

Evaluating Users' Perception of Health-Safety Measures against Pandemics

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Abstract. The unprecedented emergency determined by the COVID-19 pandemic required national governments to enact countermeasures to contain the spread of the Coronavirus disease. Nevertheless, several research studies highlighted the acceptance issues and short- and long-term consequences of restrictions such as lockdown orders, social distancing, contact tracing, and face masks. In this paper, we present the results of a study in which we analyzed individuals' knowledge, attitude, and behavior regarding the health-safety measures implemented during the COVID-19 pandemic, and we outline the human factors that can play a key role in designing solutions that have better usability and result in higher compliance from users.

Keywords: User-Centered Design, Human Factors, COVID-19.

1 Introduction

In the past year, the unanticipated outbreak of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has quickly escalated into a global emergency that infected more than 100 million individuals and caused over 2 million deaths worldwide. In addition, the coronavirus disease 2019 (COVID-19) pandemic has progressively hit the economy and impacted individuals' lives.

For the first time in recent history, national governments have been presented with a major health emergency that has urged them to design and enact countermeasures despite the lack of information about Coronavirus' dynamics and the level of connectedness of the world. As a result, effective yet drastic provisions such as local and nationwide shelter-in-place and lockdown orders have been introduced in the first phases of the pandemic and in case of faster growth of the infection curve [1][2].

Moreover, other types of preventive and non-pharmaceutical practices, including social distancing, have been enforced to ensure the safety of individuals and public spaces and to prevent the virus from spreading further while releasing mobility restrictions [3][4]. Also, the use of Personal Protection Equipment (PPE), and particularly face masks, has been introduced as a requirement in many situations, both indoor and outdoor. In addition to standard health-safety practices such as hand wash, the use of disinfectant was recommended, and businesses have been required to adopt sanitization policies [5][6]. In contrast, despite investments and promotion efforts, the deployment

of mobile applications for social tracking has resulted in a failure, due to poor user adoption and to a debate shift towards privacy and ethical concerns [7] [8].

Several factors, including the absence of information about SARS-CoV-2 and the lack of preparedness for the situation, have influenced users' behavior and have resulted in situations ranging from fear of leaving the house to complete disregard with respect to health-safety recommendations. In addition, most health-safety measures imply a reduced or impaired social interaction, introduce additional problems (e.g., interpersonal communication) and involve strong usability trade-offs. Consequently, individuals have shown different responses and acceptance dynamics as far as individual protection and practices. Indeed, the fast deployment of safety measures is a priority. However, despite the effectiveness of confinement, social distancing, and reduced communication in contrasting the spread of COVID-19, research is suggesting that they may have long-term consequences on individuals' mental health [9][10]. To this end, a more user-centered approach to the design of products and practices for fighting or coping with the pandemic may increase adoption and result in more effective solutions. In this regard, the experience of the COVID-19 emergency is an unprecedented opportunity for providing a better response to pandemics, and it can be utilized in other types of health crises. In this paper, we present a research study aimed at investigating human factors and user perspectives regarding individual and public health-safety measures introduced for combating the SARS-CoV-2 emergency. To this end, we surveyed over 500 respondents, who enabled us to understand the main changes experienced during the pandemic. Additionally, we identified common acceptance dynamics and adoption patterns concerning different preventive solutions. Our results can be utilized to design user-centered products that are more effective in addressing the current challenges of the COVID-19 pandemic and its next phases. Moreover, our approach can be incorporated into the design of the next wave of solutions for coping with pandemics, health emergencies, and future challenges.

2 Related Work

Although the COVID-19 pandemic is recent health emergency, several research studies already investigated the multifaceted human factors involved in designing disaster-management practices and deploying measures such as lockdowns, social distancing, face masks requirements, and other types of restrictions. Previous crises and epidemics (e.g., H1N1 and Ebola) already demonstrated key vulnerabilities and offered opportunities to address them and develop specific expertise [11]. Specifically, research in ergonomics can provide the healthcare sector with improved resources for managing an increased workload and it can support the development of Standard Operating Procedures that minimize risks for patients and increase safety and productivity in health workers [12] [13]. For instance, the authors of [14] identified the main themes in qualitative research related to the human factors involved in working with PPE, especially in the healthcare sector. They modeled four main themes, that is, demand and supply, fit and adaptation, physical distress, and interference with tasks. Other studies investigated the impact of PPEs on health workers and highlighted that a more user-centered approach is crucial for mitigating the perceptual and cognitive impact, which, in addition to physical and ergonomic effects, are critical in influencing workers'

performances [15]. Indeed, taking ergonomics into consideration for improving services and systems is especially relevant in contexts, such as healthcare, that are particularly exposed to the crisis. Simultaneously, incorporating human factors is even more crucial in increasing the user acceptance of practices, products, and solutions that are recommended or ordered to entire populations worldwide. For instance, the authors of [16] presented the results of a survey that investigated the user acceptance of a COVID-19 vaccine. In addition to showing individuals' overall positive acceptance rate, the study highlights a large variability in responses from different countries and correlates it with the level of trust in the national government. Similarly, in [17], the social acceptability of contact tracing systems and other and

3 Study

The objective of our research was to design viable solutions (i.e., primarily digital products and services) for helping individuals cope with the prolonged restrictions introduced to mitigate the COVID-19 pandemic and its long-term effects. Therefore, we realized a preliminary study in which we aimed at evaluating the impact of the changes caused both by the health emergency as well as by the countermeasures enacted by national governments. To this end, we designed a survey and distributed it online via Social Media, private messages, and e-mails. Participants were recruited through snow-ball sampling. The survey was circulated during the second wave of the health crisis, that is, from September 2020 to January 2021.

A total of 514 individuals participated in the research study. The group consisted of a total of 220 females (42.8%), 264 males (51.3%), and 30 respondents (5.8%) who preferred not to share their gender. Most participants (227, that is, 44.2%) aged 18-24, 83 (16.1%) were in the 25-34 bracket, 53 (10.3%) were in the 35-44 group, 90 (17.5%) were 45-54, 53 (10.3%) aged 55-64, and the remaining 8 (1.6%) preferred not to disclose their age group. The majority of participants (476, that is, 92.6%) were born and living in the United States, whereas the rest consisted of individuals from multiple countries. Their education was as follows: 204 (39.7%) had a post-secondary degree (associate or bachelor), 181 (35.2%) graduated from a high school, 83 (16.1%) had a master's degree, 30 (5.8%) had a doctorate, and the remaining 16 (3.1%) had a different type of degree. In addition, we surveyed their Internet use on different types of devices, to evaluate their exposure to technology and their behavior in regard to finding news and information online. Their average daily Internet use on a mobile device was 0-30 minutes for 16 participants (3%), 30-60 minutes for 87 (17%), 1-2 hours for 119 (23%), 2-4 hours for 150 (29%), 4-8 hours for 111 respondents (22%), and 31 participants (6%) surfed the Internet for more than 8 hours per day. As far as the average daily Internet use on a computer, it was 0-30 minutes for 40 participants (8%), 30-60 minutes for 23 (5%), 1-2 hours for 119 (23%), 2-4 hours for 87 (17%), 4-8 hours for 134 respondents (26%), and 110 participants (22%) surfed the Internet on their personal computer for more than 8 hours per day. Overall, respondents stated that their daily use of the Internet for browsing the news or searching for information was 0-30 minutes for 10 participants (2%), 30-60 minutes for 41 (8%), 1-2 hours for 108 (21%), 2-4 hours for 170 (33%), 4-8 hours for 118 (23%), and more than 8 hours per day for 67 participants (13%). Most respondents (476, that is, 92.6%) had never tested positive for COVID-19 whereas 38

(7.4%) were found positive to the SARS-CoV-2 virus one time. None of the individuals in our sample tested positive multiple times. The majority of individuals who participated in our study (340, that is, 66.2%) had never been in contact with anybody who tested positive (during their incubation or infection window) whereas 174 respondents (33.9%) were in contact with positive individuals one or more times. Also, 253 individuals (49.2%) reported that they had no vulnerable people in their household, 126 (24.5%) respondents indicated the presence of 1 vulnerable people, 95 participants (18.5%) were responsible for 2 persons, and the remaining 40 (7.8%) indicated the presence of 3 or more individuals at risk in their households.

4 Results and Discussion

In our survey, we asked respondents to rank the recommended personal health-safety practices against COVID-19 based on their perceived importance. Specifically, our interest was two-fold. On the one hand, our goal was to gauge individuals' willingness to adopt the most common precautions, in addition to their knowledge, attitude, and behavior in regard to adoption of and compliance with health-safety practices using a model derived from the cyber-hygiene domain [18] and a research framework presented in [19]. On the other hand, we aimed at analyzing their reaction with respect to a perceived lack of or poor adherence to each of the practices being examined.

When asked to rank the practices by their priority, several respondents indicated sanitation, contact tracing, the use of face masks, getting vaccinated, social distancing, and frequent temperature checks as their top priorities, as shown in Figure 1. However, weighing the priorities results in a different ranking, which is more consistent with the other data we collected. The use of a face mask was considered the most important practice, accounting for 25% of the overall perceived health-safety. Most individuals indicated a high adoption and compliance rate, despite the many drawbacks of this type of personal protection equipment, including a sense of lost interpersonal interaction and, specifically, non-verbal communication. Simultaneously, our data shows that individuals are reluctant to visit places in which people do not adhere to wearing face masks. Most participants indicated that requirements in terms of the use of personal protection equipment were mostly present and clear in most public places, which helped them adhere to the recommendation and feel safer because they were more confident in other people's compliance. Also, equipment for protecting the environment (e.g., glasses, shields, and covers) was mentioned as having a positive impact on the willingness to visit a public space. Social distancing was the second most important factor, as it accounts for 24% of the overall perceived health-safety. Although respondents revealed adherence to social distancing rules, in their comments, they mentioned an increased sense of solitude, which affected their mental health. Moreover, the high variance of our quantitative data could be explained by the answers to the qualitative questions of the survey, in which respondents admitted that they stopped enforcing social distancing rules within their milieu and in places that they considered as safe. Furthermore, participants indicated that social distancing rules were clearly communicated and easy to follow, thanks to the information available from the media and to signs in public spaces. Sanitation ranked third, and it accounts for 20% of the perceived health-safety. It is mentioned several times by respondents in their comments. Specifically, they

indicated that they would feel more comfortable visiting public spaces if they were able to know their condition in terms of sanitization. Moreover, a group of subjects responded that they adopted additional precautions such as removing all their clothes after returning home and sanitizing every item because of a lack of clear information about the right approach to cleaning surfaces. A few respondents indicated this as a major source of anxiety, especially during the first months of the pandemic. Our data show that the use of face masks, social distancing practices, and correct sanitization account for 69% of the perceived level of health-safety, and their importance is reiterated in participants' comments. Other measures such as checking temperature regularly, getting vaccinated, or the use of contact tracing applications, are perceived as less impacting on health-safety, both at the individual level and as a factor when deciding whether it is safe to visit public places. Checking temperature regularly was indicated as the fourth most important component, accounting for 14% of the perceived level of health-safety. Specifically, respondents indicated that they very seldom monitoring their own temperature and that the presence of scanners was not an influencing factor in their decision to visit a public place. This is consistent with the presence of asymptomatic and presymptomatic individuals, which may contribute to a diminished perception of the importance of monitoring the temperature [20]. Being able to get vaccinated accounts for 12% of the perceived health-safety, which may be considered counterintuitive. However, this may be due to the fact that at the time of the survey, there were no vaccines yet for COVID-19. Consequently, respondents may have ranked it low because it appeared less tangible as an option. Finally, contact tracing ranked last, accounting for only 4% of the perceived health-safety. Figure 1 shows a split of our data between respondents who considered it as having a high priority and individuals who were not aware of the existence of social tracking applications. This result demonstrates that this technology was not adopted at the government level and, consequently, not advertised to citizens, even if individuals would have probably used it. This is confirmed by respondents' comments, which indicate that they were using other techniques to monitor the well-being of the people they were in contact with. Specifically, contact tracing, which was successfully implemented by other countries, including China and the United Kingdom, could have helped lift or ease restrictions such as social distancing, especially in contexts in which social interactions could be tracked. Individuals' responses indicate that the adoption of health-safety measures is overall satisfactory, especially in regard to the use of face masks and to social distancing. Conversely, the lack of information about correct sanitization is disorienting and creates additional stress, which should be addressed by better communication or by solutions that enable increasing the awareness about sanitization practices that need to be adopted at the personal level as well as in public spaces. As individuals are informed about the health-safety practices and willing to adopt them if they are able to understand their utilization and impact, our findings suggest that solutions that address emergencies should incorporate components that address users' awareness about the positive aspects of their adoption [21]. For instance, despite involving restrictions, face masks and social distancing were considered as practices that enabled users to maintain their lifestyle. Moreover, enforcing compliance was considered by our respondents as having a positive meaning because it increased the sense of safety when interacting with others. Simultaneously, individuals may have felt more comfortable with maintaining their social contacts if they were given the opportunity of tracking their interactions.

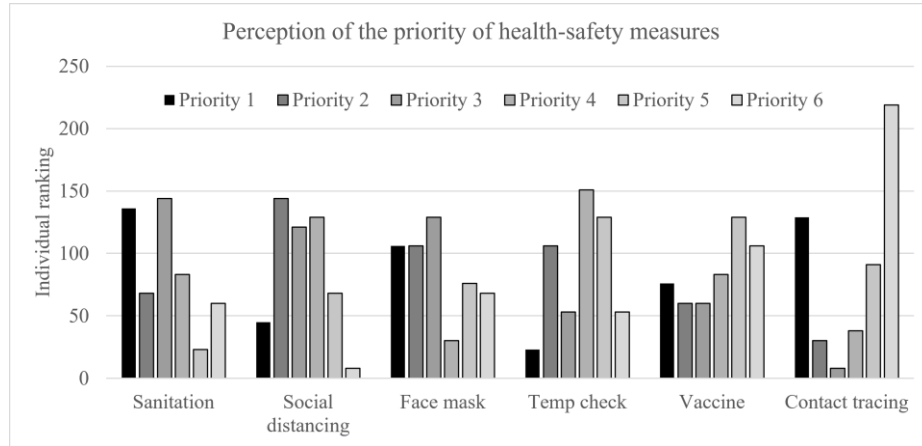


Fig. 1. Perception of the importance of the most common health-safety measures enacted during the COVID-19 pandemic.

5 Conclusion and Future Work

In the last year, the COVID-19 pandemic urged governments to rapidly develop and introduce solutions to limit the spread of the virus. In addition to restrictions, several health-safety practices were recommended and ordered at the national level and world-wide. Despite their effectiveness in fighting the emergency, the design and implementation of preventive measures have several drawbacks. In this paper, we presented the result of a study that analyzed individuals' perceptions of the most common health-safety measures. Our objective was to evaluate the overall adoption of and compliance with sanitization, social distancing, personal protection equipment, temperature checking, vaccination, and contact tracing. To this end, we circulated a survey that enabled participants to rank the perceived effectiveness of health-safety measures and comment on the successful aspects as well as their issues. Participants' responses helped identify the key human factors that have an impact on the adoption of restrictive measures and on users' adherence. They include government trust, awareness of their effects, and positive reinforcement with respect to maintaining an active and social lifestyle while preserving health-safety. Finally, based on users' feedback, we discussed how intervention measures (e.g., contact tracing and temperature monitoring) could be deployed more successfully.

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