Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Original Article

Promoting precautionary behavior during the COVID-19 pandemic: Development and validation of a behavior-change messaging campaign

Mayda Alrige*, Hind Bitar, Maram Meccawy

Information Systems Department, King Abdulaziz University, Jeddah, Saudi Arabia

ARTICLE INFO

ABSTRACT

Background: Designing a health promotion campaign is never an easy task, especially during a pandemic of a highly infectious disease such as COVID-19. In Saudi Arabia, many attempts have been made to raise public awareness about COVID-19 infection and precautionary health measures. However, most of the health information delivered through the national dashboard and the COVID-19 awareness campaigns are generic and do not necessarily make the impact needed to be seen on individuals' behavior. Health messages need to be applicable and reverent to the individual in the audience.
Objective: In light of Fogg-Behavior model, this research aims to build and validate a behavior-change-based messaging campaign to promote precautionary health behavior in individuals during the COVID-19 pandemic. Intervention messages can then be targeted appropriately during the pandemic.
Methods: An initial library of 32 text-based and video-based messages were developed and validated based on Fogg behavior model for behavior change. Based on this model, three groups of messages were created to reflect the model's three theoretical concepts of motivation, ability and triggers. Each group of messages is designed to target different segment of the audience. The content of the messages was developed based on resources from the World Health Organization and the Ministry of Health in Saudi Arabia. The validity of this content was evaluated by domain experts through the content validity index.
Results: Fogg-Behavior Model was used to segment the audience into three different groups based on their perceived ability and motivation. The three groups of messages designed for those groups were found relevant to Fogg theoretical concepts. Thirteen professional health care workers (n = 13) evaluated the content of the message libraries in Arabic and English. Thirty-two messages were found to have acceptable content validity (I-CVI = 0.87).
Conclusions: This research introduced Fogg Behavior Model as a behavior change model to develop targeted messages for three groups of the audience based on their motivation and ability level toward maintaining precautionary behavior during the pandemic. This targeted awareness messaging campaign can be utilized by health authorities to raise individuals' awareness about the precautionary measures that should be taken, maintain these measures and hence help in reducing the number of positive cases in the city of Jeddah.

Introduction

Designing a health promotion campaign is never an easy task [1]. This challenge becomes even more significant when the campaign takes place during a pandemic of a highly contagious disease or in the middle of a viral outbreak [2]. During these critical periods, the public's precautionary measures and their compliance with health authorities' instructions could make all the difference in containing the virus. Otherwise, the virus may continue to propagate in the community and could eventually bring the countries health system
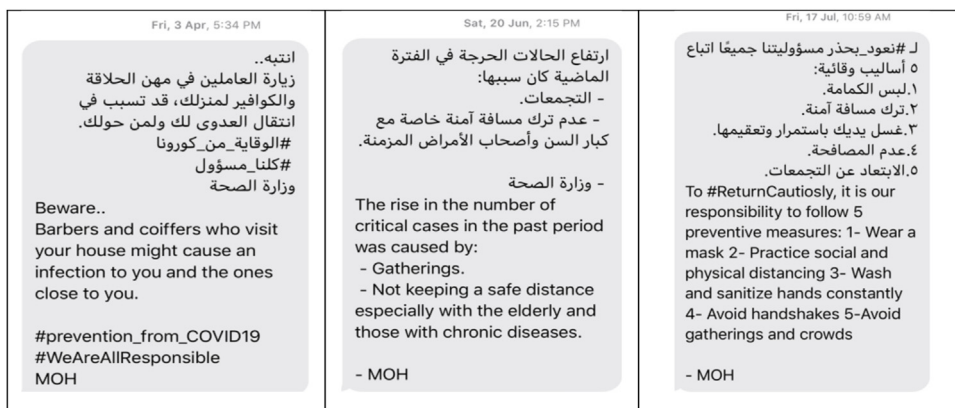
Fri, 3 Apr, 5:34 PM

انتبه..
زيارة العاملين في مهن الحلاقة والكوافير لمنزلك، قد تسبب في انتقال العدوى لك ولمن حولك.
#الوقاية_من_كورونا
#كلنا_مسؤول
وزارة الصحة

Beware..
Barbers and coiffers who visit your house might cause an infection to you and the ones close to you.

#prevention_from_COVID19
#WeAreAllResponsible
MOH

Sat, 20 Jun, 2:15 PM

ارتفاع الحالات الحرجة في الفترة الماضية كان سببها:
- التجمعات.
- عدم ترك مسافة آمنة خاصة مع كبار السن وأصحاب الأمراض المزمنة.

- وزارة الصحة

The rise in the number of critical cases in the past period was caused by:
- Gatherings.
- Not keeping a safe distance especially with the elderly and those with chronic diseases.

- MOH

Fri, 17 Jul, 10:59 AM

لـ #نعود_بحذر مسؤوليتنا جميعًا اتباع ٥ أساليب وقائية:
١.لبس الكمامة.
٢.ترك مسافة آمنة.
٣.غسل يديك باستمرار وتعقيمها.
٤.عدم المصافحة.
٥.الابتعاد عن التجمعات.
To #ReturnCautiosly, it is our responsibility to follow 5 preventive measures: 1- Wear a mask 2- Practice social and physical distancing 3- Wash and sanitize hands constantly 4- Avoid handshakes 5-Avoid gatherings and crowds

- MOH

Fig. 1. MOH's current messaging campaign.

to its knees. This is the current situation with the new coronavirus, known as COVID-19. After many months of lockdown, and before the world goes into a deep economic recession, many countries are choosing to reopen their public places and resume business as normal. However, with no verified medicine, a slow vaccination process, and the continued emergence of new COVID-19 variants, health authorities worldwide have to continue relying on lowering the numbers of infected individuals through precautionary measures. This can be achieved by increasing the public's awareness and compliance. Hence, an effective health awareness campaign must be put in place.

Depending on the most influential mechanisms, many health campaigns choose to apply the communication processes of awareness, instruction, and persuasion to steer the audience, via messages, toward desired behavioral changes. Awareness messaging aims at "informing people what to do, specifying who should do it, and cuing them about when and where it should be done" [3]. This is the current state of the messaging campaign in Saudi Ariba. The Ministry of Health (MOH) has launched a COVID-19 pandemic health awareness campaign through different media channels, including web platforms and social networks. The intent of this campaign is to educate the public about the highly contagious virus, as well as to increase their awareness about it. These efforts include sending text messages to mobile phones, prompting the adoption of healthy habits, and encouraging the public to take appropriate virus prevention measures. A few examples are shown in Fig. 1. For the public-health message to be effective, it must be simple, easy to understand and relevant to the individual. Differently phrased public-health messages appeal to different people [4]. We based our predictions on the three factors highlighted by Fogg in his behavior model (FBM): motivation, ability, and trigger.

This research aims to design, develop, and evaluate the content of a targeted awareness campaign to reinforce precautionary health behaviors of individuals during the COVID-19 pandemic by employing the FBM [5]. FBM is a holistic model describing behavior change as the convergence of three components: motivation, ability, and trigger. These three elements are the building blocks of our campaign content. FBM was initially developed to guide the design of persuasive technology, which is technology that aims to promote a certain behavior. In this study, the model is followed as health marketing strategy to develop a targeted awareness campaign aiming to promote precautionary health behavior using messaging intervention. The awareness campaign content then was evaluated by professional healthcare workers for its relevance to the three conceptual components of FBM [6,7].
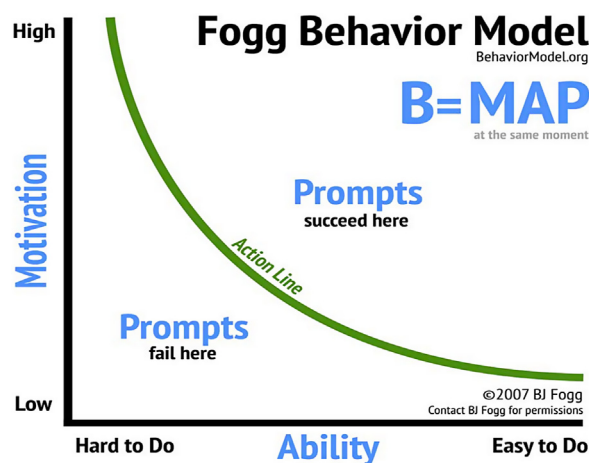

Fig. 2. Fogg Behavior Model.

Theory

To change or promote a certain human behavior, theories of behavior change are needed. In the domain of health communication, health marketing aims to change behavior not to sell a product. The present study is guided by FBM to build the content of the campaign messages. The Fogg model highlights three main factors: motivation, ability, and trigger. To embrace a new behavior, a person must be motivated, have the ability to perform the behavior, and be prompted to do so with an effective trigger.

For example, if the target behavior is to wear a face mask while a person is outside, a person must have sufficient (high) motivation, ability, and an effective trigger. These factors must be present at the same instant for the behavior to occur, which is to wear a face mask every time this individual goes outside. This is illustrated in Fig. 2.

As reported by Fogg, while designing the motivation, the goal must be to move the user to a higher position in the FBM landscape, which means to increase the user's motivation. There are three core motivators: pleasure/pain, hope/fear, and social acceptance/social rejection. In this study, we will use the hope/fear motivator to build the content of the messages. The hope/fear motivation is sourced from the anticipation of something good (hope) or bad (fear) happening. For example, the hope of not being infected by COVID-19 will motivate a person to follow government safety roles and stay at home, while a person will wear a face mask to overcome the fear of getting infected by COVID-19. Another example is that a per-

son will keep a social distance to overcome the fear built from the anticipation of getting COVID-19.

The second factor in FBM is ability. The most important condition in this factor is simplicity, since, as stated by Fogg, "Simplicity changes behaviors." [8]. To increase a person's ability, the persuasive technology design must make the behavior easy to do. For example, one-click shopping on Amazon or short and easy-to-understand messages on a phone or social media account. The author defined six elements that detract from simplicity: time, money, physical effort, brain cycles, social deviance, and non-routine. If the new or target behavior requires time to perform, it is not simple. The money element of simplicity refers to the financial requirements of the behavior; if the target behavior is costly or requires money, it is not simple, especially for users with limited monetary resources. The third element is physical effort: the new behavior must not require physical effort; otherwise, it will not be simple to do. The fourth element is brain cycles, meaning that hard thinking is required. If the target behavior requires the user to think a lot, the task is not simple. Another element is social deviance; this element describes going against the norm or breaking society's rules. If performing a new behavior will break certain rules, it is not simple. Finally, the last element is non-routine, indicating that the new behavior is not from a user's routine. If a person is seeking a behavior that is not from his or her routine, he or she may think it is not simple [8]. An example of a new behavior required during the COVID-19 health crisis is wearing a face mask. Performing this behavior will not take time, especially if a person follows some tips, such as putting the mask near the entrance. A face mask is not expensive. Also, there is no effort required to wear the mask. The user will not need efforted thinking to wear the mask. Furthermore, this behavior is not currently against society's rules, as it is one of the safety rules. Finally, non-routine: yes, wearing a face mask is not a routine, but it will be. Therefore, in most societies, people must consider this behavior as part of their routine while going outside their home.

The third factor is trigger. Fogg defines trigger as "something that tells people to perform a behavior now." [5]. There are three types of triggers: facilitators, signals, and sparks. Facilitator triggers are used if the users have high motivation but lack ability. This type of trigger can be expressed in text, video, graphics, and by other means. They are effective if they focus on simplifying the target behavior, for example, by telling users that performing a certain behavior is easy, does not take time, and is not costly. The second trigger type is signals. These triggers are a good fit if the users are high in motivation and ability, but just need a reminder. For example, a morning message to remind people to wear their face mask if they are going outside is a signal trigger. Finally, sparks triggers are used if the person lacks the motivation to perform the target behavior. The technology that will be used here must focus on the motivational element, for instance, texts to highlight the fear of catching COVID-19, or videos that highlight hope of not getting COVID-19. The most important element of these triggers is that they are "presented to the user at a moment when they can take action." [5].

FBM has been followed in several research studies to develop the appropriate IT intervention that could be used to change human behavior in public health filed and other, such as marketing and politics. For example, FBM has been followed to develop a health intervention program to aid African American women in adopting healthy eating behaviors and engaging in physical activity since there is a high rate of obesity among those target population [8], improve contraceptive social marketing during the COVID-19 lockdown in Nigeria [9], manage chronic diseases such as diabetes using different triggers [10], assess the effect of a social marketing campaign on condom use-sexual health [11] and so forth. Also, FBM has been used in political area to promote their political participation

Fig. 3. Messaging groups based on FBM.

and foster their political mindfulness through livestream platforms [12].

Methods

Materials

The messaging campaign has been built for this research. The authors built and evaluated three message groups following the Alismail and Olfam research method of validating different messaging libraries [13]. These messaging groups highlighted the three main factors underlying FBM: motivation, ability, and trigger. The authors designed and developed two main libraries in two different languages: Arabic and English. These messaging libraries were designed and developed based on FBM's main factors: motivation, ability, and trigger. We developed 30 messages using trusted sources, such as the World Health Organization and the Saudi MOH. The messages can be categorized into three main groups: the facilitator-trigger (Ability-Simplicity) group, the signal-trigger (Reminder) group, and the sparks-trigger (Hope/Fear motivator) group, as shown in Fig. 3.

All 30 messages were designed to address all the factors of FBM that need to be changed, increased, or occur. We created 10 messages for each of the three groups. The following are explanations of each of the messaging groups:

1 **Ability-Simplicity Messaging Group:** These messages target individuals with low abilities and high motivations. The messages are designed to simplify the new actions.
2 **Hope/Fear Motivator Messaging Group:** These messages target individuals with high abilities and low motivations. The messages include the motivational elements hope and fear: fear of being infected with COVID-19 and hope of being healthy and not being infected.
3 **Reminder Messaging Group:** These messages target individuals with high abilities and motivations. The messages are reminders to perform the actions.

The initial libraries, written in Arabic and English, include 30 messages for each library. All the messages are text-based except for a single video message. The research team generated these messages in iterative processes. First, we searched and reviewed trusted sources, such as the World Health Organization, to obtain significant facts and statistics about COVID-19 and simple precautions the public could follow to fight the spread of the disease. Then, one of the co-authors (HB) started to write the messages using the FBM

Table 1
Translation process steps.

The Technique	The followed steps
Back-translation technique	1- Write all messaging in Arabic, 2- Translate all messages into English, 3- Ask an expert who is a bilingual to back-translate all the English messages into Arabic, 4- Ensure that all messages reflect the exact meaning and context.
Bilingual technique	1- Ask another bilingual expert to review the messages in both languages to ensure the validity of the messages, 2- One of the bilingual authors in this research study reviews the messages one more time.

Table 2
Content validation steps [6].

1- Define the three concepts behind the Fogg Behavior Model and measure each item's relevance to them. For each item(message) in the library, experts rate the relevance of each item on a 4-point scale. (1: not relevant, 2: somewhat relevant, 3: quite relevant, 4: highly relevant).
2- For each item, the I-CVI is computed as the number of experts giving a rating of either 3 or 4, divided by the number of experts.
3- If there are 5 or less experts, the I-CVI should be 1.00 to be acceptable. If number of experts exceeds 5, I-CVI should be at least 0.83.
4- If the I-CVI for one particular item is less than 0.83, the item must be deleted or be modified and go for another round of revision.
5- Once I-CVI is calculated for each item, then S-CVI should be calculated.
6- S-CVI be obtained by averaging the I-CVIs.
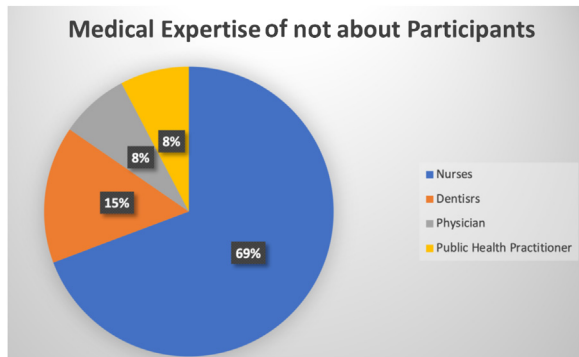7- The minimum acceptable level for S-CVI/Avg is 0.80

Fig. 4. Medical expertise for participants.

factors in Arabic. Then, she translated all messages into English. After that, the translation process was implemented based on Brislin's techniques for cross-cultural research [14]. He recommends the back-translation and bilingual techniques (outlined in Table 1). Therefore, a bilingual expert translated all the English messages into Arabic. Then, this expert reviewed the messages to ensure that all messages reflect the exact meaning and context. During the bilingual techniques, we invited another expert who is bilingual and asked her to review the messages in both languages. Finally, during this stage one of the co-authors (MA) who did not involve in the messages designing stage and also bilingual was responsible to review the messages one more time (see Table 1 for further details).

Sample

The domain experts targeted for this research were professional healthcare workers. The only inclusion criterion is to have a medical license to practice at any public or provide health care facility for at least two years in the Kingdom of Saudi Arabia (Fig. 4).

Analysis and measurement

The campaign messages were created to motivate, trigger, or demonstrate one's ability to adhere to a precautionary measure. Once the message libraries were crafted in both languages, they became the target for content validation by domain experts. To evaluate the content validity of the campaign messages, we utilized the content validity index (CVI) [6]. The CVI for each item (termed the I-CVI) is determined by the number of experts giving a rating of 3 (quite relevant) or 4 (highly relevant) divided by the total number of experts. An I-CVI score of 1.00 indicates 100% agreement among the experts, while messages with a low I-CVI score (for example <1.00) should either be modified or deleted for clarity. When there are more than five experts, there can be a modest amount of disagreement; for example, when there are six experts, the I-CVI must be at least 0.83, reflecting one disagreement [6]. Another index used

to assess message content validity is the scale content validity index (S-CVI), which considers the validity of all the messages together. The S-CVI can be calculated by averaging the I-CVI scores. The S-CVI/Ave function computes the I-CVI for each item on the scale, and then calculates the average I-CVI across all the items. The steps of content validation are outlined in Table 2.

Procedure

An online survey was sent to the professional healthcare workers using two social media channels: Twitter and Facebook. The survey consisted of three sections. The first section includes a short introduction about Fogg Behavior Model and its three building blocks. The second section asks demographic questions. The third section is divided into three further parts. Each part corresponds to one building block of Fogg Behavior Model which are motivation, ability and trigger. Each part starts with a concise definition for the theoretical concept. For example, the motivation part starts with a definition of the motivation as follows: Motivation is an internal process. It is a condition inside us that drives a change. Here we focus on two elements which are hope or fear. Hope is "the anticipation of something good happening," while fear is "the anticipation of something bad". Then, we asked the question: To what extent do you think the following messages would motivate individuals? Then we list the motivation-oriented messages we crafter for the campaign. Similarly, we structured the second part, and the third part for ability and trigger. Respondents evaluated the content of the messages with respect to the three concepts of motivation, ability, and trigger in 4-point likert scale. We validated the content of the messages in two rounds.

Results

Thirteen professional healthcare workers (N = 13) completed the survey for the three sets of messages. Of these experts, there were 9 nurses, 2 dentists, a physician, and a public health practitioner.

In the first round to evaluate the content validity of the messages, the S-CVI/Ave was 0.94, and the I-CVI was above the threshold value (0.83) for 28 out of 30 messages. This indicates that 28 out of 30 messages were found relevant to FBM theoretical concepts. Only 2 messages were found irrelevant by experts: one motivation-based message and one ability-based message (I-CVI = 0.78). Therefore, we eliminated these two messages and redesign another two messages in each group (Hope/Fear motivator and Ability-Simplicity messaging group).

In the second iteration, and as we stated above the two irrelevant messages were deleted and replaced by another 4 messages. These 4 messages were evaluated by 8 domain experts. The content validity for the added messages was much higher (I-CVI = 0.87). Thus, these four messages were included in the awareness messaging campaign, yielding a total of 32 messages (see Appendix A).

Discussion

After two iterations, we have confirmed the content validity of the messages in each group. In another word, the content of the messages in the motivation group does in fact motivate people to change toward a certain target behavior. Similarly, the content of messages in the ability group is valid and does in fact facilitate the target behavior. The same concept applies to the messages in the reminder/trigger group. This sets the stage to segment the audience based on some behavioral characteristics to run the health awareness campaign efficiently.

Our review to the literature indicates the need to design public health awareness messages relevant to the audience/public, which promotes the concept of health marketing [15]. This concept calls to segment the audience into homogenous groups after understanding them to facilitate health communication. We sought to segment the public using the FBM model and then use these segmented messages to promote precautionary behavior based on the individual's level of motivation and ability.

As stated before FBM has been widely used before in health marketing and public health informatics to develop a targeted awareness messaging campaign and promote different behaviors. [8,10–12]. Additionally, this model has been used in crime prevention and community safety [16]. Authors have proposed a conceptual framework that merged FBM with Elaboration Likelihood Model to design and assess the persuasiveness of crime prevention campaigns for tourists. The fact that authors did not design and evaluate any messages yet highlight the urgent need to use the developed framework to design more effective persuasive messages. None of the above-mentioned research studies that used FBM to build and evaluate messages content reported the effect on behavior change. However, they highlighted the significance of using this model in the health communication domain and other. Following such a theoretical model when building and designing any health intervention campaign is invaluable and recommended by social and behavioral researchers [16].

To promote type-2 diabetes self-management, Sittig and Franklin stated that following FBM to design the trigger messages for mobile health (mHealth), specifically spark and facilitator triggers, would empower once's self-efficacy [17]. Sittig and Franklin's main objective was to develop two different triggers, which were spark and facilitator that are reliable and can be used to achieve the intended designed function in the context of managing diabetes. As stated by the authors, focusing on words choice and its layout would aid in forming motivational messages. The developed messages were used in an application called capABILITY to support type II diabetes patients to manage their disease. The authors concluded that designing an appropriate spark and facilitator trigger based on FBM would assist individuals to perform a certain behavior. However, there is an urgent need to evaluate the developed messages to have reliable interpretation before using them in any mHealth applications [17]. Our research extends to this body of knowledge. We have used FBM as a guidance model to segment the audience and hence create and validate a customized awareness messaging campaign targeted to the individual's specific level of motivation and ability to promote precautionary behavior during the pandemic.

Direction for Future Work

Our direct next step in this research is to run the campaign in one district after measuring residents' motivation and ability toward the precautionary measures and segment them into three groups. The campaign message can be tailored to individuals based on their personal characteristics: their motivation and ability to adhere to the precautionary measure. Following this direction, a one-group, pre- and post-intervention study can be used to measure the participants' motivation and ability levels before and after the campaign. For this purpose, Agha et al. instrument can be used to place each participant in the appropriate group profile [11]. A pilot test can be conducted to account for any adjustments and changes to the instrument. Subsequently, the data can be analyzed using a paired sample t test to see the effectiveness of the messages on individuals' behavior. The messaging campaign also can be run through any mHealth application or GIS application.

Conclusion

Targeting individuals based on certain behavioral aspects have been widely studied in health communication research. Customization or audience segmentation has proved useful for health communication messages [18]. Health educators recognize the importance of audience segmentation as a means of reaching the neediest members of a population. This research demonstrates one step towards this goal of audience segmentation to send a customized health awareness campaign and promote precautionary health behavior. In this research we built and validated a behavior-change-based messaging campaign to promote precautionary health behavior in individuals during the COVID-19 pandemic based on FBM. A library of 32 text-based and video-based messages were developed and validated. Three groups of messages were created to reflect FBM three theoretical concepts of motivation, ability, and triggers. Each group of messages was designed to target different segment of the population based on their behavior. In the context of Covid-19 pandemic, the campaign aims to understand what prevents people from sticking to the precautionary measures and based on that design a specific message to either facilitate, motivate or trigger their behavior. The content of the messages was developed based on resources from the WHO and the MOH in Saudi Arabia. The validity of this content was evaluated by domain experts throughout the content validity index. Thirteen professional health care workers evaluated the content of the Arabic and English message libraries. As a result, thirty-two messages were found to have acceptable content validity.

In conclusion, this research approach of building, validating, the awareness campaign can be followed to design awareness campaigns during the outbreak of any other infectious diseases. Certain parameters in the approach would have to be changed based on the nature of the virus. For instance, respiratory system viruses such as SARS-CoV-2 spread primarily through droplets generated when an infected person coughs or sneezes, or through droplets of saliva or discharge from the nose. This kind of respiratory virus requires certain precautionary measures. Parameters that might have to be changed would include the precautionary measures described in the messages and the types of clinical data that must be gathered.

Authors' contributions

- **Hind Bitar** was responsible of building the messaging campaign following Fogg Behavior Model three concepts: motivation, ability and trigger.
- **Mayda Alrige** was the idea owner and was in charge of evaluating the content validity of the messages library using Content Validity index (CVI).
- **Maram Meccawy** was responsible of refining the content of the messages libraries and translating them into English, as well as created and distributed the messages on Google Form to evaluate the content validity of the messages.
- All authors contributed equally on writing and editing the submitted manuscript.

Ethics approval and consent to participate

Consent from Ministry of Health to collect real clinical data from three major health care providers is available up

Consent for publication

Available upon request.

Availability of data and materials

Data is available upon request.

Funding

Competing interests

Not declared.

Acknowledgements

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jiph.2021.09.026.

References

[1] Why is changing health-related behaviour so difficult? Public Health 2016;136(July):109–16, http://dx.doi.org/10.1016/j.puhe.2016.03.030.

[2] Randolph W, Viswanath K. Lessons learned from public health mass media campaigns: marketing health in a crowded media world; 2004 https://doi.org/10.1146/annurev.publhealth.25.101802.123046.

[3] Rice RE, Atkin CK. Public communication campaigns. SAGE; 2001.

[4] Blagov Pavel S. Adaptive and dark personality in the COVID-19 pandemic: predicting health-behavior endorsement and the appeal of public-health messages; 2021, http://dx.doi.org/10.1177/1948550620936439 [Accessed 10 June 2021].

[5] Fogg B. A behavior model for persuasive design. In: Proceedings of the 4th International Conference on Persuasive Technology. 2009. p. 1–7, http://dx.doi.org/10.1145/1541948.1541999.

[6] Lynn MR. Determination and quantification of content validity. Nurs Res 1986;35(December (6)):382–6.

[7] Polit Denise F, Beck Cheryl Tatano, Owen Steven V. Focus on research methods is the CVI an acceptable indicator of content validity? Res Nurs Health 2007;30(4).

[8] Towers E. Incorporating Choice Theory/Reality Therapy and the Fogg Behavior Model to empower African-American women to engage in physical activity and adopt a healthy diet to improve their overall physical health. Mississippi College; 2015.

[9] Meekers D, Onuoha C, Olutola O. Applying the Fogg Behavior Model to improve contraceptive social marketing during the COVID-19 lockdown in Nigeria: a case study. Gates Open Res 2020;4(September):141, http://dx.doi.org/10.12688/gatesopenres.13186.1.

[10] Sittig S, Wang J, Iyengar S, Myneni S, Franklin A. Incorporating behavioral trigger messages into a mobile health app for chronic disease management: randomized clinical feasibility trial in diabetes. JMIR mHealth uHealth 2020;8(March (3)):e15927, http://dx.doi.org/10.2196/15927.

[11] Agha S, Tollefson D, Paul S, Green D, Babigumira JB. Use of the Fogg Behavior Model to assess the impact of a social marketing campaign on condom use in Pakistan. J Health Commun 2019;24(March (3)):284–92, http://dx.doi.org/10.1080/10810730.2019.1597952.

[12] Yu T, Chen Y. Live streaming for political campaigns: persuasive affordances, political mindfulness, and political participation. p. 11.

[13] Alismail S, Olfman L. A tailored motivational messages library for a mobile health sleep behavior change support system to promote continuous positive airway pressure use among patients with obstructive sleep apnea: development, content validation, and testing. JMIR mHealth uHealth 2020;8(August (8)), http://dx.doi.org/10.2196/18793.

[14] Brislin Richard W. Cross-cultural research methods. Environ Cult 1973.

[15] Walsh DC, Rudd RE, Moeykens BA, Moloney TW. Social marketing for public health. Health Aff (Millwood) 1993;12(January (2)):104–19, http://dx.doi.org/10.1377/hlthaff.12.2.104.

[16] Agarwal S. Tourist persuasion and crime prevention. Crime Prev Community Saf 2016;18(August (3)):165–86, http://dx.doi.org/10.1057/cpcs.2016.8.

[17] Theory and model use in social marketing health interventions. J Health Commun. 18(1).

[18] Sittig S, Franklin A. Persuasive technology: designing mobile health triggers to impact health behavior; 2020.

Mayda A. Alrige is an Assistant Professor of Information Systems in King Abdulaziz University. Her research interests revolve around artificial intelligence and knowledge management. Recently, her work is focused on utilizing fuzzy-logic and multi agent systems for nutrition education and diet recommendation. She is particularly interested in the utilization of ambient intelligence and ubiquitous technologies for smart healthcare sector and smart cities. She has a bachelor's degree (BSc) in Computer Science from KAU (2009), master's degree (MSc) in Information Systems from College of Engineering and Information Technology at University of Maryland-BC (2013). During her masters, she became an active member at the Healthcare Informatics and Technologies Lab and conducted her master thesis in privacy preserving integration of publicly available health data. Mayada received her PhD in Information Systems and Technology from Claremont Graduate University (2018). For her PhD dissertation, she developed an intelligent nutrient profiling engine, a rule-based system, to educate type-2 diabetics about the nutrient content of their food and recommend customized diet. This research project was conducted in collaboration with the diabetes treatment center at Loma Linda University Diabetes Treatment Center, LLU. More about her work can be found in her Google Scholar Web Page.

Hind Bitar is an assistant professor at the Information Systems Department, FCIT, King Abdulaziz University in Jeddah, Saudi Arabia. She obtained her undergraduate degree in Computer Science (Umm Al-qura university, SA, 2008). She earned her master's degree in information systems from University of Maryland Baltimore County (UMBC), US in 2014. Dr. Bitar received her Ph.D. in Information Systems and Technology, health informatics (Claremont Graduate University (CGU), USA, 2018). Dr. Bitar reviewed many scientific research papers for several journals and conferences, such as JMIR, JAMIA and HICSS. Bitar has made some scholarly contributions in the field of health and energy informatics, as well as geoinformatics. Also, she is currently working on several research projects that have been funded by King Abdulaziz University in the health-related domain.

Maram Meccawy is an Associate Professor at the Department of Information Systems, Faculty of Computer Science and Information Technology at King Abdulaziz University (KAU), Saudi Arabia. She received her Ph.D. from the University of Nottingham in the UK. After her graduation, she spent a few years working in the industry before joining KAU as an assistant professor in 2014. Dr. Meccawy's research interests include Adaptive Educational Hypermedia, User Modelling, LMS, MOOCs, and Teaching Programming to children.