Moderating effect of people-oriented public health services on depression among socially isolated people during COVID-19: A cross-sectional study in China

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Research Article

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Abstract

Background: Public health measures including social isolation are essential for COVID-19 control, but also increase the risk of depression. This study examined the influencing and moderating factors on socially isolated people's depressive symptoms.

Methods: Data were collected from people in mandatory home or centralized social isolation in Shenzhen, China from February 28 to March 6 in 2020. We assessed their perceived COVID-19 risk, perceived tone of media coverage, perceived quality of people-oriented public health services, and depressive symptoms. Three stepwise multiple regressions were performed to examine the moderating effects controlling age, gender, education, monthly income, socially isolated venue, time spent on COVID-related news, and online social support.

Results: We examined data from 340 people. 57.6% men, averaged age at 35.5 years old (SD = 8.37), 55.6% held bachelor's degree or above. Overall, people in social isolation reported a moderate level of depressive symptoms (M = 1.24, SD = 0.4). The perceived susceptibility of being infected was relatively low (M = 1.36, SD = 0.54), and the perceived tone of media coverage was mainly positive (M = 1.97, SD = 1.05). In terms of perceived quality of public health services, 3.2% (n = 11) participants reported low-level, 49.1% (n = 167) medium-level, and 47.6 (n = 162) high-level quality of people-oriented services. Perceived risk was significantly associated with depression (β = .12, p < 0.01), and perceived tone of media coverage was negatively associated with depression (β = -.05, p < 0.01). The quality of people-centered public health service moderated the association between perceived risk and depressive symptoms (β = -.15, p < 0.05), and the relationship between perceived tone of media coverage and depressive symptoms (β = .01, p < 0.01).

Conclusions: This study found that people-oriented public health services reduced the effect of risk perception and media tone on depressive symptoms among COVID-19 socially isolated people, suggesting a critical role for frontline public health workers in protecting public mental health.

Background

COVID–19 which broke out in Wuhan, China in December 2019, has now affected more than 200 countries. According to World Health Organization (WHO), globally there are more than 5.8 million confirmed cases of COVID–19 and 362,705 deaths to date [1]. To confront this public health crisis, social isolation is a cornerstone of an effective public health response [2]. Social isolation can prevent transmission to close contacts and others. Dozens of cities started social isolation policies since late January in China.

Although public health and epidemiology research has demonstrated mass quarantine as an effective preventive measure, scholars have also called for attention to use social isolation with caution and pay attention to its adverse effect on mental health [3]. Social isolation involves social separation and restriction of movement and is known to generate a variety of psychological issues, such as depression, anxiety, negative affect, and anger [2]. These mental health problems are largely related to worry about
possibly being infected, distress and boredom due to confinement, reduced social and physical contact with others, and disruption to normal routines during the social isolation [4]. Depression is the most prevalent mental health concern linked to COVID−19 in China [5]. Previous research suggests that the negative influence of social isolation may persist for three years after the period of isolation [6].

There is variability in the extent to which people experience depressive symptoms, and this may be highly contingent upon a variety of factors. Perceptions, such as people's perceived risk and the perceived tone of media coverage, are likely to influence depressive symptoms. First, perceived risk - individuals' subjective awareness and judgment of the risk [7], is often assessed by perceived severity and perceived susceptibility of a certain disease. Perceived severity indicates the extent to which people believe the outcomes of being infected are fatal [8]; while perceived susceptibility refers to the possibility that people think they will get infected. High perceived severity and perceived susceptibility contribute to high risk perception of COVID−19 infection and are likely associated with depressive symptoms [9]. Second, the media is an indispensable channel to disseminate news and information on the COVID−19 pandemic, and shape how people understand the outbreak situation during the period of social isolation. The tone of media coverage, due to different stands and points of view, can be varied from positive and encouraging to negative and hopeless. The tone of the media has implications on mental health. Socially isolated people who are exposed to a negative tone of media coverage, are more likely to encounter depression in context of pandemic outbreaks [10].

The influence that public health services have on socially isolated people's mental health have been overlooked. During this COVID−19 epidemic, China was the first country to implement the social isolation policies. These policies were accompanied by multiple public health services. Community-based public health service providers are responsible for providing daily support to those who are placed in social isolation. The major public health services provided to the socially isolated people include delivering daily meals, offering necessities, monitoring body temperature, and providing primary guidelines for seeking medical help if needed [11]. The frontline public health staff who provide these services are the main sources of in-person human contact during the social isolation, and they may play an important role in their mental health. The provision of high quality of people-oriented public health services may attenuate depressive symptoms of those in social isolation and low-quality community-based public health services may intensify depressive symptoms.

In addition, the quality of received public health services may also moderate the relationship between perceived risks and depressive symptoms, as well as the relationship between perceived tone of media coverage and depressive symptoms among people in social isolation. For those who have high risk perception, high quality of people-oriented public health services may provide comfort and security that may associate with fewer depressive symptoms, while low-quality public health services may exacerbate negative feelings and associate with greater depressive symptoms. Similarly, for those who perceive a negative tone of the media coverage, high quality of people-oriented public health services could buffer these negative feelings, which would be associated with lower depressive symptoms; while high quality
of people-oriented public health services can also enhance the positive perception of media coverage, and thereby would be associated with lower depressive symptoms among socially isolated people.

This study aims to examine the association between perceived risk, perceived tone of media coverage, and the quality of public health services on depressive symptoms among people undergoing mandatory home-based or centralized social isolation in context of the COVID–19 pandemic. This study can raise scholarly attention on the moderating role of public health services on mental health among the socially isolated people during the epidemic.

**Methods**

**Research context**

Given the rapid expansion of the epidemic, many provincial- and municipal-level Chinese governments initiated the highest-level of response to a major public health emergency since the end of January 2020 [12]. These responses included strict measures to conduct comprehensive investigation of people arriving from cities with a higher burden of disease. Shenzhen in Guangdong Province is one of the cities that implemented strict response measures. Shenzhen, a city with 4 million permanent residents and 8.5 million migrant people, required all residents who had visited or stayed in key epidemic areas (i.e., Hubei Province) in the past 14 days to socially isolate for 14 days, and all people who had close contact with infected COVID–19 patients were placed in centralized isolation locations. Despite of encouraging citizens to adopt self-isolation like many other countries, China organized a mandatory social isolation for these groups from late January to late April. On February 21, 2020, the number of people who were under home or centralized social isolation in Shenzhen was 25,000.

An online cross-sectional survey was conducted on people in mandatory home or centralized social isolation in Shenzhen from February 28 to March 6 in 2020. As of February 28, the confirmed cases of COVID–19 patients in Shenzhen was 418. Among them, 141 were imported from Hubei Province, the epicenter of disease, and 261 were local cases [13].

**Sample collection**

Eligible participants were required to be older than 16 years old and were currently under or had completed mandatory home or centralized social isolation during the survey period. People under mandatory home or centralized social isolation can only be accessed by public health service providers. We randomly selected two districts of Shenzhen (Luohu and Longgang) and partnered with their local public health workers in communities to distribute the survey. The local public health workers sent the survey links or QR codes containing the survey link to the participants. Participants completed the survey voluntarily and anonymously.
The sample size was calculated based on the assumption that the people under home or centralized social isolation would present 10% higher depressive syndrome than the known normal people under COVID–19 [14]. Therefore, a sample of size \( n = 335 \) would ensure that a statistical analysis with \( \alpha = 0.05 \) has 80% power to examine the differences of people under mandatory social isolation in depressive syndromes.

This study has received approval from the institutional review board of Shenzhen Center for Disease Control and Prevention.

**Measurements**

**Depression**

Depression refers to a variety of negative psychological symptoms including in depressive mood, loss of interest, fatigue, difficulty with attention, and suicidal ideation. Depression was measured by the Patient Health Questionnaire Depression scale (PHQ–9) [15], which was previously validated for use among Chinese adults. The participants were asked to report the extent to which they had the nine psychological symptoms on a four-point scale, from “not at all” (0) to “nearly every day” (3). Its reliability in this study was acceptable, with a Cronbach’s alpha coefficient of 0.89. The scores of the nine items were averaged for analysis.

**Perceived risk**

Perceived risk indicates individuals’ subjective perception to certain risks, specifically represented by perceived severity and perceived susceptibility. Perceived severity in the present study was assessed by the perception of how long the epidemic would last. Participants were asked to rate on a five-point scale, ranging from “Less than one week” (1) to “More than six months” (5). Perceived susceptibility was measured by the perception of possibility that one could get infected during the social isolation. Participants rated the probabilities from “highly unlikely” (1) to “highly likely” (5).

**Perceived tone of media coverage**

Perceived tone of media coverage showcases individuals’ perception about the tone or emotions of media coverage regarding COVID–19. The perceived tone of media coverage was evaluated by seven items on a bipolar semantic scale. A wide array of opposite adjectives was presented, including negative vs positive, critical vs encouraging, complaining vs forgiving, non-reflective vs reflective, worried vs composed, indifferent vs touching, timid vs brave. Participants were required to select on a seven-point scale, ranging to −3 to 3. Cronbach’s alpha coefficient in this study was 0.91, indicting excellent reliability. The scores of the seven items were averaged for analysis.
People-oriented public health services

People-oriented public health services measured whether public health officials and workers who were tasked with supporting the daily life routine of those people who were in mandatory home or centralized social isolation were well understood, seen as caring, and trusted. People-oriented public health services were measured by three statements, such that “Public health service (PHS) workers responded to my question in the ways that I can understand”, “PHS workers cared about my feelings and emotions”, and “I perceived the PHS workers trustworthy”. Participants rated on a five-point scale, from “Strongly disagree” (1) to “Strongly agree” (5). The reliability was excellent, with Cronbach’s alpha coefficient at 0.95. We averaged the scores of each item and further categorized the people-oriented public health services into high quality (averaged scores higher than 4), and medium quality (averaged score between 3 and 4) and low quality (averaged scores lower than 3).

Control variables

Demographic variables, including age (continues variable), gender (female = 0, male = 1), education (categorical variable from primary education or below to master’s degree or above), and monthly income (categorical variable from no income to higher than 30,000 RMB), and venue of social isolation (home or centralized) were controlled for in this study. In addition, prior studies have found that media exposure and online social support could affect depressive symptoms [16, 17]. Therefore, factors such as participants’ time on COVID-related news and social support received online were also controlled in analysis. Time on COVID-related news was measured by how much time the participants spent paying attention to COVID-related news, ranging from few times (less than one hour) to many times per day (more than seven hours). Online social support was measured through how participants reported receiving information, emotional, instrumental and esteem support from others online. Participants rated on a five-point scale whether the statements such as “When I felt scared, I turned online to my relatives and/or friends to talk about my feelings” was similar to their experiences or not.

Statistical analysis

Demographic characteristics and perceptions of participants were first described. Then a multiple regression was conducted to examine the main effects of perceived susceptibility, perceived severity, perceived tone of media coverage, and people-oriented public health services on depression. These variables were mean centered to avoid multicollinearity before conducting the moderation analyses. Finally, three stepwise multiple regressions were performed to examine the moderating effects of perceived susceptibility, perceived severity, and perceived tone of media coverage with people-oriented public health services, respectively. Age, gender, education, monthly income, venue of social isolation, time spent on COVID-related news, and online social support were controlled in all regression models. The data analyses were conducted using R programming language, and p-values less than or equal to 0.05 were considered as statistically significant.
Results

Participant Characteristics

Among the 340 socially isolated participants, 196 (57.6%) were male. The average age was 35.5 years old (SD = 8.37), ranging from 17 to 68 years old. More than half of the participants (55.6%) held bachelor's degree or above. A majority of participants’ monthly income (57.4%) was higher than 1100 USD (8000 RMB). Complete demographic characteristics are shown in Table 1.

Participants reported a moderate level of depression, with an average score at 1.24 (SD = 0.4). In terms of people-oriented public health services, 3.2% (n = 11) participants reported low-level quality, 49.1% (n = 167) reported medium-level quality, and 47.6% (n = 162) reported high-level quality. Regarding risk perception, the average score of perceived severity was 3.22 (SD = 1.62), and the averaged perceived susceptibility was 1.36 (SD = 0.54). The perceived tone of media coverage was mainly positive (M = 1.97, SD = 1.05). The average score of online social support was 2.83 (SD = 0.74).

Table 1  Characteristics and behaviors of mandatory socially isolated people in Shenzhen, China, 2020 (N = 340)
| Variable                      | Characteristics             | N   | %   |
|-------------------------------|-----------------------------|-----|-----|
| Age                           | M = 35.51, SD = 8.37        |     |     |
| Gender                        | Male                        | 196 | 57.6|
|                               | Female                      | 144 | 42.4|
| Education                     | Junior high school or below | 34  | 10  |
|                               | High school                 | 117 | 34.4|
|                               | Undergraduate               | 175 | 51.5|
|                               | Master or above             | 14  | 4.1 |
| Monthly income                | No income                   | 31  | 9.1 |
|                               | Lower than 5000 RMB         | 33  | 9.7 |
|                               | 5000-8000 RMB               | 81  | 23.8|
|                               | 8001-12000 RMB              | 81  | 23.8|
|                               | 12001-30000 RMB             | 87  | 25.6|
|                               | Higher than 30000 RMB       | 27  | 7.9 |
| Venue of social isolation     | Centralized (Hotel)         | 73  | 21.5|
|                               | Home                        | 240 | 70.6|
|                               | Both                        | 27  | 7.9 |
| Time on COVID-related news    | Less than one hour          | 30  | 8.8 |
|                               | 1-2 hours                   | 138 | 40.6|
|                               | 3-4 hours                   | 124 | 36.5|
|                               | 5-6 hours                   | 33  | 9.7 |
|                               | More than 7 hours           | 15  | 4.4 |
| Online social support         | M = 2.83, SD = 0.74         |     |     |

The main effects on depressive symptoms

Perceived susceptibility was significantly associated with depressive symptoms ($\beta = .12, p < 0.01$), whereas perceived severity was not associated with depressive symptoms ($\beta = -.01, ns$). These results
indicate that socially isolated people who perceived higher possibility of getting infected were more likely to report depressive symptoms. In addition, perceived tone of media coverage was negatively associated with depressive symptoms ($\beta = -0.05, p < 0.01$), which indicated that the more perceived positive media tone was associated with fewer depressive symptoms. The results of regression also showed that people-oriented public health services did not have a direct correlation with depression ($\beta = -0.06, \text{ns}$). The adjusted R square of main model was 0.0578, indicating that these factors could explain 5.78% of depressive symptoms.

The interaction effects on depression

Model 2 in Table 2 indicated that the interaction model of perceived susceptibility and people-oriented public health services was significant, with adjusted R square increased to 6.2%. The interaction between perceived susceptibility and people-oriented public health services exerted a significant effect on depressive symptoms, $\beta = -0.15, p < 0.01$. For socially isolated people who suspected that they were infected with COVID–19, high quality of people-oriented public health services attenuated depressive symptoms (see Figure 1). The interaction model of perceived severity and the quality of public health services was not significant.

The interaction model of perceived tone of media coverage and people-oriented public health services was significant, with an adjusted R square increased to 5.82%. The interaction between perceived tone of media coverage and people-oriented public health services also yielded a significant effect on depressive symptoms, $\beta = 0.11, p < 0.01$. As illustrated by Figure 2, for people in social isolation who perceived a negative tone in media coverage, lower quality of people-oriented public health services was associated with greater depressive symptoms. However, for those participants who perceived positive tones of media coverage, higher quality of people-oriented public health services was associated with fewer depressive symptoms.

Table 2 The main effects and interaction effects on depression
|                   | Model 1 | Model 2 | Model 3 | Model 4 |
|-------------------|---------|---------|---------|---------|
| **Intercept**     | 1.21    | <.001** | 1.19    | <.001** |
|                   | *       | *       | *       | *       |
| **Main effects**  |         |         |         |         |
| Perceived susceptibility (PSU) | 0.12 | .003** | 0.09 | .025* | 0.12 | .004** |
|                   | 0.11 | .006** |
| Perceived severity (PSE) | -0.01 | .454 | -0.01 | .352 | -0.01 | .444 |
|                   | -0.01 | .378 |
| Perceived tones of media coverage (PTM) | -0.05 | .018* | -0.05 | .023* | -0.05 | .020* |
|                   | -0.05 | .028* |
| People-oriented public health services (PPH) | -0.06 | .124 | -0.05 | .229 | -0.06 | .155 |
|                   | -0.04 | .310 |
| **Moderating effects** |         |         |         |         |
| PSU * PPH | -0.15 | .011* |
| PSE * PPH | -0.02 | .289 |
| PTM * PPH | 0.10 | .006** |
| **Covariates**    |         |         |         |         |
| Age               | -0.004 | .155 | -0.003 | .230 | -0.004 | .170 | -0.004 | .149 |
| Gender            | 0.048 | .294 | 0.046 | .302 | 0.048 | .290 | 0.039 | .390 |
| Education         | -0.002 | .940 | 0.003 | .917 | 0.002 | .952 | -0.001 | .971 |
|                          | Model 1 | Model 2 | Model 3 | Model 4 |
|--------------------------|---------|---------|---------|---------|
| Monthly income           | 0.008   | 0.006   | 0.007   | 0.008   |
|                          | .634    | .713    | .678    | .629    |
| Time spent on news       | -0.0005 | -0.005  | -0.002  | .940    |
|                          | .984    | .822    | .940    | .912    |
| Venues of social isolation | 0.028   | 0.036   | 0.031   | 0.032   |
|                          | .418    | .291    | .374    | .355    |
| Online social support    | 0.043   | 0.042   | 0.040   | 0.040   |
|                          | .153    | .158    | .182    | .182    |

Note: Model 1 examined the main effects of perceived susceptibility, perceived severity, perceived tones of media coverage, people-oriented public health services on depression. Model 2 examined the effects of interaction between perceived susceptibility and people-oriented public health services on depressive symptoms. Model 3 examined the effects of interaction between perceived severity and people-oriented public health services on depression. Model 4 assessed the effects of interaction between perceived tone of media coverage and people-oriented public health services on depressive symptoms.

**Discussion**

Public health measures such as social isolation, physical distancing, and quarantine are widely considered an essential part of COVID–19 control. This study addresses the possible mental health problems among socially isolated people, especially those in mandatory home or centralized social isolation. This study found that perceived susceptibility of being infected and perceived tone of media coverage was associated with depressive symptoms. Additionally, the quality of people-oriented public health services negatively moderated the relationship between perceived susceptibility and depressive symptoms, while positively moderated the relationship between perceived tone of media coverage and depressive symptoms. This study addresses the concerns of mental health of socially isolated people, highlights the importance of people-oriented public health services during social isolation, and extends our scholarly understanding on the interactive relationships between risk perceptions, the role of media coverage and public health services.

Socially isolated people showed a moderate level of depressive symptoms. Similar to the situations during the outbreak of Ebola and SARS, people were likely to experience depressive symptoms in the COVID–19 epidemic [18]. In this study, the depression level among socially isolated participants was relatively mild, likely due to the distance of Shenzhen from the epicenter city of Wuhan, and the swiftly and efficiently control of epidemic in China [19]. Most socially isolated people believed that the epidemic
would be controlled in less than half a year. In addition, according to World Health Organization, COVID–19 was more fatal in the elderly population and among those with chronic illnesses and/or poor health condition compared to others [1]. Such news and information may have mitigated the level of depression within this study.

This study revealed perceptual factors that contribute to the level of depression among home or centralized socially isolated people. Perceived susceptibility - the fear and worry of being infected, could be a haunted feeling during the social isolation, and was associated with depression, especially for individuals having similar physical symptoms potentially related to COVID–19 [2]. Meanwhile, under social isolation, the information transmitted through media largely shapes people's perceptions. The perceived positive or negative tone of media coverage could cultivate the general picture of the situation during the fight against the epidemic, boosting or damaging confidence in succeeding in the fight with COVID–19 pandemic.

People-oriented public health services were identified as a significant moderating factor for mental health. Previous studies highlighted public health services during the epidemic and its role to provide instrumental and informational support for socially isolated individuals [4, 20]. Although public health services are likely to be overwhelmed during the epidemic in most countries, maintaining high quality of people-oriented services that enhance public health awareness and trust is still necessary. When people feel they are understood and concerned about by others, they feel less depressed, especially since public health service providers are representatives of local governments and public health administration [21]. More importantly, people-oriented services enable socially isolated people to positively cope with the social isolation and may attenuate the perceived stigma and xenophobia attached to the potential of being a source of transmitting COVID–19 pandemic [2].

This study has implications related to COVID–19 and beyond. People-oriented services can enhance individual coping strategies and mitigate negative emotions when they are fighting their battle [22]. These public health services are often provided within the community; and therefore, future public health emergency preparedness efforts should include training in the provision of high quality of people-oriented services that can protect the public mental health in addition to encouraging better prevention and control of the spread of an epidemic [23]. Moreover, despite the pandemic, the idea of people-oriented public health services is in line with patient-centered care in other medical or public health circumstances [24]. The underlying principle guiding these efforts is humanism in medicine and holistic healing [25]. Such principle aims to put human being at the center of the focus and promote better understanding of the experiences in healthcare. People-oriented services can always be as a complementary measure to improve the treatment effects and reduce potential mental health burden.

**Limitations**

Despite its strengths, this study also has limitations. First, the results of this study may be constrained by the context and timing when the study was conducted. Specific situations of COVID–19 epidemic and the
public health responses to the epidemic varied across cities. The case of Shenzhen represents the situation of cities with dense and mobile populations affected by the epidemic at a medium level. Nevertheless, under the circumstance when public health services are provided to the socially isolated people, people-oriented services could be encouraged. Second, this study used a cross-sectional survey, thus the establishment of causal relationship ask for further longitudinal or experimental examination. Third, we were unable to assess the mental health conditions of people before the survey, so we cannot determine whether or how their pre-quarantine mental health affected their current level of depressive symptoms. Finally, this study examined depressive symptoms during the period of social isolation. Future studies are needed to explore correlates of post-quarantine or post-epidemic mental health status.

**Conclusion**

This study examined depressive symptoms among people in mandatory home or centralized social isolation in Shenzhen, China. This study highlighted the moderating role of people-oriented public health services in the relationship between perceived susceptibility, perceived tone of media coverage and depressive symptoms. Despite the pressure of fighting the epidemic, people-oriented public health services for socially isolated people should be promoted.

**Abbreviations**

WHO: World Health Organization; PHQ–9: Patient Health Questionnaire Depression scale; PHS: Public health service; PSU: Perceived susceptibility; PSE: Perceived severity; PTM: Perceived tones of media coverage; PPH: People-oriented public health services.

**Declarations**

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**Availability of data and materials**
The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

**Authors’ contributions**

BC and XL contributed to the study design and conception. NW, MW, and QM participated in the coordination of the study. BC and YW analyzed the data. BC and DW drafted the manuscript, with feedback from HB, JT, and XL. All authors read and approved the final manuscript.

**Ethics approval and consent to participate**

This study has received approval from the institutional review board of Shenzhen Center for Disease Control and Prevention. Written informed consent has been obtained from all participants.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

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**Figures**

![Figure 1](image)

**Figure 1**

The effects of interaction between perceived susceptibility and people-oriented public health services on depressive symptoms.
Figure 2

The effects of interaction between perceived tone of media coverage and people-oriented public health services on depressive symptoms.