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Preventive Medicine 143 (2021) 106385

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Factors influencing social distancing to prevent the community spread of COVID-19 among Chinese adults

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ARTICLE INFO

Keywords:
COVID-19
Social distancing
Adult Chinese
Mental health
Media

ABSTRACT

The global outbreak of the coronavirus disease 2019 (COVID-19) in 2020 has been an international public health threat. Early strong social distancing efforts is needed to stop transmission of the virus. The purpose of the present study is to identify individual and environmental factors related to individuals' compliance with the recommended social distancing, as well as the moderating role of social media in influencing individuals' implementation of social distancing. A total of 2130 Chinese adults were surveyed in March 2020 during the COVID-19 pandemic. Logistic regression analyses were performed to ascertain the predictors of social distancing. Overall, the majority of respondents (95.6%) reported compliance with social distancing. Women were more likely to practice social distancing compared to men (odds ratio [OR] = 3.12, 95% confidence interval [CI] = 1.93–5.02). Psychological distress, depressive symptoms, and social media were significant predictors of social distancing after controlling for other individual and environmental factors. Social media moderated the effects of psychological distress on social distancing (OR = 0.96, 95% CI = 0.94–0.99). Findings from the study indicates that mental health status and social media are influential factors of social distancing, which have significant implications in enhancing the effectiveness of prevention strategies to contain the spread of COVID-19.

1. Introduction

A novel and highly infectious disease in humans, the coronavirus disease 2019 (COVID-19), has resulted in a major public health threat in many countries. COVID-19 is caused by a new type of coronavirus called SARS-COV-2 (Centers for Disease Control and Prevention, 2020a). The COVID-19 outbreak soon affected countries in Asian, Europe and North America, leading to a pandemic and global emergency (World Health Organization, 2020; Centers for Disease Control and Prevention, 2020b). As of the end of July 2020, over 16 million individuals have been diagnosed with COVID-19 with a death toll reaching 656,093 worldwide (World Health Organization, 2020). The mortality rate of COVID-19 is highest among persons aged 85 or older from 10% to 27% (Centers for Disease Control and Prevention, 2020b). Also, the pathogen SARS-COV-2, a member of the coronavirus family, never before seen in humans, has been confirmed as the cause of COVID-19 (Rothan and Byrareddy, 2020).

Since the incubation period of COVID-19 can last between 2 and 14 days, asymptomatic individuals infected by COVID-19 can also transmit the disease through person-to-person contact or travel to different locations (Bai et al., 2020). However, the exact transmission pathways of the disease remain unclear, and specific treatments or vaccinations are also unavailable. According to a latest report of The Centers for Disease Control and Prevention (CDC) in the U.S., the basic reproductive number (R0) for COVID-19 is 5.7 (95% CI 3.8–8.9), which indicated a doubling time of the number of infected persons of 2.3–3.3 days (Tang and Wong, 2004). The CDC further confirmed that early strong social distancing efforts is needed to stop transmission of the virus (Tang and Wong, 2004).

The goal of social distancing is to isolate cases and contacts of contagious disease, which has been long practiced in the fight against infectious diseases (Niu and Xu, 2020). As the initial country impacted by the virus, China has significantly slowed down the spread of COVID-19 nationwide by enforcing a combination of control measures including strong social distancing. Minimizing social and physical contacts between people appears to be an effective way to reduce the transmission

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https://doi.org/10.1016/j.ypmed.2020.106385
Received 17 April 2020; Received in revised form 7 December 2020; Accepted 21 December 2020
Available online 31 December 2020

of COVID-19 in many affected communities in China.

Given the effectiveness of social distancing in curbing the disease spread, many countries such as Italy and the United States are practicing this method as part of the efforts to contain the pandemic of COVID-19. The latest U.S. CDC guidance of preventing COVID-19 infection has recommended social distancing by avoid close contact with person who is sick and keep 6 ft of distance from one another (Centers for Disease Control and Prevention, 2020c). Up to August 8, 2020, all 50 states in the US have implemented social distancing policies to minimize social contacts between people. Given that COVID-19 is affecting communities and health care workers worldwide and that no specific treatments are available, continued efforts in social distancing are needed to contain the infectious disease spread.

The effectiveness of social distancing relies on individuals' deliberate control over their behaviors. According to the social cognitive theory (SCT), health behavior is affected by factors at both individual and environmental levels. Success in initiating and maintaining health behaviors hinges on the interplay between individual and environmental determinants (Bandura, 1998). In applying this model to understand factors related to the practice of social distancing in the context of the COVID-19 pandemic, individual factors such as demographic background, health status, and mental health can all play role in practicing social distancing. For example, research shows that men are more likely to engage in risky health behaviors, while women tend to have more health concerns and be more conscious about health-promoting behaviors (Waldron, 1998). Individual-level factors such as mental health can also influence individuals' health behaviors. Specifically, depressive symptoms have been found to be significantly influenced by individuals' environment, and severe depressive symptoms could be a risk factor for failure to engage in health behaviors (Allgöwer et al., 2001).

Environmental factors, such as residential areas and living arrangements, can also affect individuals' behaviors in social distancing. For instance, those who live alone may face more challenges to maintain healthy social networks during the time of social distancing (Allgöwer et al., 2001). Additionally, according to the SCT, various sources of information impact on individuals' experiences and is important to individuals' coping strategies (Benight and Bandura, 2004). Empirical evidence points out that social media can be an substantial source of informational and emotional support in the face of stressors (Fohringer et al., 2015; Taylor et al., 2012). Thus, social media may play a potential modifiable role that buffers against the effects of negative mental health on health behaviors (Benight and Bandura, 2004).

The purposes of the study are twofold: 1) the study aims to examine factors related to social distancing as a preventive behavior against COVID-19 in China; 2) to test the moderating effects of social media on mental health and social distancing. Specifically, our research questions are as follow: 1) What are the associations between social distancing and individual-level factors (age, female gender, educational level, income, self-rated health, depressive symptoms, and psychological distress)? 2) What are the associations between social distancing and environmental factors (urban residential area, living arrangement, and COVID-19 on social media)? and 3) What are the effects of social media in the association between social distancing and mental health (depressive symptoms and psychological distress)?

2. Methods

2.1. Sample

Non-probability purposive sampling was used to recruit Chinese aged 18 or older for the present study. This secondary analysis used survey data collected by the Dongbei University of Finance and Economics in China from February 14th, 2020 to March 3rd, 2020. This research study aimed to understand mental health, physical health, preventive behaviors, social networks, and other psychosocial aspects among adults who live in the context of Coronavirus crisis in China. Recruitment information was disseminated online by posting on social media like wechat, weibo (Chinese version of Twitter), and institutional listservs. Potential participants in the survey were informed that their participation in the survey was completely voluntary and that their answers would be kept confidential. Informed consent was obtained from all participants in the survey. After listwise deletion to handle the missing data, the final sample size was 2130.

2.2. Measures

2.2.1. Prevention strategy

2.2.1.1. Social distancing. Social distancing was measured using three items. Respondents were asked, since the coronavirus outbreak, whether they 1) avoid social gatherings, 2) avoid contacting people not living in their home, and 3) self-isolate at home. Respondents were considered meeting the recommendations of social distancing if they answered yes to all three items. The questions were developed based on CDC's recommendations on protecting oneself from being infected by coronavirus through social distancing (Centers for Disease Control and Prevention, 2020d).

2.3. Personal factors

Individual factors were socio-demographic variables including age (in years), gender (male/female), marital status (married/non-married), education (high school or below/above high school), and income (six ranges in Chinese Yuan), self-rated health (poor, fair, good, very good, and excellent), and mental health (depressive symptoms and psychological distress).

2.3.1. Mental health

Participants' mental health was indicated by depressive symptoms and psychological distress. Depressive symptoms were measured using the 10-item Center for Epidemiologic Studies Depression Scale (CESD-10), which has demonstrated moderate reliability and validity in Chinese population (Cheng and Chan, 2005). Participants were asked, "since the outbreak of the COVID-19, in the past month, how often have you felt the following ways". Each of the ten items measured one symptom of depression. The response categories were 0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = always. Ten items were summed up, with higher scores indicating more depressive symptoms. The Cronbach's alpha of CESD-10 for the study sample was 0.83.

Psychological distress was measured using a modified version of the 8-item Kessler Psychological Distress Scale (Kessler et al., 2002). Participants were asked, "since the outbreak of the COVID-19, in the past month, how often have you felt the following ways". Each item measured one symptom of psychological distress. The response categories were 0 = none of the time, 1 = a little of the time, 2 = some of the time, 3 = most of the time, 4 = all of the time. Eight items were summed up, with higher scores indicating more psychological distress. The Cronbach's alpha of K8 for the study sample was 0.90.

2.4. Environmental factors

Environmental factors include residential area (urban/non-urban), living arrangement (living alone/not living alone), and social media. The role of social media was measured by participants' time spend on social media to read information about COVID-19. We used the question "how long do you spend on reading information about COVID-19 on social media (including coronavirus coverage and updates, protection knowledge, and online discussion) on a daily basis?" The response categories were 1 = none of the time (0 min), 2 = very little of the time (less than 15 min), 3 = a little of the time (16–30 min), 4 = some of the time (31–45 min), 5 = often (46–60 min), and 6 = very often (more than 1 h).

2.5. Analysis strategy

Descriptive statistics were conducted to capture the sample characteristics. Hierarchical binary logistics regression using maximum likelihood estimation was performed to test whether individual factors (e.g. age, gender, education, marital status, income, self-rated health, and mental health) and environmental factors (residential area, living arrangement, and social media) predict the odds of engaging in health behaviors. Individual and environmental factors were entered in Step 1. Two interaction terms were created between media and depressive symptoms, and between media and psychological distress. Interaction terms were entered in step 2 to test whether social media moderates the effects of depressive symptoms and psychological distress on social distancing. Data separation and data sparseness were checked by performing crosstabs between predictors and social distancing outcomes individually. No violation was detected as evidenced that all expected cell counts were above 5 (Warner, 2012). No multicollinearity was found as indicated by VIF ranging from 1.01 to 2.74 (Lomax and Hahs-Vaughn, 2012).

3. Results

3.1. Sample characteristics

The average age of study sample was 28.43 (SE=10.46). Over half were female (54.84%), above high school education (78.45%), non-married (68.64%), and living in non-urban areas (52.39%). In addition, over half of the sample (56.76%) made an annual income between 0 and 10,000 Yuan (appx. 1400 USD), and more than one tenth (12.39%) made between 10,000 to 30,000 Yuan (appx. 4280 USD). Given that the median annual income was 26,523 Yuan (appx. 3784 USD) in China in 2019 (National Bureau of Statistics of China, 2020), the majority of the sampled participants and an income lower than the national median. In terms of reading about COVID-19 on media, individuals most often spent 31–45 min (34.04%) on a daily basis. With regard to preventive behaviors, the majority reported compliance with social distancing (95.63%) (See Table 1).

3.2. Logistic regression results

Logistic regression results were presented in Table 2. In terms of demographic predictors, only gender was a significant factor of social distancing. Specifically, women are about 3 times more likely to maintain social distancing than men. Also, more time spent on media (χ^2 =1.40, 95% confidence interval [CI] = 1.16–1.69) and more psychological distress (χ^2 =1.07, 95% CI = 1.03–1.12) were related to higher odds of complying with social distancing. However, more depressive symptoms (χ^2 =0.90, 95% CI = 0.86–0.95) predicted lower odds of social distancing. Significant interaction effects were found between time spent on social media and psychological distress (χ^2 =0.96, 95% CI = 0.94–0.99). A graph of the interaction terms is presented in Fig. 1. Specifically, among those who spent less time on social media, more psychological distress predicted larger odds of maintaining social distancing. However, among those who spent more time on social media, psychological distress was not related to complying with social distancing.

4. Discussion

This study sought to understand how personal factors and environmental factors are associated with social distancing for slowing the community spread of COVID-19 in China. We also examined the moderating role of social media in the relationships between mental health and social distancing. Our findings contribute to the limited knowledge about factors related to social distancing in the context of the COVID-19 pandemic. As China was the first country to be heavily hit by COVID-19 and took actions to contain the disease spread, our study can help to inform practice and policy efforts to control the pandemic. First, of the individual factors, gender, depressive symptoms, and psychological distress were identified as predictors of compliance with social

Table 1
Sample characteristics (N=2130).

Variables	*N* (%)	Mean (SE)	Range
Prevention strategy			
Social distancing			
No	93 (4.37)		
Yes	2037 (95.63)		
Personal factors			
Age		28.43 (10.46)	18–95
Gender			
Male	962 (45.16)		
Female	1168 (54.84)		
Education			
High school or below	459 (21.55)		
Above high school	1671 (78.45)		
Marital status			
Married	668 (31.36)		
Non-married	1462 (68.64)		
Income (Chinese yuan)			
0–10,000	1209 (56.76)		
10,001–30,000	264 (12.39)		
30,001-50,000	247 (11.60)		
50,001-100,000	235 (11.03)		
100,001-200,000	129 (6.06)		
Above 200,000	46 (2.16)		
Self-rated health		4.35 (0.75)	1–5
Mental health			
Depressive symptoms		14.65 (5.49)	0–37
Psychological distress		9.43 (6.31)	0–32
Environmental factors			
Residential area	1014 (47.61)		
Urban	1116 (52.39)		
Non-urban			
Living alone			
No	2059 (96.67)		
Yes	71 (3.33)		
Time spent on social media			
Never	21 (0.99)		
Less than 15 min	261 (12.25)		
16–30 min	529 (24.84)		
31–45 min	725 (34.04)		
56–60 min	348 (16.34)		
More than 1 h	246 (11.55)		

Note. SE=standard error.

Table 2
Odds ratios for preventive behaviors in logistic regressions.

Predictors	Social distancing	
	Model 1 OR (95% CI) *N=2130*	Model 2 OR (95% CI) *N=2130*
Individual factors		
Age	0.99 (0.95–1.04)	0.99 (0.96–1.04)
Female	3.12 (1.93–5.02)	3.10 (1.92–5.01)
Above high school	0.71 (0.39–1.28)	0.72 (0.40–1.31)
Non-married	0.88 (0.37–2.10)	0.88 (0.37–2.08)
Income	1.09 (0.91–1.32)	1.09 (0.90–1.32)
Self-rated health	1.07 (0.80–1.42)	1.06 (0.80–1.42)
Depressive symptoms	0.90 (0.86–0.95)	0.88 (0.78–1.00)
Psychological distress	1.07 (1.03–1.12)	1.17 (1.08–1.28)
Environmental factors		
Non-urban	0.65 (0.41–1.02)	0.64 (0.40–1.01)
Living alone	0.47 (0.21–1.06)	0.51 (0.22–1.16)
Time on media	1.40 (1.16–1.69)	1.56 (0.78–3.11)
Interaction terms		
Time on media × depressive symptoms	–	1.01 (0.97–1.06)
Time on media × psychological distress	–	0.96 (0.94–0.99)

Notes. OR=odds ratio. CI=confidence interval.

distancing. Second, of the environmental factors, social media significantly influenced Chinese adults' behaviors in social distancing.

Gender disparity in social distancing was identified. Results showed that females were three times more likely than males to practice social distancing during the COVID-19. Consistently, men were at a markedly higher risk of getting infected and developing severe cases compared with women (Wei et al., 2020). Similar to existing literature on preventive behaviors, men were significantly less likely to practice preventive behaviors (ex., wear facemasks, temperature measures) to prevent infectious diseases (ex., severe acute respiratory syndrome) than women in China (Tang and Wong, 2004; Lau et al., 2003). Our study added evidence to the current literature that men were less likely to keep social distancing and are at higher risks of exposure to COVID-19. A study using a sample of Chinese adults has found that, compared to women, men have higher incidences of COVID-19 and more severe health and death outcomes (Jin et al., 2020). Our finding provided a clue of the gender disparity in the morbidity and mortality of COVID-19 from a social determinant of health perspective. According to stereotypic role beliefs, women and men have different expected family and social roles: women have more family internal responsibility and are more likely than men to be homemakers; however, men are more agentic (self-assertive and motivated to be social) and more likely to hold positions of authority than women (Eagly and Wood, 2016; Eagly and Steffen, 1984). Additionally, a general belief that men have stronger immunity than women places men in a position of taking family responsibility for going out, such as going to the grocery store (Klein and Flanagan, 2016). Similar findings were reported, as evidenced in a review study that, in many countries, men tend to have higher rated of health-risking behaviors that are linked with more COVID-19 infection and mortality (Griffith et al., 2020).

Also, this study found that social distancing is significantly associated with individuals' mental health. Surprisingly, depressive symptoms and psychological distress have opposite directions of association with social distancing. Particularly, psychological distress regarding COVID-19 can lead people to practice social distancing. Psychological stress is a consequential response to the pandemic outbreak (Douglas et al., 2009). A previous study suggested that preventive health behaviors were positive correlated with perceived of risk for infection with diseases (Chapman and Coups, 2006). Perceived risk for infection withCOVID-19 can stimulate individuals' self-protection and motivate them to practice social distancing. Therefore, psychological distress demonstrated protective effects on social distancing as a strategy to avoid being infected by COVID-19.

However, our finding indicated that adults with depressive symptoms were less likely to keep social distancing. Depression can worsen individuals' preventive health care behaviors, which has been well documented in existing literature (Witt et al., 2009; Callahan et al., 1994). The negative association between social distancing and depression during COVID-19 may also reflect resource mobilization. According to the resource mobilization framework (Wheaton, 1985) (Wheaton, 1985), individuals experiencing depressive symptoms are likely to reach out to their social network members to seek support for managing their stressors (Nguyen et al., 2017). For those experiencing COVID-19-related depressive symptoms, avoiding social contact might be challenging because it can serve as a major resource for stress coping.

Third, information about COVID-19 on social media was suggested by our findings to be a significant facilitator of practicing social distancing. This finding is consistent with a recent study that social media in China delivered rapid, reliable information to stop the spread of COVID-19 in communities, which was of key importance to the infection control (Chan et al., 2020). Reading information on social media about the serious consequences of COVID-19, increasing prevalence and mortality rates, and the suggested preventive behaviors will promote individuals to practice social distancing. People who receive little information about COVID-19 from media may not be motivated or fail to perceive the need to practice the suggested COVID-19 preventive behaviors. As a consequence, those who spend little time on social media reading about COVID-19 may be more vulnerable to the disease due to their limited knowledge about preventive behaviors and lack of motivation to engage in health-protecting behaviors.

More important, reading information about COVID-19 on social media plays a moderating role between psychological stress and social distancing. Reading information about COVID-19 on social media can buffer the effects of psychological stress on social distancing. The ramifications of lacking information from social media and dishonest communication often induce stress, anxiety and mistrust in suggested preventive behaviors (Wang et al., 2019; Laranjo, 2016). Another possible explanation is that among those with limited information from social media, psychological distress plays a more salient role in individuals' perceived risk of the disease, which further leads to their active engagement in practicing social distancing. On the contrary, people who receive immense amount of information about COVID-19 may master suggested preventive behaviors regardless of their levels of psychological distress, suggesting that social media is powerful in influencing people's behaviors in social distancing.

4.1. Limitations

One inherent limitation of the study concerns the fact that the use of cross-sectional data is not able to make causal inference. This study was not able to build the causal relationships among independent factors and the outcome factor. Second, the social distancing outcome is skewed with the majority reporting compliance. It is possible that study participants are more likely to provide socially desirable responses regardless of whether they are practicing social distancing. Third, online sampling and recruitment also had largely excluded older adults who have limited access to internet in China because the utilization of social media among older adults still lags behind younger age groups (Xie et al., 2012). As a result, the study findings may not be generalizable to older population. The non-significant findings for income, marital status, self-rated health, residential area and living arrangement in predicting social distancing could be due to the young age of the study sample, whereas these individual-level and environmental-level factors may be more salient in predicting health behaviors in an older population. In spite of this limitation in the sampled participants, to comply with the stay-at-home orders in China, online sampling is the most effective strategy to reach a large pool of Chinese population, including individuals in Hubei area which was the center of the pandemic. Future studies may further examine the socio-demographic differences in the association between mental health and health behaviors among older adults.

5. Conclusion

This study analyzed the factors influencing practicing social distancing among Chinese adults in the context of the coronavirus crisis. There are three main findings in this study. First, females are more likely than males to practice social distancing. Second, psychological stress is a facilitator of social distancing, but depression is a barrier of social distancing. Third, reading information about COVID-19 on social media is a strong predictor of social distancing, and it can moderate the effects of psychological stress on social media. Our findings suggested that developing interventions around promoting social distancing need to be gender sensitive. Additionally, interventions, such as online support groups and education workshops, can be paramount to those experiencing elevated depressive symptoms. Also, given the educational and informational role of social media in motivating individuals to engage in social distancing, expanding media coverage to hard-to-reach and marginalized populations may be an effective strategy to promote social distancing in communities (Lawlor and Kirakowski, 2014). To slow down or stop the spread of the virus, a combination of control measures, including early and active surveillance, quarantine, and especially

strong social distancing efforts, are needed. The decline in newly confirmed cases in China in March 2020 strongly suggest that the spread of the virus can be contained with strong distancing (Centers for Disease Control and Prevention, 2020c). Given that the social distancing investigated in this study is coronavirus-specific and time-sensitive, our findings of social distancing can provide valuable implications to other epicenters of COVID-19, such as Japan, Italy, and the U.S. It's necessary to consider cultural and political differences when generalizing the findings of this study to other countries and regions.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Submission declaration

The work described has not been published previously, nor it is under consideration for publication elsewhere.

Declaration of Competing Interest

None.

Acknowledgments

This study was considered exempt from human subjects review by University of North Carolina at Charlotte.

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