 416) = 2.42, p = 0.03$). The univariate $F$ tests showed that there was a significant difference between participants above and below the cut-off of GAD for Fear of Infection, $F(1, 210) = 9.93, p = 0.002$, partial $\eta^2 = 0.05$; and Fear of Insecurity, $F(1, 210) = 11.79, p = 0.001$, partial $\eta^2 = 0.053$. High GAD anxiety group tended to have higher fear of infection and instability when compared to those in the low anxiety group. The univariate $F$ tests on place of study revealed a significant difference in fear of instability only, $F(2, 210) = 3.89, p = 0.02$. Subsequent one-way analysis of variance showed a significant difference in fear of instability among students in the three places of study, $F(2, 216) = 8.68, p < 0.0001$. Post-hoc Scheffé tests showed that students in mainland China ($M = 3.29, SD = 1.18$) had lower fear of instability when compared to students in both Hong Kong ($M = 4.22, SD = 1.56$) and overseas ($M = 4.14, SD = 1.73$). No significant difference was obtained for students in Hong Kong and overseas. Table 3 shows the mean (standard deviation) of COVID-19 fear scores by GAD group and place of study.

### 3.5 | Relationship between COVID-19 related fear and anxiety

#### 3.5.1 | Partial correlation

We conducted partial correlations to examine the linear relationship between fear of COVID-19 and anxiety level. Since there was a gender difference in a GAD-7 score and a difference in COVID-19 infection

| Mainland China, n (%) | Hong Kong SAR, n (%) | Overseas, n (%) | Total | $\chi^2$ | $p$ |
|----------------------|----------------------|-----------------|-------|---------|-----|
| High anxiety | 5 (6.6%) | 4 (6.1%) | 12 (15.6%) | 21 (9.6%) | 4.94 | 0.085 |
| Low anxiety | 71 (93.4%) | 62 (93.9%) | 65 (84.4%) | 198 (90.4%) |
| Total | 76 (100%) | 66 (100%) | 77 (100%) | 219 (100%) |

Note: High anxiety group included those participants with a Generalized Anxiety Disorder 7-item scale total score of 10 or higher. Low anxiety group included those participants with a Generalized Anxiety Disorder 7-item scale total score below 10.

| Mainland China | Hong Kong | Overseas |
|----------------|-----------|----------|
| **Infection** |           |          |
| High anxiety | 10.20 2.59 5 | 11.50 1.29 4 | 11.83 2.51 12 |
| Low anxiety | 8.64 2.55 71 | 9.20 2.67 61 | 9.23 2.98 65 |
| **Instability** |          |          |
| High anxiety | 3.40 1.34 5 | 5.25 1.26 4 | 4.75 1.91 12 |
| Low anxiety | 3.28 1.17 71 | 4.15 1.56 61 | 4.03 1.68 65 |
| **Insecurity** |          |          |
| High anxiety | 5.20 1.92 5 | 7.50 2.38 4 | 5.58 2.57 12 |
| Low anxiety | 4.70 1.61 71 | 4.79 1.53 61 | 4.29 1.49 65 |

Note: High anxiety group included those participants with a Generalized Anxiety Disorder 7-item scale total score of 10 or above, Low anxiety group included those participants with a Generalized Anxiety Disorder 7-item scale total score below 10.
score among students in the three places of study, these two variables were controlled as covariates. The results are shown in Table 4.

Age was positively correlated with GAD-7 and COVID-19 Fear of Instability, older students had higher anxiety level and fear of instability brought about by quarantine and other infectious disease preventive measures. GAD-7 score was significantly and positively correlated with all COVID-19 Fear (Higher Education) subscale scores as well as the COVID-19 Fear (Higher Education) scale total score. The three dimensions of fear together accounted for about 18% of the total variance of GAD-7 (r = 0.43, r² = 0.18). Fear of Insecurity had the highest correlation with GAD-7, this dimension alone accounted for 12% of the GAD-7 score (r = 0.37, r² = 0.12).

### 3.6 Hierarchical regression analysis

We examined the relative importance of the three COVID-19 Fear (Higher Education) scores in predicting level of generalised anxiety, i.e., GAD-7 scores as an independent variable. Age, gender and study places were entered in step 1 first. The equation was significant, F(3, 213) = 5.62, p = 0.001, R = 0.27, R² = 0.07. These three variables accounted for about 7% of the total variance of GAD-7 total score. Being older, β = 0.17, p < 0.01, and a female, β = -0.23, p < 0.01, significantly predicted higher GAD-7 scores. Infection, instability and insecurity were entered in step 2. The model was significant, F (6, 210) = 11.26, p < 0.001, R = 4.93, R² = 0.24. The final equation accounted for 24% of variances, with the newly added predictors significantly explained additional 17% of the variance in GAD-7 (ΔR² = 0.17, p = 0.0001). Age (β = 0.14, p = 0.02) and gender (β = -0.18, p = 0.004) were still significant predictors of GAD-7 score. Study places were not a significant predictor of GAD-7 scores, β = 0.07, p = 0.30. Moreover, higher fear of infection (β = 0.22, p = 0.002) and insecurity (β = 0.23, p = 0.002) were significant individual predictors of GAD-7 score whereas fear of instability was not, β = 0.23, p = 0.40. These suggested that fear of infection and insecurity were significant predictors of GAD-7 even after the effects of age, gender and study places were taken into account (Table 5).

### 4 Discussion

#### 4.1 The COVID Fear (Higher Education) Scale

This study investigated fear related to the COVID-19 outbreak among Chinese university students studying in three different locations: mainland China, Hong Kong, and overseas as international students. The first objective of this study was to establish a new questionnaire, named COVID-19 Fear (Higher Education) Scale, to measure the severity of different dimensions of fear towards COVID-19 among university students.

Similar to the SARS Fear Scale (Ho et al., 2005), we used exploratory factor analysis (EFA) to examine the factor structure of the COVID-19. Nine items were selected from the EFA to measure three domains of fear related to COVID-19: Infection (4 items), Insecurity (3 items) and Instability (2 items). These three domains are identical to the three subscales of the SARS Fear Scale. The COVID-19 Fear of Infection subscale indicates the severity of health-related fear under the pandemic. It has two items overlapped with the Infection subscale of the SARS Fear (‘fear that I will infect others’ and ‘fear that I will be infected’), and another two items related to other health problems of self and family members. The COVID-19 Fear of Insecurity subscale has one item overlapped with the SARS Fear of Insecurity subscale (‘feel that I have lost control of life’) and measures fear of potential harm, death and life out of control. Finally, the COVID-19 Fear of Instability has two items related to infection control measures (‘fear being quarantined or forced to limit activities’ and ‘feel concerned about the complicated procedure back to my country’). It should be noted that both items under this subscale are different from items of the SARS Fear of Instability subscale, which contains items related to increased workload, being deployed to the SARS ward, etc. The COVID-19 Fear of Instability, on the other hand, indicates concerns related to preventive measures such as quarantine, limited activities, etc. when the students in higher education returned to their home country. Unlike the FCV-19S developed by

| Partial correlations with gender and place of study as co-variables (n = 219) |
|-----------------|-----------------|----------------|----------------|----------------|
| Age             | GAD-7           | Infection      | Instability    | COVID-19 Fear Total |
| Age             | 1               | -0.005         | 0.154          | 0.073           | 0.071           |
| GAD-7           | 1               | 0.352**        | 0.280**        | 0.372**         | 0.426**         |
| Infection       | 1               | 0.382**        | 0.450**        | 0.862**         |
| Instability     | 1               | 0.483**        | 0.711**        |
| Insecurity      | 1               | 0.769**        |

Note: GAD-7 = Generalized Anxiety Scale 7-item scale; Infection = COVID-19 Fear (Higher Education) scale Infection subscale score; Instability = COVID-19 Fear (Higher Education) scale Instability subscale score; Insecurity = COVID-19 Fear (Higher Education) scale Insecurity subscale score; COVID-19 Fear Total = COVID-19 Fear (Higher Education) scale Total score.

*p < 0.05.

**p < 0.01.
Ahorsu and colleagues (Ahorsu et al., 2020), our COVID-19 Fear (Higher Education) scale measures different domains of fear (i.e., Infection, Instability and Insecurity) related to COVID-19 among students in higher education. We consider that the two scales are complementary to each other and can be used together in a single study. The Cronbach's alphas of the Infection (α = 0.83) and Insecurity (α = 0.80) subscales of the COVID-19 Fear (Higher Education) are good and similar to the corresponding subscales of the SARS Fear Scale. The Instability subscale has two items and a lower Cronbach's alpha of 0.69. Although its reliability alpha is similar to the Instability subscale of the SARS Fear (α = 0.66), this subscale should be used with caution. Future studies to increase the number of items and the reliability of this dimension could be conducted. On the other hand, we believed that the COVID-19 Fear (Higher Education) scale should also be used to measure fear towards an infectious disease pandemic in other populations, such as employees working in other countries.

### 4.2 Risk factors of generalised anxiety disorder

#### 4.2.1 Demographic factors

Our results suggested that female students tended to score higher in the GAD-7 scale measuring potential GAD symptoms. This result was consistent with another study among Russian and Belarus university students that used the 7-item Fear of COVID-19 scale (Reznik et al., 2020). These findings were consistent with previous research which has shown that females tend to feel a higher level of anxiety, worries and fear; they also have greater difficulty in emotional adjustment than males (Bender et al., 2012; Bottesi et al., 2018; Halbreich & Kahn, 2007; McLean & Hope, 2010). Female students' higher anxiety levels and stronger COVID-19 fear may be explained by women's higher anxiety sensitivity and physiological reactivity than men (Norr et al., 2016; Stoyanova & Hope, 2012). Partial correlations showed that age was positively correlated with both GAD scores and Fear of COVID-19 Instability score (re Table 4). Senior year students might have more concerns about the negative effects of the COVID-19 outbreak and the school's preventive measures than junior year students. As seniors are about to graduate from universities outside mainland China, they may be more anxious about missing out on in-person commencement, or they may be more anxious about not being able to get a plane ticket back to their hometown.

Another objective of this study is to compare anxiety levels and fear towards COVID-19 among mainland China, Hong Kong, and overseas university students. Hong Kong students from mainland China are of particular interest because their mental health might be negatively affected by both the social events in 2019 (Hou & Hall, 2019) and the COVID-19 outbreak in 2020 (Hou & Hall, 2019; Ni et al., 2020; Torales et al., 2020). During the social events in 2019, Hong Kong was in a state of chaos. University students were particularly affected since they were evacuated from residential halls, and classes were suspended (Chan, 2020). We did not, however, collect any information about the social events influences because of time urgency and the highly stressful data collection period of this study. However, this social event is assumed to be affecting all students in Hong Kong.

Our results showed that a higher percentage of those overseas students (15%) were categorised into GAD high anxiety group when compared to both mainland China (6.6%) and Hong Kong (6.1%) students (re Table 3). MANOVA results also showed that those with international student status had a higher fear of instability (i.e., changes related to infectious disease measures) than those local students. It has been reported that Asian international students are more inclined to exhibit severe mental health symptoms including suicide ideation and they are less inclined to seek help when compared to local American students and other international students (Xiong, 2018). Being in an unfamiliar place away from family during a crisis of infectious disease outbreak might make international students more prone to psychopathology. Based on our findings that fear of instability is higher for university students away from family, preventive measures or infection control policies may be another important source of international students’ higher anxiety levels. Increased severity of COVID-19 in many countries outside China at the time of survey completion (World Health Organization, 2020c) may also contribute to higher international university students’ anxiety. Support for international students including remote counselling, free mask and COVID-19 testing are among some ways a university can offer to help international students (Durrani, 2020).
It is interesting to note that the social unrest in Hong Kong since 2019 did not show an accumulative effect on mainland China students studying in Hong Kong. A similar percentage of students in both mainland China and Hong Kong (about 6%) were classified as GAD clinical cases. Similar to those with international student status, students in Hong Kong had a higher COVID Fear of Instability score than their mainland counterparts. This is probably because many university students in Hong Kong needed to move back to mainland China during the COVID-19 pandemic as they were asked to move out of university dorms. They have concerns about self-quarantine and other infection control measures when they moved back to mainland China. This result should be generalisable to all international students studying outside of their home countries. For instance, American students studying in China may have the same concerns as Chinese university students studying outside of China.

4.3 | Relationship between COVID fear and GAD

Partial correlations controlling for gender and place of study (Table 4) revealed significant and positive relationships between the three domains of the COVID-19 Fear (Higher Education) Scale and GAD score. It should be noted that the relationship can be bidirectional. In other words, it is possible that those with pre-pandemic anxiety problems would have stronger fear towards COVID-19 or stronger fear towards COVID-19 would lead to more severe anxiety symptoms. The current cross-sectional study could not verify which of the relationships are more applicable to the current COVID-19 pandemic. On the other hand, our results are consistent with previous studies that fear is related to anxiety (Buss et al., 2013, 2020).

Regression analysis showed that among the three dimensions of the COVID-19 Fear (Higher Education) Scale, infection and insecurity were significant predictors of anxiety even after the effect of demographic factors (age, gender and place of study) were taken into account. A previous study on SARS showed that an increase in self-efficacy to prevent infection could reduce fear related to the infectious disease (Ho et al., 2005). Realistic and sustainable measures such as an infectious disease control checklist to help students to comply with and maintain infection control practices could be developed and make available to all students on online platforms. Facial masks, hand sanitisers and other infection control tools should be easily accessible to students. Another study during the SARS period has shown that social support is an important factor to increase resilience (Bonanno et al., 2008). We consider that this is particularly important to international students staying in a place away from home during a crisis. Online support groups or social media groups for mutual support could be considered to alleviate the fear and anxiety of the students. Finally, insecurity fear is related to loss and existential issues (e.g., fear of dying and life getting out of control) which can be triggered by an infectious disease outbreak. Perhaps, existential and narrative therapy could be considered as a means of support (Correia et al., 2018).

4.4 | Limitations and conclusion

However, the study has several limitations. First, about 75% of participants were females, which might affect the results and lead to insignificant findings within male participants. Second, we were particularly interested in comparing students in three locations including mainland China, Hong Kong, and other countries. As a result, we failed to collect the data that indicates the county where the overseas participants were studying. Besides, we did not consider the outbreak status and medical readiness of different overseas countries due to time constraints during the data collection period. Consequently, the lack of background information of those overseas countries may affect the result. Also, the findings might not be applied to students studying at primary or secondary schools. Moreover, the study solely relies on online self-reported questionnaires which are susceptible to self-reported biases. Future studies may want to have a more balanced number of males and females and replicated the findings in groups of students from different cultures or age ranges; in addition, physiological indicators of fear and anxiety may be included together with self-reported questionnaires. It is possible to have other dimensions of fear (e.g., fear of others around will cause infection to oneself; fear of unstable course arrangement during COVID-19), however, we wanted to follow the dimensions from the SARS Fear scale to adapt the scale to COVID-19. Also, we limited the number of fear items as we wanted to avoid eliciting stress responses in this difficult situation while completing the survey. Some of the sociodemographic factors such as the participants’ socioeconomic status was not collected in the questionnaire. This might contribute to a biased sample as we failed to show the sample characteristics by place of study. Furthermore, our sample size of 219 could not allow us to do both exploratory and confirmatory factor analyses to confirm the factor structure. We are not able to calculate the response rate since there was no way to record how many people visited the WeChat study site and decided not to participate. Lastly, due to the pandemic situation and lack of knowledge at that time, we did not collect data about the outbreak severity, medical equipment supplies and infection control policies in each county. However, those data can also explain the phenomenon of a higher risk of anxiety in overseas students.

Despite the above limitations, this study has several contributions to understanding and fighting against the negative psychological impact of the COVID-19 outbreak among university students. First, a 9-item COVID-19 Fear (Higher Education) Scale consisting of three domains is established specifically for students in higher education to facilitate future research. Second, our findings highlight the difficulty of international university students during a critical situation such as the COVID-19 outbreak. Thirdly, the results showed that fear of infection and fear of insecurity were significantly related to generalised anxiety symptoms. Interventions to reduce these two dimensions of fear such as increasing self-efficacy, social support, and addressing some existential issues triggered by the crisis would be effective to reduce anxiety. However, further research should be conducted to
inform the development of psychological interventions for university students.

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How to cite this article: Feng S, Zhang Q, Ho SMY. Fear and anxiety about COVID-19 among local and overseas Chinese university students. *Health Soc Care Community*. 2021;00:1-10. https://doi.org/10.1111/hsc.13347