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Multiple forms of mass anxiety in coronavirus disease-2019 pandemic

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ABSTRACT

Background: Heightened public anxiety was observed at the early stage of the COVID-19 pandemic. Our study enriches scholarly understanding of this mass response by investigating both generic and pandemic-specific anxiety that explain preventive health behavior.

Methods: In our two-phase, mixed-methods study, pandemic-specific anxiety items elicited during the qualitative phase from March 2-8, 2020 were then tested in the quantitative phase from March 16-22, 2020. Eligible participants were U.S. or U.K. residents aged 18-65.

Results: Of the 1,400 participants, 52% met the criteria for moderate to severe anxiety. In addition to anxiety over possible personal COVID-19 infection, participants were also anxious about others’ health, others’ reactions (e.g., panic-buying, discrimination), societal problems (e.g., economic slowdown, healthcare system breakdown), and personal finances. The positive association between generic anxiety and hygiene practice frequency was explained by two interpersonal-oriented forms of pandemic-specific anxiety: anxiety over others’ health (b = 0.0040, 95% CI: 0.0031-0.0050) and others’ reactions (0.0031, 0.0021-0.0042).

Limitations: The study was conducted with participants from developed countries at an early stage of the pandemic, and the results were not necessarily generalizable to developing countries or other stages of the pandemic. Also, hygiene practices was the sole behavior of interest, and the findings may differ for other behaviors.

Conclusions: The new findings indicate the importance of adopting a nuanced approach that unveils the multifaceted nature of anxiety using a mixed-methods design. Individuals from COVID-19-affected regions experience pandemic-specific anxiety due to concerns related to not only personal but also interpersonal-oriented issues.

1. Introduction

Coronavirus Disease-2019 (COVID-19) is caused by a novel virus that is highly transmissible (Anastassopoulou et al., 2020; Choi and Ki, 2020; Wang et al., 2020). This unknown disease has triggered a global pandemic that had infected nearly 16 million people from 192 regions worldwide as of May 12, 2021, with the global death toll exceeding 3 million (Johns Hopkins Coronavirus Resource Center, 2021, May 12). The sudden surge in critical COVID-19 cases has overwhelmed the healthcare systems of many countries, imposing intense anxiety on medical staff worldwide (e.g., Lenzo et al., 2021; Liu et al., 2021).

Beyond patients and healthcare professionals, the pandemic is affecting huge numbers of people in the community, with widespread public anxiety and socioeconomic upheaval observed all over the world (e.g., Cheng et al., 2021; Fancourt et al., 2021). For instance, false news and misinformation about the unknown virus disseminated online have made many individuals feel fearful and confused (Cheng et al., 2020; Freiling et al., 2021). Stores worldwide have seen the panic buying of groceries and personal hygiene products, and such hoarding behavior has instigated price gouging and the disruption of critical medical supplies (Collett, 2020; Leung et al., 2020). Further, stock markets have witnessed panic sell-offs, provoking a global crash in February and March of 2020 (Higgins, 2020; Yoon, 2020). Public fear about contracting an unknown disease, together with public self-quarantine policies and travel bans, has led to the mass avoidance of social activities and travel; and sharp curbs in consumption have compounded the societal problems of economic slowdown and unemployment (Kocher and Barroso, 2020; Rushe and Holpuch, 2020). Fears of infection have also fueled stigmatization and discrimination against certain social groups (Lin, 2020; Zhai and Du, 2020). All of these phenomena suggest that the COVID-19 pandemic’s impact far exceeds its health threat, with the disease likely to have far-reaching repercussions for public well-being.

Keywords:
- Anxiety
- COVID-19
- Mental health
- Panic
- Preventive health behavior
- Psychological well-being

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and other aspects of society.

To explain health anxiety and health behaviors, scholars typically espouse an individual approach (e.g., Fergus and Asmundson, 2019; Lebel et al., 2020). The oft-cited cognitive-behavioral models of health anxiety highlight the role of dysfunctional health-related thoughts that hamper rational decision-making, resulting in the deployment of maladaptive coping behaviors (Asmundson et al., 2010). These models are highly useful in explicating, predicting, and treating the behaviors of individuals with heightened health anxiety and hypochondriasis (Marcus et al., 2007). However, their explanatory utility is rather limited in the present pandemic, with numerous questions about the newly emerged virus still awaiting answers (Vetter et al., 2020). For example, the symptoms of COVID-19 are ambiguous owing to their similarity to the symptoms of other viruses (World Health Organization 2020). As noted above, the global COVID-19 pandemic has aroused intense public anxiety observed worldwide during the early stage of the pandemic is not entirely unfounded. It may even be adaptive in raising individuals’ awareness of the need to adopt health behaviors to prevent contracting the highly contagious disease.

The individual approach has also been used in research on public anxiety during outbreaks of other atypical viruses, including Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS), with generic anxiety assessed in most such studies (Alsubaie et al., 2019; Cheng and Cheung, 2005). Studying generic anxiety can yield valuable data on the overall level of anxiety experienced during outbreaks. As noted above, the global COVID-19 pandemic has aroused widespread public anxiety pertaining to a variety of issues, but the particular sources of anxiety that exert a salient impact on public well-being remain unknown. Also, the underlying psychological mechanisms that drive people’s reactions are unexplored. The study of generic anxiety should thus be supplemented by study of pandemic-specific anxiety to fill these knowledge gaps.

The present study provides a comprehensive perspective that examines both generic and multiple forms of pandemic-specific anxiety. Our study aims to (a) identify the dimensions of anxiety experienced during the pandemic, (b) estimate the prevalence of moderate to severe generic anxiety in the general population, and (c) test the hypothesized role of pandemic-specific anxiety in explaining the association between generic anxiety and preventive health behavior.

2. Methods

2.1. Research design and study sample

This study employed a two-phase, mixed-methods research design. The initial qualitative phase of item elicitation (n = 123, 52% men) was designed to address the first study aim, with a follow-up quantitative phase using survey methodology (n = 1400, 48% men) then addressing the second and third aims. In both phases, we recruited community adults through an online crowdsourcing platform with a large, diverse participant pool. Participants were prescreened for age (18-65) and survey track record to ensure good data quality (task approval rate > 95%), and there was no overlap in participants between the two phases. In Phase 2, we added a third prescreening filter, namely, nationality (U.S. and U.K., n = 700 each) because the survey platform allowed quota sampling to obtain representative samples from these two populations only.

2.2. Measures

The outcome variable was hygiene practices, the primary preventive measure recommended by the WHO and many governments worldwide (World Health Organization 2020). We assessed this variable (e.g., practicing hand hygiene, cough etiquette) using a modified measure developed and validated for the SARS outbreak (Cheng and Ng, 2006). We used the same measure to gauge cognitive (personal infection susceptibility and severity) and affective (anxiety over possible personal infection) responses to the COVID-19 pandemic. Generic anxiety was measured by the commonly used State–Trait Anxiety Inventory Form Y–1 (Spielberger, 1983), with the well-known cutoff score of 44 indicating moderate to severe anxiety symptoms. At the end of the survey, participants were instructed to report their sex, age, education level, employment status, income level, marital status, and ethnicity.

2.3. Procedures

This study is a part of a large multinational project entitled “Psychological Responses to COVID-19 Epidemic” (PRICE). After obtaining ethical approval from the Institutional Review Board of the corresponding author’s university, we carried out a qualitative elicitation study to identify contextually meaningful and salient items for the COVID-19 pandemic. Phase 1 took place during the week of March 2–8, 2020. Participants responded to an open-ended question asking them to list the issues that were causing them anxiety during the pandemic. Their answers were first coded by two trained coders independently, and both coders then reviewed their lists to combine semantically similar items and remove redundant ones. Items cited by less than 2% of participants were omitted, yielding a concise list of 16 items (see Table 1). In Phase 2, we conducted an anonymous online survey from March 16–22, 2020, a week that saw the number of confirmed COVID-19 cases...
in the U.S. and U.K. begin to surge (to around 9000 and 2600, respectively; Johns Hopkins Coronavirus Resource Center, 2021, May 12). In both phases, online informed consent was obtained from all participants before survey commencement, and they were paid upon completion.

2.4. Statistical analysis

The principal factor analytic approach was adopted to identify latent constructs from the pandemic-specific anxiety items derived from the elicitation phase. We followed standard procedures to reach a high-quality decision for an optimal factor solution (Conway and Huffcutt, 2003). First, the principal axis factoring technique was used for factor extraction, with items having a factor loading of >0.30 retained in the solution. Second, we determined the appropriate number of factors based on the eigenvalue (> 1), scree test (bending point of the scree plot), and proportion of cumulative explained variance (> 60%). Third, as recommended (Tabachnick and Fidell, 2007), we performed promax oblique rotation to address potentially correlated factors. Before performing these analyses, we checked both the Kaiser-Meyer-Olkin (KMO) index and Bartlett’s test of sphericity. A KMO index greater than 0.50 and significant Bartlett’s test (p < 0.05) indicated sampling adequacy for principal factor analysis.

We computed the unadjusted odds ratio (OR) to determine the magnitude of the association between a given demographic variable and generic anxiety in the sample. In addition, we performed an independent-samples t-test to compare the mean of the study variables between the moderate/severe anxiety group and no/mild anxiety group, and analysis of variance to examine the demographic differences in each study variable.

Finally, we performed multiple hierarchical regression to scrutinize the associations between psychological (cognitive and affective) responses and hygiene practices. We employed the common bootstrap method with 5000 replications, with bias-corrected and accelerated confidence intervals (CI) obtained. In the first regression model, generic anxiety and the demographic variables with significant effects were entered. In the second model, all of the pandemic-specific variables were entered to evaluate the incremental explanatory utility of this new set of variables for hygiene practices. We further verified the hypothesized mediation effects by running Hayes’ PROCESS macro for SPSS version 3.4 (Hayes, 2018). This program utilizes bootstrapping to evaluate both direct and indirect effects. A significant indirect effect and non-significant direct effect reflect full mediation, whereas significant indirect and direct effects reflect partial mediation. The mediation analyses were carried out using PROCESS Model 4 with 5000 bootstrap replications (Hayes, 2018). All of the statistical analyses were conducted using SPSS version 23.0 (IBM Corp., Armonk, NY).

3. Results

3.1. Sample characteristics

The survey sample contained 1400 adults, with slightly more women (52%). The average age was 42±20 (SD = 13±01, range: 18–65). Most participants were university graduates or current undergraduates (39%), and 32% had attended a college or technical school. Almost half of the sample (48%) worked full-time, and 20% working part-time. The median annual household income range was $30,000–$40,000. Nearly half of the sample (48%) was single, divorced, separated, or widowed; 23% of the participants partnered or married without children; and 29% had children. The participants were predominantly white (84%).

3.2. Identification of pandemic-specific anxiety

Principal axis factoring was conducted because the KMO index (0.88) indicated a high degree of data factorability and the Bartlett’s test was significant (p < 0.0001). We applied the eigenvalue-greater-than-one rule and obtained a four-factor solution. The scree plot provided further support for the solution, which accounted for 61% of the cumulative explained variance. Table 1 shows the promax-rotated factor loadings for the four factors. The internal consistency of the entire 16-item scale was high (Cronbach’s alpha = 0.88).

The four factors were interpretable and practically useful for unveiling the various sources of anxiety experienced during the pandemic. The first factor captured concerns regarding possible infection or adverse health condition of the members of one’s social network and those in the wider community, which we interpreted as ‘others’ health.’ The second factor referred to issues that have arisen in society, such as a deteriorating economy and healthcare system breakdown, which we interpreted as ‘societal problems.’ The third factor focused on concerns pertaining to other people’s responses to events and policies during the pandemic, and we thus labeled it ‘others’ reactions.’ Finally, the fourth factor comprised personal matters pertaining to work and finances, and we termed it ‘personal finances.’

The overall factor solution was clean. Only one item—‘the pandemic’s economic implications’—loaded onto both the ‘societal problems’ and ‘personal finances’ factors, indicating that the participants feared that the economic aftermath of the pandemic would have an adverse impact on both society and their own financial status. We retained this item on the higher loaded factor of ‘societal problems.’

3.3. Prevalence of generic anxiety and demographic differences

For generic anxiety, slightly more than half the participants (52%) met the criteria for moderate to severe anxiety. The prevalence rate was almost identical for the U.S. and U.K. samples (OR = 0.96, 95% CI: 0.77–1.18). No demographic differences were found other than sex, with the female participants more susceptible to moderate to severe anxiety than their male counterparts (OR = 1.09, 95% CI: 1.40–2.46). The results showed the prevalence of generic anxiety to be high and largely universal, varying only between the sexes.

The results of comparisons between the participants with moderate or severe anxiety and those with no or mild anxiety are summarized in Table 2. Compared to the no/low anxiety group, the moderate/severe anxiety group generally (a) perceived themselves to have greater susceptibility to COVID-19 infection and such possible personal infection to be more severe, (b) reported higher levels of all five types of pandemic-specific anxiety, and (c) adopted hygiene practices more frequently. The demographic differences in all of the foregoing variables are presented in Table 3. As sex, income, and marital differences were identified in the adoption of hygiene practices, these demographic variables were included in the regression analysis.

![Table 2](image-url)
3.4. Associations between multiple forms of anxiety and health behavior for COVID-19 prevention

The results of hierarchical regression analysis are summarized in Table 4. Generic anxiety, sex, and marital status (with vs. without children) were significantly associated with hygiene practices in the initial model. However, the association between generic anxiety and hygiene practices was no longer significant after the pandemic-specific variables had been entered. Five of these variables were significantly associated with hygiene practices: personal infection susceptibility, personal infection severity, anxiety about others’ health, anxiety about others’ reactions, and anxiety about personal finances. All of these variables had significantly positive associations, except for personal infection susceptibility that had a significant inverse association.

The explanatory mechanisms of the three pandemic-specific anxiety reactions, and anxiety about personal finances. All of these analyses revealed generic anxiety to exert a significant indirect effect on the adoption of hygiene practices through anxiety about others’ health ($B = 0.0040, SE = 0.0005, 95\% CI: 0.0031–0.0050$), whereas its direct effect was non-significant ($B = 0.0003, SE = 0.0011, 95\% CI: –0.0018–0.0024$). Similarly, the indirect effect of generic anxiety on the adoption of hygiene practices through anxiety about others’ reactions was significant ($B = 0.0031, SE = 0.0005, 95\% CI: 0.0021–0.0042$), although its direct effect was not ($B = 0.0012, SE = 0.0011, 95\% CI: –0.0010–0.0033$). These results document full mediation effects for both forms of interpersonal-oriented pandemic-specific anxiety. However, generic anxiety was found to exert a significant indirect effect on the adoption of hygiene practices through anxiety about personal finances ($B = 0.0021, SE = 0.0004, 95\% CI: 0.0013–0.0031$) and its direct effect was also significant ($B = 0.0022, SE = 0.0011, 95\% CI: 0.0001–0.0043$), demonstrating partial mediation for this form of pandemic-specific anxiety.

4. Discussion

In this study conducted at the early stage of the COVID-19 pandemic, the prevalence of moderate-to-severe anxiety was higher than that reported in the literature in general (Azar and Singer, 2012; Tuokko and Hadjistavropoulos, 2014), but similar to that in studies conducted during the SARS outbreak (Cheng and Cheung, 2005; Xie et al., 2011). It is important to note that we assessed state rather than trait anxiety, and thus our findings do not necessarily imply that half of our participants suffer from chronic anxiety or generalized anxiety disorder. Rather, generic anxiety levels were found to be positively associated with hygiene practices, indicating that individuals who are more (vs. less) anxious in the initial stage of a pandemic tend to adopt this preventive health behavior more (vs. less) frequently. Hence, in the current pandemic, anxiety experienced early on may have been adaptive in alerting individuals to the need to adopt health behaviors to prevent COVID-19 infection.

Our new findings further highlight the complex nature of the anxiety experienced during the ongoing pandemic. Previous theories of and findings on health anxiety have focused primarily on how an individual’s perception of a disease or illness influences his or her adoption of preventive health behaviors (Asmundson et al., 2010). Using a more nuanced approach, we found that the anxiety experienced during the COVID-19 pandemic involves multiple issues, not only those of individuals themselves, but also those of the people around them and society as a whole. More importantly, we found that a major reason for some individuals’ adoption of hygiene practices to cope with the pandemic is anxiety about other people’s health condition. Such anxiety may stem from widely disseminated media stories about so-called COVID-19 “super-spreaders.” One of the most notable “super-spreaders” was a South Korean church member, dubbed “Patient 31,” who was identified as the source of a collective infection in her church that accounted for more than half of total confirmed cases in the entire country (Hockaday, 2020). Such pandemic-specific anxiety is also reflected in the tragic case of an Indian man who mistakenly thought he

Table 3
Demographic differences in COVID-19 pandemic-specific psychological responses.

| Study variable | Sex | Age | Ethnicity | Education level | Employment status | Household income | Marital status |
|----------------|-----|-----|-----------|-----------------|-------------------|-----------------|---------------|
| Cognitive response – Personal infection susceptibility | 4.09** | 2.49 | 15.56** | 2.74* | 2.84 | 1.71 | 0.98 |
| Cognitive response – Personal infection severity | 4.09** | 8.86** | 2.27 | 5.54** | 5.33** | 1.60 |
| Anxiety – Personal infection | 3.72** | 1.36 | 0.002 | 1.22 | 2.72 | 0.59 | 2.06 |
| Anxiety – Personal finances | 6.07** | 1.407** | 0.28 | 0.49 | 1.92 | 5.49** |
| Anxiety – Others’ health | 3.04** | 1.55 | 1.46 | 2.02 | 0.41 | 1.75 | 4.17 |
| Anxiety – Others’ reactions | 2.74** | 1.95 | 1.75 | 1.15 | 1.51 | 1.88 |
| Anxiety – Societal problems | 3.97** | 11.58 | 1.88 | 0.91 | 1.15 | 3.29** |
| Outcome behavior – Hygiene practices | 3.53** | 0.67 | 1.06 | 0.59 | 1.81 | 3.69** | 10.25** |

* $p < 0.05$.  ** $p < 0.01$.

Table 4
Hierarchical regression analysis with hygiene practices as dependent variable.

| Model | Regressor | $b$ | SE | BCA 95% CI lower | BCA 95% CI upper |
|-------|-----------|-----|----|-----------------|-----------------|
| 1     | Sex       | 0.122** | 0.031 | 0.063–0.182 | 0.040–0.263 |
|       | Income    | 0.005  | 0.005 | –0.004–0.015 | 0.000–0.010 |
|       | Marital status–partnered | 0.020 | 0.038 | –0.053–0.096 | 0.002–0.037 |
|       | Marital status–children | 0.110* | 0.042 | 0.028–0.192 | 0.000–0.029 |
|       | Generic anxiety | 0.044** | 0.001 | 0.002–0.070 | 0.000–0.047 |
| 2     | Sex       | 0.101** | 0.029 | 0.044–0.158 | 0.000–0.051 |
|       | Income    | 0.009  | 0.005 | –0.001–0.018 | 0.000–0.010 |
|       | Marital status–partnered | 0.005 | 0.036 | –0.066–0.077 | 0.000–0.023 |
|       | Marital status–children | 0.097* | 0.040 | 0.020–0.175 | 0.000–0.041 |
|       | Generic anxiety | –0.001 | 0.001 | –0.004–0.001 | 0.000–0.000 |
|       | Cognitive response – Personal infection susceptibility | –0.045 | 0.019 | –0.083–0.006 | 0.000–0.039 |
|       | Cognitive response – Personal infection severity | 0.049* | 0.022 | 0.006–0.092 | 0.000–0.074 |
|       | Pandemic-specific anxiety – Personal infection | 0.010 | 0.026 | –0.039–0.060 | 0.000–0.054 |
|       | Pandemic-specific anxiety – Personal finances | 0.041* | 0.019 | 0.003–0.078 | 0.000–0.044 |
|       | Pandemic-specific anxiety – Others’ health | 0.191** | 0.029 | 0.135–0.246 | 0.000–0.075 |
|       | Pandemic-specific anxiety – Others’ reactions | 0.054* | 0.027 | 0.001–0.106 | 0.000–0.048 |
|       | Pandemic-specific anxiety – Societal problems | –0.022 | 0.029 | –0.079–0.003 | 0.000–0.030 |

Note. BCA = Bias-corrected and accelerated intervals derived from bootstrapping of 5000 samples. CI = confidence interval. Sex was coded as a dummy variable (0 = male, 1 = female). Marital status was recoded into two dummy variables: marital status–partnered (0 = single/widowed/separated/divorced, 1 = married/cohabitating) and marital status–children (0 = without children, 1 = with children).
had contracted COVID-19. He became so anxious about the possibility of infecting his fellow villagers that he proactively quarantined himself and subsequently committed suicide (Goyal et al., 2020).

Another major dimension of pandemic-specific anxiety relates to the reactions of other members of society, further indicating that COVID-19 infection is more than a threat to physical health, but can have broader social implications. The case of “super-spreader” Patient 31 sparked a wave of fury among the South Korean public, prompting the church’s founder to make a tearful public apology on his knees (Hockaday, 2020). In other parts of the world, a number of healthy Asians wearing face-masks were mocked or even assaulted (Lin, 2020; Zhai and Du, 2020). These and other similar instances demonstrate that social pressure can exert a more adverse impact on individuals than the infection itself, thereby supporting our espousal of a novel nuanced approach to examining context-specific anxiety during the current pandemic.

The new findings presented herein have practical implications for the design of public education programs for COVID-19 prevention. Most of the preventive measures so far recommended by the WHO and governments worldwide are based on an individual approach that directly targets the intended audience. For example, in February 2020, the WHO published a list of basic protective measures against COVID-19 infection, educating the general public in what to do and how to implement the measures properly (World Health Organization 2020). However, the general public response to such recommendations has been rather muted, which is unsurprising when viewed in light of our finding that anxiety over the possibility of contracting COVID-19 oneself plays a minor role in the decision to adopt hygiene practices. The main reason to adopt such practices, according to our results, is actually fear over the possibility of infecting the members of one’s social network and other people in the wider community. In short, our findings imply that public education messages highlighting the danger of infecting significant others and vulnerable social groups may be more persuasive than those emphasizing the danger to individuals themselves.

4.1. Limitations

Before concluding, we must acknowledge several limitations of this study, which suggest directions for future research. First, the participants were community adults in the U.S. and U.K., both developed countries with high national income levels. Our findings may not be generalizable to other countries, especially developing countries with low national income levels and scarce healthcare resources. Further research conducted in countries at diverse stages of socioeconomic development is recommended to evaluate the generalizability of our findings. Second, it is noteworthy that the study was conducted in mid-March of 2020, when the U.S. and U.K. were still in the initial stages of the pandemic. As studies have documented fluctuating affective and behavioral responses across various phases of the SARS outbreak (Chen et al., 2006; Cheng and Cheung, 2005), the present findings are not necessarily applicable to responses displayed at other stages of the COVID-19 pandemic. Follow-up studies should be conducted to capture the trajectory of change in responses across various phases of the pandemic. Finally, hygiene practice was the sole behavior assessed in this research. Anxiety may play a different role in other types of behavior, particularly in socially undesirable behavior such as the stockpiling of daily essentials. Future studies should examine a wider range of outcome behaviors to broaden the scope of our research.

5. Conclusions

In summary, the findings of this study indicate that the COVID-19 pandemic not only constitutes a physical health crisis, but also poses significant threats to mental health worldwide. Slightly more than half of our participants from the U.S. and U.K. reported moderate to severe anxiety. Our work, which adopted a nuanced approach, enriches the anxiety literature by revealing the complex nature of this mental health problem, which comprises multiple personal, interpersonal, and societal issues related to the pandemic. Such complexity was well-expressed by one of our participants, who wrote:

“My concerns on this matter [COVID-19 pandemic] relate more to how people are responding rather than [to] the virus itself. I have elderly parents and some quite ill relatives. I wouldn’t [sic] like to get the virus and present any further risk to them. I do not, however, consider myself getting the virus to be a massive concern. People reacting badly (the bulk buying, reports of people breaking curfews or being anti-social) to the current situation is something that could impact me negatively. It’s an indirect impact of the situation as a whole, rather than the virus itself.” (Case# UU2-0302)

Contributors

All authors contributed to the study concept and design. CC and HW managed the dataset, and analyzed and interpreted the data. CC wrote the first draft of the manuscript. HW and LC critically revised it and added important intellectual content. CC obtained research funding and supervised the study. All authors have reviewed and approved the final version of the manuscript for publication.

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Conflict of Interest

The authors have no conflicts of interest to declare.

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Supplementary materials

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