



COVID-19 Preventive Behavior Practices and Determinants: A Scoping Review

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Abstract

Edited by: Eli Djulejic
Citation: Lusmilasari L, Putra ADM, Sandhi A, Saifullah AD. COVID-19 Preventive Behavior Practices and Determinants: A Scoping Review. Open Access Maced J Med Sci. 2022 Jan 19; 10(F):23-32. <https://doi.org/10.3889/oamjms.2022.8162>
Keywords: COVID-19; Determinants; Preventive behaviors; Adult
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Received: 04-Dec-2021
Revised: 06-Jan-2022
Accepted: 09-Jan-2022
Copyright: © 2022 Lely Lusmilasari, Alenda Dwiadila Matra Putra, Ayyu Sandhi, Azam David Saifullah
Funding: This study obtained grant from Universitas Gadjah Mada
Competing Interests: The authors have declared that no competing interests exist
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BACKGROUND: Since early 2020, the global community has been battling a pandemic caused by coronavirus disease, known as COVID-19. In response to the pandemic, preventive behaviors have been widely applied regardless of the sociocultural, economic and educational status of individuals. However, studies related to its implementation have not been completely reviewed to identify the implementation as well as the determining factors for COVID-19 preventive behaviors.

AIM: This review aimed to synthesize evidence from existing studies about the implementation of COVID-19 preventive behaviors, its determinants, and its measurement tools

METHODS: This study employed a scoping approach using five electronic databases (Scopus, ScienceDirect, SAGE Journals, ProQuest, and EBSCOhost). The screening is guided by a PRISMA flowchart.

RESULTS: Around 27 articles were included in this review with 26 of 27 selected articles incorporating cross-sectional research design and only a study using a three-wave prospective correlational design. Four sub-themes were identified to describe the preventive behaviors implementation, namely: (1) Personal preventive measures, (2) community preventive measures, (3) immune boosting, and (4) self-screening and medication. In addition, determinant factors of COVID-19 preventive measures are also identified as such (1) socio-demographic factors, (2) social psychological factors, (3) health status factors, and (4) enabling factors.

CONCLUSION: The aspects of COVID-19 preventive behavior implementation include personal and community preventive measures, immune boosting, and self-screening/medication. These measures are affected by multifactorial. Further research needs to be focused on intervention development to improve the adherence of the preventive measures by considering reported determinants factors.

Introduction

Since early 2020, the global community has been battling a pandemic caused by coronavirus disease, known as COVID-19. This disease, which affects both the adult population and the respiratory system of children, has become widespread in countries [1]. With respect to this situation, the World Health Organization (WHO) has declared the SARS-CoV-2 epidemic a global public health emergency since March 2020. The WHO reported that there were 260,493,573 confirmed cases, with more than 5 million deaths by November 28, 2021 [2].

The COVID-19 pandemic is resulting in enormous drawbacks as the number of morbidity and mortality has surged since the pandemic hit the global community hard. Saladino *et al.* [3] strongly revealed that psychological and social issues have significantly occurred amidst the pandemic. What is more, people experience the feeling of being separated from relatives and helplessness, loss of freedom, and uncertainties related to disease development [4], [5].

Preventive behaviors which can reduce the transmission of COVID-19 play an important role amidst the pandemic. Disease prevention behavior is a reaction to prevent the onset of the disease [6]. The COVID-19 preventive behavior is defined as measures to suppress the transmission of COVID-19. Several measures recommended by the government, such as social/physical distancing, self-isolation and quarantine, lockdown, and other measures have been performed as mass prevention strategies. These strategies are conducted in order to stop the infection-related pandemic [7]. According to CDC [8] and WHO [9], the COVID-19 preventive behavior comprises avoiding to touch eyes, nose, and mouth, washing hand with soap and water or alcohol-based liquid regularly, performing cough etiquette or respiratory hygiene, social or physical distancing, self-isolating if feeling ill, avoiding crowds, and maintaining distance from people who are sick. Other related behaviors to prevent COVID-19 transmission include consuming nutritious food, exercising regularly, and receiving COVID-19 immunizations [10].

Preventing the transmission of COVID-19 requires compliance with preventive behavior by local

governments and the local community as the virus is easily transmitted in humans. This virus is transmitted by droplets from the nose and mouth of patients, through contact, fomite and fecal-oral contact [11], [12]. Therefore, the COVID-19 preventive behavior cannot be conducted without active participation of society [13]. Each community member has to regularly perform the COVID-19 preventive behavior to control the virus spreading amidst the pandemic.

The implementation of behavior is influenced by several factors, according to LaMorte [14] is effectively performed if obstacles, benefits, threats, the willingness to act as well as self-efficacy is acknowledged by people. This is explained that individuals will take preventive action when one is aware of the susceptibility of a certain situation (perceived susceptibility), perception of the worst condition might happen (perceived severity), the understandings of loss reduction (perceived benefit), and perception of negative effect related to health (perceived barriers) [15]. Therefore, an evaluation to assess the COVID-19 preventive behavior is essentially needed as a component in monitoring and developing an intervention based on community needs.

Since the start of the global COVID-19 pandemic in 2019, preventive behaviors have been widely applied regardless of the sociocultural, economic, and educational status of individuals. However, studies related to its implementation have not been completely reviewed to identify the behavior that is obedient as well as the determining factors for its implementation. According to this emerging situation, authors are intrigued to explore the implementation behavior of COVID-19 prevention among people across countries.

Methods

As the topic of COVID-19 preventive behaviors has not been comprehensively reviewed, this study employed a scoping approach to synthesize evidence from existing studies about the implementation of COVID-19 preventive behaviors, its determinants, and its measurement tools following the guidelines by a: (1) Formulation of the research question(s), (2) identification of relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results. To assess the methodological quality of selected studies and to determine the extent to which selected studies have addressed the possibility of bias, critical appraisal was performed individually by four authors using Joanna Briggs Institute Critical appraisal tools [16].

Research questions

This scoping review determined three research questions. These research questions were: (1) "How

was COVID-19 preventive behaviors described?" (2) "What are the determinants of COVID-19 preventive behaviors?" and (3) "What are the measurement tools of COVID-19 preventive behaviors?"

Search methods

Five electronic databases (Scopus, ScienceDirect, SAGE Journals, ProQuest, and EBSCOhost) had been searched to retrieve relevant studies. Keywords of (adult OR family OR "informal caregiver") AND ("preventive behavior" OR "preventive practice") AND (pandemic OR covid-19) were applied to identify studies published between January 2019 and August 2021 with free full-text availability in English.

Eligibility criteria

Studies were included if those were original studies employing quantitative, qualitative, or theoretical design; involving adults or family members older than 18 years of age only who performed COVID-19 preventive behaviors; and published in peer-reviewed journals. Studies were excluded if preventive behaviors were described in a general context (not related to COVID-19 pandemic) and no description of socio-demographic characteristics of participants.

Screening

There were 875 studies identified, of which 120 studies were duplicates. Two authors (LL and ADMP) then independently screened 755 studies by title and abstract. After screening by title and abstract, the full texts of 39 studies were assessed for eligibility. After screening the full text, 27 studies were found to meet the objectives of this scoping review.

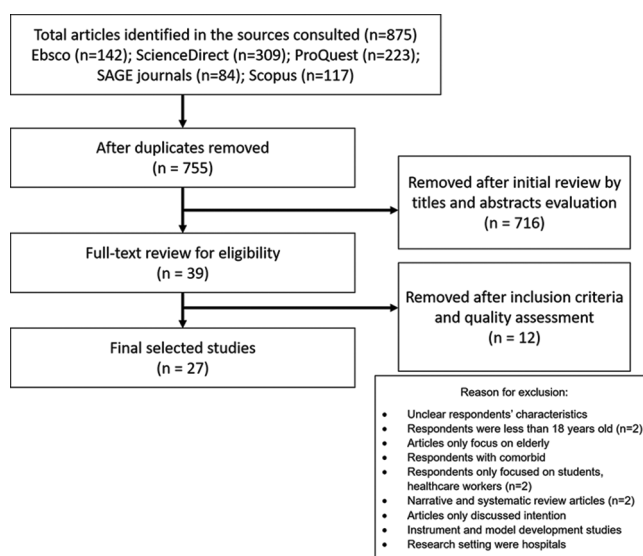


Figure 1: PRISMA flow diagram

Data extraction

Data extraction was conducted by four authors in an Excel spreadsheet to identify the following information from selected studies such as author, publication date (year), country, participants, design, determinants factors to COVID-19 preventive measures, implementation of COVID-19 preventive measures, and instrument used. A data charting table was created to identify themes from study findings which correspond to research objectives and questions [17].

Data analysis

Data analysis was performed by four authors who summarized the major findings from selected studies to draw themes and subthemes independently [17]. The authors then merged the data analysis and performed joint analysis to determine the sub-themes of research questions.

Results

After following the article screening guideline, 27 articles were included in this review article. Almost half of the selected studies were conducted in Asian countries: Iran (3 studies), Saudi Arabia (3 studies), one study in Taiwan, Vietnam, Malaysia, Korea, and Hong Kong, followed by African countries with Egypt (3 studies), Ethiopia (2 studies), one study from Cameroon, Malawi, and Kenya. The remaining studies were from European countries with one study each: Germany, Slovenia, and Hungary. Furthermore, two studies from the USA, one study from Brazil and Mexico can be seen in Table 1. In addition, 26 of 27 selected articles used cross-sectional research design and only a study using a three-wave prospective correlational design. Furthermore, Table 1 also presents the summary of every selected study including determinant factors and the implementation of COVID-19 preventive measures.

Turning to the analytical and synthesis findings of the selected articles, this review deduced two main themes, namely implementation and determinant factors of COVID-19 preventive behaviors. Moreover, four sub-themes were identified to describe the preventive behaviors implementation as seen in Table 2, namely: (1) Personal preventive measures, (2) community preventive measures, (3) immune boosting, and (4) self-screening and medication. In addition, (1) socio-demographic factors, (2) social psychological factors, (3) health status factors, and (4) enabling factors were obtained as the sub-themes of determinant factors of COVID-19 preventive measures as seen in Table 3.

Implementation of preventive measures

Most of the authors of the selected studies used self-developed questionnaires to identify the implementation of COVID-19 preventive behaviors. All instruments were developed from literature or previous study and/or combining with the WHO guidelines [18], [19], [20], [21], [22] and CDC guidelines [22], [23], H1N1 epidemic [24], HIV-related surveys [25], [26], SAR-related study [13], and each Ministry of Health (MOH) guideline in each country [19], [20], [21], [22]. Moreover, only eight authors presented reliability scores of their instruments [18], [26], [27], [28], [29], [30], [31], [32] and the remaining did not provide clear information about psychometric testing.

Personal preventive measures

Personal preventive measures which were well-practiced by most respondents in the selected studies are: regular handwashing [13], [19], [20], [21], [22], [23], [25], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [42] except Yehualashet *et al.* [26], wearing face masks [13], [19], [21], [22], [23], [24], [29], [30], [31], [34], [35], [36], [38], [39], [40], [41] except 4 studies [26], [33], [37], [42], cough/sneeze etiquette [13], [20], [22], [23], [24], [26], [29], [30], [32], [34], [36], [40], [41] except Faria de Moura Villela *et al.* [37], physical/social distancing [13], [21], [22], [23], [24], [29], [30], [31], [33], [34], [35], [37], [38], [40] except three studies [20], [26], [42], using hand sanitizer [13], [21], [23], [24], [31], [34], [36], [37] [38] except Gutu *et al.* [20] and Yehualashet *et al.* [26], avoid touch face [13], [23], [24], [29], [32], [34], [37], [38], [40], [41] except four studies [20], [26], [30], [42], avoid handshake [19], [20], [21], [29], [32], [38], [42] except Ali *et al.* [30], disinfect personal belongings [13], [29], [37] except [26], [34], [40], maintain ventilation [13], [29], [40], avoid contact with animals [29], and dispose used PPS in a hygienic manner [29]. On the other hand, regular body temperature [34], [37], wearing gloves when leaving home [19], [40], [42], separate use of clothing inside and outside home [40], and regular replacement of masks and gloves [40] were poorly adopted by respondents.

Community preventive measures

Community preventive measures which were well-performed by respondents are reported as follows: avoid crowded place/public spaces [13], [21], [22], [24], [25], [29], [30], [33], [34], [35], [36], [38], [39], [40], [41] except two studies [36], [40], avoid meetings [13], [21], [33], [34], [38], [40], [42] except one study [31], staying at home [13], [21], [22], [23], [24], [29], [30], [32], [36], [38], [41], [42] except three studies [26], [33], [35], avoid public transportation [21], [34], [36], [38], [42], avoid contact with infected/vulnerable person [21], [30], [36], [41], [42] except one study [40], avoid travelling [13],

Table 1: Summary of selected studies

Author and Country	Sample	Design	Determinants factors of COVID-19 Preventive Measures	Implementation of COVID-19 Preventive Measures	Instruments
Lin <i>et al.</i> , 2020 Iran	1563 Iranian adults aged 18 years and older	Three-wave prospective correlational	Intention, coping planning, action planning, maintenance, self-efficacy, perceived behavioral control	N/I	A self-developed questionnaire, based on four preventive behaviors recommended by the WHO. This questionnaire has a Cronbach alpha of 0.80.
Lin and Chen, 2021 Taiwan	1012 LINE users in Taiwan	Cross-sectional	Fear arousal, age, gender education level and gender	N/I	Self-developed instruments adopted from previous literature. This specific questionnaire measuring the preventive behavior has Cronbach alpha of 0.721.
Lüdecke and von dem Knesebeck, 2020 Germany	3186 Germans aged 18 years and older	Cross-sectional	Perceived benefit, perceived barriers, self-efficacy	Majority of respondents obeyed to perform handwashing, avoid crowded places, reduce meetings, do physical distancing, and use disinfectant. While they did not regularly practice to adapt school or work situation, stay at home, and wear face masks	Self-developed instrument. There is no clear information on the validity or reliability of the questionnaire.
Mirzaei <i>et al.</i> , 2021 Iran	558 Iranian adults (18 years or older) from 24 provinces across the country	Cross-sectional	Perceived adaptation of the community to lockdown, fear, residing in large cities, access to official COVID-19 information, working in healthcare/medical student	N/I	Self-developed questionnaire to measure preventive and cautious behaviors of COVID-19. There is no information about the CVI score, but it is mentioned in the questionnaire reviewed by experts. The Cronbach alpha of the questionnaire is 0.91.
Nguyen <i>et al.</i> , 2020 Vietnam	2175 Vietnamese citizen (18 years or older)	Cross-sectional	Age and women	Physical distancing, wearing face masks, covering mouth and nose while coughing/sneezing, washing hands immediately, and using hand sanitizer regularly were the personal preventive measures often practiced by respondents. Turning to community measures, avoid meetings, avoid public/crowded spaces, avoid social events, avoid public transportation, avoid using utensils with strangers, and not travelling were the obeyed measures.	Self-developed questionnaire. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Ngwewondo <i>et al.</i> , 2020 Cameroon	1006 Cameroonian residents (18 years or older)	Cross-sectional	access to personal protective equipment and psychological effects of COVID-19	Social distancing, washing hands and using sanitizers, wearing masks, and taking vitamin C and fruits were the most common preventive behaviors by respondents. Whereas total confinement, using traditional medicine, taking self-medication were the low frequency behavior by respondents.	Self-developed 32-item instrument consisting of demographics, knowledge, attitudes, practices, and symptomatology was developed. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Nourmoradi, <i>et al.</i> , 2020 Iran	558 Iranian people (18 years or older)	Cross-sectional	younger age, higher education, female, discomfort when wearing masks, forget and not accustomed to wear mask, lack of governmental push, financial barriers, and unavailability of mask and sanitizer	14 of 18 preventive measures showed a good adherence. While only 4 behaviors were poorly performed	Self-developed 50-item instruments consisted of demographics, knowledge, attitudes, practices, and fear was developed. The Cronbach alpha of the questionnaire 0.92.
Ali <i>et al.</i> , 2021 Egypt	731 adult Egyptian community (≥18 year old)	Cross-sectional	lowest income	Staying at home, covering the mouth and nose while sneezing, wearing masks, social distancing, handwashing, self-isolation when contacting an infected person, avoiding parties, and disinfecting surroundings were regularly practiced measures.	A self-developed online survey questionnaire consists of four sections of the questionnaire. The reliability test was using a test retest resulting in Cronbach alpha of 0.72.
Alkhalidi <i>et al.</i> , 2021 Saudi Arabia	2393 Saudi Arabian respondents (18 year old and above)	Cross-sectional	elderly, female, healthcare practitioners	There were 18 preventive measures abided by respondents with more than 80% of them practicing these measures.	Self-administered web-based questionnaire (web hosted on SURVS with full General Data Protection Regulation coverage. The survey was originally designed for the COVID-19 outbreak in Hong Kong (Kwok <i>et al.</i> , 2020).
Almoayad <i>et al.</i> , 2021 Saudi Arabia	847 residents of Riyadh city who were over 18 years of age	Cross-sectional	older adult	Avoid crowded places, wear masks, keeping distance, regular handwashing, cough etiquette, sterilize surfaces and equipment, and home quarantine were all obeyed by respondents.	An online questionnaire available on Microsoft Forms was distributed via social media and Whatsapp group. It was developed by researchers based on a review of the literature, CDC and the Saudi MoH guidelines.
Aschwanden <i>et al.</i> , 2021 The United States of America	2256 participants from every US state and Washington as well as Puerto Rico, age range 18-98 year old	Cross-sectional	ethnicity and marital status	Eight of nine preventive behaviors toward COVID-19 were regularly performed by respondents in this study with more than 70% of them.	Self-developed online questionnaire including preventive behavior, perceived behavioral control, attitudes towards behavior, perceived subjective norm based on recommendations on sickness prevention published by the CDC. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Bachok <i>et al.</i> , 2021 Malaysia	1290 participants from 14 Malaysian states	Cross-sectional		All ten preventive measures were complied by respondents in this study with more than 60% in each measure.	A self developed questionnaire was designed to record all of the information, based on the literature and previous research of the H1N1 influenza epidemic in 2010, which had been validated. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.

(Contd...)

Table 1: (Continued)

Author and Country	Sample	Design	Determinants factors of COVID-19 Preventive Measures	Implementation of COVID-19 Preventive Measures	Instruments
Banda <i>et al.</i> , 2021 Malawi	619 respondents of Malawi resident	Cross-sectional	N/I	Only handwashing and avoiding crowds were well-adopted by both respondents in rural and urban areas.	A self developed questionnaire administered by phone interviews. Questionnaires were adapted from instruments used in previous study and HIV-related surveys. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Barakat and Kasemy, 2020 Egypt	182 Egyptians	Cross-sectional	age, high education, healthcare worker, perceived susceptibility, perceived benefit, perceived barriers, and ability to follow the preventive measures against the disease	All 8 preventive behaviors were well-performed by respondents over the three periods of time	Questionnaire by personal interviews and online (Google Form). The questionnaire has a good reliability as Cronbach's alpha has been calculated, and it was 0.83.
Bazaid <i>et al.</i> , 2020 Saudi Arabia	5105 Saudi residents aged 18 years and older	Cross-sectional	Female, high socioeconomic status, high level of education, youth, resident of the northern part of the KSA	Avoid handshaking, practicing handwashing, and wearing face masks were the most common practices by respondents.	A self developed online self-reported questionnaire that was created according to the Saudi MOH and WHO guidelines to measure the knowledge and commitment of the Saudi public. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Gutu <i>et al.</i> , 2021 Ethiopia	634 adults from urban in Ethiopia (aged 18 and older)	A community based Cross sectional	Knowledge about COVID-19, urban and rural areas, and social media use	Avoid contact greetings, cook meat and eggs before eating, and regular hand washing were the most often preventive behavior adoptions conducted by respondents. However, other measures were poorly performed	A self developed questionnaire based on the preventive behavior recommendation of WHO and MOH to reduce the spread of COVID-19. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Faria de Moura Villela <i>et al.</i> , 2021 Brazil	23.896 adults (18 and older) living in Brazil	Survey Study	Younger people, male, living in rural area, student, and workers	Physical distancing, cough etiquette, regular handwashing, using hand sanitizer, avoiding touch face, and disinfecting phones were regularly performed by respondents to prevent COVID-19 infection. Wearing face masks, checking body temperature, and avoid travelling were not obeyed by respondents	A self developed online questionnaire survey. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Karijo, 2021 Kenya	2156 youth (aged 18–35) in Kenya	Cross-sectional	N/I	Respondents adopted almost all preventive measures regularly, however, only 45.7% of them were keen to voluntarily test themselves to know their COVID-19 status.	An online questionnaire including a set of 40 questions were adopted from previous COVID-19 related studies in Kenya. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Kim and Kim, 2020 Korea	1525 Korea's general population aged 18 years and older	Cross-sectional	Women, age, number of elderly in family, perceived severity, perceived benefit, self-efficacy, good family health, media exposure, knowledge, personal health status, and social support	Respondents of the study well-complied with all 19 preventive measures assessed in this study	A self developed questionnaire that was designed based on previous studies on SARS and COVID-19. The most important questions were those measuring the preventive behaviors recommended by the government, the WHO, and other scientific organizations. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Lee <i>et al.</i> , 2021 Korea	970 Korean aged 18 years or older	Cross-sectional	knowledge, efficacy belief, lack of access to healthcare, and pre-existing health condition	This study only assessed 3 preventive practices, they were wearing face masks, practicing hand hygiene, and avoiding crowded places, all of which were well-performed by the respondents	A self-developed questionnaire measuring precautionary behavior practices that covered the following two categories: preventive measures and social distancing. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Quandt <i>et al.</i> , 2020 The United States of America	67 families with at least one farmworker (FWF) and 38 comparable families with no farmworkers (nonFWF) in North Carolina	Cross-sectional	N/I	Avoiding travelling, handwashing, avoid eating outside of the house, staying at home when sick, avoiding close contact, avoiding crowds, and wearing face masks were the preventive measures which were well-practiced by both farmworkers and non-farmworkers	Self-developed Questionnaire to measure personal behaviors to protect health and prevent spread of the coronavirus in the past month. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Sánchez-Arenas <i>et al.</i> , 2021 Mexico	1030 participants	Cross-sectional	female, older age, professional worker, homemaker, retiree, regular physical exercise, high health literacy, and access to COVID-19 information, perceived severity and perceived effectiveness	15 of 18 preventive behaviors were well-performed by the respondents	A self developed questionnaire based on the World Health Organization (WHO) and the Mexican government's recommendations on preventive measures of COVID-19. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Smail <i>et al.</i> , 2021 The United States of America	4445 respondents	Cross-sectional	age, gender, race, educational attainment, perceived risk of infection, perceived risk of death, and perceived effectiveness of behavior	N/I	Self-developed Questionnaire to measure voluntary preventive behaviors on COVID-19. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Turk <i>et al.</i> , 2021 Slovenia	2467 participants	Cross-sectional	Gender, age, education level, settlement size, retired participant, and living with a vulnerable person	11 of 25 suggested behavior to prevent COVID-19 transmission were performed by more than 50% of respondents	Self-developed Questionnaire based on health guidelines related to COVID-19. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.

(Contd...)

Table 1: (Continued)

Author and Country	Sample	Design	Determinants factors of COVID-19 Preventive Measures	Implementation of COVID-19 Preventive Measures	Instruments
Urbán <i>et al.</i> , 2021 Hungary	5254 adult age residing in Hungary	Cross-sectional	Gender and age	Most of the respondents performed 8 of 15 COVID-19 prevention behaviors regularly in this study	Self-developed questionnaire to measure preventive behaviors. There is no clear information regarding the expert review, validity, or reliability of the questionnaire.
Wong <i>et al.</i> , 2020 Hong Kong	501 randomly selected Chinese adults in Hong Kong	Cross-sectional	COVID-19 information sharing with family member, individual health literacy, and family well-being	Regular hand washing and wearing masks were the most abided preventive measures in this study among other measures	Self-developed questionnaire to measure preventive behaviors against COVID-19. Its internal consistency was satisfactory with Cronbach's alpha 0.72.
Yehualashet <i>et al.</i> , 2021 Ethiopia	683 respondents, North Shoa zone, Amhara regional state, Ethiopia	Cross-sectional	Perceived susceptibility and perceived barriers	Covering mouth and nose when coughing or sneezing was the only sufficiently-performed behavior with 57.9% of respondents among other behaviors.	Self-developed questionnaire adopted from a WHO survey tool for COVID-19 (from HIV/AIDS). The questionnaire has a Cronbach alpha of 0.68.

[29], [34], [36], [37], [38], [41] except one study [20], adapting school/work situation [21], [36] except one study [33], disinfecting surroundings [13], [21], [22], [23], [29], [30], [33], [36], [38], [41] except three studies [26], [31], [40] and avoiding using common plates with strangers [34].

Immune boosting

With respect to immune boosting importance, there were five articles exploring this preventive behavior. Immune boosting measures are related to consuming diet and lifestyle modification to improve the immune system during the pandemic. Participants showed good preventive practices such as taking vitamins [13], [35], maintaining a healthy diet [13], and cooking meat and eggs [20]. One study enlists that smoking was still performed by the participants [29].

Self-screening and medications

Self-screening and medication behavior to prevent COVID-19 transmission were poorly practiced by respondents in all studies assessing these measures. Ngwewondo *et al.* reported a very few respondents took traditional medicine, chloroquine, and paracetamol/ibuprofen as preventive measures [35]. In addition, getting tested for COVID-19 [38] and assessing COVID-19 risk using government web applications [21] were still not popular among residents.

Determinant factors

Socio-demographic factors

There were 17 studies which found 15 factors to COVID-19 preventive measures according to socio-demographic characteristics. The most frequent reported factor by 13 authors was age [13], [19], [21], [22], [23], [27], [30], [32], [35], [37], [40], [42], [43], followed by gender which were presented in 12 studies [13], [19], [21], [22], [27], [30], [33], [35], [37], [40], [42], [43], education level [19], [30], [32], [33], [40], [43], occupation [20], [21], [31], [33], [36], [39], marital status [24], ethnicity [24], [43], socioeconomic status [19], [30], [36], residential area [19], [20], [34], [37] and settlement size [40].

Social psychological factors

Six-related studies revealed that perceived severity was related to COVID-19 preventive behaviors [13], [21], [27], [29], [34], [43]. In addition, perceived barriers [26], [28], [30], [32], perceived benefits [13], [28], [32], [34], perceived susceptibility [26], [32], [43], self-efficacy and maintenance [13], [18], [21], [28], [39], [43] and knowledge about COVID-19 [13], [20], [31], [39] were also the determinant factors associated with preventive measures. What is more, Lin *et al.* presented that intention, coping planning, and action planning were the additional factors related to the preventive measures [18].

Health status factors

This review article found that health status is associated with the adherence of COVID-19 preventive behaviors. Three authors displayed family health status [13], [31], [40] and three authors presented personal health status [13], [21], [39] as the part of the determinant factors.

Enabling factors

Enabling factors is external stimulus influencing one's preventive behavior. There are six factors associated with COVID-19 preventive measures as the element of enabling factors. These factors include lack of governmental push [30], media exposure [13], [20], access to information [31], [34], access to PPE [29], access to healthcare [39], and social support [13].

Discussion

The COVID-19 pandemic which has lasted for almost two years is an impactful health crisis for millions of people worldwide. Every country has put many efforts to improve the COVID-19 preventive behavior compliance to reduce the transmission of the virus. Health prevention behavior is a response to prevent diseases including activity undertaken by a person

Table 2: The findings of COVID-19 preventive measures implementation

Preventive Measures	Good Practice Findings	Poor Practice Findings
Personal Preventive Measures		
Regular handwashing	Lüdecke and von dem Knesebeck, 2020; Nguyen <i>et al.</i> , 2020; Ngwewondo <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Banda <i>et al.</i> , 2021; Barakat and Kasemy 2020; Bazaid <i>et al.</i> , 2020; Gutu <i>et al.</i> , 2021; Faria de Moura Villela <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Lee <i>et al.</i> , 2021; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021; Wong <i>et al.</i> , 2020	Yehualashet <i>et al.</i> , 2021
Wear face masks	Nguyen <i>et al.</i> , 2020; Ngwewondo <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Bazaid <i>et al.</i> , 2020; Karijo 2021; Kim and Kim 2020; Lee <i>et al.</i> , 2021; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021; Wong <i>et al.</i> , 2020	Lüdecke and von dem Knesebeck, 2020; Faria de Moura Villela <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021; Yehualashet <i>et al.</i> , 2021
Cough/sneeze etiquette	Nguyen <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Barakat and Kasemy 2020; Gutu <i>et al.</i> , 2021; Kim and Kim 2020; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021; Yehualashet <i>et al.</i> , 2021	Faria de Moura Villela <i>et al.</i> , 2021
Physical/social distancing	Lüdecke and von dem Knesebeck, 2020; Nguyen <i>et al.</i> , 2020; Ngwewondo <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Faria de Moura Villela <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Sánchez-Arenas <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021; Wong <i>et al.</i> , 2020; Karijo 2021	Gutu <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021; Yehualashet <i>et al.</i> , 2021
Use hand sanitizer	Nguyen <i>et al.</i> , 2020; Alkhalidi <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Faria de Moura Villela <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Sánchez-Arenas <i>et al.</i> , 2021; Wong <i>et al.</i> , 2020	Gutu <i>et al.</i> , 2021; Yehualashet <i>et al.</i> , 2021
Avoid touch face	Nguyen <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Aschwanden <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Barakat and Kasemy 2020; Faria de Moura Villela <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Quandt <i>et al.</i> , 2020; Turk <i>et al.</i> , 2021;	Ali <i>et al.</i> , 2021; Gutu <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021; Yehualashet <i>et al.</i> , 2021
Avoid handshake	Nourmoradi <i>et al.</i> , 2020; Barakat and Kasemy 2020; Bazaid <i>et al.</i> , 2020; Gutu <i>et al.</i> , 2021; Karijo 2021; Sánchez-Arenas <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021	Ali <i>et al.</i> , 2021
Disinfect personal belongings	Nourmoradi <i>et al.</i> , 2020; Faria de Moura Villela <i>et al.</i> , 2021; Kim and Kim 2020	Nguyen <i>et al.</i> , 2020; Turk <i>et al.</i> , 2021; Yehualashet <i>et al.</i> , 2021
Maintain ventilation	Nourmoradi <i>et al.</i> , 2020; Kim and Kim 2020; Turk <i>et al.</i> , 2021	
Avoid contact with animals	Nourmoradi <i>et al.</i> , 2020;	
Dispose used PPE in a hygienic manner	Nourmoradi <i>et al.</i> , 2020;	
Regular body temperature check		Nguyen <i>et al.</i> , 2020; Faria de Moura Villela <i>et al.</i> , 2021
Wear gloves when contacting objects/leave home		Bazaid <i>et al.</i> , 2020; Turk <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021
Separate use of clothing inside and outside		Turk <i>et al.</i> , 2021
Regular replacement of masks and gloves		Turk <i>et al.</i> , 2021
Community Preventive Measures		
Avoid crowded place/public space (Avoid eating outside home, Avoid social events)	Lüdecke and von dem Knesebeck, 2020; Nguyen <i>et al.</i> , 2020; Ngwewondo <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Alkhalidi <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Banda <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Lee <i>et al.</i> , 2021; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021; Ali <i>et al.</i> , 2021	Turk <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021
Avoid meeting	Lüdecke and von dem Knesebeck, 2020; Nguyen <i>et al.</i> , 2020; Karijo 2021; Kim and Kim 2020; Sánchez-Arenas <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021;	Wong <i>et al.</i> , 2020
Stay at home	Nourmoradi <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Bachok <i>et al.</i> , 2021; Barakat and Kasemy 2020; Karijo 2021; Kim and Kim 2020; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021	Lüdecke and von dem Knesebeck, 2020; Ngwewondo <i>et al.</i> , 2020; Yehualashet <i>et al.</i> , 2021
Avoid public transportation	Nguyen <i>et al.</i> , 2020; Alkhalidi <i>et al.</i> , 2021; Karijo 2021; Sánchez-Arenas <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021	
Avoid contact with infected/vulnerable person	Ali <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021	Turk <i>et al.</i> , 2021
Avoid travelling	Nguyen <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020; Alkhalidi <i>et al.</i> , 2021; Faria de Moura Villela <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Quandt <i>et al.</i> , 2020	Gutu <i>et al.</i> , 2021
Adapted school/work situation	Alkhalidi <i>et al.</i> , 2021; Sánchez-Arenas <i>et al.</i> , 2021	Lüdecke and von dem Knesebeck, 2020
Avoid using common plates with strangers	Nguyen <i>et al.</i> , 2020	
Disinfect surrounding	Lüdecke and von dem Knesebeck, 2020; Nourmoradi <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Alkhalidi <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Karijo 2021; Kim and Kim 2020; Quandt <i>et al.</i> , 2020; Sánchez-Arenas <i>et al.</i> , 2021;	Turk <i>et al.</i> , 2021; Wong <i>et al.</i> , 2020; Yehualashet <i>et al.</i> , 2021
Immunity boosting		
Taking vitamin	Ngwewondo <i>et al.</i> , 2020; Kim and Kim 2020	
Maintain healthy diet (Storing food)	Kim and Kim 2020	Nourmoradi <i>et al.</i> , 2020; Urbán <i>et al.</i> , 2021
Cook meat and eggs well before eating	Gutu <i>et al.</i> , 2021	
Avoid smoking		Nourmoradi <i>et al.</i> , 2020;
Self-screening and medications		
Use of traditional concoctions		Ngwewondo <i>et al.</i> , 2020;
Taking chloroquine		Ngwewondo <i>et al.</i> , 2020;
Taking paracetamol/ibuprofen		Ngwewondo <i>et al.</i> , 2020;
Get tested for COVID-19		Karijo 2021
Assessing COVID-19 risk using government web application		Sánchez-Arenas <i>et al.</i> , 2021;

who believes himself to be healthy for the purpose of preventing disease [44]. In terms of COVID-19 preventive behavior, the community is expected to abide by the international recommendations from WHO [45] such as washing your hands, wearing a face mask, and social distancing. The purpose of this review is to describe the implementation and the factors associated with COVID-19 preventive measures.

The results of the 27 selected studies show that there are four themes of COVID-19 preventive behavior

implementation, namely personal preventive, community preventive, immune boosting, as well as self-screening and medication. The description of these behaviors was measured using various instruments. These instruments were developed by each author of the studies using previous literature/studies. Some authors referred to the WHO guidelines [18], [19], [20], [21], [22] and CDC guidelines [22], [23], H1N1 epidemic [24], HIV-related surveys [25], [26], SAR-related study [13], and each MOH guideline in each country [19], [20], [21], [22].

Table 3: Determinant factors of COVID-19 preventive measures implementation

Determinant factors	Authors
Socio-demographic factors	
Age	Lin and Chen 2021; Ngwewondo <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Aschwanden <i>et al.</i> , 2021; Barakat and Kasemy 2020; Bazaid <i>et al.</i> , 2020; Faria de Moura Villela <i>et al.</i> , 2021; Kim and Kim 2020; Turk <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021; Sánchez-Arenas <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021
Gender	Lin and Chen 2021; Lüdecke and von dem Knesebeck, 2020; Ngwewondo <i>et al.</i> , 2020; Ali <i>et al.</i> , 2021; Almoayad <i>et al.</i> , 2021; Bazaid <i>et al.</i> , 2020; Faria de Moura Villela <i>et al.</i> , 2021; Kim and Kim 2020; Turk <i>et al.</i> , 2021; Urbán <i>et al.</i> , 2021; Sánchez-Arenas <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021
Education level	Lüdecke and von dem Knesebeck, 2020; Ali <i>et al.</i> , 2021; Barakat and Kasemy 2020; Bazaid <i>et al.</i> , 2020; Turk <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021
Occupation	Nguyen <i>et al.</i> , 2020; Almoayad <i>et al.</i> , 2021; Barakat and Kasemy 2020; Faria de Moura Villela <i>et al.</i> , 2021; Sánchez-Arenas <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021
Marital status	Bachok <i>et al.</i> , 2021
Ethnicity	Bachok <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021
Socioeconomic status	Bazaid <i>et al.</i> , 2020; Alkhalidi <i>et al.</i> , 2021; Ali <i>et al.</i> , 2021;
Residential area	Nguyen <i>et al.</i> , 2020; Bazaid <i>et al.</i> , 2020; Gutu <i>et al.</i> , 2021; Faria de Moura Villela <i>et al.</i> , 2021;
Settlement size	Turk <i>et al.</i> , 2021
Social Psychological Factors	
Perceived severity	Kim and Kim 2020; Sánchez-Arenas <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021; Lin and Chen 2021; Nguyen <i>et al.</i> , 2020; Nourmoradi <i>et al.</i> , 2020
Perceived barriers	Mirzaei <i>et al.</i> , 2021; Barakat and Kasemy 2020; Yehualashet <i>et al.</i> , 2021; Ali <i>et al.</i> , 2021;
Perceived benefit	Mirzaei <i>et al.</i> , 2021; Barakat and Kasemy 2020; Kim and Kim 2020; Nguyen <i>et al.</i> , 2020;
Perceived susceptibility	Barakat and Kasemy 2020; Yehualashet <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021;
Self-efficacy and Maintenance	Lin <i>et al.</i> , 2020; Mirzaei <i>et al.</i> , 2021; Kim and Kim 2020; Lee <i>et al.</i> , 2021; Sánchez-Arenas <i>et al.</i> , 2021; Smail <i>et al.</i> , 2021
Intention and Coping planning	Lin <i>et al.</i> , 2020
Action planning	Lin <i>et al.</i> , 2020
Knowledge about COVID-19	Gutu <i>et al.</i> , 2021; Kim and Kim 2020; Lee <i>et al.</i> , 2021; Wong <i>et al.</i> , 2021;
Health status factors	
Family health status	Kim and Kim 2020; Wong <i>et al.</i> , 2021; Turk <i>et al.</i> , 2021
Personal health status	Kim and Kim 2020; Lee <i>et al.</i> , 2021; Sánchez-Arenas <i>et al.</i> , 2021
Enabling factors	
Lack of governmental push	Ali <i>et al.</i> , 2021
Media exposure	Kim and Kim 2020; Gutu <i>et al.</i> , 2021
Access to information	Nguyen <i>et al.</i> , 2020; Wong <i>et al.</i> , 2021
Access to PPE	Nourmoradi <i>et al.</i> , 2020;
Access to healthcare	Lee <i>et al.</i> , 2021
Social support	Kim and Kim 2020

However, few instruments reported their reliability scores [18], [26], [27], [28] [29], [30], [31], [32] while those which did not report their psychometric testing cannot be identified for their instrument reliability. According to Waltz *et al.* [46], the use of validated measurement tools is needed to reduce measurement errors and incorrect conclusions. Hence, the findings of this review can be used as the foundation to develop a valid and reliable COVID-19 preventive behavior instrument which is cultural-based and psychometrically tested.

Regarding the WHO [47], COVID-19 preventive behaviors include hand washing; cleaning with soap and water or sanitizer, especially after touching a surface in a public place; using masks and gloves; covering the mouth and nose while coughing and sneezing; not touching the face with unclean hands; and social distancing. Based on the use of instruments in articles, all selected studies found that the purpose of preventive measures are to help protect individuals from becoming infected and prevent virus transmission from those who

are infected and community preventive measures are in the range of good and poor practice. In addition, other measures were identified in this scoping review, namely immune boosting as well as self-screening and medications

Immune boosting measures are related to consuming diet and lifestyle modification to improve the immune system during the pandemic such as taking vitamins, maintaining a healthy lifestyle, and cooking meat and eggs well. Immune boosting is a part of immune strengthening which is expected to reduce symptoms. On the other hand, some people believe that consuming certain foods such as vitamin C, citrus fruits, garlic, ginger, and honey with warm water, plenty of fluids, boiled water and gargling with saline water may prevent the transmission of COVID-19. Indeed, consuming these supplements may provide symptomatic relief for the common cold; however, no evidence exists for these approaches in the treatment or prevention of COVID-19 [48]. These findings show the importance of immune boosting measures as part of the health education to improve community health literacy that will be seen in COVID-19 preventive behavior adherence.

According to the findings, there are diverse reported preventive behavior attributes. This might be the result of every country having different regulations and recommendations despite the similarity of the preventive strategies. The timeliness, scale and assertiveness of implementation regimes have varied considerably [47]. For instance related to ventilation, proper ventilation has an important role in reducing the transmission of COVID-19 indoors. However, not all studies include ventilation as a component of COVID-19 preventive strategies.

In general, a healthy lifestyle as a component of preventive measures is affected by internal and external factors. The internal and external factors of the selected articles which are related to preventive behaviors can be classified into four categories: socio-demographic factors, social psychological factors, health status factors, and enabling factors. This review article presents the COVID-19 preventive measures as influenced by several factors. In line with Health Belief Model (HBM) theory related to individual readiness in modifying behavior, healthy lifestyle is affected by the perception of oneself [49].

Conclusion

The aspects of COVID-19 preventive behavior implementation include personal and community preventive measures, immune boosting, and self-screening/medication. These measures are reported as good and poor practice. In addition, factors related to these measures involving socio-demographic, socio-psychological, health status, and enabling factors.

Further research needs to be focused on intervention development to improve the adherence of the preventive measures by considering reported determinants factors.

Authors' Contribution

All authors contributed equally to conceptualization, methodology, article search, data analysis, and writing as well as editing of the manuscript.

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