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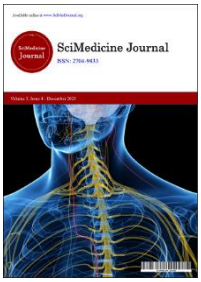

COVID-19 Perceptions: Applying the Health Belief Model

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Abstract

This study aimed to explore the Sudanese COVID-19-related perceptions on preventive measures using the Health Belief Model, a psychosocial frame that explains and predicts health-related behaviours. A cross-sectional using an online-questionnaire through social media platforms, or channels. A snowball sampling technique was used. Descriptive analyses using frequencies and percentages for categorical variables, mean (±SD) for numerical variables. Bivariate relationships between the variables were assessed using a t-test. We conducted multiple variable analysis using the correlation between HBM constructs. Eight hundred seventy-seven participants with a mean age 37.8 (SD±11.94), primarily males, had a university education, employed and residing in Khartoum. Scores of 69% self-efficacy prevent COVID-19, 60% perceived severity if infected with COVID-19, 54% perceived susceptibility to COVID-19. Furthermore, high scores reported for hand hygiene barriers 50 and 53% social distancing. Self-efficacy correlated negatively with susceptibility (r=-0.084), positively with severity, benefits of and barriers to hand hygiene, benefits and barriers to social distancing (r=0.117, r=0.347, r=0.202, r=0.396, r=0.276), respectively. The lack of self-efficacy and low perception of severity and susceptibility, and increased perception of barriers to social distancing and hand hygiene among a considerable portion of the public hindered the compliance with the preventive measures.

Keywords: COVID-19; Sudan; Severity; Susceptibility; Health Belief Model; Perception.

1. Introduction

Pneumonia of unknown cause detected in Wuhan, China, was first reported to the World Health Organization (WHO) in China on Dec 31 2019 [1]. On 11 February 2020, WHO used the term 2019 novel coronavirus to refer to a coronavirus that affected the patients' lower respiratory tract. Further studies formally recognized this virus related to Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and renamed it SARS-CoV-2 [2]. The coronavirus belongs to a family of viruses that are common in animals and may affect humans. Cause various symptoms such as pneumonia, fever, breathing difficulty, and lung infection [2]. On Mar 11, the coronavirus disease 2019 (COVID-19) outbreak spread to 46 countries and was declared by WHO as a pandemic, the first in recent history [3].

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Different sources from which the public receives the information about the COVID-19 cases and mortality rate may have different levels of knowledge and different perceived severity and susceptibility to the disease. All of these could associate with the public's emotional and behavioural reactions towards the COVID-19. Public behaviours are essential for outbreak management, particularly during the early phase when no treatment or vaccination is available. The only option is the engagement in precautionary behaviours, such as wearing masks, hand hygiene and social distancing [4]. Humans, like other animals, possess a set of defensive systems for combating ecological threats; strong fear appeals produce the most significant behaviour change only when people feel a sense of efficacy. Whereas persuasive fear appeals with low-efficacy messages produce the highest levels of defensive responses [5].

Health Belief Model (HBM) is one of the first theories of health behaviour. It was developed in the 1950s and assumes that health behaviour modification assessments depend on the balance between the barriers to benefits of action [6, 7]. HBM is a social and psychological health behaviour change model developed to explain and predict health-related behaviours, particularly concerning the uptake of health services [8]. The theoretical constructs that constitute the HBM are broadly defined; furthermore, the HBM does not specify how constructs of the model interact with one another. Consequently, different operationalization of the theoretical constructs may not be strictly comparable across studies [9, 10]. The HBM is focused, and there is evidence that the effectiveness of interventions to promote health behaviour change and improve health outcomes could depend on the use of models like the HBM [6].

Perceptions or beliefs about an outbreak may be necessary for determining compliance with health advice [11]. The public may be more likely to comply with health recommendations if they believe they are effective [12]. Also, the perceived susceptibility, severity and high likelihood may be affected by the outbreak [13]. A study in China showed that being older, having good health, having higher education, perceiving the virus to be more severe, and having more knowledge were positively related to social compliance [14]. The social compliance, risk perception and severity are not consistent across demographic variations, social status and overtime. Indeed, previous studies have shown that perceptions and behaviours often change over time [15].

On Mar 13 2020, Sudan reported its first COVID-19 in Khartoum, and the cases exceed 30,873 confirmed cases of COVID-19 with 1,940 deaths, despite the total lockdown and other measures [16]. Sudan faces an immense crisis due to the pandemic and weak health system's political instability and economic impact. Implementation of public health measures should be based on the understanding of the public's perceptions, beliefs, and attitude; therefore, this study aimed to explore the roles of perceived threat (perceived susceptibility and perceived severity), benefits, and barriers on the health preventive measures towards COVID-19 among Sudanese population. The survey results will be helpful to assess the subsequent interventions and communication strategies as the epidemic progresses.

2. Methods

A Cross-sectional online survey was conducted between 1st-16th April 2020 among Sudanese adults (aged ≥18 years). A snowball sampling technique was used, starting from known professional and social media groups and individuals. To ensure high coverage, all those contacted were requested to share the survey link and promote messages on their webpages, social media platforms, or channels, which they usually use to convey information to their contacts, with no restriction on their dissemination.

The online survey link was distributed on various internet platforms, including *WhatsApp* (the most popular app in Sudan), Facebook and Twitter. The link (*https://forms.gle/D3VhQgQVEirFH3gF6*) opens standardized instructions about the study's purpose and the procedure for completing the survey. Individuals who were aged ≥18-year living in Sudan were eligible to participate. The survey could not be taken twice from the same electronic device. Participation was voluntary, and no incentive rewards were given. Anonymity was ensured as no identifiable information was collected. The survey could be completed in less than ten minutes. If a participant filled and submitted the form, it was considered as consent to the participation. The questionnaire was constructed in English and administered in Arabic. The questionnaire was translated from English into Arabic and subsequently back-translated into English by experts in both languages. A pilot study testing the accuracy of translation and understanding of the questions was conducted before administration of the study among selected participants. This pilot was conducted, including 20 participants (male, female). Some minor adjustments to the survey instrument were performed before it was administered in the survey. A timeline of two weeks was set, with two reminders and the link was closed after that. Eight hundred seventy-nine individuals participated in the survey. This study obtained approval from the Research Ethics Committee at the University of Science and Technology, Omdurman, Sudan UST (See Figure 1).

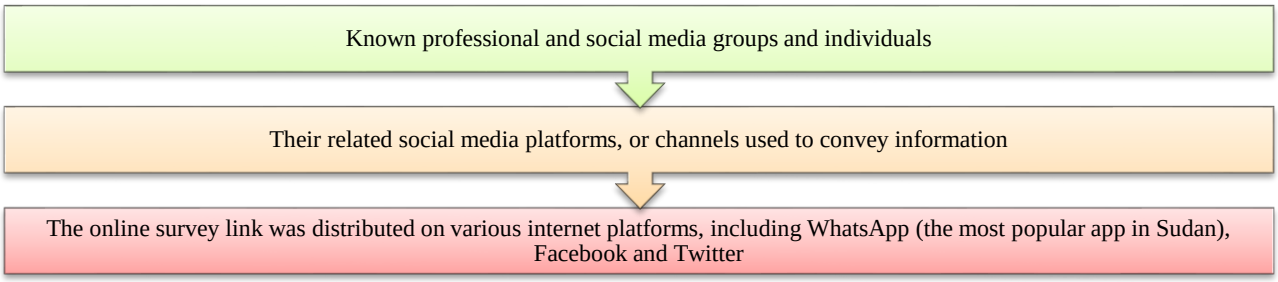

Figure 1. Data collection flowchart

3. Measures

The survey instrument was based on HBM constructs of self-efficacy, perceived susceptibility and severity to COVID-19 benefits from and barriers to the preventive measures [7], beside socio-demographic characteristics, health-related information and COVID-19 related-history. Respondents completed subscales assessing the HBM constructs. All items were rated on five-point Likert's scales (from strongly disagree to agree strongly) literature and were averaged to create HBM constructs (Table 1).

Two items measured perceived susceptibility to COVID-19. Using a five-point scale. A sum variable, "Perceived susceptibility to COVID-19" (Cronbach's α=0.80), was constructed and dichotomized on the mean (6.66± SD 1.96).

Three items measured perceived severity if infected with COVID-19 was measured by using three items. Using a five-point scale. A sum variable "perceived severity if infected with COVID-19" (Cronbach's α=0.68) was constructed from the three items and was dichotomized on the mean (11.9 ± SD 2.4).

Two items measured barriers to benefits of hand hygiene; Using a 5-point scale. A sum variable "benefits of hand hygiene to prevent COVID-19" (Cronbach's α=0.68) was constructed from the two items and was dichotomized on the mean (8.18 ± SD 1.76).

Two items measured barriers to hand hygiene Using a five-point scale (5= strongly agree; 1=strongly disagree). A sum variable, "barriers of hand hygiene to prevent COVID-19" (Cronbach's α=0.10), was constructed from the two items and dichotomized on the mean (7.20 SD ±1.62).

Two items measured social distancing benefits using a five-point scale (5 = strongly agree; 1=strongly disagree). A sum variable "benefits of social distancing to prevent COVID-19" (Cronbach's α=0.83) was constructed from the two items and was dichotomized on the mean (9.07± SD 1.18).

Two items measured barriers to social distancing; A sum variable "barriers of social distancing to prevent COVID-19" (Cronbach's α=0.48) was constructed from the two items and was dichotomized on the mean (7.22± SD 1.87).

Five items measured self-efficacy towards health COVID-19; A sum variable "self-efficacy to prevent COVID-19" (Cronbach's α=0.73) was constructed and dichotomized on the mean (22.44±2.21 S.D).

Table 1. Mean (±SD), Min-Max, and CI of HBM constructs

Variable	Mean (±SD)	CI	Min/ Max
Self-Efficacy	22.44 (2.21)	22.29, 22.59	14/25
Susceptibility	6.66 (1.96)	6.53, 6.79	2/10
Severity	11.9 (2.4)	11. 7, 12.0	3/15
Benefits Hand Hygiene	8.18 (1.76)	8.07, 8.30	2/10
Barriers Hand Hygiene	7.20 (1.62)	7.09, 7.30	2/10
Benefits Social Distancing	9.07 (1.18)	8.99, 9.15	4/10
Barriers Social Distancing	7.22 (1.87)	7.10, 7.35	2/10

4. Data Analysis

We analyzed data using the Statistical Package for the Social Science, version 23 (IBM SPSS). We performed descriptive analyses using frequencies and percentages for categorical variables, mean and Standard Deviation (±SD) for numerical variables. Bivariate relationships between the variables were assessed using a t-test. We conducted multiple variable analysis using the correlation between HBM constructs. Estimates are presented as Pearson Correlation coefficients (r) with a 95% confidence interval (CI); a two-sided significance level of ≤ 5% was implied for all analyses.

5. Results

5.1. Sample Profile

Some 877 individuals participated in the survey with a mean age of 37.8 (SD±11.94); most participants (77%) were in the age-group 24-55-year-old. Males were slightly higher than the females, 59% (517). The majority had university or higher education 94.4% (828), most of them 73% (636) were employed, and resided in Khartoum State 76.4% (670), with almost all had no history of travelling during the past 14 days 92% (807) (See Figure 2). Regarding reported health status, most of the participants perceived having good/very good health status 87.8% (770), reported no medical consultation in the past month 86.2% (756), no respiratory symptoms 74.2% (651), and no organic/mental illness 75.3% (661). Almost all the participants reported no relation neither with COVID-19 infection nor with anyone with COVID-19 infection 97.9% (859), 88.9% (867).

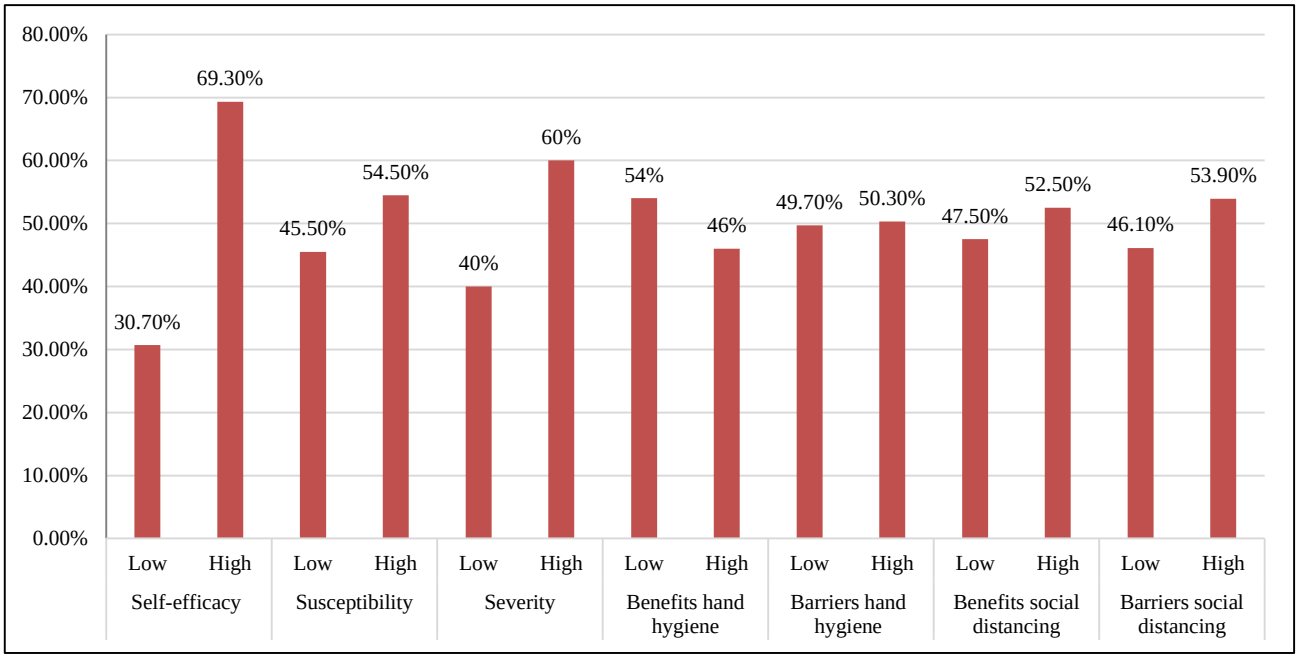

Figure 2. Percentage distribution of HBM Constructs

5.2. Health Belief Model Constructs

When HBM constructs were dichotomized, the participants' scores were divided almost equally through all the constructs after being dichotomized using the mean scores (See Table 2). Participants scored high in almost all constructs ranging from 52% to 60%, except for barriers and benefits hand hygiene. The participants were almost equally distributed 50.3% versus 49.7% regarding hand hygiene barriers, but benefits hand hygiene was the single constructs where more participants scored low benefits 54% versus 46%.

There were statistically significant differences among gender, as males perceived higher barriers to hand hygiene, while females perceived higher benefits and social distancing barriers. Many statistically significant differences were observed: Those who reported a lower education level perceived higher benefits hand hygiene. Participants with a history of medical consultation last 14 days perceived higher susceptibility compared to their counterparts. Those with respiratory symptoms perceived higher susceptibility to and severity of the infection and threat perception; they perceived fewer barriers to hands hygiene and less self-efficacy. Participants who had a travelling history in the last month perceived less severity and threat perception of the infection than their counterparts. Participants reporting no relation with the infection perceived less susceptibility and severity to the infection. Those reporting no relation with anyone affected with the infection scored less severity and benefits of social distancing.

When HBM constructs were regressed, almost all constructs correlated statistically significant to each other except for susceptibility to benefits and barriers to social distancing, as well as the severity of barriers to social distancing. Self-efficacy correlated positively with all the constructs and negatively with susceptibility. The correlation was stronger with the benefits of social distancing. The least correlated were severity and susceptibility. Susceptibility negatively correlated with self-efficacy, barriers, and benefits hand hygiene, while correlated positively with severity, which was the strongest correlation; the least correlation was with severity. Severity correlated with self-efficacy, susceptibility, benefits hand hygiene and social distancing, while correlated negatively with hand hygiene barriers.

Benefits hand hygiene correlated positively with self-efficacy, severity, benefits and barriers social distancing,

while correlated negatively only with susceptibility. Barriers to hands hygiene correlated positively with self-efficacy benefits hand hygiene, benefits and barriers social distancing, while correlated negatively with susceptibility and severity. Benefits social distancing correlated positively with all other constructs. Barriers social distancing correlated positively with all constructs except susceptibility and severity.

Table 2. Correlation of the HBM constructs

	Self-Efficacy	Susceptibility	Severity	Ben. H.H.	Bar. HH	Ben. SD	Barr. S.D.
Susceptibility	-0.084*	1					
Severity	0.117**	0.189**	1				
Ben. HH	0.347**	-0.162**	0.116**	1			
Bar. HH	0.202**	-0.109**	-0.073*	0.126**	1		
Ben. SD	0.396**	0.042	0.148**	0.289**	0.194**	1	
Barr. SD	0.276**	-.052	-0.041	0.084*	0.351**	0.329**	1

*. p≤ 0.05 Level (2-Tailed). ** p≤ 0.01 Level (2-Tailed)

Ben. HH= benefits of hand hygiene, Bar. HH= barriers to hand hygiene, Ben. SD= benefits of social distancing, Barr. SD= barriers to social distancing.

6. Discussion

The application of psychological theories would provide systematic explanations of observable facts. Health behaviour research has explored the effectiveness and applicability of various health behaviour modification models [17]. According to the framework of the HBM in the context of COVID-19 suggests that a person would be more likely to comply with recommended preventive behaviours if he/she perceives being susceptible to the infection (perceived susceptibility) and that the infection could lead to severe consequences (perceived severity).

This study provides a timely assessment of the perceived constructs of the HBM of the preventive measures (hand hygiene and social distancing) recommended by health authorities in Sudan using HBM. Although less than expected for several reasons, Sudan literacy constitutes 75.9%, and the total internet users are only 26.4% of the population. Only 8.3% is active users of social media platforms the online survey posted [18]. The gender distribution among the participants almost similar to the population as the ratio of males to females (1.44-1.01), respectively.

Among the participants, almost one-third of them scored low perceived self-efficacy. That means to lack self-efficacy to follow the preventive measures' guidelines to slow the SARS/CORONA-2 virus [19]. Perceived high self-efficacy is inversely related to perceived susceptibility, positively related to perceived severity leading to more people adopting preventive measures, and consistent with other studies [4, 14]. The previous experiences and literature indicate that an emphasis on sustained interventions towards changing social norms yields the most effective results [20]. Mitigating behaviours require significant efforts to strengthen beliefs about disease, which includes self-efficacy. Self-efficacy has been increasingly associated with health behaviour change, and it is a strong predictor of health-promoting behaviours [21, 22]. The higher the perceived barriers of social distancing and hand hygiene, the more likely participants were to perceive high self-efficacy. This is not according to other studies in which negative relation was established between these constructs [23, 24].

Males perceived higher barriers to hand hygiene and social distancing than females. This is in line with the literature that females perceived higher benefits [25]. Females' prompted compliance of preventive measures in protecting themselves and others related to health issues. Perhaps targeting health promotion messages through females (for example, mothers, wives) who are more health-conscious and risk-averse would be worth exploring in an attempt to raise the level of protective precautions undertaken by this vulnerable subgroup [26, 27]. This study reported that the observed low perceived susceptibility and severity of contracting a disease or condition, including consequences) 45% - 40% respectively, which contradicts a similar study in Hong Kong in which high perceived susceptibility and severity were reported (89-97%) [4]. Respondents who had respiratory, health-related issues, or relation with coronavirus perceived higher susceptibility, severity and threat of the infection, consistent with other responses during other epidemics like SARS [26].

This wide gap may be explained by as in China where the disease started far from Sudan, and here comes the role of "optimism bias", which believes that bad things are less likely to happen to oneself than others [28]. While optimism bias may be beneficial for avoiding anxiety emotions during a pandemic, it can lead people to underestimate their chance of contracting a disease, and therefore disregard public health warnings [29]. Another reason is fear, known as a factor that can lead to behavioural changes among people. Fear was the most significant change in behaviours among those who perceived high self-efficacy and produced defensive responses among those who perceived low efficacy towards their health [30]. Hence, Sudan's communication strategies should follow a balance between breaking through optimism bias without inducing excessive fear.

6.1. Strengths and Limitations

This study's apparent strength is that data collection took place during the COVID-19 pandemic, where the threat was regarded as high, and the scenarios were not based on hypothetical situations. Again this study is based on HBM, enables analysis and comparison with other studies using the model to explain health behaviour. Although these findings give valuable insight into health behaviours among the Sudanese population, several limitations should be noted. Using a web-based questionnaire might lead to selection bias. The only internet users were not fully representative of the general population. Therefore, the findings of this study should be cautiously interpreted and generalized. Considering the use of self-report questionnaires, cross-sectional design, low response rate and small sample size.

7. Conclusion

The application of a psychological model helps in the guiding and structuring of the research process. The findings showed that the HBM constructs and some of the personal characteristics are important factors that form individuals' perceptions. Gender and educational differences were among those factors. HBM constructs correlated to each other as well as other socio-demographic factors. Education level was one of the important factors thus maintaining the important role of health education. Benefits and barriers are proximal factors to preventive measures. Susceptibility and severity perceptions are the distal driving factors that form individuals' actions. Self-efficacy was found as an effective factor that must be taken into account as a potent changing factor to susceptibility and severity perceptions. Increasing self-efficacy might decrease the perceived susceptibility. Correlations found in this study might help drive behaviour – changing efforts. The lack of self-efficacy and low perception of severity and susceptibility, as well as increased perception of barriers to social distancing and hand hygiene among a considerable portion of the public hindered the compliance with the guidelines of the preventive measures.

8. Declarations

8.1. Author Contributions

The authors' roles were E.F.N., A.K.E., and H.M.A. which contributed to the study's conception and design, the acquisition of data, analysis, and interpretation of data. The authors wrote the paper and had critically read and edited the paper. All authors have read and approved the final manuscript.

8.2. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

8.3. Ethical Approval

This study obtained approval from the Research Ethics Committee at the University of Science and Technology, Omdurman, Sudan UST.

8.4. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

8.5. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix I: Questionnaire

1. Gender;
2. Age (years);
3. Educational level;
4. Occupation;
5. Address;
6. How do you evaluate your current health situation;
7. Did you get medical advice during the previous 14 days?
8. Have you had any respiratory symptoms (coughing, shortness of breath, runny nose) during the previous 14 days?
9. Did you travel outside Sudan during the past month?
10. Do you have anything to do with corona infection?
11. Do you have anything to do with someone with corona (a friend, neighbour or family member)?
12. Do you suffer or have any organic or mental illness?
13. Corona infection is likely to develop;
14. If you get corona infection, the situation is dangerous;
15. If I get corona infection, I can lose my life;
16. If I get corona infection it will affect my daily life;
17. If I get corona infection, I will fully recover;
18. If I get corona infection, I will fully recover;
19. Hand hygiene (washing hands or disinfectants) properly and correctly will protect me completely from corona infection.
20. Feel safe from infection by cleaning hands (hand washing or antiseptics);
21. My hands get damaged during hand hygiene (washing hands or antiseptics) the right way or for a long time;
22. Always forget about hand hygiene (washing hands or antiseptics);
23. Community spacing protects me from the transmission of corona infection;
24. Feel safe from infection by applying societal spacing;
25. I feel a bad feeling of applying societal divergence;
26. Always forget to apply community spacing;
27. Maintaining good health is an important part of my life;
28. I think I am a person who cares well for his general health;
29. I think it is important for me to have good general health;
30. I think it is important for me to avoid infectious diseases;
31. I think I am a person who takes correct health measures;
32. One of my acquaintances (family, neighbour, or friend) is more likely to develop corona infection;