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Research paper

Probable anxiety and components of psychological resilience amid COVID-19: A population-based study

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ABSTRACT

Background: This study examined the associations between components of psychological resilience and mental health at different levels of exposure to COVID-19 stressors.
Methods: A population-representative sample of 4,021 respondents were recruited and assessed between February 25th and March 19th, 2020. Respondents reported current anxiety symptoms (7-item Generalized Anxiety Disorder scale [GAD-7]), cognitive components (perceived ability to adapt to change, tendency to bounce back after adversities) and behavioral components (regularity of primary and secondary daily routines) of resilience, worry about COVID-19 infection, and sociodemographics.
Results: Logistic regression revealed that cognitive and behavioral components of resilience were not correlated with probable anxiety (GAD-7$\geq$10) among those reporting no worry. Among respondents who were worried, all resilient components were inversely associated with probable anxiety. Specifically, propensity to bounce back and regular primary routines were more strongly related to lower odds of probable anxiety among those reporting lower levels of worry.
Limitations: The cross-sectional design limits causal inference. Second, other resilient components and some key daily routines that could be related to better mental health were not assessed. Third, generalizability of the findings to other similar major cities is uncertain because cases and deaths due to COVID-19 in Hong Kong have been comparatively lower.
Conclusions: To foster mental health, cultivation of confidence in one's ability to adapt to change and a propensity to bounce back from hardship should be coupled with sustainment of regular daily routines. Such assessment and intervention protocols could be more relevant to those who suffer heightened levels of exposure to COVID-19 stressors.

1. Introduction

Different forms of lockdown, quarantine, and social/physical distancing have been implemented across most countries affected by the COVID-19 pandemic. These infection control strategies have changed key life domains, impacting on personal mobility (e.g. activity limitations due to home confinement), interpersonal relationships (e.g. reduced face-to-face interaction), and occupational/educational activities (e.g., changes in employment roles and daily activities of workers and students). Recent evidence showed that these pandemic-related stressful events and life changes could lead to serious psychological distress (Ben-Ezra et al., 2020a,b; Goodwin et al., 2020b), and could be a reference of functional impairments consequential to common mental disorders, such as depression, suggesting a probable mental health toll (Holmes et al., 2020; Üstün and Kennedy, 2009). There is therefore an urgent need for identifying adaptive psychological and behavioral pathways that reduce the potential burden on mental health services.

Using convenience samples studies have already identified a handful

of psychosocial predictors of mental health since the outbreak of the pandemic. Loneliness was related to higher levels of anxiety, depressive, and PTSD symptoms in a community sample of 3,480 Spanish people (González-Sanguino et al., 2020). Perceived effective social distancing and lower negative impact of COVID-19 were associated with more positive and less negative feelings amongst Italians both in Italy and living abroad (N=9,000) (Zanin et al., 2020). Higher levels of social support and greater self-efficacy were associated with lower perceived stress and anxiety symptoms amongst Chinese medical staff treating COVID-19 patients (Xiao et al., 2020) as well as college students (Cao et al., 2020). Compared with people unaffected by quarantine, depressive and PTSD symptoms were higher among Chinese people under quarantine during COVID-19, with higher levels of symptoms related to absence of perceived support from the community and government (Lai et al., 2020c).

2. Psychological resilience

One construct that is of high relevance to adaptation to the current COVID-19 pandemic is psychological resilience. Resilience has been intensively investigated as an outcome that reflects a human potential to lead a normal living, even after experiencing major life challenges. Masten (2001, 2014) suggested this "ordinary magic" is present among children and adolescents who demonstrated normative psychological functioning despite past and present adversity. "Ordinary magic" means that resilience is not attributable to extraordinary qualities but normative adaptation and coping resources in everyday life. Across stressful life events such as bereavement, terrorist attack, mass violence, natural disasters, and life-threatening illnesses, the majority of the people demonstrated subclinical levels of psychological distress or psychological well-being over time (Bonanno, 2004; Galatzer-Levy et al., 2018; Hou et al., 2010; Infurna and Luthur, 2017). During the severe acute respiratory syndrome (SARS) epidemic in Hong Kong, patients of SARS who demonstrated consistently subclinical levels of psychological distress reported lower levels of SARS-related worry and higher levels of perceived social support relative to those demonstrating clinically significant psychological distress over time (Bonanno et al., 2008). Higher perceived social capital was found to be associated with lower depression risk amid COVID-19 pandemic in Hong Kong (Li et al., 2020).

Psychological resilience has also been considered as a multidimensional construct regulated dynamically by the complex interaction of external and internal social, behavioral, cognitive, biological, and neural factors (Kalisch et al., 2017). Resilience encompasses at least three key components: (1) flexible adaptation to changing external/-environmental and internal/mental demands (e.g. Luthar et al., 2000); (2) propensity to bounce back and demonstrate positive functioning in adversity (e.g., Zautra et al., 2010); and (3) effective interpersonal interactions and quality relationships that buffer individuals from psychosocial distress (e.g., Skodol, 2010). These components of psychological resilience have been used to reflect overall coping ability in adversity and are associated with adaptive psychological functioning (Connor and Davidson, 2003; Hu et al., 2015). Longitudinal investigations have reported that survivors who demonstrated stably high psychological resilience also reported lower levels of anxiety, depressive, or PTSD symptoms in the years following the Great East Japan Earthquake (Okuyama et al., 2018; Kukihara et al., 2014). There is further evidence suggesting the importance of considering individual cognitive components in evaluating mental health during COVID-19. Perceived tenacity and strength of overcoming difficulties were lower among health care workers who lacked experiences in public health emergency treatment compared to those with more relevant experiences and resources. Both of these two components were inversely associated with psychological distress (Cai et al., 2020).

Apart from such cognitive components, the Drive to Thrive (DTT) theory suggests that patterns of daily behavior are concomitant with underlying processes of psychological resilience during trauma and chronic stress conditions (Hou et al., 2018, 2020a). Regularized routines have been found to buffer the adverse impact of stress exposure on mental health (Hou et al., 2020b). Survivors of natural disasters tend to maintain regular daily activities in response to post-disaster stress (Fukuda et al., 1999; Parks et al., 2018), with the restoration or preservation of pre-disaster daily routines predictive of lower psychological distress prospectively in the years following the Great East Japan Earthquake (Goodwin et al., 2019). Meta-analysis of conflict-affected forced migrants found that a disruption in different types of daily experiences mediated the positive association between premigration trauma exposure and postmigration psychiatric symptoms, with premigration trauma related to more disrupted daily living and greater mental health problems in postmigration settings (Hou et al., 2020c). While resilience factors such as self-efficacy and social relationships/support have been found to predict lower psychological distress during COVID-19 (Lai et al., 2020c; Xiao et al, 2020), cognitive and behavioral components of psychological resilience were understudied.

2.1. COVID-19: stressor exposure

To examine associations between the components and outcomes of psychological resilience during COVID-19, it is important to take into account stressor exposure (Bonanno, 2004; Masten, 2014). Proxies for indicating stressor exposure include perceived or actual threat to human functioning (Lazarus and Folkman, 1984) or subjective feelings of stress (Cohen et al., 2007). In particular, in Hong Kong, a region that was badly impacted by SARS in 2003, perceived risk of infection by SARS was associated with higher depressive symptoms three years after the SARS outbreak (Liu, et al., 2012). Worry about infection and perceived susceptibility were associated with higher psychological symptoms including anxiety, depression, and posttraumatic stress disorder (Kwok et al., 2020; Wang et al, 2020).

2.2. The present study

This study aims to examine associations between the understudied aspects of psychological resilience (i.e., cognitive and behavioral components) and mental health during COVID-19 in Hong Kong. We expect that both cognitive and behavioral components will be inversely associated with probable anxiety (i.e. Generalized Anxiety Disorder scale [GAD-7] score $\geq$10) across different levels of exposure to COVID-19 stressors. We also investigated whether the inverse associations between cognitive and behavioral components and the risk of anxiety will be positively or inversely related to levels of worry.

3. Methods

3.1. Respondents and procedure

Upon obtaining Ethics Committee's approval from The Education University of Hong Kong, respondent recruitment and telephone interviews were conducted by the Centre for Communication and Public Opinion Survey of The Chinese University of Hong Kong, and Hong Kong Public Opinion Research Institute between February 25 and March 19, 2020 (the acute phase of the epidemic in Hong Kong). A Computer-Assisted Telephone Interview (CATI) system was used. Random digit dialing was used to recruit a population representative sample of Hong Kong residents. A dual-frame approach of sampling with both landline and mobile phone numbers (50% each) was utilized. Telephone numbers were randomly extracted from databases of telephone numbers released by the Hong Kong Communication Authority. A person was considered eligible if he/she was (1) a Hong Kong Chinese resident, (2) 15 years of age or older, and (3) Cantonese-speaking. For the landline phone calls, if multiple household members were eligible after successful contact, the one with the closest birthday to the interview date was selected. Further attempts would be arranged by CATI to the dial-

out numbers which were "no answer," "busy," or "eligible respondent not at home." Oral informed consent was obtained at the beginning of interview. All interviews were conducted during both working and non-working hours from 2pm to 10pm on weekdays and weekends.

Among the total 92,509 telephone numbers attempted, 38,538 (41.7%) of them were ineligible for interview (i.e., invalid, non-resident/business telephone, fax numbers, no eligible respondent); 48,765 (52.7%) were unconfirmed whether eligible or not. Among the 5,206 (5.6%) contacted eligible cases, interviews were completed by 4,021 (77.2%), whereas 884 (17.0%) indicated refusal and 301 (5.8%) eligible respondents did not complete the interviews. A cooperation rate of 77.2% was recorded (i.e., number of completed interviews / number of contacted eligible cases). The sampling error was within ±2.2% at 95% confidence level. The participation and nonparticipation rates were acceptable and comparable with the population-representative samples in prior studies in Hong Kong (Galea and Tracy, 2007; Hou et al., 2015; Leung et al., 2005).

3.2. Measures

Cognitive components of resilience. Connor-Davidson Resilience Scale-2 (CD-RISC2) was used to assess the cognitive components of "ability to adapt to change" and "tendency to bounce back after illness or hardship" within the construct of psychological resilience (Vaishnavi et al., 2007). Respondents were asked to rate the items with reference to their experience in the past two weeks on an 11-point scale ranging from 0 (not true at all) to 10 (true nearly all the time). This abbreviated scale was translated into Chinese and have been validated among Hong Kong Chinese with good validity and reliability (Ni et al., 2015). Cronbach's alpha was 0.78 in the current administration.

Behavioral components of resilience. Items from the Sustainability of Living Inventory (SOLI; Hou et al., 2019) were adapted to assess regularity of primary and secondary daily routines. Primary routines are necessary for maintaining livelihood and biological needs whereas secondary routines are optional in accordance with motivations and preferences (Hou et al., 2019). Respondents rated to what extent healthy eating and sleep (primary routines) and socializing and leisure activities (secondary routines) were disrupted in the past two weeks on an 11-point scale (0=high level of disruption, 10=no disruption). The two items have been found to be validly associated with mental health in population survey (Lai et al., 2020a). Higher scores indicated greater regularity.

Anxiety symptoms. The 7-item Generalized Anxiety Disorder scale (GAD-7) was used to assess anxiety symptoms (Spitzer et al., 2006). Respondents rated each item on a 4-point Likert scale (0=not at all, 1=on several days, 2=on more than half of the days, 3=nearly every day) based on their experience in the past two weeks. Higher scores indicated greater severity of anxiety symptoms (range=0–21). High internal consistency and validity of the scale have been shown in different populations (Spitzer et al., 2006). Alpha in the current study was 0.93. Scores of 10 or higher were used to indicate clinically significant anxiety symptoms (Plummer et al., 2016), with the scores recoded into 0 (scores=0–9) or 1 (scores=10–21).

Worry about COVID-19 infection. Respondents reported the extent to which they felt worried about being infected with COVID-19 on a 4-point scale (0=not at all, 1=some, 2=quite a bit, 3=very much).

Sociodemographics. A standardized proforma was used to ask respondents' age in years, gender, marital status, education level, employment status, monthly household income, and income change (gain, no change, or loss) since the COVID-19 outbreak.

3.3. Analytic plan

Multiple imputation was conducted to replace missing data (<1%) using SPSS (Version 26; SPSS Inc., Chicago, IL). COVID-19 stressor exposure referred to responses to the item on worry about infection: not

at all (0), some (1), quite a bit (2), and a lot (3). Prevalence of probable anxiety and descriptive statistics of the cognitive and behavioral components of resilience, namely ability to adapt to change, propensity to bounce back, and regularity of primary routines (i.e., healthy eating and sleep) and secondary routines (i.e., socializing and leisure activities) were identified for respondents at different levels of worry separately.

The associations of probable anxiety (GAD-7≥10) with cognitive and behavioral components of psychological resilience were tested in multivariable logistic regression models, adjusted for gender (female vs. male), age group (15-24 vs. 25-34, 35-44, 45-64, ≥65), marital status (unmarried vs. married), education level (primary/below and secondary vs. tertiary/above), employment status (dependent and unemployed vs. employed), monthly household income (<HK$20,000, $20,000-$39,999, $40,000-$59,999, and $60,000-$79,999 vs. ≥$80,000), and income change (gain/no change vs. loss). The resilient components and sociodemographic factors were treated as continuous variables and categorical variables in the models, respectively. Separate models were conducted for those without worry ("not at all") and with worry ("some," "quite a bit," and "very much"). Adjusted odds ratio (aOR) with 95% confidence interval (CI) was used to indicate the associations between each resilient component and the odds of probable anxiety. The model of respondents reporting worry was stratified by the levels of worry in order to (1) demonstrate the component-outcome associations on each level of worry and (2) compare the component-outcome associations between different levels. The logistic regression was conducted using the glm function of Stats Package in R software environment (R Core Team, 2016).

4. Results

4.1. Sample and descriptive statistics

The 4,021 respondents ranged in age between 15 and 92 years ($M =$ 46.1, $SD =$ 17.7, median = 46); 2,220 (55.2%) were female. A total of 67 (1.7%) respondents reported receiving no formal education, 304 (7.6%) primary education, 1,759 (43.7%) secondary education, and 1,891 (47.1%) tertiary education or above. The current sample resembled the population in terms of age group distribution, gender, education level, and monthly household income level (Census and Statistics Department, 2020). The demographics are summarized in Table 1.

The prevalence of probable anxiety (GAD-7 ≥10) in different groups of worry about infection were 4.9% (not at all), 6.2% (some), 16.3% (quite a bit), and 35.4% (very much). Prevalence linearly increased with higher ratings on worry, with a small difference between the group without worry and the group at low worry. A decreasing trend was observed on the scores on ability to adapt to change, propensity to bounce back, regularity of primary routines, and regularity of secondary routines as ratings on worry increased (Table 2). The trends are illustrated in Fig. 1.

4.2. Logistic regression analysis

Controlling for demographic and socioeconomic variables, the odds of probable anxiety were not associated with ability to adapt to change, propensity to bounce back, and regular healthy eating and sleep among respondents without worry about infection ("not at all") (Table 3). All four cognitive and behavioral components were associated with reduced odds of probable anxiety at each level of worry, except for ability to adapt to change on "some" worry (Table 4). The inverse associations of probable anxiety with propensity to bounce back (aOR = 0.74–0.86, 95% CI= 0.65–0.75, 0.86–0.98) and regularity of healthy eating and sleep (aOR = 0.76–0.83, 95% CI= 0.69–0.76, 0.84–0.91) were stronger at lower levels ("some"/"quite") of worry relative to higher levels ("very much"). In addition, persons reporting income loss were at higher odds of probable anxiety across all levels of worry (aOR = 1.36–4.40, 95% CI = 1.09–1.34, 1.69–14.39), compared to those reporting gain/no change

Table 1
Demographic variables and sample characteristics by different levels of worry.

	Overall	Not at all	Some	Quite a bit	Very much
Sample size	N = 4,021	N = 429	N = 1,757	N = 818	N = 1,017
	n (%)	n (%)	n (%)	n (%)	n (%)
Mean age (SD)	46.1 (17.7)	53.3 (17.1)	48.7 (17.3)	39.8 (16.8)	43.5 (17.5)
Sex					
Female	2,220 (55.2)	195 (45.5)	989 (56.3)	436 (53.3)	600 (59.0)
Male	1,801 (44.8)	234 (54.5)	768 (43.7)	382 (46.7)	417 (41.0)
Education level					
No formal education received	67 (1.7)	13 (3.0)	25 (1.4)	3 (0.4)	26 (2.6)
Primary school	304 (7.6)	58 (13.6)	141 (8.0)	28 (3.4)	77 (7.6)
Junior high school	491 (12.2)	74 (17.2)	232 (13.2)	60 (7.3)	125 (12.3)
Senior high school	1,268 (31.5)	135 (31.5)	567 (32.3)	236 (28.9)	330 (32.4)
College (Non–degree)	417 (10.4)	36 (8.4)	186 (10.6)	97 (11.9)	98 (9.6)
College or above (Degree)	1,474 (36.7)	113 (26.3)	606 (34.5)	394 (48.1)	361 (35.5)
Marital status					
Married	2,291 (57.0)	256 (59.7)	1079 (61.4)	403 (49.3)	553 (54.4)
Single	1,312 (32.6)	104 (24.2)	487 (27.7)	368 (45.0)	353 (34.7)
Divorced	212 (5.3)	36 (8.4)	91 (5.2)	25 (3.0)	60 (5.9)
Widowed	203 (5.1)	33 (7.7)	100 (5.7)	22 (2.7)	51 (5.0)
Employment status					
Employed	2,272 (56.5)	216 (50.3)	960 (54.7)	518 (63.3)	578 (56.8)
Unemployed	179 (4.5)	23 (5.4)	77 (4.4)	29 (3.5)	50 (4.9)
Retired	745 (18.5)	130 (30.3)	382 (21.7)	88 (10.8)	145 (14.3)
Housewife	444 (11.0)	43 (10.0)	204 (11.6)	57 (7.0)	140 (13.8)
Student	381 (9.5)	17 (4.0)	134 (7.6)	126 (15.4)	104 (10.2)
Monthly household income (HK$) *					
$9,999 or below	544 (13.5)	87 (20.3)	234 (13.3)	53 (6.5)	170 (16.7)
$10,000 – $19,999	532 (13.2)	70 (16.3)	244 (13.9)	86 (10.5)	132 (13.0)
$20,000 – $29,999	612 (15.2)	64 (14.9)	267 (15.2)	132 (16.1)	149 (14.7)
$30,000 – $39,999	598 (14.9)	62 (14.5)	272 (15.5)	124 (15.2)	140 (13.8)
$40,000 – $49,999	409 (10.2)	37 (8.6)	178 (10.1)	91 (11.1)	103 (10.1)
$50,000 – $59,999	412 (10.2)	32 (7.5)	170 (9.7)	110 (13.5)	100 (9.8)
$60,000 – $79,999	339 (8.4)	22 (5.1)	150 (8.5)	77 (9.4)	90 (8.8)
$80,000 or above	575 (14.3)	55 (12.8)	242 (13.8)	145 (17.7)	133 (13.1)
Income change					
Gain/No change	2,906 (72.3)	334 (77.9)	1,307 (74.4)	600 (73.3)	665 (65.4)
Loss	1,115 (27.7)	95 (22.1)	450 (25.6)	218 (26.7)	352 (34.6)

* US$ 1 ≈ HK$7.80.

in income.

5. Discussion

This study examined the associations between components of psychological resilience and the odds of probable anxiety during the acute

Table 2
Descriptive statistics of the study variables by different levels of worry.

	Not at all	Some	Quite a bit	Very much
Sample size	N = 429	N = 1,757	N = 818	N = 1,017
Mean score of GAD-7 (SD)	1.83 (3.81)	2.93 (3.65)	5.57 (4.41)	7.73 (5.48)
Range of GAD-7	0 – 21	0 – 21	0 – 21	0 – 21
Prevalence of probable anxiety [†]	4.9%	6.2%	16.3%	35.4%
Mean resilient components (SD)				
Ability to adapt to change	8.18 (2.10)	7.67 (1.69)	7.22 (1.70)	6.87 (2.10)
Propensity to bounce back	8.18 (2.22)	7.60 (1.69)	6.96 (1.78)	6.60 (2.18)
Regularity of primary routines	7.50 (2.61)	7.08 (2.19)	6.19 (2.33)	5.74 (2.66)
Regularity of secondary routines	6.83 (2.91)	5.90 (2.60)	5.08 (2.57)	4.27 (2.89)

Note. GAD-7
[†] Probable anxiety was defined as GAD-7 ≥ 10.

phase of COVID-19 in Hong Kong. Consistent with our expectations, ability to adapt to change, propensity to bounce back, and regularity of primary and secondary daily routines were significantly inversely related to probable anxiety at each level of worry, suggesting that despite comparable levels of stressor exposure both cognitive and behavioral components are related to mental health increments. In contrast, only regularity of secondary routines was related to lower odds of probable anxiety in the absence of worry. We also found that propensity to bounce back and regular primary routines were more strongly related to lower odds of probable anxiety at lower rather than higher levels of worry. Finally, income loss was related to higher odds of probable anxiety across persons with and without worry.

Living in one of the most densely populated regions in the world, Hong Kong population has been demonstrating major changes in behaviors in response to the threat of the pandemic (Cowling et al., 2020). Perceived ability to adapt to change and propensity to bounce back are relevant to such substantial population behavioral changes, and the inverse associations of them with clinically significant anxiety symptoms were consistent with previous evidence collected among Mainland Chinese (Cai et al., 2020). Similar findings have also been obtained from a sample of Italians (N=220) during the early stage of the COVID-19 pandemic, with resilience-related coping abilities associated with lower psychosocial distress and higher subjective well-being (Yildirim and Arslan, 2020). The inverse associations between components of psychological resilience and probable anxiety were significant across all levels of worry about infection with the exception of the non-significant association between ability to adapt to change and anxiety, which occurred only at higher worry. This is consistent with previous evidence on the importance and relevance of the ability to adapt to change to mental health in the aftermath of more extreme levels of stress/trauma, such as experience of war (Connor, 2006; Tran et al., 2013).

Regular primary (healthy eating and sleep) and secondary (socializing and leisure activities) routines were inversely associated with the risk of anxiety. COVID-19 arguably impacts the daily life of all people with different backgrounds. College students who reported being under home quarantine and had shorter sleep duration (<6 hours/night) were more likely to demonstrate higher depressive and PTSD symptoms (Tang et al., 2020). Working adults who stopped working due to the pandemic reported higher levels of psychological distress relative to those who returned to the office and worked from home after a month of quarantine, with the inverse association between severity of COVID-19 in a person's home city and life satisfaction strongest amongst people who exercised less (Zhang et al., 2020). We add to this evidence by showing that regularizing daily routines is related to lower risk of anxiety at different levels of stressor exposure (Hou et al., 2018, 2019). This
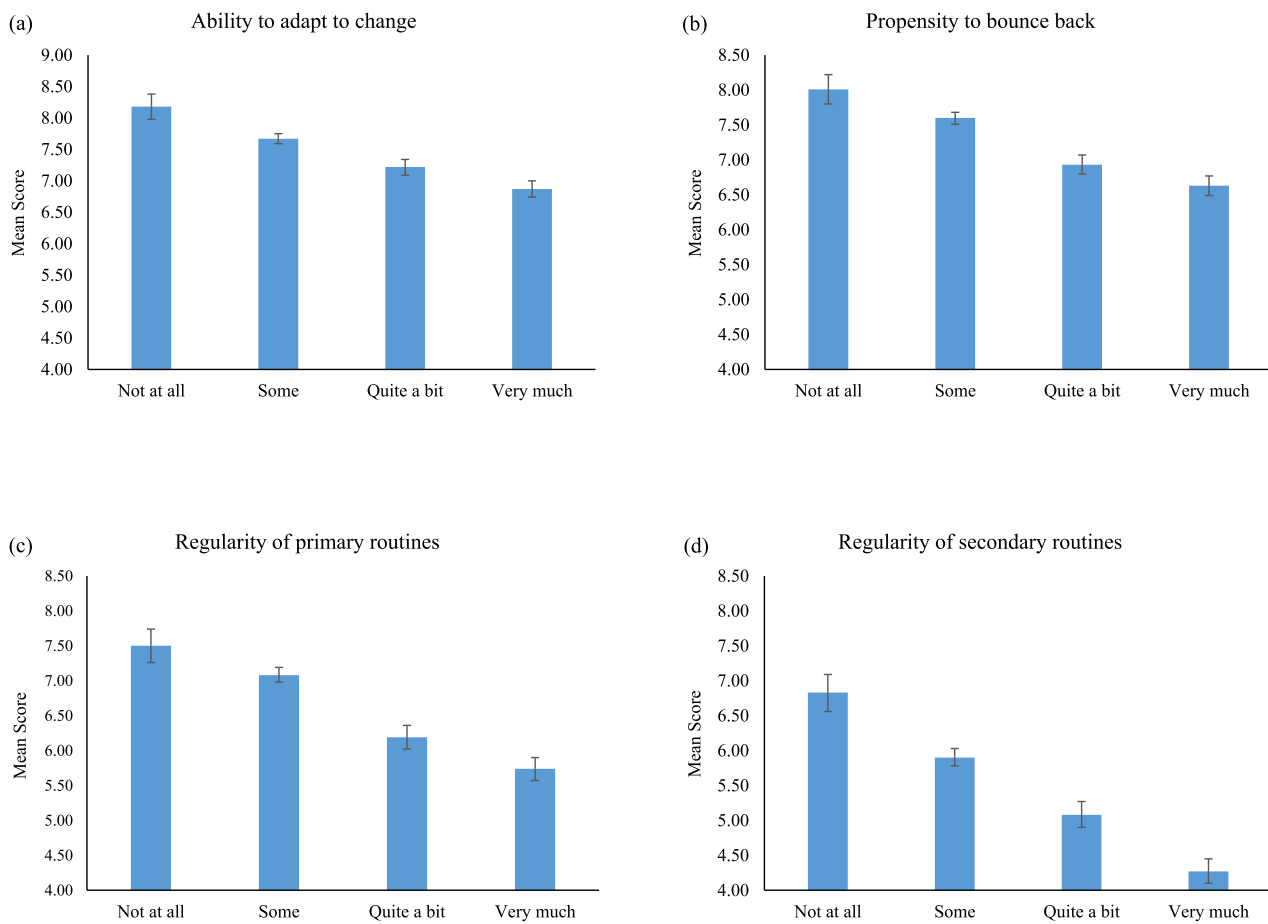
Fig. 1. Cognitive and behavioral components of psychological resilience across respondents with different levels of worry about COVID-19 infection.

can have important implications for public health messages and interventions both during and after COVID-19. For many disease control strategies involving physical distancing and quarantine it might be difficult to increase the practice of adaptive routines such as healthy eating, sleep, socializing, and leisure activities, and any subtle suggestion involving increases in frequency could lead to confusion that would compromise mental health and increase infection risk (Hou et al., 2020a). This could be of specific relevance to people with multiple chronic conditions, who are more likely to experience disrupted routines even at time without major stressors (Lai et al., 2020b). Rather, people should focus on regulating those routines which improve mental health. For example, weekly video calls with closer social partners living apart can be seen as a reliable source of emotional support (Rea et al., 2015) and negotiating the challenges of COVID-19 could consolidate close interpersonal relationships (Goodwin et al., 2020a), whereas leisure activities on a regular basis reduce the adverse impact of ongoing stress on mental health (Wada et al., 2007).

We reported stronger associations of a propensity to bounce back from adversities and regular healthy eating and sleep with lower odds of anxiety at lower levels of exposure to COVID-19 stressors. This suggests that these resilient components could be complementary to other core correlates of psychological resilience among person with high stressor exposure, such as frontline healthcare professionals and essential workers including cleaners, couriers, and porters. These people face an increased exposure to the risk of infection. Previous studies have shown that health care workers treating patients with COVID-19 directly and indirectly reported considerable levels of psychological distress and anxiety and depressive symptoms, which were inversely related to sleep quality, self-efficacy, and perceived social support (Lai et al., 2020c; Xiao et al, 2020). The most direct and effective resources for these

people to cope with the increased risk of infection are sufficient supplies of protective gears, shorter working hours, and reduced workload (Greenberg et al., 2020). Apart from these external factors, a resilient mentality along with regular healthy eating and sleep may be under greater personal control (Galea et al, 2020; Ryan et al., 2020). These resilient components should be prioritized in order to maintain adaptive psychological functioning, despite the continuous challenges of the pandemic (Harper et al., 2020).

We also observed that, compared to persons with gain/no change in income, those with income loss were at higher odds of anxiety across all levels of worry about being infected with COVID-19. The world faces huge financial insecurity with global mass lay-offs and reduced income potential as a result of the COVID-19 pandemic (World Bank Group, 2020). Conservation of resources (COR) theory proposes that loss of personal, social, and material resources is a significant predictor of poorer psychological adaptation during trauma and chronic stress conditions (Hobfoll, 2010; Hou et al.,2015). Loss of financial resources during and after disasters can have a significant adverse impact on the affected populations' coping and mental health and meanwhile elevate vulnerability to further and future resource loss (Hobfoll, 2010). Those losing financial resources may be more susceptible to infection through lower access to quality health care and greater financial strain (Galea and Abdalla, 2020).

6. Limitations and conclusion

Cautions are warranted in interpreting our findings due to some limitations. First, the cross-sectional design limits causal inference, although it seems less likely that anxiety symptoms are driving cognitive and behavioral components of resilience while the association between

Table 3

Multivariable logistic regression examining the associations of resilient components with probable anxiety among persons without worry.

	Probable anxiety †	
	aOR (95% CI)	*P*
Gender		
Male	1.0	
Female	0.65 (0.20–2.15)	0.479
Age		
15–24	1.0	
25–34	0.74 (0.08–6.67)	0.787
35–44	0.30 (0.03–2.91)	0.301
45–64	0.13 (0.02–1.01)	0.051
65 or above	0.29 (0.03–3.00)	0.302
Marital status		
Married	1.0	
Unmarried/divorced/widowed	0.46 (0.11–1.85)	0.273
Education level		
Tertiary or above	1.0	
Secondary	1.04 (0.31–3.50)	0.953
Primary or below	0.38 (0.04–4.07)	0.427
Employment status		
Employed	1.0	
Dependent	0.59 (0.11–3.13)	0.538
Unemployed	0.46 (0.04–4.97)	0.525
Monthly household income (HK$)		
$80,000 or above	1.0	
$60,000–$79,999	1.57 (0.10–23.75)	0.743
$40,000–$59,999	1.04 (0.16–6.73)	0.966
$20,000–$39,999	0.42 (0.07–2.64)	0.353
$19,999 or below	0.75 (0.11–5.09)	0.766
Income change		
Gain/No change	1.0	
Loss	4.40 (1.34–14.39)	0.014
Resilient components		
Ability to adapt to change	0.78 (0.55–1.10)	0.157
Propensity to bounce back	1.22 (0.88–1.69)	0.243
Regularity of primary routines	0.85 (0.71–1.03)	0.098
Regularity of secondary routines	0.62 (0.50–0.77)	< 0.001

Note. † Probable anxiety was defined as GAD-7 ≥10. aOR, adjusted odds ratio. CI, confidence interval.

Table 4

Multivariable logistic regression examining the associations of resilient components with probable anxiety at different levels of worry.

	Probable anxiety †	
	aOR (95% CI)	*P*
Gender		
Male	1.0	
Female	1.32 (1.07–1.64)	0.009
Age		
15–24	1.0	
25–34	1.37 (0.95–1.99)	0.094
35–44	1.51 (1.01–2.27)	0.047
45–64	0.97 (0.66–1.43)	0.893
65 or above	1.13 (0.73–1.76)	0.580
Marital status		
Married	1.0	
Unmarried/divorced/widowed	1.27 (1.00–1.63)	0.051
Education level		
Tertiary or above	1.0	
Secondary	0.81 (0.64–1.03)	0.080
Primary or below	0.68 (0.43–1.09)	0.112
Employment status		
Employed	1.0	
Dependent	1.22 (0.93–1.60)	0.155
Unemployed	0.94 (0.58–1.52)	0.798
Monthly household income (HK$)		
$80,000 or above	1.0	
$60,000–$79,999	0.69 (0.44–1.08)	0.102
$40,000–$59,999	0.92 (0.65–1.30)	0.645
$20,000–$39,999	0.73 (0.52–1.02)	0.064
$19,999 or below	0.58 (0.40–0.85)	0.005
Income change		
Stable/ Increase	1.0	
Decrease	1.36 (1.09–1.69)	0.007
Some worry		
Ability to adapt to change	0.92 (0.80–1.06)	0.265
Propensity to bounce back	0.74 (0.65–0.86)	< 0.001
Regularity of primary routines	0.83 (0.76–0.91)	< 0.001
Regularity of secondary routines	0.84 (0.77–0.92)	< 0.001
Quite a bit worry		
Ability to adapt to change	0.80 (0.70–0.93)	0.003
Propensity to bounce back	0.86 (0.75–0.98)	0.029
Regularity of primary routines	0.76 (0.69–0.84)	< 0.001
Regularity of secondary routines	0.90 (0.82–0.99)	0.024
Very much worry		
Ability to adapt to change	0.83 (0.77–0.91)	< 0.001
Propensity to bounce back	0.90 (0.83–0.98)	0.013
Regularity of primary routines	0.90 (0.85–0.96)	< 0.001
Regularity of secondary routines	0.89 (0.85–0.95)	< 0.001

Note. † Probable anxiety was defined as GAD-7 ≥ 10. aOR, adjusted odds ratio. CI, confidence interval.

symptoms and worry can be reasonably seen as bidirectional. It is important to note that our cross-sectional measure of clinically significant anxiety symptoms is not readily comparable with a resilient trajectory over time. Resilience as outcomes may be best examined in prospective studies (Kalish et al., 2017). Our cross-sectional data can thus be best seen as offering an initial evidence base for future longitudinal investigations and interventions assessing psychological resilience during and after the COVID-19 pandemic. Second, we did not consider other resilient components that are related to better mental health during COVID-19, such as self-efficacy and social relationships/support (Lai et al., 2020c; Xiao et al, 2020). Perceived ability to adapt to change and propensity to bounce back from illness and hardship were focuses of the current study because they have both been suggested as the core components of psychological resilience (Connor, 2006; Kalisch et al., 2017; Masten, 2014) but were understudied in the current pandemic. We used the two items in Connor-Davidson Resilience Scale to reflect cognitive components of psychological resilience, while the two items could be considered as reflecting trait resilience that explained a small part of variance in resilient outcomes in previous studies (Meyer et al., 2019). Third, other key daily routines were not assessed in the current study, including personal/household hygiene, household chores, exercising, and work/study involvement that could have been disrupted and may impact mental health (World Health Organization, 2020). Fourth, regular socializing might be in contradiction to disease control strategies of physical distancing (Gerhold, 2020). Our item nonetheless reflected overall regularity that encompasses both face-to-face and indirect means such as phone and internet. Finally, because confirmed cases and deaths due to COVID-19 in Hong Kong have been lower than those in other major cities or regions such as

Singapore, London, and New York, future studies need to confirm the current findings in other similar regions.

Notwithstanding these limitations, the current study offers one of the largest population-representative analyses of psychological resilience during COVID-19. Governments (Centers for Disease Control and Prevention, 2020; Public Health England, 2020) and representative non-governmental organizations (Mayo Clinic, 2020; World Health Organization, 2020) have provided structured guidelines for people to improve their mental health through cultivating positive attitudes and restoring regularity and normalcy in daily living. This study provides additional, more focused information for fostering psychological resilience among those exposed to heightened stress. In conjunction with consolidating useful routines (e.g., good sleep and leisure activities at home) and developing novel meaningful routines (e.g., via connections with close social partners living apart), it is also important to maintain or cultivate confidence in one's ability to adapt to change and bounce back from hardship.

Credit authorship contribution statement

WKH and TMCL conceived and designed the study. LL and HT

prepared and conducted the data analysis. WKH oversaw the data analysis and conducted data interpretation. The manuscript was written by WKH and TMCL with input from HT, LL, TWL, HL, MBE, and RG. All authors have read and approved the manuscript.

Declaration of Competing Interest

All authors declare that they have no conflict of interest.

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