Uptake and Utilization of the COVID-19 Alert App within a University Community in New York

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Abstract

The rapid onset of the COVID-19 pandemic elicited a swift response to control the virus ubiquitous within the United States. Expanded telehealth and health informatics became critical components of the pandemic response. The aim of this study was to assess the utilization of the COVID-19 New York (NY) Alert App and identify the perceived benefits and limitations of the App. A cross-sectional design was employed to collect data by using questionnaires with closed-ended and open-ended questions. The survey was developed and administered during March through April 2021. The study found that the highest rated benefit from using the COVID-19 NY Alert App was receiving alerts about being in close proximity to individuals diagnosed with COVID-19. Results showed that ineffective (insufficient and inappropriate) usage was the highest rated potential challenge for using the App. Study subjects were likely to download this Alert App when they perceived more benefits and less barriers to using the App. Findings from this study can help improve utilization of the App and inform development of similar tele-education tools. The study illuminated considerations for health information applications in scaling-up traditional COVID-19 tracing efforts and may facilitate the design of similar emergency preparedness health technology.

Key Words: COVID, telehealth, health informatics, tele-education tools

INTRODUCTION

After the Wuhan Municipal Health Commission in China reported a cluster of cases of pneumonia on December 31, 2019, a novel strain (i.e., coronavirus) was first identified as the cause of the pneumonia.[1] Because this virus precipitated global crises taking millions of lives worldwide with its high transmissibility and lethality, the World Health Organization (WHO) declared the COVID-19 outbreak a global pandemic on March 12, 2020.[2] The U.S. was one of the most affected countries with more than 103 million cases and 1.1 million deaths related to COVID-19.[3] In particular, New York State (NYS) recorded a higher COVID-19 infection rate (about 6.8 million cases, 6.6% of total cases in the U.S.) and mortality (about 77,000 deaths, 6.9% of total deaths in the U.S.) relative to other states. A large portion of the confirmed cases and mortality in NYS stemmed from New York City, one of the largest and most densely populated cities in the world.[4] When the situation became increasingly serious, the NYS implemented several public measures such as stay-at-home orders, travel bans, limited gatherings of people, and operation of businesses only at specified times to mitigate the spread of COVID-19. As such, individuals were isolated from social contacts outside the home.

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To control a large-scale communicable disease, using health information technology can benefit individuals in social isolation in several ways. For example, those who needed information about COVID-19-related risks and public guidance could get real-time updates through their mobile devices. Using telehealth, they could also communicate with their health care provider and receive timely professional medical advice as well as treatments/prescriptions from a remote location when diagnosed with COVID-19. The NYS has recognized the importance of effective mobile health (mHealth) and telehealth as a preventive and control measure to halt further transmission of coronavirus, plan for efficient outbreak/pandemic preparedness, and end the pandemic.

Accordingly, NYS was one of several states who joined the regional COVID-19 Alert App Network in 2020.[5] The COVID-19 Alert App was designed to supplement the existing COVID-19 contact tracing efforts. Contact tracing is a long-established, proven public health practice that has helped reduce community disease transmission and mortality in outbreaks. Contact tracing uses Bluetooth technology to notify people of potential exposure to COVID-19. Once individuals find themselves exposed to someone who has contracted COVID-19, they will self-quarantine and avoid contacting others until a COVID-19 test shows negative results. As such, the contact tracing strategy is key to slowing down the spread of COVID-19 infections. The contact tracing process includes a health education component whereby the public health workers provide health guidance, answer questions, and offer support.[6]

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Thus, users of the COVID-19 NY State Alert App were notified quickly during the pandemic if they had been exposed to a person tested positive for COVID-19. This COVID-19 NY State Alert App is a free-to-download mobile application (hereafter, "app") available to anyone 18 or older who lives, works, or attends college in NYS. Because the App does not track users' location and transmit/store personal information, it protects the users' privacy. This app is available in multiple languages including English, Spanish, Chinese, Bengali, Korean, Russian, Haitian Creole, Yiddish, and Arabic.

To investigate the knowledge, adoption, and use of the COVID-19 NY Alert App, this study undertook a survey using data from New York City residents. Specifically, the goals of this study were to: 1) assess awareness about the COVID-19 NY Alert App; 2) assess the utilization of the App; and 3) identify both advantages and barriers to using the App. Findings from this study can help improve utilization of the App, thus scaling-up traditional COVID-19 tracing efforts to help prevent transmission of the virus.

METHODS

A cross-sectional study design was used to survey a sample of New York City residents. The survey was developed and administered during the period of March to April 2021. All study data were collected remotely using an online survey tool, Survey Monkey. Institutional Review Board approval was obtained from St. John's University, Queens, NY (FWA # 00009066) prior to the start of this study.

Study Subjects

The study recruited participants from students and employees in St. John's University (SJU), Queens Campus community, located in Queens, New York. Persons aged 18 years or older, all gender identities, and races/ethnicities were eligible to participate in the study. To identify potential survey participants, a random sample from St. John's University's email list was generated. An email was sent to prospective study participants. The email contained detailed information about the study. Survey participants who provided informed consent were able to proceed to the survey.

Instrumentation

Instrument Development Process

To develop the survey questionnaire, we employed the following systematic four-step process: clearly defining the research objectives, conducting a thorough literature review of existing knowledge on the topic, developing a conceptual framework, and having the developed questions reviewed by key experts to reduce biases and ensure clarity.

1. *Research Objectives:* The first step in developing the survey was to clearly define the study objectives. The defined objectives were to (1) assess awareness about the COVID-19 NY Alert App; (2) assess the utilization of the App; and (3) identify both advantages and barriers to using the App. This step ensured that the developed survey questions aligned with these specific objectives.
2. *Literature Review:* The second step included conducting a comprehensive literature review to gather existing knowledge and previous research on the topic. This strategy helped us understand the concerns related to technology use and facilitated the formulation of relevant and informed survey questions. Since there were limited published surveys available on this topic, we needed to develop a new survey instrument.
3. *Conceptual Framework & Question Design:* We created a conceptual framework that encompassed key themes to explore through the survey. Based on this framework, we designed a combination of closed-ended and open-ended questions. The structured (multiple-choice) questions provided predefined response options, allowing for quantitative analysis and comparison of responses; while the unstructured questions enabled respondents to provide qualitative responses, offering more detailed insights and allowing for a broader range of perspectives.
4. *Survey Review:* Prior to conducting the survey, we had the final set of survey questions reviewed by the experts. That is, we sought input from subject matter experts at St. John's University who provided valuable feedback to mitigate biases in responses, ensure the clarity of questions, and verify their alignment with the research objectives.

By following this rigorous process, we aimed to develop a survey questionnaire that was well-grounded in the literature, aligned with the research objectives, and vetted by experts in the field.

Survey Administration and Themes:

The survey was administered online via Survey Monkey. The survey collected participants' demographic information including age, gender (male or female), race (White, African American, Asian, American Indian/Alaska Native, others), ethnicity (Hispanic/Latino, not Hispanic/Latino), and status at SJU (employee or student). In addition, the survey assessed the following constructs:

1) *Knowledge about the COVID-19 NY State Alert App*. To measure this construct, the survey asked whether participants knew about the COVID-19 NY State Alert App.

2) *Utilization of the App*. The survey also included a question whether participants downloaded the COVID-19 NY State Alert App. If the participants downloaded the App, they were asked what features in the App they had used. Those who did not download the App were provided a follow-up question asking reasons for not downloading.

3) *Perceived advantages and barriers to using the App.* Participants were also provided questions asking the

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advantages and barriers to using the App. The response options for the advantages of the App included its ability to track personal health information, to alert others of the user's positive COVID-19 status, to alert about being in close proximity with individuals who are COVID-19 positive, to allow quick access to COVID-19 statistics, and to facilitate contact tracing using technology. The response options for the barriers to using the App included risk of privacy, inequity (unequal access to the app), ineffectiveness (insufficient and inappropriate usage), and challenges using the technology.

Following the main survey questions, participants were provided with a brief video to learn about the App, with the option to download the COVID-19 NY State Alert App onto their respective devices.

Statistical Analysis

Descriptive statistics were calculated for the demographic characteristics of the respondents using means and standard deviations for continuous variables and frequencies and percentages for categorical variables. The responses to the App usage questions were summarized and reported with frequencies and percentages of the responses. In addition, chi-squared tests were performed to evaluate whether responses (i.e., knowledge and utilization of the App, reasons for not downloading the App, features used in the App, and perceived benefits and barriers of the App) differed by gender, race/ethnicity, and status at SJU. Logistic regression was also employed to assess differences in these responses by age. Finally, chi-squared tests were conducted to examine the association of the utilization of the App with respondents' perceived benefits and perceived challenges of using it. The level of significance for all statistical tests was $p < 0.05$. All analyses were conducted using SPSS 24.0 (SPSS Inc., Chicago, IL).

RESULTS

Table 1 presents the demographic characteristics of the study respondents. Of 140 respondents, approximately two-thirds were females (n=88, 62.9%); one-third, males (n=52, 37.1%). The majority of respondents were White (n=88, 62.9%), followed by Asians (n=29, 20.7%) and African Americans (n=10, 7.1%). Hispanics and Latinos made up 16.1% of the study sample (n=22). A total of 93 were students (66.4%) and 47 were employees (33.6%) of the University.

Knowledge and Utilization of COVID-19 Alert App:

Table 2 shows knowledge and utilization of the COVID-19 Alert App. Approximately half of respondents (n=77, 56.2%) reported that they had known about this App prior to participating in the survey, while the remaining 60 participants (43.8%) had not been aware of it. A total of 77 participants (55.0%) responded to the survey question asking about whether they had downloaded the App onto their phones. Of these 77 responses, about half of them (n=38, 49.4%) indicated that they had downloaded the App before participating in this study. There were 97 participants who did not provide a response to this question asking about their behavior of downloading the App and those who responded "no" to the question (i.e., those who had not downloaded the App). Of these 97 participants, about one-third (n=28, 28.9%) reported that they downloaded this App onto their device after completing the survey.

Participants responding that they had downloaded the App were provided a follow-up question asking what features on the App they had used. The most frequently used feature was 'COVID data' (n=47, 82.5%) followed by 'My COVID Alert' (n=41, 71.9%) and 'My Health Blog' (n=27, 47.4%). The least utilized feature was 'Sharing My COVID Status' (n=25, 43.9%). Those who had not downloaded the App reported the reasons for not downloading. More than half of them had not downloaded the App because of no interest in using it (n=37, 55.2%). Also, they had been concerned about confidentiality of their data (n=24, 35.8%) or they had had no chance to download it (n=13, 19.4%). Other reasons for not downloading it included: (a) no need for the App because they had already been vaccinated (n=3); (b) no possession of a smart phone or insufficient storage to download on a smart phone (n=2); (c) technical difficulty in downloading (n=2); and (d) still undecided to download (n=1).

Perceived Benefits and Challenges of COVID-19 Alert App:

Figure 1 demonstrates participants' perceived benefits and challenges of using the COVID-19 Alert App. A total of 61 participants responded to the benefit questions. The highest ranked benefit of the App was its function to provide alerts when being in close proximity with individuals diagnosed with COVID-19 (n=50, 82.0%). Technology using contact tracing was the second most important benefit (n=48, 80%). The third highest rated benefit was quick access to COVID-19 statistics (n=44, 72.1%) followed by the App's ability to alert others of the App user's positive COVID-19 test result (n=42, 68.9%). About one-third (n=21, 34.4%) considered the App's ability to track personal health information to be a further benefit of this App. Of the 60 participants responding to the challenge questions, 41 (68.30%) felt that ineffectiveness (insufficient and inappropriate usage) of the App represented the main obstacle to adopting it. Risk to privacy was reported as the second highest rated challenge (n=36, 60.0%). The third rated barrier was inequity (unequal access to the App) (n=23, 38.3%). Lastly, 16 respondents (26.7%) felt that there were technical challenges in using the App.

Results from Analytical Analyses:

Results from analytical analyses showed no significant difference in responses (i.e., knowledge and utilization of the App, reasons for not downloading the App, features used in the App, and perceived benefits and barriers of the App) by gender, race, ethnicity, and status at SJU (data not shown). However, results from logistic regression analyses showed that age was significantly related to one of the reasons for not downloading

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the App (i.e., no chance to download it). That is, there was a 12% increase in the odds of not downloading the App because of having no chance to download it for each one-year increase in age after controlling for gender, race, ethnicity, and status at the University (Odds ratio (OR) = 1.122, 95% CI: 1.020, 1.234). Moreover, results from chi-squared tests indicated that respondents' perceived benefits of the App were significantly related to their behavior of downloading it. Specifically, as respondents perceived any benefits from the App, they were more likely to download it ($x^2(1, 135) = 80.85$, $p < 0.001$). The significant relationship with downloading the App was observed for every aspect of their perceived benefits. In other words, respondents were more likely to download the App as they perceived its benefit of providing alerts about being in proximity with those diagnosed COVID-19 ($x^2(1, 135) = 60.02$, $p < 0.001$), facilitating contact tracing through technology use ($x^2(1, 135) = 72.10$, $p < 0.001$), allowing quick access to COVID-19 statistics ($x^2(1, 135) = 45.06$, $p < 0.001$), providing alert to others of the App user's positive COVID-19 status ($x^2(1, 135) = 50.68$, $p < 0.001$), and tracking personal health information ($x^2(1, 135) = 18.55$, $p < 0.001$). Furthermore, respondents' perceived challenges of the App were significantly related to their behavior of not downloading it. When respondents perceived any challenges to using the App, they were not likely to download it ($x^2(1, 135) = 84.18$, $p < 0.001$). This significant relationship was observed for every aspect of their perceived challenges. That is, respondents were not likely to download the App as they perceived its ineffectiveness ($x^2(1, 135) = 48.32$, $p < 0.001$), risk to privacy ($x^2(1, 135) = 37.30$, $p < 0.001$), inequity ($x^2(1, 135) = 17.78$, $p < 0.001$), and difficulties in using technology ($x^2(1, 135) = 19.11$, $p < 0.001$).

DISCUSSION

Results found that about half of the participants had already known about the COVID-19 Alert App before participating in this study. Also, 38 respondents had previously downloaded this Alert App and 28 respondents downloaded it after completing the survey, resulting in a total 66 participants (47.1%) downloading the App. This statistic is comparable to other studies reporting uptake and utilization of an COVID-19 Alert App. In Belgium, 48.7% of study subjects were willing to use the COVID Alert App.[7] In Canada, the download percentage of the Alert App was 46.7%.[8] This download percentage varied across countries ranging from 21.1% in New Zealand to 68.6% in Switzerland and 78.6% in the U.K.[8]

This study also found that the highest rated benefit of the Alert App was its function of alerting users about being in close proximity with individuals diagnosed with COVID-19. This finding is supported by prior studies. In many countries, contact tracing apps have been rolled out as part of lockdown mitigation strategies.[9] In one study, the app was found to better protect the personal space of citizens and afford multiple benefits: it allowed for collection of detailed information about infected people in a privacy-preserving fashion; and, in turn this enabled both contact tracing, and the early detection of outbreak hotspots on a more finely granulated geographic scale.[10] Similarly, the use of contact-tracing apps was found to effectively suppress the spread of COVID-19.[11]

Additionally, our results showed that most participants felt that the ineffectiveness of the App (defined as insufficient and inappropriate usage) and risk to privacy were the two highest rated challenges of using the App. Several studies support this finding, showing that deployment of COVID-19 tracking app technology posed serious challenges of effectiveness, technological problems, and risks to privacy and equity.[12,13] App-related privacy concerns were found to negatively influence people's intention to use the App.[7] The use of digital technologies for contact tracing, tracking, or monitoring had the potential to threaten important and well-established rights to individual privacy.[14] Such personal privacy concerns were about disclosure of location information and personal health information. In addition, questions remain on who will bear responsibility if inaccurate or false formation were to be reported in contact tracing or if personal location information were to be leaked without an individual's consent.[15] In this sense, continued efforts to ensure validity of tracer app content is needed both to increase effectiveness and improve user trust.

This study found that perceived benefits and perceived barriers were significantly related to App download behavior. That is, individuals who perceived the App's benefits were more likely to download the App whereas those perceiving the barriers to using the App were less likely to download it. This finding is clearly explained by the Health Belief Model (HBM).[16] The HBM was developed in 1966 to identify predictors of health-related behaviors. This model suggests perceived benefits and perceived barriers to be the key drivers making people engaged in health behaviors. This model has been successfully applied to explaining a wide range of behaviors such as smoking,[17] healthy eating,[18] weight managing,[19] and cancer screening.[20,21] Building on the pervious applications, this current study added to the health behavior literature by demonstrating the applicability of the HBM to the adoption of the Alert App during a social disruption. This finding has some implications for public health. To make the App as useful and helpful as possible to provide credible information and various approaches to lower the risk of infection, it's essential to raise the public's awareness of the value and benefits of the Alert App. Regarding the challenges of the App, follow-up actions should be taken to address the public's concerns, for example, by ensuring safeguards for data security and confidentiality and assisting those who have difficulty in using technology.

Despite concerns among some respondents, our study found a moderate to high level of engagement with the App, indicating willingness to explore health information apps as an option to support contact tracing. As tracking technology becomes

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increasingly accessible for Americans, using apps such as the COVID-19 Alert App will become more tolerable and acceptable for individuals. Moreover, demonstration of vaccination status can be integrated into contact tracking apps, thereby making health technologies a one-stop app for health information, education, and documentation.

Limitations:

This study had several limitations because of its cross-sectional design and sample size. Although the study sample size was large enough to conduct statistical analyses, a larger population may be needed to identify more precise associations between variables and gain larger validity of study findings. A portion of the participants of the study did not answer every question in the survey, making several responses incomplete and potentially leading to biased results from these incomplete data. Also, this study focused on a single academic community, which raises concerns about the generalizability of the findings. Our study sample had a higher proportion of females (63%) compared to the percentages in NY City and the U.S. (52% and 51%, respectively). Additionally, the percentage of White participants in our sample (63%) was higher than that in NY City (40%), but lower than the national average (76%). The percentage of African American participants in our sample (7%) was lower than the percentages in NY City and the U.S. (23% and 14%, respectively) while the percentage of Asians (21%) was higher than those in NY City and the U.S. (14% and 6%, respectively). To explore the impact of demographic factors on the study results, we conducted post-hoc analyses. The results revealed a significant relationship between age and the behavior of not downloading the App in females (OR=1.106, 95% CI: 1.001, 1.221), but not in males (OR=1.318, 95% CI: 0.944, 1.840). Consequently, the higher percentage of females in our study may have contributed to the observed significant relationship between age and the behavior of not downloading the App. Notably, a study including a high percent of males may not show this significant relationship. Furthermore, our post-hoc analyses consistently demonstrated that perceived benefits and perceived barriers were significantly related to App download behavior across different age groups, genders, and races. Therefore, we believe that different study samples would likely yield similar results regarding these relationships between perceived benefits/barriers and App download behavior. In summary, it is important to interpret our study findings cautiously, taking into account the generalizability issue, specifically the gender effect on the relationship between age and the behavior of not downloading the App. Future research with a larger and more representative sample will verify our findings.

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Disclaimer: The statements, opinions, and data contained in all publications are those of the author(s).

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Table 1. Characteristics of study respondents (N=140)

Variables	
Age, mean±SD (range)	32.84±17.98 (18-79)
Gender, n(%)	
Male	52 (37.14%)
Female	88 (62.86%)
Race, n (%)	
White	88 (62.86%)
African American	10 (7.14%)
Asian	29 (20.71%)
American Indian/Alaskan Native	1 (0.71%)
Others	12 (8.57%)
Hispanic/Latino, n(%)	
Yes	22 (16.06%)
No	115 (83.94%)
Status at St. John's University	
Employee	47 (33.57%)
Student	93 (66.43%)

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Table 2. Knowledge and utilization of COVID-19 Alert App

Variables	Frequency (%)
Know about the COVID-19 Alert App? (n=137)	
Yes	77 (56.20%)
No	60 (43.80%)
Download the COVID-19 Alert App before the study? (n=77)	
Yes	38 (49.35%)
No	39 (50.65%)
Download the COVID-19 Alert App as a result of the study? (n=97)	
Yes	28 (28.87%)
No	69 (71.13%)
Features used by the COVID-19 Alert App? (n=57)	
COVID Data	47 (82.46%)
My COVID Alert	41 (71.93%)
My Health Blog	27 (47.37%)
Sharing my COVID Status	25 (43.86%)
Reasons for not downloading the COVID-19 Alert App (n=67)	
No interest in using the App	37 (55.22%)
Distrust about confidentiality of data	24 (35.82%)
Did not have a chance to download the App but plan to download	13 (19.40%)
Others	8 (11.94%)

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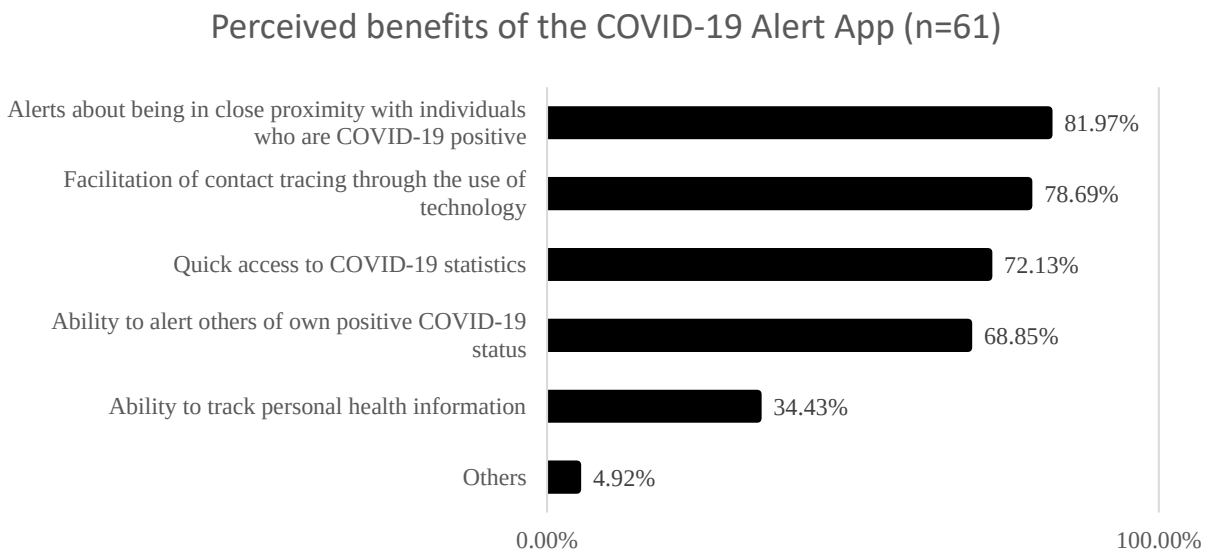
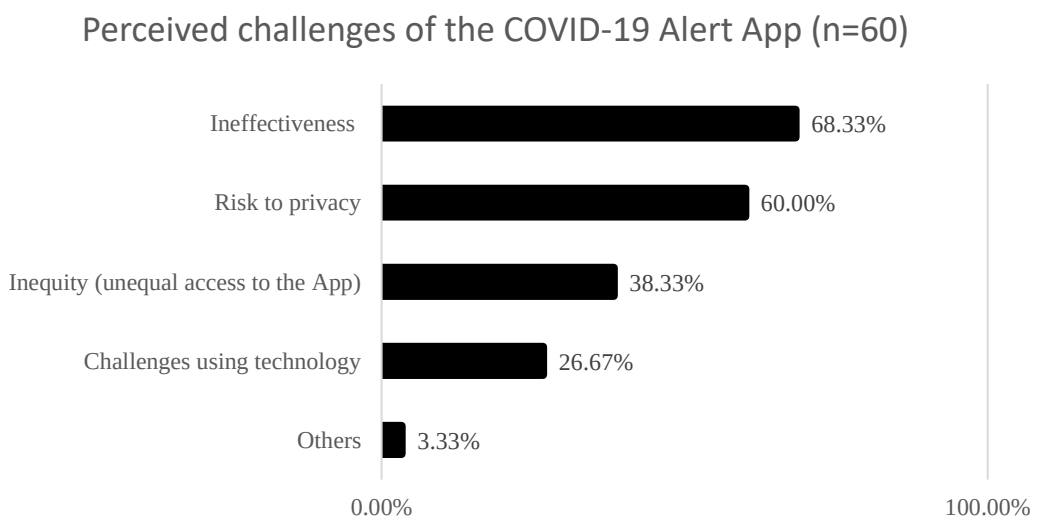
Figure 1. Perceived benefits and challenges of COVID-19 Alert App

(a) Perceived benefits



(b) Perceived challenges



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