



# Beyond Material Resources: Sleep Well and Be Hopeful for Less Worry and Better Wellbeing

Esther Yuet Ying Lau<sup>1,2,3</sup> · Sing-Hang Cheung<sup>4</sup> · Cheng Li<sup>1,2,4</sup> · Si-Yuan He<sup>1</sup> · Ho Fung Hugo Choi<sup>1,4</sup> · Shu Fai Cheung<sup>5</sup> · C. Harry Hui<sup>4</sup>

Received: 4 August 2021 / Accepted: 16 December 2022 / Published online: 4 July 2023  
© The Author(s) 2023

## Abstract

The extreme scarcity of material resources related to survival needs often hurts wellbeing. This occurred during COVID-19 outbreaks when the shortage of face masks and other personal protective equipment intensified the threat. Under this context, we proposed and tested a new model of how better sleep and greater hope may predict less worries, preserving quality of life and wellbeing. Participants aged 18 years or above were recruited from the community in Hong Kong. There were 1,091 online survey responses collected near the beginning of the COVID-19 pandemic. Individuals with greater hope or better sleep quality worried less and had better wellbeing, even after accounting for the effects of mask-stock. Moreover, hope and sleep quality have a significantly multiplicative effect to produce superior quality of life and psychological wellbeing, despite a shortage of personal protective equipment. Furthermore, sleep quality, but not mask-stock, predicted flourishing. Our findings underscore the importance of raising awareness of sleep health. During crises, a supply of material resources is critical; yet, boosting hope and promoting sleep quality also support quality of life and flourishing.

**Keywords** COVID-19 · Pandemic · Sleep · Quality of Life · Wellbeing · Face Masks

---

✉ Esther Yuet Ying Lau  
laueyy@eduhk.hk

✉ Sing-Hang Cheung  
singhang@hku.hk

<sup>1</sup> Sleep Laboratory, Department of Psychology, The Education University of Hong Kong, Hong Kong SAR, China

<sup>2</sup> Centre for Psychosocial Health, The Education University of Hong Kong, Hong Kong SAR, China

<sup>3</sup> Centre for Religious and Spirituality Education, The Education University of Hong Kong, Hong Kong SAR, China

<sup>4</sup> Department of Psychology, The University of Hong Kong, Hong Kong SAR, China

<sup>5</sup> Department of Psychology, University of Macau, Macao SAR, China

## Introduction

Wealth up to a certain level has been found to be generally related to a person's psychological and physical wellbeing (e.g., Diener & Fujita, 1995; Rios & Zautra, 2011; Sarriera et al., 2015). While this may be true in most circumstances, there are extreme times like during wars, disasters, and public health crises when even money cannot buy certain goods essential for survival, owing to disruptions in supplies and/or sudden and continual surges of the demands for those goods. This was the case of protective equipment, including face masks, during the worldwide pandemic of COVID-19.

Given the prominence, severity, and global nature of COVID-19, much effort has been channeled into investigating how it predicts physical and mental health. For instance, COVID-induced adversities and worries about those adversities such as limited access to food or medication are found to predict mental health (Wright et al., 2021a) and poor sleep (Wright et al., 2021b), which is a transdiagnostic biopsychological variable driving wellbeing (Dolsen et al., 2014).

However, little is known about the moderators of the effects of both the material scarcity or the worries of it on wellbeing outcomes, except for some protective effects of social support on sleep quality (Wright et al., 2021b). To our knowledge, no previous studies have examined how individual differences might buffer the effects of the scarcity of a protective resource like face masks and the worries of its inadequacy, especially after controlling for the actual stock of that resource. Understanding such protective factors is of paramount importance not just in combating the health risks of COVID-19 specifically, but also in preparing us for the next pandemic or other crises. In this study, we first examined the effects of a material resource shortage directly on wellbeing and indirectly through worries. We also asked whether two psychological resources—hope and sleep quality—would counter the effects of insufficient material resources. Lastly, the potential moderating effects of an array of psychological variables were explored.

## Resources, Worries, and Wellbeing Outcomes

Medication, personal protective equipment, and others such as cleaning supplies and groceries are examples of survival-related resources in a public health crisis. The conservation of resources (COR) theory (Hobfoll, 1989) states that people strive to acquire, preserve, protect and construct such resources, the lack of which is associated with more worries and psychological symptoms (Hobfoll et al., 2016). During the early stage of the COVID-19 pandemic, there was a global shortage of certain supplies, triggering stockpiling and panic buying in many countries (Ahmadi et al., 2021; Bentall et al., 2021). Given the expectation of face masks in preventing virus transmission (Bazant & Bush, 2021), Hong Kong residents were caught in a “mask-panic” during that time (Leung et al., 2020). Despite the 5-times surge in price (World Health Organization, 2020), many people lined up outside supermarkets, pharmacies, and warehouses for different kinds of masks day and

night (Leung, 2020). Even though most residents had access to some stocks, such mass mask-panic went on for many weeks,<sup>1</sup> likely due to the uncertainty of how COVID-19 would develop and Hong Kong being one of the most-densely populated city in the world (World Population Review, 2022). Indeed, mask-worry was found to be one of the correlates of symptoms of depression and anxiety during COVID-19 in a Hong Kong community sample of 774 respondents (Choi et al., 2020). Although there were some early studies reporting COVID-19-related psychological distress, depression, anxiety, and associated comorbidity (Ben-Ezra et al., 2020; Muñoz-Navarro et al., 2021; Parlapani et al., 2020), the specific role of worries about sufficiency of face masks after controlling for actual stock and its relationship with other psychological factors were yet to be elucidated.

Worry has been defined as “a chain of thoughts and images, negatively affect-laden and relatively uncontrollable” (Borkovec et al., 1983, p. 10). It is a cognition that “a state of an object (self, in-group, society, or world) in one or more domains of life (health, safety, environment, social relations, meaning, achievement, or economic) will become or remain discrepant from its desired state” (Boehnke et al., 1998, p. 778). Worries result in less concrete elaboration of the problem on hand (Stöber et al., 2000). The degree of people’s worries was associated with a negative view of both the problem they were facing and their problem-solving ability, which in turn generated more negative emotions (Belzer et al., 2002). Compared to non-worriers, worriers exhibited higher levels of anxiety, depression, hostility, and tension (Borkovec et al., 1983), as well as lower life satisfaction (Paolini et al., 2006). Anticipation of fewer recurrences of positive life events and more recurrences of negative ones was associated with reduced flourishing (Wang et al., 2015). In the context of COVID-19, we contend that worries about inadequacy of protective equipment presumed to be directly linked with survival in the pandemic would be more intimately associated with wellbeing outcomes than would other worries about material insufficiency in non-life-threatening situations. As such, we predicted that worries about inadequacy of face masks under the COVID-19 pandemic would be associated with more negative emotions, lower quality of life satisfaction, and diminished flourishing.

**H1:** Lower mask-stock size predicts higher worries about mask-stock inadequacy, which in turn predicts poorer wellbeing.

While the lack of material resources may hurt psychological wellbeing directly and indirectly through worries, other internal factors may determine worries and wellbeing, above and beyond the external influence like mask-stock inadequacy. In the following, we argue that hope and sleep are two factors that may influence wellbeing even after the salient effects of mask-stock inadequacy are taken into account.

---

<sup>1</sup> Relative Google search volume for “face mask” in Chinese in Hong Kong peaked during the week of January 26, 2020, remained high for another three weeks, and did not return to a low level until around late August 2020. Google search data can be retrieved through this link: <https://trends.google.com/trends/explore?date=2019-12-01%202021-11-30&geo=HK&q=%E5%8F%A3%E7%BD%A9>

## The Role of Hope in Worries and Wellbeing Outcomes

Hope is a positive psychological capital defined as the expectation of goals being achieved through possession of strategies (pathways) and goal-directed motivation (agency) (Snyder et al., 1991). State hope, a person's current hope level for a specific time or a specific event, correlates positively with positive affect, life satisfaction and flourishing, and negatively with negative affect (Gallagher & Lopez, 2009). In times of a serious health threat aggravated by the lack of personal protective equipment, hope can be understood as a positive psychological resource to mitigate the effect of material shortage on wellbeing (Kaye-Tzadok et al., 2019). Michael (2000) stated that "hope protects against perceptions of vulnerability, uncontrollability, and unpredictability, as well as off-task cognitive interference", suggesting that hope may influence cognitive appraisal of the threat level and in turn, worries in stressful situations. State hope of mothers of children with disabilities negatively correlated with worries about their children (Ogston et al., 2011). A recent study reported that cognitive emotion regulation strategies have been found to moderate the association of worries with anxiety during the COVID-19 pandemic (Muñoz-Navarro et al., 2021). We contend that state hope may be a cognitive mechanism that functions as a psychological resource for coping with primary resource inadequacy under the threat of the COVID-19 pandemic.

H2: Higher state hope predicts lower worries about mask-stock inadequacy.

## The Role of Sleep in Worries and Wellbeing Outcomes

When a protective resource is in high demand during a public health threat, people typically spend much time and energy to source for it, sometimes at the expense of sleep. This was the case of face masks during the COVID-19 pandemic, at least for some populations in the world (Cheung & Lum, 2020). In addition to spending extra time on procurement of protective equipment, other pandemic-related factors that might affect sleep include decrease in outdoor activities and exercises due to lockdown, disruption of daily routines, increase in screen time, long work-shifts (especially for healthcare workers), financial concerns, and lack of social support and loneliness owing to social distancing. In fact, sleep disturbances were prevalent at around 40% globally during the COVID-19 pandemic (see reviews by Jahrami et al., 2021, 2022). Sleep not only restores body energy, but also enables effective cognitive (Chee & Peigneux, 2020) and emotional brain processes (Watling et al., 2017). Longer sleep duration and better sleep quality were associated with less worrying (Pillai & Drake, 2015), suggesting a regulatory effect of sleep on worries through influencing inhibitory control and evaluative processing (Dorrian et al., 2019). Sleep quality also predicted positive emotional outcomes, life satisfaction and flourishing (Stephoe et al., 2008) and less negative emotions including depression, anxiety, and psychological stress (Lau et al., 2017).

Poor sleep might directly lead to worries and negative moods or exert its influence on moods via lowering hope. Sleep quality has been shown to predict optimism

and vice versa in college students longitudinally (Lau et al., 2017). Another study showed that sleep conditions predicted hope and happiness in elementary and high schoolers (Lau et al., 2021). With poor sleep, one's cognitive processes are compromised (Lim & Dinges, 2008) and affective processes dysregulated (Mauss et al., 2013), making it difficult to perceive the *ways* and feel the *will* to overcome obstacles to acquiring protective supplies.

H3: Sleep quality predicts state hope.

Alternatively, the effects of hope can be moderated by sleep quality. We postulated that people of poor sleep quality would be particularly prone to the effects of low hope in acquiring protective supplies and hence would experience more worries. Conversely, a good sleeper might be relatively resilient to the effects of hopelessness and have less worries.

H4: Sleep quality and hope interact in predicting worries about inadequacy of mask-stock.

## The Current Study

Material, mental and other personal resources are potential predictors of wellbeing in the midst of a health crisis. At the time this study was conducted (February 20 to March 20, 2020), Hong Kong, like other regions, was unprepared for the pandemic. People learned that it could be a dangerous disease but were uncertain of its transmission routes or preventive/treatment strategies, except that mask-coverage and sterilization seemed critical. While some regions were lacking in testing kits, Hong Kong experienced an inadequate supply of sanitizers and even more so, face masks. Applying the COR theory, this study attempted to understand the roles of hope and sleep quality interposed in the lack of face masks and the worries about its inadequacy, under the context of the public health threat of the COVID-19 pandemic, to elucidate the interplay of physical, mental, and other personal variables in predicting flourishing. While previous studies have shown the impact of financial crises and material insufficiencies in psychological wellbeing (Diener & Fujita, 1995; Sarriera et al., 2015), little is known about whether and how personal factors moderate the impact of the lack of protective equipment and its associated worries under a substantial and extended public health threat. Our findings would have far-reaching implications in public policies in psychological interventions for similar crises in the future.

## Method

### Procedure and Participants

Chinese adults and students aged 18 years or above were recruited through various channels (e.g., bulk emails in various local universities in Hong Kong, social networks,

and advertisements on social media) to enhance sample representativeness. The Human Research Ethics Committee of the Education University of Hong Kong has approved the data collection procedures. The hypotheses of this study have been pre-registered on the Open Science Framework before the authors accessed the data (<https://osf.io/x68qg>). Supplementary materials, which include the dataset, analysis scripts, and other transparency information, are also accessible through the Open Science Framework ([https://osf.io/anq73/?view\\_only=e428a7b728d847e59f278e29a93b37bc](https://osf.io/anq73/?view_only=e428a7b728d847e59f278e29a93b37bc)).

Participants were informed that they would be completing an online survey, and there would be follow-up questionnaires in the next few years. They were also told that a HK\$50 monetary reward would be given upon completion, or they could donate the reward to one of several designated charities. During February 20 to March 29, 2020, a total of 1,091 responses (901 women; 82.858%) were received. Participants' mean age was 24.35 years ( $SD=6.32$ ). About 25% of participants ( $n=270$ ) reported a monthly family income of under HK\$20,000 (about US\$2,500), 43.56% ( $n=467$ ) of HK\$20,000 to 39,999, and 31.25% ( $n=335$ ) of HK\$40,000 or above. Almost all participants were residing in Hong Kong ( $n=1071$ ; 98.16%), the remaining in Macao, Mainland China, Taiwan, or other regions. The majority were full-time students in tertiary institutions ( $n=828$ ; 75.89%), while the others were either working or unemployed. Most of the participants reported having no religious affiliation ( $n=798$ ; 73.14%), 19.61% ( $n=214$ ) were Protestant Christians, 3.21% ( $n=35$ ) Catholics, 3.39% ( $n=37$ ) Buddhists, and 0.46% ( $n=5$ ) Taoists. Further details are in Supplementary Materials.

## Measures

### Mask-Stock

The question "How many days will your current mask-stock last?" assessed the current individual mask resource in consideration of the varied quantity of masks that each individual and their family members who shared the same stock needed each day, given individual circumstances such as the type of masks (e.g., disposable masks vs. cloth masks) and job nature (indoor vs. outdoor). This was an open-ended question. Responses readily convertible to numbers of days were converted. Other responses were converted as close as possible to numbers of days. The detailed coding can be found in Supplementary Materials.

### Mask Worry

The question "To what extent are you worried about the adequacy of your mask-stock due to the COVID-19 outbreak?" assessed the worries about potential insufficiency in mask resources (1 = *not at all worried*; to 4 = *very worried*).

### Modified State Hope Scale (SHS)

The Chinese version of the State Hope Scale (SHS;  $\alpha=0.67\text{--}0.85$ ; Sun et al., 2012), translated from the original 12-item adult hope scale (Snyder et al., 1991), was modified to measure the agency and pathway to achieve the specific goal of acquiring adequate protective supplies. Respondents were first asked if purchasing protective supplies (such as face masks and hand sanitizer) was an important goal to them at the time of completing the survey. If they responded "yes," the modified SHS was presented to them. The modified SHS comprises 5 items. There are also 4 fillers to conceal the purpose of the instrument. Sample items are "I have been quite successful in obtaining protective supplies" (agency) and "I have many ways to obtain protective supplies" (pathway). The items were scored on an 8-point Likert scale (1 = *definitely false*; 8 = *definitely true*). Ratings on the items were averaged, with higher scores indicating higher state hope for acquiring adequate protective supplies.

### Pittsburgh Sleep Quality Index (PSQI)

Sleep quality was measured with the Chinese version of the 18-item Pittsburgh Sleep Quality Index (PSQI; Tsai et al., 2005). The items are scored in seven components with scaled scores range of 0 to 3: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total global score ranges from 0 to 21, with poor sleep quality indicated by a score above 5.

### Sleep Condition Indicator

To explore potential effects of insomnia risks, we adopted the Chinese 2-item short form of the Sleep Condition Indicator (SCI-02; Wong et al., 2017). The two items cover the weekly frequency of sleep problems and how much these sleep problems affect the respondents. The total score was calculated and higher scores indicate lower risks for insomnia.

### Depression Anxiety Stress Scale (DASS-21)

Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995; Moussa et al. 2021; Taouk et al., 2001) were used to measure emotional responses during the previous week. This 21-item scale has been widely used among Hong Kong Chinese (e.g., Fu et al., 2019). Participants reported the frequency of each of the 21 symptoms during the previous week, on a 4-point scale (0 = *did not apply to me at all*; 3 = *applied to me very much, or most of the time*). Hence the range of the three 7-item subscales is 0 to 21. The higher the score, the more the negative symptoms during the previous week.

## Flourishing

The Flourishing Scale (FS) is an 8-item scale that encompasses various characteristics of human functioning like positive relationships, feelings of competence, and meanings and purposes in life (Diener et al., 2010). Items were all phrased in a positive direction, on a 7-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*). The total score ranges from 8 to 56.

## Quality of Life (QoL)

This variable of wellbeing was measured with the Hong Kong Chinese version of World Health Organization Quality of Life Measures (WHOQOL-BREF(HK); Leung et al., 1997), on a 5-point scale. This measure has been widely used in Hong Kong (e.g., Wong et al., 2013). For the current study, we excluded an item on sex life (for being too intrusive) and included 24 items constituting four subscales, namely physical QoL (e.g., “To what extent do you feel that physical pain prevents you from doing what you need to to?”), psychological QoL (culturally adjusted for Hong Kong; e.g., “How much do you enjoy life?”), social QoL (e.g., “How satisfied are you with your personal relationship?”), and environment QoL (e.g., “How healthy is your physical environment?”). Scores of each subscales are converted to scaled scores ranging from 4 to 20.

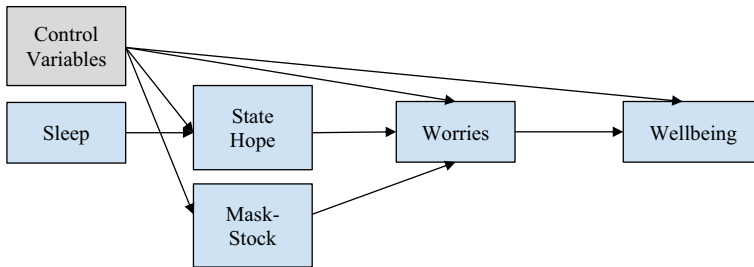
## Social Support

Four items from the social support subscale in the Resilience Scale for Adults (RSA, Friberg et al., 2003) were extracted to measure social support. They included “I have some close friends/family members who really care about me”, “I have some friends/family members who back me up”, “I always have someone who can help me when needed”, and “I have some close friends/family members who are good at encouraging me”. Respondents were instructed to rate how accurate these statements were with a 5-point (1–5) Likert scale in describing their social lives. The total scores of the four items range from 4 to 20, with higher scores indicating better social support received for the individual.

## Analytic Strategies

Path analysis was conducted to test the proposed model (Model 1) depicted in Fig. 1. In all models we fitted, residuals of the outcome variables were allowed to be correlated. Preliminary analysis suggested that the distributions of some outcome variables conditioned on the predictors were nonnormal. Therefore, robust maximum likelihood estimation (Savalei, 2014; Yuan & Bentler, 2000) was used in the following series of analyses. Full information maximum likelihood estimation was used to handle missing data. As pre-registered, goodness of fit of the proposed model





**Fig. 1** The Proposed Model

was assessed by RMSEA using the close fit test against RMSEA less than or equal to 0.05, with  $p$ -value of 0.05 (Browne & Cudeck, 1992). RMSEA was used as the main index to evaluate model fit, and CFI and TLI were used only as supplementary measures, with a cut-off criterion of 0.95 (0.90 had been proposed in the pre-registration but a more stringent and current widely accepted criterion was subsequently adopted). The R package *lavaan* (Rosseel, 2012) was used for the path analysis.

## Results

### Descriptive Statistics

The age of the participants ranged from 19 to 61 years (Mean=24.35, SD=6.32). There were 901 females and 190 males. More than 97.6% of the participants were college students or had some higher education. The distribution of mask-stock is positively skewed (skewness=3.5), mean=45.7 days, median=30 days, and interquartile range=30.25 days. Descriptives and reliability indices were reported in Table 1.

### Model Selection

PSQI and SCI were strongly correlated ( $r=0.642$ ,  $p<0.001$ ), probably due to conceptual overlap. Preliminary analyses also showed that the patterns of results were similar for these two measures. For brevity sake, we reported below only results using the PSQI in the main analyses of model testing. Other results with both PSQI and SCI included in the model can be found in Supplementary Materials.

The model as pre-registered did not fit on RMSEA, the main index we adopted (model chi-square [26]=236.13,  $p<0.001$ , RMSEA=0.089, 90% CI 0.079–0.100, CFI=0.971, TLI=0.779), but the paths predicted in Hypotheses 1 and 2 (for most outcome variables) were significant. The path from PSQI to state hope was not significant ( $B=-0.001$ , 95% CI=-0.030—0.029,  $p=0.977$ ). In Model 2,

**Table 1** Descriptive statistics for sample characteristics

Construct	No. of items	Mean or %	SD	Range	Cronbach's $\alpha$
Mood	21				
Depression symptoms	7	5.7	4.5	0–21	.86
Anxiety symptoms	7	6.8	4.5	0–21	.84
Stress symptoms	7	4.5	3.6	0–20	.78
Quality of Life	24				
Physical health	7	14.1	2.0	6.3–19	.61
Psychological health	7	12.7	2.5	4–20	.84
Social relationship	2	14	2.8	4–20	.68
Environment	8	12.2	2.3	4–20	.74
Mask Stock (days)	1	45.7	40.2	0–480	
Mask Worry	1	2.9	0.8	1–4	
Insomnia	2	5.8	2.0	0–8	.79
High insomnia risk <sup>1</sup>		35.8%			
Sleep Quality	19	6.4	3.2	0–19	.69
Poor sleeper <sup>2</sup>		54.7%			
Flourishing	8	39.8	7.5	8–56	.89
Hope	5	4.5	1.6	1–8	.88
Social Support	4	16.1	2.6	4–20	.87

*Note:* The ranges in this table represent the ranges in the data; the ranges of possible values have been reported in the Method section. SD=standard deviation

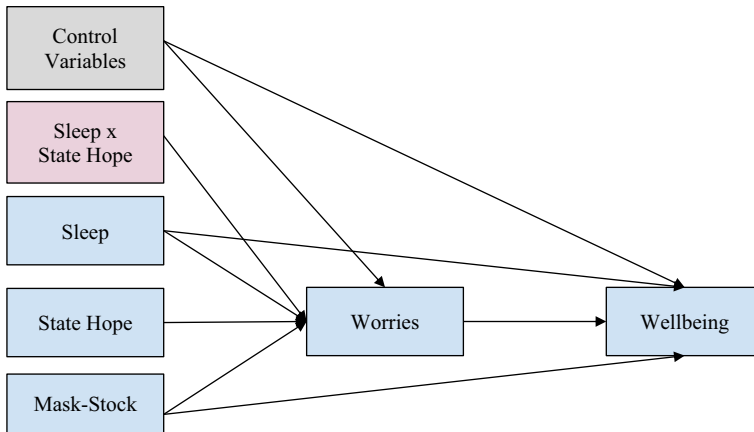
1. SCI-02 score smaller than 6

2. PSQI Global score larger than 5

we explored the possibility that sleep quality moderated the effect of state hope on mask worry (H4, which was pre-registered as an exploratory hypothesis). In this modified model, we also added direct paths from PSQI and mask-stock to all outcome variables given that the posited complete mediation in Model 1 was not supported.

Model 2 fitted satisfactorily (model chi-square [16]=72.49,  $p < 0.001$ , RMSEA=0.061, 90% CI 0.047–0.075, CFI=0.991, TLI=0.904). The moderation effect of PSQI of the effect of state hope on mask-stock worries was significant,  $B = 0.009$ , 95% CI 0.000–0.018,  $p = 0.040$ ; or with state hope and mask-stock worries standardized,  $B = 0.019$ , 95% CI 0.001–0.037. The worse the sleep quality (higher PSQI scores) was, the weaker the protective effect of state hope on mask-stock worries became.

Lastly, we explored Model 3, which is Model 2 with the moderation effects of the following pre-registered exploratory variables added: Big Five personality traits, social support, and religious affiliation. Given the exploratory nature of this analysis, we compared this model against another with the coefficients fixed to zero. The chi-square difference test was not significant (chi-square difference [8] = 12.28,  $p = 0.139$ ). Since this omnibus test was not significant, the



**Fig. 2** The Final Model (Model 2) Note: Control variables include age, gender, socioeconomic status, religious affiliation, education, social support and big-five personality traits

other exploratory moderation effects were not added to the model. We adopted Model 2 as our final model<sup>2</sup> (Fig. 2).

### Final Model (Model 2)

The model can explain substantial amount of variance of most of the dependent variables (mask worry,  $R^2=0.265$ ; depression,  $R^2=0.419$ ; anxiety,  $R^2=0.495$ ; stress,  $R^2=0.352$ ; physical QoL,  $R^2=0.400$ ; psychological QoL,  $R^2=0.555$ ; social QoL,  $R^2=0.399$ ; environment QoL,  $R^2=0.300$ ; and flourishing,  $R^2=0.525$ ). As shown in Table 2, mask worry and PSQI significantly predicted depression ( $\beta=0.081$ ,  $p=0.003$  and  $\beta=0.132$ ,  $p<0.001$ , respectively), anxiety ( $\beta=0.094$ ,  $p<0.001$ ;  $\beta=0.225$ ,  $p<0.001$ ), stress ( $\beta=0.114$ ,  $p<0.001$ ;  $\beta=0.217$ ,  $p<0.001$ ), physical QoL ( $\beta=-0.130$ ,  $p<0.001$ ;  $\beta=-0.339$ ,  $p<0.001$ ), psychological QoL ( $\beta=-0.067$ ,  $p=0.004$ ;  $\beta=-0.150$ ,  $p<0.001$ ), and environment QoL ( $\beta=-0.206$ ,  $p<0.001$ ;  $\beta=-0.137$ ,  $p<0.001$ ). Only PSQI, but not mask worries, predicted flourishing ( $\beta=-0.058$ ,  $p=0.026$ ).

Furthermore, our analyses on standardized indirect effects (Table 3) have found mask worries to be mediating several pathways, namely between hope and depression (indirect effect =  $-0.027$ ,  $p=0.003$ ), between hope and anxiety (indirect effect =  $-0.031$ ,  $p<0.001$ ), between hope and stress (indirect effect =  $-0.038$ ,  $p<0.001$ ), between hope and physical QoL (indirect effect =  $0.043$ ,  $p<0.001$ ), between hope and psychological QoL (indirect effect =  $0.022$ ,  $p=0.008$ ), as well as between hope and environment QoL

<sup>2</sup> An anonymous reviewer reminded us of the value of exploratory analysis using alternative models. We therefore explored two alternative models suggested. The results are available at OSF for interested readers. We are open to the possibility that other models are also plausible and may have a good fit.

**Table 2** Standardized and unstandardized coefficients of direct effects in Model 2

	<i>B</i>	95% <i>CI</i>	$\beta$	<i>p</i>
(1) Effects on Mask Worry				
Hope	-.158	[-.187, -.130]	-.330	<.001
Mask-Stock	-.005	[.006, -.004]	-.255	<.001
PSQI	.003	[-.012, .018]	.013	.695
(2) Effects on Depression				
Mask Worry	.487	[.166, .809]	.081	.003
Mask-Stock	.000	[-.005, .005]	.000	.991
PSQI	.185	[.104, .266]	.132	<.001
(3) Effects on Anxiety				
Mask Worry	.558	[.254, .862]	.094	<.001
Mask-Stock	.003	[-.002, .008]	.026	.263
PSQI	.313	[.237, .389]	.225	<.001
(4) Effects on Stress				
Mask Worry	.553	[.283, .823]	.114	<.001
Mask-Stock	.003	[-.001, .008]	.035	.177
PSQI	.246	[.168, .323]	.217	<.001
(5) Effects on Physical QoL				
Mask Worry	-.347	[-.496, -.199]	-.130	<.001
Mask-Stock	.000	[-.002, .002]	.003	.910
PSQI	-.212	[-.245, -.178]	-.339	<.001
(6) Effects on Psychological QoL				
Mask Worry	-.223	[-.376, -.069]	-.067	.004
Mask-Stock	.000	[-.002, .003]	.008	.713
PSQI	-.116	[-.152, -.080]	-.150	<.001
(7) Effects on Social QoL				
Mask Worry	-.072	[-.273, .129]	-.020	.482
Mask-Stock	-.002	[-.006, .002]	-.030	.291
PSQI	-.026	[-.075, .022]	-.031	.284
(8) Effects on Environment QoL				
Mask Worry	-.623	[-.806, -.441]	-.206	<.001
Mask-Stock	-.002	[-.005, .001]	-.038	.126
PSQI	-.097	[-.141, -.053]	-.137	<.001
(9) Effects on Flourishing				
Mask Worry	-.330	[-.796, .137]	-.033	.166
Mask-Stock	.000	[-.007, .008]	.002	.938
PSQI	-.136	[-.256, -.016]	-.058	.026

*Note:* Physical QoL: Quality of life-Physical health domain; Psychological QoL: Quality of life-Psychological health domain; Social QoL: Quality of life-Social domain; Environment QoL: Quality of life-environment domain;

*B* = unstandardized coefficients;  $\beta$  = standardized coefficients

**Table 3** Standardized and unstandardized coefficients of indirect effects in Model 2

	<i>ab</i>	95% <i>CI</i>	$\alpha\beta$	<i>p</i>
<b>Indirect effects of Hope on Wellbeing through Mask Worry</b>				
(1) Hope → Mask Worry → Depression	-.077	[-.129, -.026]	-.027	.003
(2) Hope → Mask Worry → Anxiety	-.088	[-.138, -.039]	-.031	< .001
(3) Hope → Mask Worry → Stress	-.088	[-.132, -.043]	-.038	< .001
(4) Hope → Mask Worry → Physical QoL	.055	[.028, .082]	.043	< .001
(5) Hope → Mask Worry → Psychological QoL	.035	[.009, .061]	.022	.008
(6) Hope → Mask Worry → Social QoL	.011	[-.021, .044]	.006	.488
(7) Hope → Mask Worry → Environment QoL	.099	[.063, .134]	.068	< .001
(8) Hope → Mask Worry → Flourishing	.052	[-.024, .129]	.011	.182
<b>Indirect effects of Mask-Stock on Wellbeing through Mask Worry</b>				
(1) Mask-Stock → Mask Worry → Depression	-.002	[-.004, -.001]	-.021	.006
(2) Mask-Stock → Mask Worry → Anxiety	-.003	[-.004, -.001]	-.024	.001
(3) Mask-Stock → Mask Worry → Stress	-.003	[-.004, -.001]	-.029	< .001
(4) Mask-Stock → Mask Worry → Physical QoL	.002	[.001, .002]	.033	< .001
(5) Mask-Stock → Mask Worry → Psychological QoL	.001	[.000, .002]	.017	.007
(6) Mask-Stock → Mask Worry → Social QoL	.000	[-.001, .001]	.005	.480
(7) Mask-Stock → Mask Worry → Environment QoL	.003	[.002, .004]	.053	< .001
(8) Mask-Stock → Mask Worry → Flourishing	.002	[-.001, .004]	.008	.166

*Note:* Physical QoL: Quality of life-Physical health domain; Psychological QoL: Quality of life-Psychological health domain; Social QoL: Quality of life-Social domain; Environment QoL: Quality of life-environment domain;

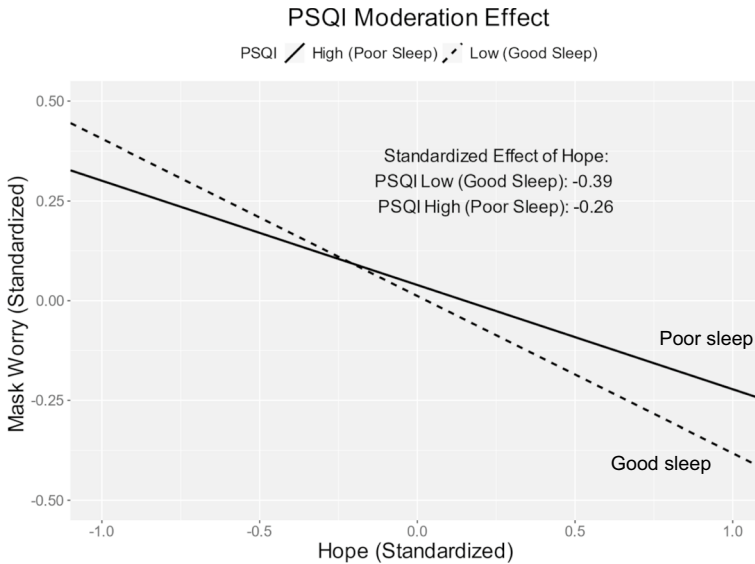
*ab*=unstandardized indirect effects;  $\alpha\beta$ =standardized indirect effects. All of the indirect effects involving PSQI were not significant and not included in the table

(indirect effect = 0.068,  $p < 0.001$ ). All of the indirect effects involving PSQI were not significant.

Nevertheless, mask-stock, together with hope, were significant predictors ( $\beta = -0.255$ ,  $p < 0.001$ ;  $\beta = -0.330$ ,  $p < 0.001$ ) of mask worry. The effect of hope on mask worry was moderated by PSQI ( $\beta = 0.062$ ,  $p = 0.04$ ). The higher the PSQI score (i.e., the worse the sleep quality), the weaker the relation between hope and mask worries (Fig. 3).

## Discussion

Consistent with our hypotheses, poor wellbeing was predicted by a high level of worries about mask-stock inadequacy (H1), which was found in individuals with a low stock of masks (H1) and those at a low level of hope (H2). Contrary to H3, our data did not show sleep quality predicting hope, but instead showed an interaction effect between hope and sleep quality on worries about mask-stock (H4). Hope lowers worries more so for good sleepers than for poor sleepers. That



**Fig. 3** Moderation Effect of PSQI on the Effect of Hope on Mask Worry

is, hope and good sleep strengthen each other's protection against worries about resource constraint.

As predicted, individuals who reported a lower stock of masks also reported poorer wellbeing. Such effects on all three wellbeing outcomes were completely mediated by worries about mask-stock adequacy. The finding was in agreement with the COR theory and previous findings that less material resource predicts increased stress responses and reduced wellbeing (Kaye-Tzadok et al., 2019; Warner et al., 2015). The mediation by worries is in line with previous findings that worries as a form of cognitive avoidance are maladaptive and associated with negative outcomes, such as anxiety, depression, and poor psychological adjustments (Borkovec et al., 2004; Muñoz-Navarro et al., 2021; Paolini et al., 2006). The significant link of worries with quality of life also corroborates evidence that negative anticipation may affect wellbeing (Wang et al., 2015). Taken together, our findings showed that worries about one specific life aspect (mask-stock adequacy in this case) might bring about a broad impact on wellbeing, both in terms of heightened negative moods and reduced quality of life. Interestingly, all effects of mask-stock can be explained by worries, implying that the effects of material resources on wellbeing can potentially be averted by other precursors of worries. Our findings revealed two such factors, hope and sleep quality.

According to Snyder's hope theory, the motivation to attain one's goal as well as the availability of strategies constitute the hope that fights off worries. State hope, as expected, serves as a coping mechanism to sustain positive wellbeing even in a crisis with extreme scarcity of a resource. The effects of state hope on worries, and on wellbeing measures through worries, were still significant even after accounting for mask-stock and other control variables. Although state hope may not increase material resources, it may compensate for the adverse psychological impact of

material scarcity. When it is not feasible to overcome material scarcity, hope can protect a person's wellbeing, "hopefully" helping the person endure the scarcity until the supply of the resources increases. This relationship probably generalizes to other resources such as food, fuel, and finance.

Poor sleep quality predicted worries about mask-stock even after controlling for the actual mask-stock. It also weakened the benefit of hope on lowering worries, which in turn predicted more mood symptoms and lower quality of life. In our sample, 54.7% of participants had poor sleep according to the recommended cut-off (i.e., PSQI score > 5; Buysse et al., 1989). In terms of insomnia, 35.8% of our sample scored above the threshold for high risks (SCI-02 < 6), which matched closely with the reported insomnia rates of 37.6% during the COVID-19 pandemic in Greece (Voitsidis et al., 2020) and was higher than the 3.9%-22% for worldwide insomnia before the global pandemic of COVID-19 (Kay-Stacey & Attarian, 2016). Given the wide range of adverse consequences of poor sleep in physical and mental health, it can be concluded that around half of our participants were under the threat of poor wellbeing related to sleep disruptions during the pandemic. Poor sleep is associated with negative thinking patterns like rumination and catastrophic thinking (Pillai & Drake, 2015). In sleeplessness, one may repeatedly think about the potential threats of the coronavirus, resulting in more worries and worse wellbeing. Our findings extend the association of insomnia with depression under the COVID-19 pandemic as reported by Voitsidis and colleagues (Voitsidis et al., 2020), to the broader construct of sleep quality and a wider scope of functioning beyond depression. While one is keen on protecting the wellbeing of oneself and loved ones through acquisition of protective supplies, the importance of maintaining sleep health cannot be neglected. While recent cross-sectional studies have revealed some correlates of poor sleep, such as urban residence, uncertainty and worry about COVID-infection, intolerance to uncertainty, loneliness and depressive symptoms (Voitsidis et al., 2020), prospective studies with baseline measures as controls are called for in investigating drivers of sleep quality during a health crisis.

## Limitations and Implications

This study is limited by its cross-sectional nature, which precludes causal inference. Besides, our self-reported data may inflate correlations due to common-method variance. Moreover, the sample composition could be biased by differential accessibility and responsiveness to our advertisement as well as survey platforms. Furthermore, even though COVID-19 was a worldwide pandemic, different regions of the world may be affected by it differently. Therefore, cross-cultural comparisons would be warranted to understand the generalizability of our findings.

Notwithstanding, our results show that masks can protect not only physical health but also psychological health during the COVID-19 outbreak, providing empirical support for the application of the COR theory in a public health crisis. Interestingly, the protective effects of a reserve of masks on psychological wellbeing were fully explained by the cognitive process of worries. Our findings highlight the importance of psychological drivers of wellbeing, of which sleep is one.

An implication of the present research on preserving quality of life is that it is critically important to ameliorate sleep disturbances when people are under chronic threat. Strategies should be devised to target potential factors of sleep disruptions specific to the pandemic. These include surging stress due to the drastic changes and unpredictability of the situation, reduced physical activities and exposure to sun due to lockdown, and increased online activities of various sorts such as purchasing protective supplies, etc. Citizens should be informed of the importance of maintaining sleep health and educated of ways to handle worries. Gathering of resources should be done with prudence and caution to avoid compromising sleep quality and duration.

**Acknowledgements** The authors are grateful for the participants' completion of the survey and for the insightful comments and suggestions of the anonymous reviewers and the editors.

**Authors' Contributions** Esther Yuet Ying Lau, Sing-Hang Cheung, C. Harry Hui, and Shu Fai Cheung developed the study concept and contributed to the study design. Data collection was performed by Esther Yuet Ying Lau, Sing-Hang Cheung, Shu Fai Cheung, C. Harry Hui, and Ho-Fung Hugo Choi. Cheng Li, Si-Yuan He, and Ho-Fung Hugo Choi performed the data analysis and interpretation under the supervision of Shu Fai Cheung. All members participated in drafting the manuscript and approved the final version of the manuscript for submission.

**Funding** This study was supported by the General Research Fund (EdUHK#18611419), Research Grants Council, HKSAR, and the open access option was enabled by the Open Access Publishing Fund of the Faculty of Education and Human Development, EdUHK.

**Availability of Data and Material** The data and supplementary materials are accessible through the link: [https://osf.io/anq73/?view\\_only=e428a7b728d847e59f278e29a93b37bc](https://osf.io/anq73/?view_only=e428a7b728d847e59f278e29a93b37bc)

**Code Availability** The codes are accessible through the link: [https://osf.io/anq73/?view\\_only=e428a7b728d847e59f278e29a93b37bc](https://osf.io/anq73/?view_only=e428a7b728d847e59f278e29a93b37bc)

## Declarations

**Conflicts of Interest** The authors declare that they have no conflict of interest.

**Ethics Approval** The Human Research Ethics Committee of The Education University of Hong Kong has approved the data collection procedures (EdUHK Ethics Ref. # 2018–2019-0131).

**Consent to Participate** Informed consent was obtained from all individual participants included in the study.

**Consent for Publication** We confirm that all named authors have consented to publish the manuscript.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.



## References

- Ahmadi, I., Habel, J., Jia, M., Lee, N., & Wei, S. (2022). Consumer stockpiling across cultures during the COVID-19 pandemic. *Journal of International Marketing*, 30(2), 28–37. <https://doi.org/10.1177/1069031X211037590>
- Bazant, M. Z., & Bush, J. W. M. (2021). A guideline to limit indoor airborne transmission of COVID-19. *Proceedings of the National Academy of Sciences of the United States of America*, 118(17), e2018995118. <https://doi.org/10.1073/pnas.2018995118>
- Belzer, K. D., D’Zurilla, T. J., & Maydeu-Olivares, A. (2002). Social problem solving and trait anxiety as predictors of worry in a college student population. *Personality and Individual Differences*, 33(4), 573–585. [https://doi.org/10.1016/S0191-8869\(01\)00173-8](https://doi.org/10.1016/S0191-8869(01)00173-8)
- Benfall, R. P., Lloyd, A., Bennett, K., McKay, R., Mason, L., Murphy, J., ... & Shevlin, M. (2021). Pandemic buying: Testing a psychological model of over-purchasing and panic buying using data from the United Kingdom and the Republic of Ireland during the early phase of the COVID-19 pandemic. *PLoS One*, 16(1), e0246339.
- Ben-Ezra, M., Sun, S., Hou, W. K., & Goodwin, R. (2020). The association of being in quarantine and related COVID-19 recommended and non-recommended behaviors with psychological distress in Chinese population. *Journal of Affective Disorders*, 275, 66–68. <https://doi.org/10.1016/j.jad.2020.06.026>
- Boehnke, K., Schwartz, S. H., Stromberg, C., & Sagiv, L. (1998). The structure and dynamics of worry: Theory, measurement, and cross-cultural replications. *Journal of Personality*, 66, 745–782. <https://doi.org/10.1111/1467-6494.00031>
- Borkovec, T. D., Alcaine, O., & Behar, E. (2004). Avoidance theory of worry and generalized anxiety disorder. In R. G. Heimberg, C. L. Turk, & D. S. Mennin (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 77–108). The Guilford Press.
- Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy*, 21(1), 9–16. [https://doi.org/10.1016/0005-7967\(83\)90121-3](https://doi.org/10.1016/0005-7967(83)90121-3)
- Browne, M. W., & Cudeck, R. (1992). Alternative Ways of Assessing Model Fit. *Sociological Methods & Research*, 21(2), 230–258. <https://doi.org/10.1177/0049124192021002005>
- Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- Chee, M. W. L., & Peigneux, P. (2020). Editorial overview: Sleep and cognition. *Current Opinion in Behavioral Sciences*, 33, iii–vi. <https://doi.org/10.1016/j.cobeha.2020.04.002>
- Cheung, T. & Lum, A. (2020). *Coronavirus: desperate scenes as 10,000 queue for masks at Hong Kong industrial estate*. <https://www.scmp.com/news/hong-kong/health-environment/article/3049082/coronavirus-10000-queue-masks-hong-kong>. Accessed 5 Feb 2020.
- Choi, E. P. H., Hui, B. P. H., & Wan, E. Y. F. (2020). Depression and anxiety in Hong Kong during COVID-19. *International Journal of Environmental Research and Public Health*, 17(10), 3740. <https://doi.org/10.3390/ijerph17103740>
- Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., & Biswas-Diener, R. (2010). New Well-being Measures: Short Scales to Assess Flourishing and Positive and Negative Feelings. *Social Indicators Research*, 97(2), 143–156. <https://doi.org/10.1007/s11205-009-9493-y>
- Diener, E., & Fujita, F. (1995). Resources, personal strivings, and subjective well-being: A nomothetic and idiographic approach. *Journal of Personality and Social Psychology*, 68(5), 926–935. <https://doi.org/10.1037/0022-3514.68.5.926>
- Dolsen, M. R., Asarnow, L. D., & Harvey, A. G. (2014). Insomnia as a transdiagnostic process in psychiatric disorders. *Current Psychiatry Reports*, 16(9), 471.
- Dorrian, J., Centofanti, S., Smith, A., & McDermott, K. D. (2019). Self-regulation and social behavior during sleep deprivation. *Progress in Brain Research*, 246, 73–110. <https://doi.org/10.1016/bs.pbr.2019.03.010>
- Friborg, O., Hjemdal, O., Rosenvinge, J. H., & Martinussen, M. (2003). A new rating scale for adult resilience: What are the central protective resources behind healthy adjustment? *International Journal of Methods in Psychiatric Research*, 12(2), 65–76. <https://doi.org/10.1002/mpr.143>. PMID:12830300; PMCID:PMC6878238

- Fu, G., Jin, Y., & Guo, J. (2019). Mobile Phone Addiction and Career Preparation in College Students. *Higher Education of Social Science*, 16(2), 10–16. <https://doi.org/10.3968/11215> Available from: URL: <http://www.cscanada.net/index.php/hess/article/view/11215>.
- Gallagher, M. W., & Lopez, S. J. (2009). Positive expectancies and mental health: Identifying the unique contributions of hope and optimism. *The Journal of Positive Psychology*, 4(6), 548–556. <https://doi.org/10.1080/17439760903157166>
- Hobfoll, S. E., Tirone, V., Holmgreen, L., & Gehard, J. (2016). Conservation of resources theory applied to major stress. In G. Fink (Ed.), *Stress: Concepts, cognition, emotion, and behavior* (pp.65–71). Academic Press. <https://doi.org/10.1016/B978-0-12-800951-2.00007-8>
- Hobfoll, S. E. (1989). Conservation of Resources: A New Attempt at Conceptualizing Stress. *American Psychologist*, 44(3), 513–524. <https://doi.org/10.1037/0003-066X.44.3.513>
- Jahrami, H. A., Alhaj, O. A., Humood, A. M., Alenezi, A. F., Fekih-Romdhane, F., AlRasheed, M. M., Saif, Z. Q., Bragazzi, N. L., Pandi-Perumal, S. R., BaHammam, A. S., & Vitiello, M. V. (2022). Sleep disturbances during the COVID-19 pandemic: A systematic review, meta-analysis, and metaregression. *Sleep Medicine Reviews*, 62, 101591. <https://doi.org/10.1016/j.smr.2022.101591>
- Jahrami, H., BaHammam, A. S., Bragazzi, N. L., Saif, Z., Faris, M., & Vitiello, M. V. (2021). Sleep problems during the COVID-19 pandemic by population: A systematic review and meta-analysis. *Journal of Clinical Sleep Medicine*, 17(2), 299–313.
- Kay-Stacey, M., & Attarian, H. (2016). Advances in the management of chronic insomnia. *BMJ*, 354, i2123. <https://doi.org/10.1136/bmj.i2123>
- Kaye-Tzadok, A., Ben-Arieh, A., & Kosher, H. (2019). Hope, Material Resources, and Subjective Well-Being of 8- to 12-Year-Old Children in Israel. *Child Development*, 90(2), 344–358. <https://doi.org/10.1111/cdev.13130>
- Lau, E. Y., Hui, C. H., Lam, J., & Cheung, S. F. (2017). Sleep and optimism: A longitudinal study of bidirectional causal relationship and its mediating and moderating variables in a Chinese student sample. *Chronobiology International*, 34(3), 360–372. <https://doi.org/10.1080/07420528.2016.1276071>
- Lau, E. Y. Y., Lam, Y. C., & Lee, J. C. K. (2021). Well-slept children and teens are happier and more hopeful with fewer emotional problems. *Child Indicators Research*, 14, 1809–1828. <https://doi.org/10.1007/s12187-021-09823-2>
- Leung, C. C., Lam, T. H., & Cheng, K. K. (2020). Mass masking in the COVID-19 epidemic: People need guidance. *Lancet*, 395(10228), 945. [https://doi.org/10.1016/S0140-6736\(20\)30520-1](https://doi.org/10.1016/S0140-6736(20)30520-1)
- Leung, C. W. (2020). Covid-19 outbreak sparks mass panic buying in Hong Kong. *BBC news*. <https://www.bbc.com/zhongwen/simp/chinese-news-51396305>. Accessed 6 Feb 2020.
- Leung, K. F., Tay, M., Cheng, S. S. W., & Lin, F. (1997). *Hong Kong Chinese version World Health Organization quality of life measure-abbreviated version*. Hospital Authority.
- Lim, J., & Dinges, D. F. (2008). Sleep Deprivation and Vigilant Attention. *Annals of the New York Academy of Sciences*, 1129(1), 305–322. <https://doi.org/10.1196/annals.1417.002>
- Lovibond, S. H., & Lovibond, P. (1995). *Manual for the depression anxiety stress scales*. Psychology Foundation of Australia.
- Mauss, I. B., Troy, A. S., & LeBourgeois, M. K. (2013). Poorer sleep quality is associated with lower emotion-regulation ability in a laboratory paradigm. *Cognition and Emotion*, 27(3), 567–576. <https://doi.org/10.1080/02699931.2012.727783>
- Michael, S. T. (2000). Hope conquers fear: Overcoming anxiety and panic attacks. In C. R. Snyder (Ed.), *Handbook of hope: Theory, measures, and applications* (pp. 301–319). Academic Press. <https://doi.org/10.1016/B978-012654050-5/50018-X>
- Moussa, M., Lovibond, P. F., & Laube, R. (2001). Psychometric properties of a chinese version of the 21-item depression anxiety stress scales (DASS21). New South Wales Transcultural Mental Health Centre, Cumberland Hospital, Sydney. <http://www2.psy.unsw.edu.au/Groups/dass/Chinese/Chinese%20DASS21%20Paper.pdf>
- Muñoz-Navarro, R., Malonda, E., Llorca-Mestre, A., Cano-Vindel, A., & Fernández-Berrocá, P. (2021). Worry about COVID-19 contagion and general anxiety: Moderation and mediation effects of cognitive emotion regulation. *Journal of Psychiatric Research*, 137, 311–318. <https://doi.org/10.1016/j.jpsyres.2021.03.004>
- Ogston, P. L., MacKintosh, V. H., & Myers, B. J. (2011). Hope and worry in mothers of children with an autism spectrum disorder or Down syndrome. *Research in Autism Spectrum Disorders*, 5(4), 1378–1384. <https://doi.org/10.1016/j.rasd.2011.01.020>
- Paolini, L., Yanez, A. P., & Kelly, W. E. (2006). An Examination of Worry and Life Satisfaction Among College Students. *Individual Differences Research*, 4(5), 331–339.

- Parlapani, E., Holeva, V., Voitsidis, P., Blekas, A., Gliatas, I., Porfyri, G. N., Golemis, A., Papadopoulou, K., Dimitriadou, A., Chatzigeorgiou, A. F., Bairachtari, V., Patsiala, S., Skoupra, M., Papigkioti, K., Kafetzopoulou, C., & Diakogiannis, I. (2020). Psychological and Behavioral Responses to the COVID-19 Pandemic in Greece. *In Frontiers in Psychiatry, 11*, 821. <https://doi.org/10.3389/fpsy.2020.00821>
- Pillai, V., & Drake, C. L. (2015). Sleep and Repetitive Thought: The Role of Rumination and Worry in Sleep Disturbance. *Sleep and Affect: Assessment, Theory, and Clinical Implications, January 2018*, 201–225. <https://doi.org/10.1016/B978-0-12-417188-6.00010-4>
- Rios, R., & Zautra, A. J. (2011). Socioeconomic disparities in pain: The role of economic hardship and daily financial worry. *Health Psychology, 30*(1), 58–66. <https://doi.org/10.1037/a0022025>
- Rossee, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1–36. <https://doi.org/10.18637/jss.v048.i02>
- Sarriera, J. C., Casas, F., Bedin, L., Abs, D., Strelhow, M. R., Gross-Manos, D., & Giger, J. (2015). Material resources and children's subjective well-being in eight countries. *Child Indicators Research, 8*(1), 199–209.
- Savalei, V. (2014). Understanding Robust Corrections in Structural Equation Modeling. *Structural Equation Modeling: A Multidisciplinary Journal, 21*(1), 149–160. <https://doi.org/10.1080/10705511.2013.824793>
- Snyder, C. R., Harris, C., Anderson, J. R., Holleran, S. A., Irving, L. M., Sigmon, S. T., Yoshinob, L., Gibb, J., Langelle, C., & Harney, P. (1991). The will and the ways: Development and validation of an individual-differences measure of hope. *Journal of Personality and Social Psychology, 60*(4), 570–585. <https://doi.org/10.1037//0022-3514.60.4.570>
- Stepoe, A., O'Donnell, K., Marmot, M., & Wardle, J. (2008). Positive affect, psychological well-being, and good sleep. *Journal of Psychosomatic Research, 64*(4), 409–415. <https://doi.org/10.1016/j.jpsychores.2007.11.008>
- Stöber, J., Tepperwien, S., & Staak, M. (2000). Worrying Leads to Reduced Concreteness of Problem Elaborations: Evidence for the Avoidance Theory of Worry. *Anxiety, Stress, & Coping, 13*(3), 217–227. <https://doi.org/10.1080/10615800008549263>
- Sun, Q., Ng, K.-M., & Wang, C. (2012). A Validation Study on a New Chinese Version of the Dispositional Hope Scale. *Measurement and Evaluation in Counseling and Development, 45*(2), 133–148. <https://doi.org/10.1177/0748175611429011>
- Taouk, M., Lovibond, P. F., & Laube, R. (2001). Psychometric Properties of a Chinese Version of the 21-Item Depression Anxiety Stress Scales (DASS21). *Report for New South Wales Transcultural Mental Health Centre, Cumberland Hospital, Sydney*.
- Tsai, P. S., Wang, S. Y., Wang, M. Y., Su, C. T., Yang, T. T., Huang, C. J., & Fang, S. C. (2005). Psychometric evaluation of the Chinese version of the Pittsburgh Sleep Quality Index (PSQI) in primary insomnia and control subjects. *Quality of Life Research, 14*(8), 1943–1952. <https://doi.org/10.1007/s11136-005-4346-x>
- Voitsidis, P., Gliatas, I., Bairachtari, V., Papadopoulou, K., Papageorgiou, G., Parlapani, E., Syngelakis, M., Holeva, V., & Diakogiannis, I. (2020). Insomnia during the COVID-19 pandemic in a Greek population. *Psychiatry Research, 289*, 113076. <https://doi.org/10.1016/j.psychres.2020.113076>
- Wang, Q., Gould, T., & Hou, Y. (2015). Is the future always brighter than the past? Anticipation of changes in the personal future after recall of past experiences. *Memory, 23*(2), 178–186. <https://doi.org/10.1080/09658211.2013.877147>
- Warner, L. M., Gutiérrez-Doña, B., Villegas Angulo, M., & Schwarzer, R. (2015). Resource loss, self-efficacy, and family support predict posttraumatic stress symptoms: A 3-year study of earthquake survivors. *Anxiety, Stress, & Coping, 28*(3), 239–253. <https://doi.org/10.1080/10615806.2014.955018>
- Watling, J., Pawlik, B., Scott, K., Booth, S., & Short, M. A. (2017). Sleep Loss and Affective Functioning: More Than Just Mood. *Behavioral Sleep Medicine, 15*(5), 394–409. <https://doi.org/10.1080/15402002.2016.1141770>
- Wong, M. L., Lau, E. Y. Y., Wan, J. H. Y., Cheung, S. F., Hui, C. H., & Mok, D. S. Y. (2013). The interplay between sleep and mood in predicting academic functioning, physical health and psychological health: A longitudinal study. *Journal of Psychosomatic Research, 74*(4), 271–277. <https://doi.org/10.1016/j.jpsychores.2012.08.014>
- Wong, M. L., Lau, K. N. T., Espie, C. A., Luiik, A. I., Kyle, S. D., & Lau, E. Y. Y. (2017). Psychometric properties of the sleep condition indicator and insomnia severity index in the evaluation of insomnia disorder. *Sleep Medicine, 33*, 76–81. <https://doi.org/10.1016/j.sleep.2016.05.019>

- World Health Organization. (2020). *Shortage of personal protective equipment endangering health workers worldwide*. <https://www.who.int/news/item/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>. Accessed 3 Mar 2020.
- World Population Review. Hong Kong Population 2022 (Demographics, Maps, Graphs). Retrieved Apr 7, 2022, from <https://worldpopulationreview.com/countries/hong-kong-population>.
- Wright, L., Steptoe, A., & Fancourt, D. (2021a). Does thinking make it so? Differential associations between adversity worries and experiences and mental health during the COVID-19 pandemic. *Journal of Epidemiology and Community Health*, *75*(9), 817–823. <https://doi.org/10.1136/jech-2020-215598>
- Wright, L., Steptoe, A., & Fancourt, D. (2021b). Are adversities and worries during the COVID-19 pandemic related to sleep quality? Longitudinal analyses of 46,000 UK adults. *PLoS ONE*, *16*(3), e0248919.
- Yuan, K. H., & Bentler, P. M. (2000). Three Likelihood-Based Methods for Mean and Covariance Structure Analysis with Nonnormal Missing Data. *Sociological Methodology*, *30*(1), 165–200. <https://doi.org/10.1111/0081-1750.00078>

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.