



Perceived Susceptibility and Severity of COVID-19 on Prevention Practices, Early in the Pandemic in the State of Florida

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Accepted: 1 April 2022 / Published online: 22 April 2022

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Abstract

Early in the pandemic and prior to the development of the COVID-19 vaccine, prevention measures were promoted to help inhibit the spread of the virus. To optimize adherence to prevention practices, it's important to understand factors that may influence adherence. A study was conducted in the month of April, 2020, to explore the influence of perceptions of COVID-19 on prevention practices. The sample included members of a public social-media group focused on providing updates and information on COVID-19. A total of 719 individuals completed an online survey that assessed various aspects of COVID-19 which included experience, perceptions, and prevention practices. The perceptions of COVID-19 included perceived susceptibility of contracting the virus, and perceived potential severity if contracted COVID-19. To assess prevention practices, the survey included a 10-item prevention practices questionnaire that included items such as wearing a mask, and social distancing. Results revealed that perceived susceptibility of contracting COVID-19, and potential severity of COVID-19 were significant in predicting prevention practices. Further, results suggest that perceived potential severity predicts a greater proportion of the variance in prevention practices than susceptibility of contracting COVID-19. In addition, a moderation analysis revealed no interaction between perceived susceptibility and severity, which provides evidence that the variables do not influence one another. Theoretical and practical implications are discussed.

Keywords COVID-19 · Pandemic · Health belief model · Prevention practices

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus [1]. The manifestation of the disease can range from mild to moderate respiratory symptoms, to serious illness leading to death with higher risk for those who are older or have underlying medical conditions. In early December, 2019, the first cases of patients with shortness of breath and fever of unknown origin were reported in Wuhan, Hubei Province, China. Reporting of the first cases led to the identification of the novel coronavirus on January 7, 2020 [2]. The first reported case of

COVID-19 in the United States was January 31, 2020, with the first reported death on February 27, 2020. On March 11, 2020, the World Health Organization (WHO) characterized COVID-19 as a pandemic [2], with the subsequent declaration of a national emergency in the U.S. [3]. As of January 31, 2022, there have been 373,229,380 confirmed cases globally with 5,658,702 deaths [4]. In the United States, as of the same date there were 73,531,094 reported cases with 875,755 deaths [5].

As a response to the COVID-19 public health crisis, global lockdowns were implemented to help contain the spread of the virus. In addition, the WHO [6] recommended prevention practices that included staying six feet apart from others, wearing a face mask if unable to have physical distance or in poorly ventilated settings, washing hands regularly with soap and water or an alcohol-based sanitizer, and staying home if feeling unwell. The WHO provided videos on social media highlighting the importance of these preventative practices [6, 7]. Early in the pandemic and prior to the development of the COVID-19 vaccine, these prevention measures were meant to help inhibit the spread of the virus.

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To ensure these prevention measures are practiced, the public needs to understand the purpose and value of the measures, and be persuaded to comply, which involves behavior change [8, 9]. Adherence to these behavioral changes is expected to be influenced by the perception of the challenge, herein COVID-19.

Various models, such as the Health Belief Model (HBM), can be used to understand an individual's engagement in health-related behaviors [10]. The HBM typically contains four dimensions [10]. The first, perceived susceptibility, references a person's perception of risk, or susceptibility of contracting a condition. The second, perceived severity, relates to concerns regarding the seriousness of contracting a particular illness and the potential consequences that result. The third, perceived benefits, relates to the belief that an action will be effective in reducing a threat. The fourth, perceived barriers, are the potential challenges with undertaking a recommended behavior. The HBM has been used in studies to explore behaviors related to chronic conditions [11] as well as health screening and health promotion [12–18].

The HBM has been used to better understand the association between the HBM and COVID-19 prevention measures. One study explored perceptions related to COVID-19 in a sample of adults ($n=795$) in the United States. Results revealed that perceived personal susceptibility of contracting COVID-19 was not associated with social distancing, while the perceived severity of COVID-19 was associated with social distancing [19]. In a sample of 1,525 participants from Korea's general population, researchers found perceived severity to positively influence a combined score of prevention practices which included wearing a mask, covering one's mouth when coughing, social distancing, ventilating rooms twice a day, avoiding public transportation, and washing hands. Interestingly, perceived susceptibility was negatively associated with these prevention practices [20]. Tong et al. [21] explored the applicability of the HBM on people's adherence to prevention measures. In the study of 616 adults in Macao China, three factors of the HBM including perceived severity, perceived benefits, and perceived barriers, were statistically significantly associated with prevention measure, but there was no association with susceptibility. In another study of 750 participants from the Golestan Province, Iran, perceived benefits, perceived barriers, but not perceived severity or perceived susceptibility, were associated with prevention measures [22]. A study by Shewasinad Yehualashet et al. [23] of 683 participants from North Shoa zone, Ethiopia, found the factors of perceived benefits, perceived barriers, and perceived susceptibility, but not perceived severity, to be associated with prevention measures. Using the COVID-19 Snapshot MOonitoring (COSMO) questionnaire, which was translated into Arabic, a study of 1027 participants, Alagili et al. [24] found that benefits and barriers, but not severity and susceptibility,

predicted prevention practices. Tadesse et al. [25] found in a sample of 628 participants from Addis Ababa, Ethiopia that only perceived barriers predicted prevention practices.

In an investigation of 500 U.S. adults, Guidry et al. [26] found all the factors of the HBM to predict at least some prevention practices. Specifically, out of seven prevention practices, perceived benefits predicted all seven being social distancing, handwashing, not touching face, respiratory hygiene, home while sick, staying away from sick people, and not attending large meetings. Perceived barriers predicted five practices which did not include respiratory hygiene, and not attending large meetings. Susceptibility predicted only three, respiratory hygiene, staying away from sick people, and not attending large meeting. Finally, severity predicted only two, not touching face, and social distancing. The results also revealed that the constructs appeared to work independent of the model.

The HBM has provided a framework in several studies to better understand the association between the HBM and COVID-19 prevention practices though results show varied support for the specific HBM domains. There were more consistent findings regarding the positive association with the domains of perceived benefits [22–24] and perceived barriers [22–25] and use of prevention practices. The same consistency was not found for the domains of perceived severity and perceived susceptibility. Some studies showed that perceived susceptibility of contracting COVID-19 was not associated with preventative practices [19, 22, 24] or had a negative association [20]. Some studies showed positive associations between perceived severity of COVID-19 and personal preventative measures [19–21] while others did not support an association [23, 24].

There appears to be consistency in predicting prevention practices related to COVID-19 and the HBM dimensions of perceived benefits and perceived barriers. However, evidence is mixed for the dimensions of susceptibility and severity on predicting prevention practices. These inconsistencies may be due in-part to factors such as culture and age, but also how the prevention practices were assessed. In some instances, prevention practices were based on a single practice such as wearing a mask, while other studies included multiple practices. To compensate for the varied selection of prevention practices, being individual or grouped, it may be prudent to create a prevention practice score that is based on multiple practices that are promoted by various health organizations (see [6, 7, 27]). We are not aware of such a specific prevention practice questionnaire.

A challenge may also be due to participants knowledge of prevention practices. To understand the association between the HBM and prevention practices, it would seem appropriate to assess a sample that has at least good general knowledge of COVID-19. Shewasinad Yehualashet et al. [23] for example, found in the sample of

683 participants from North Shoa zone, Ethiopia, nearly half of the participants (47.1%) had inadequate knowledge of COVID-19. This variability in knowledge could explain in-part differences in how the HBM associated with prevention practices. Further, rather than applying the entire HBM as a model, an exploration of the dimensions with the most variability could provide additional evidence to the value of the HBM. The act of using the dimensions individually can be found in research that has used select dimensions rather than the model in its entirety. Jones et al. [28] for example, found in a systematic review of 18 interventions, only six studies used the HBM in its entirety.

Finally, with the mixed evidence as to the association of perceived susceptibility and severity on prevention practices, another question arises as to a potential interaction between perceived susceptibility and severity on prevention practices. For example, will the relationship between perceived susceptibility and prevention practices, change based on perceived severity.

Study Objective

Several factors were considered to create the study's objectives. First, while there is good evidence as to the predictive value of perceived benefits and barriers, evidence is mixed when exploring the influence of perceived susceptibility and severity on COVID-19 prevention practices. Since there is evidence to the use of individual dimensions of the HBM in research [28], the study focused specifically on susceptibility and severity. Second, since previous research has questioned the knowledge of participants (e.g., [23], we included a general COVID-19 knowledge questionnaire. Third, since there appears to be variability in results due to how prevention practices were assessed, we created a 10-item prevention practices questionnaire.

The present study's primary objective was to explore in a sample of participants with good general COVID-19 knowledge, the influence of perceived susceptibility and severity on a combined set of prevention practices. A secondary objective was to explore a potential interaction between perceived susceptibility and severity on prevention practices. To accomplish these objectives, a COVID-19 knowledge questionnaire was created, as well as a prevention practices scale based on the summation of 10 prevention practices. As a foundation for the present study, the following research question was explored. *In a sample of individuals with general knowledge of COVID-19, how do the variables of perceived susceptibility of contracting COVID-19, and perceived severity of COVID-19, collectively or individually influence prevention practices?*

Method

Participants

A total of 719 individuals completed an online survey. The survey was posted on a COVID-19 information social media group page. The sample included 663 females and 51 males while 4 preferred not to answer. The average age of the sample was 49.89 (SD = 12.59) with a range of 18 to 85. Ethnicity was reported as: American Indian/Alaskan Native (n = 3), Asian (n = 10), Black or African American (n = 10), Hispanic or Latino (n = 54), Native Hawaiian (n = 1), White (n = 623), or other (n = 10).

Materials

The online survey created in Qualtrics, included demographics, COVID-19 knowledge, two dimensions of the HBM specifically adapted for COVID-19, and prevention practices. The demographic items included age, sex, and ethnicity. The COVID-19 knowledge section included an item relating to participants perceived knowledge of COVID-19. To assess general knowledge of COVID-19, four items were used that included onset of symptoms, actual symptoms, social distancing recommendations, and appropriate washing of hands.

To assess perceived COVID-19 knowledge, the survey included an item pertaining to participants perceived general knowledge of COVID-19. The five response options ranged from well below average general knowledge, to well above average general knowledge.

The two dimensions of the HBM included perceived susceptibility of being infected, and the potential severity if infected. The following item was used to assess susceptibility: what is your perceived likelihood to get the coronavirus. Response options included, very unlikely, unlikely, likely, and very likely. To assess potential severity, the following item was included: what is your perceived potential severity of the coronavirus on your own health. Response options included, not at all serious, somewhat serious, serious, and very serious.

At the time of the present study (April, 2020), organizations such as the CDC, and the WHO, were promoting up to ten prevention practices which included, staying home, limiting socializing, social distancing, washing hands, using hand sanitizer, cleaning surfaces, limiting trips to public areas, and wearing a mask [6, 7, 27]. Therefore, assessment of prevention practices included the summation of ten items (See Table 1).

Response options for the prevention practices questionnaire were based on a 4-point Likert-type scale with

Table 1 Prevention practices questionnaire

Item	Statement
1	I'm staying home as much as possible
2	I'm limiting my in-person socializing time with people outside my home
3	I'm practicing social distancing (6 feet apart) whenever I go out in public
4	I'm limiting my trips to the store as much as possible
5	I'm using hand sanitizer more now than I did before the coronavirus was identified in the US
6	I'm washing my hands more now than I did before the coronavirus was identified in the US
7	I'm cleaning high-use areas in the house more often than I did before the coronavirus was identified in the US
8	Whenever I come in from being out in the public, I wash my hands
9	I wear a mask (or scarf) over my mouth and nose whenever I go to places where social distancing will be difficult
10	I'm trying to keep myself up to date on recommended coronavirus social and behavioral practices

response options of Strongly Disagree, Disagree, Agree, and Strongly Agree. A total prevention practices score was generated by summing the ten items with higher scores representing greater prevention practices. The Cronbach's alpha for the ten-item prevention practice questionnaire was 0.823.

Procedure

Institutional Review Board approval was obtained from the University. Upon agreement with the social media group administrator, the online survey was posted on the social media group site dedicated to sharing COVID-19 content. At the time of the survey posting (April, 2020), the group had 30,500 followers. Potential participants had the option to select the survey link, read and consent to participation, and complete the anonymous survey. The survey was formatted to be completed on computers, tablets, and smartphones. The survey was made available for 2 weeks.

Results

The survey was made available online from April 15 to April 27, 2020. The average completion time of the survey was 11.04 min (SD = 6.48).

The primary variables of interest which served as predictor variables, included a single item for susceptibility of contracting COVID-19 (susceptibility), and a single item for potential severity if contract COVID-19 (severity). The sum of a 10-item prevention practices questionnaire (prevention practices) served as the criterion variable. Secondary variables included demographics and knowledge, experiences with COVID-19 (e.g., experienced respiratory like symptoms in the last 90 days).

COVID-19 Knowledge and Experience

When asked about their general knowledge relating to COVID-19, eight (1.1%) participants self-reported reported below average knowledge, 188 (26.2%) reported average knowledge, 521 (72.7%) reported above average knowledge, and two did not provide a response. Based on COVID-19 information available at the time of data collection (April, 2020), and relative to general knowledge of COVID-19, the sample showed good knowledge. For example, when asked about the time recommended to wash your hands, a total of 634 (88.2%) correctly answered at least 20 s. Six-hundred and fifteen (85.8%) correctly identified the appropriate distance for social distancing to be 6 feet. Pertaining to onset of symptoms, 615 (85.5%) correctly identified 2–14 days. Overall, the average score on the knowledge task was 82.2%.

Relative to susceptibility, 45 (6.3%) participants reported they were very unlikely to contract COVID-19, 328 (45.7%) unlikely to contract COVID-19, 284 (39.6%) likely to contract COVID-19, and 61 (8.5%) reported they were very likely to contract COVID-19. Response to the potential severity if contracting COVID-19, 107 (14.9%) participants reported it would not at all be serious, 310 (43.1%) somewhat serious, 181 (25.2%) serious, and 121 (16.8%) participants reported that the severity would be very serious.

COVID-19 Prevention Practices

The ten items that assessed prevention practices were summed to generate a prevention practice score. The mean score for prevention practice questionnaire was 35.01 (SD = 4.32), with a range of 10 to 40. Higher scores relate to greater prevention practices.

To explore associations between susceptibility, severity, and prevention practices, correlations were computed. Table 2 includes correlations among susceptibility, severity, and prevention practices. As can be seen, the model revealed

Table 2 Correlations among susceptibility, severity, and prevention practices

Variable	n	M	SD	1	2	3
1 Susceptibility	719	2.50	.739	–		
2 Severity	719	2.44	.939	.214* [.143, .283]	–	
3 Prevention Practices	719	35.01	4.33	.272* [.203, .339]	.472* [.413, .527]	–

Values in squared brackets indicate 95% confidence interval for each correlation
n sample size, *M* mean, *SD* standard deviation

*Indicates $p < .001$

significant correlations among the three variables with the strongest correlation between prevention practices and severity. The difference between the correlations of perceived susceptibility (0.214) and severity (0.472) with prevention practices was significant using a dependent overlapping test, $z = 4.764$, $p < 0.001$, [0.118, 0.282] due to Meng et al. [29], with the 95% confidence interval calculated by the method of Zou [30].

To explore the variance in prevention practices that could be explained by perceptions of susceptibility and severity, a multiple regression was conducted. The predictor variables were susceptibility and severity, while the criterion variable was the prevention practice score. The multiple regression model predicted prevention practices, $F(2, 715) = 121.391$, $p < 0.001$, $R^2 = 0.253$. Both variables added significantly to the prediction, $p < 0.001$. Regression coefficients and standard errors can be found in Table 3. As can be seen, when severity remains constant, for every one unit increase in susceptibility to contract COVID-19, the model would forecast a 1.051 unit increase in prevention practices. In addition, when susceptibility remains constant, for every one unit increase in severity if contract COVID-19, the model would forecast a 1.996 unit increase in prevention practices.

To investigate the secondary objective, a moderation analysis was conducted to explore if the relationship between perceived susceptibility and prevention practices was moderated by perceived potential severity. To conduct the moderation analysis, the variables susceptibility and severity were each centered, and a product variable was

created. A regression was then conducted with the centered results of susceptibility, severity, and the product variable (susceptibility \times severity) serving as the predictors, and prevention practices as the criterion. Results revealed the Beta (-0.056) associated with the product variable was non-significant ($p = 0.761$).

Discussion

The present study provides evidence that perceptions relating to COVID-19 are associated with prevention practices. Specifically, perceived susceptibility of contracting COVID-19, and potential severity of COVID-19 statistically significantly predict prevention practices. Further, results suggest that potential severity plays a stronger role in predicting prevention practices than susceptibility of contracting COVID-19. To maximize behavior change (i.e., increased prevention practices), public health education programs should emphasize the potential severity of COVID-19, over the potential susceptibility of contracting COVID-19, without concern that the relationship depends on the alternative variable. More specifically, successful behavior change due to emphasis on severity, is not dependent on emphasis on perceived susceptibility.

Throughout the pandemic, a recurring factor reported by health organizations was the number of cases and number of deaths [31, 32]. This information essentially provides data pertaining to susceptibility, or prevalence (i.e., total

Table 3 Multiple regression predicting prevention practices from susceptibility and severity

Prevention practice	B	95% CI for B		SE B	β	R^2	adj. R^2
		LL	UL				
Model						.253	.251*
Constant	27.514	26.411*	28.616	.561			
Susceptibility	1.051	.671*	1.432	.194	.180*		
Severity	1.996	1.697*	2.295	.152	.433*		

B unstandardized regression coefficient; *CI* confidence interval; *LL* lower limit; *UL* upper limit; *SE B* standard error of the coefficient; β standardized coefficient; R^2 coefficient of determination; *adj. R^2* adjusted R^2

* $p < .001$

COVID-19 cases/total population). It also provides the data to estimate mortality rate, and infection fatality rate. While death is certainly an aspect of severity, other potentially disconcerting symptoms were not widely promoted. These symptoms are more aligned with severity. When viewing COVID-19 reporting websites (e.g., CDC, WHO), the sites main page highlight susceptibility being cases and deaths [31, 32]. While these sites do report aspects of severity, the information tends to be highlighted on secondary web pages, and not part of any lead messaging. Essentially, it's easy to find data on susceptibility, but more difficult to find data on severity, beyond death. When exploring the secondary pages that provide details of severity, several COVID-19 symptoms are identified such as difficulty breathing or shortness of breath, tiredness or fatigue, difficulty thinking or concentrating, chest or stomach pain, headache, fast-beating or pounding heart, joint or muscle pain, diarrhea, sleep problems, fever, dizziness on standing, rash, change in smell or taste, and changes in menstrual period cycles [33, 34]. Much less is written about post-COVID-19 conditions, which are defined as a wide range of health consequences that are present four or more weeks after a COVID-19 infection [34, 35]. Currently, these conditions include dyspnea or increased respiratory effort, fatigue, post-exertional malaise and/or poor endurance, cognitive impairment, chest pain, headache, palpitations and/or tachycardia, arthralgia, myalgia, paresthesia, abdominal pain, diarrhea, insomnia and other sleep difficulties, impaired daily function and mobility, and anosmia or dysgeusia [36]. From a general health viewpoint, COVID-19 symptoms appear to cause significant discomfort, while the post-COVID-19 conditions may cause long-term health challenges. Evidence from the present study suggests greater emphasis and promotion of COVID-19 symptoms severity as well as post COVID-19 conditions may result in increased prevention practices.

The value in the present study can be found in the potential alignment with healthcare education and social marketing research. During the early stage of a pandemic and prior to a vaccine, effective management of the spread of the virus is largely dependent on the communities practice of prevention measures. Implementation of these prevention practices is largely dependent on effective healthcare education, and public health mass media programs [37]. It may be beneficial to integrate the results of the present study with social marketing practices, so that healthcare education programs may better influence the desired behavior change (e.g., prevention practices). For example, in a meta-analysis, social marketing researchers explored the influence of social marketing and behavioral change of health behaviors. The researchers found that most successful interventions were designed to show users the consequences of their behavior [38]. Further, marketing research shows that the more messages communicated, the lower the likelihood of any single message being

communicated [39]. Randolph and Viswanath [40] found for example, campaigns that limited the number of messages in a campaign, resulted in greater behavioral change. Finally, content marketing where the message is strategically ordered in relation to public perceptions, is important to achieving desired behavior [41].

Based on the present study and marketing research principles, it can be recommended that future healthcare education programs for a pandemic strategically order the content of the education program. This could be done by ordering the message based on the amount of variance each factor (e.g., potential severity) has on prevention practices with the factors showing the greatest predictive value being promoted first. In addition, education program leaders should emphasize fewer factors rather than all potential factors. In this instance, a cut-off predictor value (the adj. R^2) could be identified resulting in only the factors above the cutoff be included in the education/media program.

Implications for Practice

There are practical and theoretical implications of the present study. Practically, healthcare educators and community leaders should consider emphasizing the severity of COVID-19 including post-COVID-19 conditions. This increased emphasis on the severity of COVID-19 could lead to increased prevention practices. Theoretically, researchers could further explore the predictive properties and associations between the HBM dimensions of benefits, barriers, susceptibility, and severity. While there is good evidence to the value of benefits and barriers to prevention practices, the mixed evidence of susceptibility and severity suggest the individual dimensions of the HBM may be used to understand the use of prevention practices during a pandemic. However, since there is evidence to the value of the dimensions individually, further research seems warranted to fully understand the HBM and prevention practices. Researchers could also explore associations between the HBM and other factors such as general health knowledge, personal health history, age groups (e.g., college students), and possibly personality traits on prevention practices.

Strengths and Limitations

The strengths of the study include sample size and date of data collection. The study included responses from 719 participants. The data was also collected early in the pandemic. The challenges in gaining compliance with CDC guidelines, along with current challenges in compliance with vaccine recommendations, is in-part a cause of continued struggles in this pandemic. We believe a retrospective look at noncompliance early in the pandemic is where researchers should be exploring to identify causal attributions of this, and future

pandemics. Limitations include a sample that was entirely from a COVID-19 informational social media site. This suggests active interest in the pandemic, which was evidenced by their good knowledge of general aspects of COVID-19. However, the sample did not include individuals with poor knowledge of COVID-19. Further, the participants were from the southern part of the United States, predominantly female, and white. It is difficult to assess the homogeneity of the sample as we have been unable to obtain characteristics of the specific social media group page from which the data was collected. The social media page is a public page that anyone on Facebook could join.

Conclusion

It is frightening to think that we will experience another pandemic in our lifetime. However, it is imperative that social science researchers take the time to study and document behavioral aspects during this pandemic, to better prepare society for the next pandemic. To optimize prevention practices, the present study provides evidence that public health education programs should emphasize the potential severity of COVID-19, over the potential susceptibility of contracting COVID-19, without concern that the relationship depends on the alternative variable. Indeed, to inhibit the spread of future viruses leading to a pandemic, it may be prudent to further build relationships between social scientists, healthcare researchers, and marketing researchers. This goes beyond psychology, healthcare, and marketing, into the realm of behavioral health marketing.

Author Contributions All authors contributed to the design and implementation of the study.

Funding No funding was received to assist with the preparation of this manuscript.

Data Availability Study data is available upon request to the corresponding author.

Code Availability N/A.

Declarations

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Ethical Approval Institutional Review Board (IRB) approval was obtained prior to the implementation of research.

Consent to Participate All participants completed an online consent, which was approved by the IRB, prior to completing the survey.

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