

COVID-19 pandemic response behaviors: a Singapore experience of the “circuit breaker”

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ABSTRACT

Preventive health behaviors such as hand hygiene are crucial amidst pandemics like COVID-19 but reports on nonadherence persist. This could be due to the lack of Consideration of Future Consequences (CFC), a cognitive-motivational construct known to improve health-related behaviors. Therefore, we examined the relationship between CFC and five behaviors—mask-wearing, social distancing, hand hygiene, excessive necessities buying, and COVID-19 information searching using an internet-based Singapore-wide survey conducted from April 20 to May 4, 2020. Behavioral differences 2 weeks before and after the state-wide confinement were examined using paired t-tests. Relationships between CFC and COVID-19 behaviors were examined using regression analyses adjusted for depression and anxiety. Participants were regrouped into three categories—increased behavior performance, maintained high performance, and maintained low performance where mean differences were analysed using MANOVA. Three hundred and thirty-six participants completed the survey (mean age, $SD = 32.9$ years [$SD = 12.6$]; 38.7% males). CFCfuture predicted mask wearing ($B = 0.16$; $p < .05$), social distancing ($B = 0.0.19$; $p < .01$), hand hygiene ($B = 0.17$; $p < .01$), and information searching ($B = 0.21$; $p < .001$). CFCimmediate predicted hand hygiene ($B = 0.09$; $p < .05$), excessive necessities buying ($B = 0.07$; $p < .05$) and information searching ($B = 0.08$; $p < .05$). Anxiety predicted excessive buying ($B = 0.08$; $p < .05$) and hand hygiene ($B = 0.13$; $p < .01$). Post-hoc test showed significantly higher CFCfuture ($p < .01$) in participants who increased and maintained high behavioral performance.

Keywords

Time perspective, COVID-19, Behavior, Anxiety, Depression, Pandemic

INTRODUCTION

As of October 20, 2020, the novel coronavirus disease (COVID-19) had infected approximately 40 million people and claimed above 1.1 million lives worldwide [1]. Without a targeted vaccine nor antiviral drug, the most effective way to curb the viral spread is for the public to adopt socially responsible preventive behaviors such as social distancing [2, 3].

While Singapore was initially lauded for containing the outbreak, a sudden rise in incident infection rates (4 on February 29 to 65 on April 3) triggered the

Implications

Practice: Healthcare practitioners could incorporate future- or present-oriented thinking when performing patient education on health promoting behaviors depending on the temporal nature of the benefits (long- or short-term).

Policy: COVID-19 preventive behaviours are likely going to constitute a new social norm. Health policies and promotion programs could incorporate future-oriented thinking in promotional campaigns.

Research: Future research could explore the influence of other personality trait and sociodemographic attributes that influences public health behaviors.

implementation of a series of restrictive measures and a month-long confinement named “circuit breaker” (CB) on April 7, 2020 [4]. The main restrictions were (a) closing of nonessential services (e.g., unrelated to healthcare or food services); (b) compulsory wearing of masks in public, and (c) maintaining ≥ 1 m of social distancing in public. Residents were to work from home if possible and refrain from going out unless necessary (e.g., buying groceries or working in essential services). However, compliance with such preventive behaviors (i.e., social distancing and wearing of masks) was unsatisfactory. Within the first week of the CB, more than 6,200 serious warnings and 500 fines (SGD300 [USD216] for a first offence) were issued upon inspection by 3,000 enforcement officers, CB ambassadors and drones [4].

When daily reports of more than 1,000 new positive COVID-19 cases started to emerge on April 20 (1,426 cases, mostly foreign workers living in packed dormitories), confinement measures were stepped up (e.g., workforce classified as essential services future reduced from 20% to 15% and limiting cross-household

interactions) and the CB was extending by another month to June 2, 2020. After which, the city-state opened up in phases. However, cases of non-compliance persisted despite a governmental appeal for the performance of socially responsible preventive behaviors to curb community transmission.

According to the temporal self-regulation theory [5], noncompliance could be due to a lack of consideration of future consequences (CFC) [6]. CFC refers to the extent to which one places cognitive focus on future-thinking and is often associated with the tendency to perform better health behaviors by prioritizing future (CFCf) over immediate outcomes (CFCi) [7]. It is a cognitive-motivational construct that influences one's adherence to preventive health recommendations such as healthy eating [8], physical exercise [9], heart failure self-care [10], smoking cessation [11], and lower alcohol consumption [12]. Although there are mixed findings on the influence of CFC on health behaviors, existing evidence suggests that CFC may be useful for understanding and shaping population-wide promotion of preventive behaviors. However, we could not find studies that explored this area in terms of pandemic response behaviors.

Therefore, we aimed to examine the change in COVID-19 response behaviors before and after confinement and its association with the two-factor CFC (immediate and future). Understanding the association between CFC and prevention behaviors would inform public health policy-making (e.g., mandating certain behaviors), health promotion (e.g., message framing), and preventing communicable disease spread. Accordingly, we hypothesized that:

- H₁: CFCf would be positively associated with the COVID-19 preventive behaviors.
- H₂: CFCi would be negatively associated with COVID-19 preventive behaviors.
- H₃: Following the start of the CB, CFCf would be positively associated with an increased performance of COVID-19 preventive behaviors.

METHODS

Participants and procedure

A population-wide cross-sectional study was conducted from April 20 to May 4, 2020. Participants were invited through social media advertisements (i.e., Facebook) and by the word of mouth (i.e., WhatsApp chat groups) to complete an anonymized online Qualtrics survey. Interested participants were first presented with the study information before giving informed consent. Ethics approval was obtained from the Singapore University of Technology and Design (SUTD) Institutional Review Board (reference number: 20-312). All procedures performed in this study involving human participants were following the ethical standards of the institutional and/or national research committee

and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Data collection

The survey collected data on sociodemographic profile (e.g., age, sex, highest education level); CFC; COVID-19 preventive behaviors; anxiety; and depression.

Five COVID-19 prevention behaviors were measured using five items on a four-point scale (1 = never/rarely; 4 = always/daily) 2 weeks before and after the start of the CB: (a) wearing a mask in public (mask-wearing); (b) observing ≥ 1 m of social distancing (social distancing); and (c) handwashing/disinfecting after touching a public surface (hand hygiene); (d) buying more necessities than usual (excessive buying), and (e) finding out more about how COVID-19 precautions prevent transmission (increased COVID-19 information searching).

CFC was measured on a seven-point scale (1 = least characteristic of me; 7 = most characteristic of me) using a modified six-item CFC scale (CFCS) [7]. The CFCS comprised of two subscales—CFCf and CFCi—of which item scores on each subscale were summed and averaged for subscale analysis. A total scale score is obtained by calculating the sum average of CFCf and CFCi (reverse coded) scores. A higher score on the CFCS and CFCf subscale indicates a higher extent to which one considers about future consequences while a higher score on the CFCi indicates a higher extent to which one considers about immediate consequences. Examples of the respective subscales are, “When I make a decision, I think about how it might affect me in the future” and “I only act to satisfy immediate concerns, figuring the future will take care of itself.” Both subscales demonstrated good internal reliability ($\alpha_{\text{CFCi}} = 0.821$; $\alpha_{\text{CFCf}} = 0.775$).

Depression and anxiety were measured on a four-point scale (1 = not at all, 2 = several days; 3 = more than half the days; 4 = nearly every day) using the two-item Patient Health Questionnaire-2 (PHQ-2) [13] (and two-item Generalized Anxiety Disorder-2 (GAD-2) [14] respectively. Sum scores of ≥ 3 for each scale represented possible cases of depression and anxiety.

Data analyses

Descriptive statistics were examined for all measures. Behavior changes 2 weeks before and after the start of the CB was examined using Wilcoxon Signed-rank test. Logistic regression (behavior performance scores were recoded into binary data: high performance = scores 3 and 4, and low performance = scores 1 and 2) analyses were performed to model the associations between CFC and COVID-19 behaviors, adjusting for anxiety and depression. Finally, participants were regrouped into those who (a) continued nonperformance, (b) increased in

performance, or (c) continued high performance of each behavior. A series of one-way multivariate analysis of variance (MANOVA) analyses followed by posthoc tests with Bonferroni adjusted alpha of 0.0125 were conducted to examine the differences in CFC, anxiety and depression between groups. Based on G^* power 3 calculations, a sample size of 385 was required to detect a significant effect with a 5% margin of error at a 95% confidence interval (CI). Depression and anxiety were included as covariates of healthy lifestyle behaviors [15, 16]. All analyses were conducted using IBM SPSS Statistics 25.

RESULTS

Three hundred and thirty-six participants completed the survey. The mean age of our participants was 32.9 years ($SD = 12.6$), 38.7% were males and

84.9% had at least a tertiary education (Table 1). 81.0% of our participants were employed and among them, 74.6% were working from home during the CB period. Among the 67 employed participants who were not working from home, 87.0% were working in essential services. The possible presence of anxiety and depression was found in 49.7% and 53.3% of the participants, with mean scores of 3.13 ($SD = 1.51$) and 3.24 ($SD = 1.55$) respectively

Based on negative ranks, the self-reported performance of all behaviors were significantly increased after the CB started albeit to varying extent: wearing a mask (35.7% to 88.4%; $z = -12.8, p < .001$); social distancing (56.8% to 92.6%; $z = -11.8, p < .001$); and hand hygiene (51.8% to 71.4%; $z = -9.3, p < .001$); buying more necessities (11.6% to 17.9%; $z = -5.3, p < .001$) and finding out more about COVID-19

Table 1 | Sociodemographic profile of residents ($N = 336$)

Characteristics	n (%)	Changes in performance, n (%)		
		Continued low-performance	Increased in performance	Continued high performance
Age (years) ^a , mean (SD)	32.9 (12.6)			
≤25	81 (24.1)	13 (16.0)	40 (49.4)	28 (34.6)
26–35	148 (44.0)	11 (7.4)	89 (60.1)	48 (32.4)
36–45	42 (12.5)	5 (11.9)	23 (54.8)	14 (33.3)
46–55	25 (7.4)	4 (16.0)	14 (56.0)	7 (28.0)
≥56	29 (8.6)	4 (13.8)	14 (48.3)	11 (37.9)
Males	130 (38.7)	10 (7.7)	73 (56.2)	47 (36.2)
Highest education				
Pretertiary	51 (15.2)	15 (29.4)	19 (37.3)	17 (33.3)
Tertiary	147 (43.8)	13 (33.3)	81 (43.8)	53 (47.3)
Postgraduate	138 (41.1)	11 (8.0)	85 (61.6)	42 (30.4)
Employment status				
Employed	272 (81.0)	26 (9.6)	155 (57.0)	91 (33.5)
Seeking employment/retired	19 (5.7)	4 (21.1)	8 (42.1)	7 (36.8)
Student	45 (13.4)	9 (20.0)	22 (48.9)	14 (31.1)
Working from home ^b				
Yes	203 (74.6)			
No	34 (12.5)			
Sometimes	35 (12.9)			
Working in essential services ^c	60 (87.0)			
Anxiety, mean (SD)	3.13 (1.51)			
GAD-2 scores ≥3	167 (49.7)	23 (13.8)	90 (53.9)	54 (32.3)
Depression, mean (SD)	3.24 (1.55)			
PHQ-2 scores ≥3	179 (53.3)	19 (10.6)	89 (49.7)	71 (39.7)
Wear a mask in public		39 (11.6)	185 (55.1)	112 (33.3)
Observe ≥1 m social distancing		25 (7.4)	127 (37.8)	184 (54.8)
Perform hand hygiene		96 (28.6)	78 (23.2)	162 (48.2)
Excessive purchase of necessities		96 (28.6)	78 (23.2)	162 (48.2)
Find out more about COVID-19		96 (28.6)	78 (23.2)	162 (48.2)

Note: SD, standard deviation.

^aEleven participants chose not to provide their age.

^bPercentages presented are representations within participants who were employed, $n = 272$.

^cPercentages presented are representations within participants who were not working from home, $n = 69$; GAD-2, Generalized Anxiety Disorder two-item; PHQ-2, Patient Health Questionnaire two-item.

precautions (60.7% to 67.7%; $z = -3.9, p < .01$). Before the CB, with each unit increase in CFCf, the odds of mask-wearing (odds ratio [OR] = 1.39; 95% confidence interval [CI] 1.08–1.79), social distancing (OR = 1.48; 95% CI 1.16–1.88), hand hygiene (OR = 1.36; 95% CI 1.07–1.73), and finding more information (OR = 1.52; 95% CI 1.18–1.97) increased significantly (Table 2). With each unit increase in CFCi, the odds of hand hygiene (OR = 1.21; 95% CI 1.01–1.43) and buying more necessities (OR = 1.33; 95% CI 1.02–1.73) increased significantly. During the CB, CFCf continued to be a significant predictor of social distancing (OR = 1.67; 95% CI 1.13–2.48), hand hygiene (OR = 1.46; 95% CI 1.12–1.91) and finding more information on COVID-19 prevention (OR = 1.45; 95% CI 1.11–1.90). However, CFCi was no longer a significant predictor of any behavior. Instead, we observed that the odds of finding more information on COVID-19 prevention increased

significantly with rising anxiety levels (OR = 1.28; 95% CI 1.02–1.60).

Finally, MANOVA results showed significant differences between the three groups (i.e., continued nonperformance; increased in performance; and continued high performance) for the combined variable effect of CFC, anxiety, and depression for all the behaviors except excessive buying (Supplementary File 1). A posthoc test showed that the mean CFCf scores were significantly higher in those who maintained high-performance than those who continued low-performance for wearing a mask in public, social distancing, hand hygiene and finding out more information (Supplementary File 2). Significantly higher mean CFCf scores were also found in those who increased their performance compared to those who continued non-performance of social distancing.

Table 2 | Descriptive statistics and predictors of each behavior two weeks before and after the circuit breaker which started on April 7, 2020 ($n = 336$)

COVID-19 behaviors	Before circuit breaker measures		After circuit breaker measures	
	High performer (%)	Logistics regression Odds ratio (95% CI)	High performer (%)	Logistics regression Odds ratio (95% CI)
Preventive behaviors				
Wearing a mask	35.7		88.4	
CFCFf		1.39 (1.08, 1.79)*		1.34 (0.96, 1.85)
CFCFi		1.15 (0.96, 1.37)		1.26 (0.94, 1.69)
GAD-2		1.04 (0.85, 1.28)		0.87 (0.65, 1.16)
PHQ-2		1.05 (0.86, 1.30)		1.13 (0.84, 1.52)
Observe ≥1 m social distancing	56.8		92.6	
CFCFf		1.48 (1.16, 1.88)**		1.67 (1.13, 2.48)*
CFCFi		1.08 (0.91, 1.29)		1.24 (0.87, 1.77)
GAD-2		1.03 (0.85, 1.26)		1.05 (0.71, 1.54)
PHQ-2		0.96 (0.79, 1.17)		0.89 (0.63, 1.26)
Hand hygiene	51.8		71.4	
CFCFf		1.36 (1.07, 1.73)*		1.46 (1.12, 1.91)*
CFCFi		1.21 (1.01, 1.43)*		1.20 (0.98, 1.48)
GAD-2		1.05 (0.86, 1.28)		1.24 (0.98, 1.57)
PHQ-2		0.98 (0.81, 1.20)		0.96 (0.77, 1.19)
Social behaviors				
Excessive buying of necessities	11.6		17.9	
CFCFf		1.17 (0.80, 1.71)		1.16 (0.85, 1.59)
CFCFi		1.33 (1.02, 1.73)*		1.19 (0.96, 1.49)
GAD-2		0.96 (0.72, 1.28)		1.14 (0.89, 1.45)
PHQ-2		1.34 (1.00, 1.79)		1.13 (0.88, 1.45)
Increased COVID-19 information searching	60.7		67.6	
CFCFf		1.52 (1.18, 1.97)**		1.45 (1.11, 1.90)**
CFCFi		1.16 (0.96, 1.40)		1.15 (0.94, 1.40)
GAD-2		1.11 (0.90, 1.36)		1.28 (1.02, 1.60)*
PHQ-2		0.97 (0.79, 1.19)		0.99 (0.80, 1.22)

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; CFCf, Consideration of Future Consequences future subscale; CFCi, Consideration of Future Consequences immediate subscale; GAD-2, Generalized Anxiety Disorder two-item; PHQ-2, Patient Health Questionnaire two-item.

DISCUSSION

In this study, all five behaviors were significantly increased after the start of the CB, which was expected. This showed the effectiveness of implementing a nation-wide health policy that mandates socially responsible behaviors monitored by designated personnel. The interesting finding was that CFCf significantly predicted all behaviors before and after CB initiation except excessive buying, which was instead predicted by CFCi and anxiety (Table 1). Anxiety was positively associated with hand hygiene and excessive buying only after CB initiation, explaining the phenomenon of panic buying, domestic stockpiling or “hoarding” that was not only observed in Singapore but also in other countries. In New Zealand, grocery spending’s spiked by 40% while in Malaysia sales of hand sanitizer increased by 800% [17]. This was also previously observed in the panic response in China during the Severe Acute Respiratory Syndrome outbreak in 2003 [18]. In line with our observation that those with higher levels of anxiety also tended to perform more hand hygiene and COVID-19 information searching, this presents an opportunity to enhance preventive behaviors [19]. Hand hygiene and increased COVID-19 information searching were significantly associated with both CFCf and CFCi, indicate a comparative value of both their immediate and future behavioral consequences. CFCf continued to predict better preventive behavior performance, supporting our first and third hypotheses. On the other hand, CFCi predicted hand hygiene, excessive buying and increased COVID-19 information searching before the CB, partially rejecting our second hypothesis that CFCi will be negatively associated with all COVID-19 response behavior performances.

Our findings support existing literature that individuals with higher CFCf tend to perform better at preventive behaviors such as exercise, healthy eating, screening, and vaccination. This could be related to the higher appeal, relatability, and immediacy of certain undesirable behaviors [8, 20]. Thus, we speculate that the three behaviors (i.e., cleaner hands, obtaining necessities, and obtaining information) were predicted by CFCi due to their relative immediacy and salience as compared to the delayed benefits of wearing a mask and social distancing (i.e., prevent themselves and their families from COVID-19 infections). Our study contributes to current evidence that the two constructs may differ in predictive capacity for behaviors with immediate or delayed outcomes.

Our study was limited by the sample comprising of younger and higher-educated participants with a greater female representation (61.3%). Moreover, our sample was smaller than required. Therefore, there is a need to validate of our findings with a larger, more representative population although we accounted for demographic differences in our analyses.

CONCLUSION

To the best of our knowledge, this is the first study to show the association between CFC and pandemic response behaviors. The different predictive effects of CFCi and CFCf on different behaviors suggests the importance of health message framing in promoting preventive behaviors. For example, messages aimed at increasing preventive behaviors with delayed benefits could focus on future benefits while those aimed at reducing risky behaviors could focus on immediate outcomes. Pandemic prevention and social behaviors observe no spatial-temporal boundaries. To improve public pandemic response behaviors, promotional efforts have to be based on the understanding of public motivations to enhance the resource efficiency of pandemic containment and mitigation. Concerning the current COVID-19 pandemic, our study found that emphasizing on the consideration of future consequences of one’s behavior would improve the proactive performance of preventive behaviors with future benefits (i.e., wearing of masks in public, social distancing and hand hygiene, and the social behavior of increased information searching). The consideration of future consequences was also highlighted in our study to be associated with increased performance and sustained high performance of these prevention behaviors over time. The findings suggest that we could improve pandemic response behavior compliance by highlighting the larger value of future benefits in relation to its immediate costs in public health promotion campaigns.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Translational Behavioral Medicine* online.

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Compliance with Ethical Standards

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