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Modeling the acceptance and resistance to use mobile contact tracing apps: a developing nation perspective

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Abstract

Purpose – This study proposes and validates an integrated theoretical model involving the theory of planned behavior (TPB), health belief model (HBM), personal norms and information privacy to understand determinants of acceptance and resistance to the use of mobile contact tracing app (MCTA) in a pandemic situation.

Design/methodology/approach – This study draws on online surveys of 194 research respondents and uses partial least squares structural equation modeling (PL-SEM) to test the proposed theoretical model.

Findings – The study establishes that a positive attitude towards MCTA is the most important predictor of individuals' willingness to use MCTA and resistance to use MCTA. Furthermore, barriers to taking action positively influence resistance to the use of MCTA. Personal norms negatively influence resistance to the use of MCTA. Information privacy showed a negative and positive influence on willingness to use MCTA and use the resistance of MCTA, respectively, but neither was statistically significant. The authors found no significant influence of perceived vulnerability, severity, subjective norms and perceived behavioral control on either acceptance or use resistance of MCTA.

Originality/value – The study has been one of the first in the literature to propose an integrated theoretical model in the investigation of the determinants of acceptance and resistance to the use of MCTA in a single study, thereby increasing the scientific understanding of the factors that can facilitate or inhibit individuals from engaging in the use of a protection technology during a pandemic situation.

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1. Introduction

Considering the pandemic and especially ways the spread of the coronavirus and its variants can be adequately monitored and controlled, numerous scholars and industry practitioners (Alsaad and Al-Okaily, 2021; Duan and Deng, 2021; Munzert *et al.*, 2021; Saw *et al.*, 2021; Trang *et al.*, 2020; Viktor *et al.*, 2020; Walrave *et al.*, 2020) have suggested the importance of integrating mobile contact tracing apps (MCTA) into the existing COVID-19 disease surveillance system. Ntsiful *et al.* (2022) briefly explain that the MCTA is an application downloadable on smart devices and uses Bluetooth to warn people when they come close to SARS-CoV-2 contagious areas or infected persons. Indeed, the MCTA uses Bluetooth and location services that are compatible with android and apple devices and works as follows: When the MCTA user comes into contact with a person with a smart device anchored with Bluetooth, the two devices automatically communicate and exchange codes via Bluetooth. When later a person with whom the MCTA user had contacted is declared COVID-19 positive, the Bluetooth of the infected person shares this information with all Bluetooth that had come into contact with the exchanged codes. Further, the location service on the MCTA user's device also records and saves all the places the user visits so that when those places are declared COVID-19 contagious, the MCTA user can also know. Both privacy information shared by Bluetooth and the location services are essential for the MCTA user to self-isolate and, by extension, reduce the spread of the COVID-19 virus. The MCTA has also been shown to be helpful to human contact tracers (Lu *et al.*, 2021). Extant studies have explained that although human tracers provide additional benefits such as health advice and emotional reassurance to the infected persons, the procedures involved are cumbersome and saddled with reporting inaccurate data (Braithwaite *et al.*, 2020; Lu *et al.*, 2021). These deficiencies are minimized with the use of MCTA.

While the idea behind the introduction of this app is excellent, an important concern remains whether the intended users and, in particular, citizens intend to use the MCTA, especially given the existential worries about a potential breach of privacy (Rowe, 2020; Villius Zetterholm *et al.*, 2021). Although studies on this important topic (MCTA) are in their infancy, contributions of prior research (Duan and Deng, 2021; Lin *et al.*, 2021; Trang *et al.*, 2020) deserve acknowledgment as they shape our understanding on individuals' intention to use or resist the MCTA. Despite these prior contributions on the issue, our review of the emerging studies on this topic reveals that studies have been primarily focused on the citizen contexts in very few parts of the world, such as Australia (Duan and Deng, 2021; Lin *et al.*, 2021), Western European countries (Fox *et al.*, 2021; Guillon and Kergall, 2020; Oldeweme *et al.*, 2021; Tomczyk *et al.*, 2021; Trang *et al.*, 2020; Walrave *et al.*, 2020), the US (Hassandoust *et al.*, 2021; Li *et al.*, 2021) and Asian countries such as South Korea, Jordan, China and Singapore (Alsaad and Al-Okaily, 2021; Garrett *et al.*, 2021; Joo and Shin, 2020; Kim, 2021; Saw *et al.*, 2021). In particular, until now, there has been scant research on MCTA acceptance or resistance in developing countries such as those in the African continent and where only (about) 1% of its population remains vaccinated to date (The New York Times, 2021) due mostly to low vaccine supplies (Otu *et al.*, 2021; The Economist Intelligence Unit [EIU], 2021) and partly also to vaccine hesitancy (Cooper *et al.*, 2021; Reuters, 2021; Sisay, 2021). Second, the review of the existing studies also shows that prior studies have only concentrated on the acceptance or adoption of the MCTA without recourse to what might fuel the citizenry to

resist this innovation to tackle a critical situation in which the world finds itself. Following these findings, we see a considerable gap in the literature that needs to be filled. To contribute our quota to fill this critical gap in the literature, we set the objective in this study to explore the factors influencing the acceptance of MCTA, especially in developing economies, where scholars are yet to pay much attention, as earlier highlighted. At the same time, we also explore what could account for the citizenry's unwillingness to use this digital technology in the fight against COVID-19. In achieving these two objectives, we draw on several theories' strengths and propose and validate a comprehensive research model involving the theory of planned behavior (TPB), health belief model (HBM), and contextual variables such as information privacy and personal norms. While the single utility of TPB and HBM has been useful in studies where they were applied, we believe that the proposal to integrate and extend them with personal norms and information privacy is important for several reasons:

(1) One theory could not help explain the two-way outcome (acceptance and resistance) our study seeks to achieve. The integration of TPB and HBM, which we will elaborate on in section 2.3, has been proven effective in several health-related studies (Gerend and Shepherd, 2012). Apart from their integration, we also extend the two theories with privacy information and personal norms. These two variables are critical in technology acceptance and decisions. As highlighted earlier, although people may see the relevance of MCTA, such as an opportunity to detect COVID-19 infection early, individual personal norms and the privacy issues with this digital technology need to be explored.

(2) By adopting an integrated theoretical approach, we deviate from prior studies whose models or concepts were either based on a mere literature review or, at best, applying one theory. In particular, most of the research so far on MCTA acceptance has been anchored on a single theoretical perspective (Alsaad and Al-Okaily, 2021[protection motivation theory]; Joo and Shin, 2020 [coping theory]; Oldeweme *et al.*, 2021 [uncertainty reduction theory]; Walrave *et al.*, 2020 [HBM]) or based on selected variables in the literature (Guillon and Kergall, 2020; Li *et al.*, 2021; Saw *et al.*, 2021; Trang *et al.*, 2020).

(3) Applying the integrated theoretical perspective will provide rich insights into the topic, which no single theoretical model may provide.

Accordingly, this study offers many contributions to the body of knowledge. Apart from being the first or at least part of the few studies attempting to integrate two theoretical paradigms (TPB and HBM), we extend these theories with information privacy and personal norms in explaining the dynamics in MCTA acceptance and resistance in a single study. Second, we also offer perspectives on the motivating factors of MCTA acceptance and, at the same time, what could cause citizenry resistance to MCTA. Additionally, the findings from our research could provide governments, especially those in underrepresented countries, with full scientific knowledge and rich health information about MCTA acceptance and resistance. This information helps the policymakers draft effective policy implementation messages that help MCTA's acceptance and reduce its rejection in the pandemic context.

The rest of the paper is organized as follows: Section 2 reviews the relevant theoretical perspectives and then forms hypotheses based on them. Section 3 describes the method used to gather data for the study, while the analysis and results are reported in Section 4. The last section concludes by discussing our findings, research implications and limitations of the current research, which also offers an opportunity for additional investigation on this important topic.

2. Theoretical background and hypotheses development

2.1 Theory of planned behavior (TPB)

The theory of planned behavior (TPB) explains the processes of human behavior (Ajzen, 2011). According to Ajzen (2011), the basic assumption of TPB is that behavior is motivated by one's intention, which is also influenced by subjective norms, attitude and perceived behavioral control. Indeed, TPB offers rich insights into the understanding of human behavior, is very parsimonious in its assumption, and has shown strong predictive power in most extant studies. Accordingly, TPB has been applied in several prior information systems studies (research (Fan *et al.*, 2021; Hsieh, 2015; Shmueli, 2021). It is against this background that we believe that adopting TPB in the current research context will be useful in helping us understand the factors affecting the acceptance or resistance to the use of MCTA, more so that we are dealing with the issue of voluntary adoption as recommended by WHO (2020).

According to this theory, an attitude refers to either a negative or positive evaluation of an object and, in this specific context, MCTA (Ajzen, 2011; Armitage and Conner, 2001). This, therefore, implies that a positive evaluation of MCTA will go a long way in determining its eventual acceptance (cf. Zhao *et al.*, 2018), while further reducing resistance to using the technology (Kim and Park, 2020). This accordingly leads to the formulation of the following hypotheses:

H1a. Attitude has a positive influence on the intention to use MCTA.

H1b. Attitude has a negative influence on resistance to the use of MCTA.

The TPB construct of subjective norm refers to the influence of significant others on an individual's engagement in a particular course of action (Ajzen, 2011; Armitage and Conner, 2001; Fortes and Rita, 2016; Sun *et al.*, 2013; Venkatesh and Bala, 2008). Indeed, human beings are not only a part of a larger society but also belong to closely knitted groups such as the nuclear and extended families and peer groups. They are, therefore, consistently subject to social pressures from others, which could lead to the formation of behavioral responses towards a specific object. In summary, subjective norm, which is borne out of conformity pressure or social influence, can promote acceptance decisions related to new technologies use (Fortes and Rita, 2016; Hsieh, 2015; White Baker *et al.*, 2007; Zhao *et al.*, 2018) and further reduce resistance to using (Matsuo *et al.*, 2018). Accordingly, we argue that individuals are subject to social pressures, which primarily inform their choices and decision-making. Consequently, we expect subjective norms will influence the behavioral responses (acceptance and resistance) to MCTA (Van Offenbeek *et al.*, 2013). Specifically, we expect subjective norms to have the opposite influence on adoption intention and resistance to using MCTA. This leads us to the following set of hypotheses:

H2a. Subjective norms have a positive influence on the intention to use MCTA.

H2b. Subjective norms have a negative influence on resistance to the use of MCTA.

Following previous research, perceived behavioral control reflects the degree to which an individual perceives that successfully engaging in the behavior is entirely under their volitional control (Ajzen, 2011; Armitage and Conner, 2001). In context, perceived behavioral control reflects the degree to which the user believes using an MCTA is easy or difficult. We argue that the behavioral response to MCTA will be positively affected by adequate access to the necessary resources needed for the deployment of MCTA, as well as the willpower to exercise control over it (Ajzen, 2011). Concerning the empirical relationship between perceived behavioral control and use intentions, several studies (e.g. Hsieh, 2015) establish a positive link between perceived behavioral control and intention. Additionally, consistent with earlier research (Ellen *et al.*, 1991; Mani and Chouk, 2017), the current argues that perceived behavioral control may reduce resistance to using MCTA. We explain that the

individuals may perceive that they would have control over using the MCTA, lowering the likelihood of resisting it. Accordingly, we formulate the following set of hypotheses.

H3a. Perceived behavioral control has a positive influence on the intention to use MCTA.

H3b. Perceived behavioral control has a negative influence on resistance towards using MCTA.

2.2 Health belief model (HBM)

HBM is one of the most widely adopted theories in the literature used in studying preventive health behavior (Carpenter, 2010; Huang *et al.*, 2020a, b; Janz and Becker, 1984; Mou *et al.*, 2016; Rosenstock, 1974; Shmueli, 2021; Sulat *et al.*, 2018) and it has also been recently applied in the investigation of MCTA acceptance (Guillon and Kergall, 2020; Walrave *et al.*, 2020). According to influential HBM authors (Janz and Becker, 1984; Rosenstock, 1974; Rosenstock *et al.*, 1988), factors such as perceived barriers to taking action, perceived disease severity and perceived disease vulnerability affect a person's decision to engage in preventive health behavior. Overall, HBM is an explanatory framework used in understanding "which beliefs should be targeted in communication campaigns to cause positive health behaviours" (Carpenter, 2010, p. 661).

Perceived barriers to taking action refer to the underlying circumstances that may hold back the individual from engaging in preventive health behavior (Janz and Becker, 1984; Jose *et al.*, 2021; Sulat *et al.*, 2018; Walrave *et al.*, 2020). In our research context, the underlying circumstances of MCTA may be related to individuals' forgetfulness to use MCTA, especially when they are in public spaces, and further borne by the perceived busyness of the individual. All these issues, therefore, may hinder the individual from engaging in the use of MCTA. Notably, it has been found by empiricists such as Walrave *et al.* (2020) that perceived barriers to taking action negatively influence the adoption intention of MCTA and rather imply that it exacerbates resistance to the use of MCTA. Considering the above, as well as empirical findings in numerous other study contexts (Al-Metwali *et al.*, 2021; Carpenter, 2010; Lu *et al.*, 2019; Mou *et al.*, 2016; Sulat *et al.*, 2018), it is reasonable to expect perceived barriers of taking action to reduce use intention of MCTA while further strengthening the resistance to use the app. In sum, the above discussion leads us to the following set of hypotheses:

H4a. Perceived barriers to taking action negatively influence the intention to use MCTA.

H4b. Perceived barriers to taking action positively influence resistance to use MCTA.

Furthermore, regarding perceived disease severity and about COVID-19, this refers to feelings concerning the serious threat that COVID-19 imposes on the individual's health and its related dire consequences such as death and 'long COVID" (alternatively referred to as post-COVID syndrome (see also Huang *et al.*, 2020a, b; Janz and Becker, 1984; Sulat *et al.*, 2018). According to previous research (Carpenter, 2010; Lu *et al.*, 2019; Sulat *et al.*, 2018; Yu *et al.*, 2021), perceived disease severity has a positive influence on the individual's willingness to engage in preventive health behavioral outcomes, and such as in this case, willingness to adopt MCTA. Based on these findings, it is expected that perceived disease severity will not only positively lead to a willingness to use MCTA but also inhibit resistance to using MCTA. Consequently, we formulate the following set of hypotheses:

H5a. Perceived disease severity positively influences the intention to use MCTA.

H5b. Perceived disease severity negatively influences resistance to the use of MCTA.

For the HBM component of perceived disease vulnerability, scholars such as Zhao *et al.* (2018: 245) define it as the "judgement that one will feel that his/her health is being threatened [by COVID-19]". In the context of this study, perceived disease vulnerability reflects the perception of a relatively high risk of contracting COVID-19 disease. Empirically, several studies have found support that perceived disease vulnerability, also known as perceived susceptibility to a disease, has a positive influence on individuals' willingness to engage in preventive health behaviours (Huang *et al.*, 2020a, b; Janz and Becker, 1984; Lu *et al.*, 2019; Mou *et al.*, 2016). This also implies that perceived disease vulnerability could significantly lower barriers to MCTA adoption. Based on extant studies (e.g. Walrave *et al.*, 2020), we argue that individuals who perceive that they are at high risk of contracting the COVID-19 virus will be more likely to use the MCTA, and by extension, reducing their initial resistance to using the app. This, thus, leads to the formulation of the following set of hypotheses:

H6a. Perceived disease vulnerability has a positive influence on the intention to use MCTA.

H6b. Perceived disease vulnerability has a negative influence on the resistance to the use of MCTA.

2.3 TPB and HBM integration

Although the two theories (**TPB and HBM)** differ in many respects: scope, parsimony and explanatory power, several shared parameters make their integration a good fit for our study. First, the two theories relate to human or social cognition (Bish *et al.*, 2000). For instance, while the TPB construct of attitude involves a person's stance, which could be either positive or negative following a cognitive appraisal of an event or situation (Ajzen, 2011; Armitage and Conner, 2001), the perceived barriers to taking action, perceived disease severity and the perceived disease vulnerability constructs in HBM are all perception based. Second, the TPB and HBM theories are ideal for social inoculation studies. Social inoculation is a technique used to change attitudes, which involves gradually exposing subjects (people) to the dummy version of a stronger future threat that may befall them (Evans and Getz, 2003; McGuire, 1964; Traberg *et al.*, 2022) and in this context, exposing the citizenry to viewing videos of people who have died or suffered from COVID-19 pandemic. Third, TPB and HBM integration have been applied in many research, particularly in health-related studies (Barattucci *et al.*, 2022; Bish *et al.*, 2000; Gerend and Shepherd, 2012; Huang *et al.*, 2020a, 2020b; McClenahan *et al.*, 2007; Taylor *et al.*, 2006). In most of these studies, the utility and efficiency of TPB and HBM integration have been remarkably symbiotic. For instance, in using TPB and HBM to predict testicular self-examination behavior, McClenahan *et al.* (2007) found that both models were similar in the quality of results they produced. Given these similarities, we believe that integrating the two theories is justified, and their application in the current study will produce more valid results.

2.4 Contextual factors (personal norm and information privacy)

The personal norm has been defined as the "feelings of moral obligation to perform or refrain from specific actions" (Schwartz and Howard, 1981, p. 191). Roos and Hahn (2017), while referring to previous research, noted that personal norms "represent an individual's own moral obligation or responsibility to perform, or not to perform a behaviour, beyond perceived social pressure" (p. 115). Based on the above studies, we argue that individuals who score high on personal norms will be more likely to use and less likely to resist using the MCTA because they will perceive the app as technology that will protect them from contracting COVID-19 (Alsaad and Al-Okaily, 2021). Indeed, research on driving safety has found that personal norms, which Kim (2018) refers to as personal moral norms, inhibit

texting while driving. Similarly, the studies by Maity *et al.* (2019) and Udo *et al.* (2016) logically established that personal norm have a negative influence on intentions to engage in digital piracy. Moreover, other studies have found support for the positive implication of personal norms in engendering acceptable and desirable behaviors in society (Ateş, 2020; Juraskova *et al.*, 2012; Maity *et al.*, 2019; Roos and Hahn, 2017, 2019) and further reinforces our expectation that personal norms will be critically related to acceptance and resistance to the use of MCTA. Based on the above review, the following hypotheses are proposed:

H7a. Personal norms have a positive influence on the intention to use MCTA.

H7b. Personal norms have a negative influence on resistance to using MCTA.

Information privacy: Consistent with extant studies (Mani and Chouk, 2019; Bélanger and Crossler, 2011; Mutimukwe *et al.*, 2020), information privacy is defined as the high level of concern individuals have for privacy and the desire to protect their personal data. In the context of MCTA and largely considering its novelty as well as the extremely difficult times the world is currently going through, people are bound to be even more concerned about how their personal information will be processed, stored and managed by a third-party (Rowe, 2020). Some experts, including international organizations such as Amnesty International, have warned that using MCTA can considerably violate individuals' privacy (Litan and Lowy, 2020). Indeed, multiple studies in the literature suggest that the issue of information privacy poses a significant barrier to digital health adoption, including the use of MCTA (Dhagarra *et al.*, 2020; Duan and Deng, 2021; Fortes and Rita, 2016; Fox, 2020; Sergueeva *et al.*, 2020; Tomczyk *et al.*, 2021) and consequently leading to either a low adoption rate (cf. Li *et al.*, 2021) or resistance of MCTA (Chan and Saqib, 2021). For instance, Dhagarra *et al.* (2020) specifically found that information privacy negatively influences the use intentions of digital healthcare services. Meanwhile, Chan and Saqib (2021) also found that information privacy is associated with individuals' unwillingness to download and use MCTA. It is argued that when members of the general public perceive that their privacy is more likely to be infringed upon by adopting MCTA, acceptance of MCTA is expected to be low (Fox *et al.*, 2021) and therefore exacerbating the use resistance of MCTA. Nonetheless, it might also be interesting to know whether the current COVID-19 situation provides an extraordinary context for assessing if individuals might be willing to tradeoff their concerns over privacy with the expected ingrained benefits of MCTA, which scholars refer to as the privacy dilemma (Fox, 2020; Fox *et al.*, 2021). Simultaneously, there are preliminary findings within the US and Germany that the decision to adopt MCTA may be seriously hampered by citizens' concern over privacy (Kaptchuk *et al.*, 2020; Trang *et al.*, 2020). Taken together, the authors formulate the following set of hypotheses:

H8a. Information privacy has a negative influence on the intention to use MCTA.

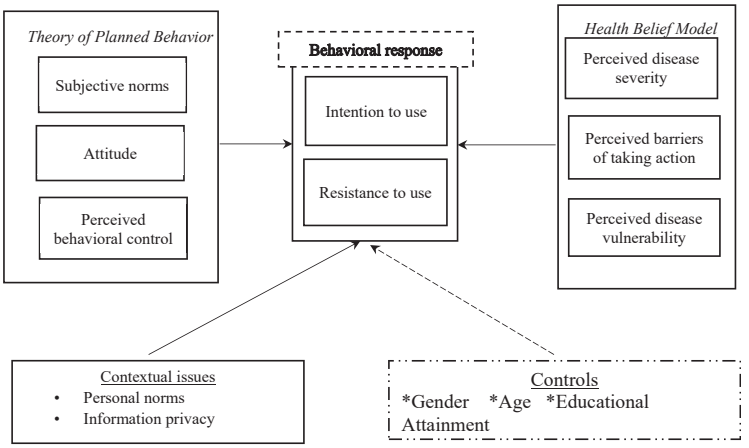
H8b. Information privacy has a positive influence on resistance to the use of MCTA.

In summary, the research hypotheses are captured in our proposed model in Figure 1.

3. Methodology

3.1 Empirical setting, data collection procedure and sample

The empirical setting for the study was Ghana, which was selected because, according to a section of the media, the country's government has developed an app-termed as GH COVID-19 Tracker app-that will enable them to trace members of the public that might have had close contact with COVID-19 patients (CGTN Africa, 2020; ITU News, 2020). Furthermore, Ghana is also one of the first countries to come out of national lockdown after only three weeks of strict lockdown in two of its most prominent regions, i.e. Greater



Source(s): Author's own, 2023

Figure 1.
Proposed MCTA theoretical model

Accra and Kumasi regions and effective (digital) contact tracing is critical in order not to overwhelm the country's relatively weak health sector. As of August 8, 2021, the current pandemic has resulted in about 107,000 confirmed cases in the country but with 854 deaths (WHO dashboard). While the current fatality rate in Ghana is understandably lower than in other developing nations such as India, Brazil and South Africa, there is genuine concern that the actual number of cases could have exceeded the reported cases, especially because of limited testing capacities in the country. Moreover, places such as Ghana cannot afford to have a higher number of cases due to its relatively weak healthcare system and the persistence of poverty among several households in the country reliant on daily income for their survival. Additionally, the impact of the current crisis, especially in Africa and Ghana, could be very devastating for citizens due to the lack of social safety nets. In addition to the above, far more important is the worrying concern regarding the notion that countries such as Ghana might be able to achieve herd immunity against COVID-19 until about 2024 since these countries are currently lacking sufficient supplies of vaccines. All these, we believe, make Ghana an adequate case for the current study.

In this study, the data collection was done using online surveys, which is congruent with related research (Alsaad and Al-Okaily, 2021; Duan and Deng, 2021). Moreover, due to ethical considerations, it was imperative to use online surveys. The online survey was created using Google Forms to facilitate the data collection process; we solicited support from individuals online and group administrators who assisted by sharing the survey link within their extended network and group members. Therefore, the current study relied on snowball sampling. At the end of the online survey exercises, we recruited 232 respondents. Out of the 232 received responses, 38 were discarded due to incomplete responses, and thus, 194 were used for the analysis. Details about the research respondents can be found in Table 1.

3.2 Measures

In this study, we used existing and validated measurement scales. Still, we were also acutely aware that in these extraordinary times, it is important not to overburden respondents with too many questions, and thus, where possible, we used shortened scales. To avoid common method, bias due to the context-specific modifications to the scales used, we revalidated the scales. Specifically, the entire questionnaire was handed over to fifteen academics comprising five (5)

Attribute	Categorization	Frequency
Gender	Female	74
	Male	117
	Prefer not to say	3
Age	18–25	46
	26–30	47
	31–39	72
	40–50	24
	Above 50	5
Educational attainment	Basic/Primary school	–
	High School	14
	HND/Diploma	29
	Bachelor degree	99
	Postgraduate	52

Source(s): Author's own, 2023

Table 1. Characteristics of research respondents (N = 194)

Ph.D. students and ten (10) academics from the marketing and management discipline as pre-testing before dissemination. Comments and recommendations ranging from sentence structure, wording and consistency were noted and amended accordingly. This revalidation process helped to ensure that the clarity, face and content validity of the entire questionnaire was guaranteed. A list of the measures and their main sources in the literature can be found in Appendix A. Finally, we controlled the influence of extraneous factors and particular demographics (see also Figure 1) since they could play a role in decisions regarding the acceptance of MCTA.

3.3 Common method of bias assessment

To proactively counter the possibility of common method bias (CMB) in the study, we considered recommendations from several past pieces of literature, and we provided general information about MCTA. Relatedly, in the header section of the online questionnaire, respondents were informed about the broader objective of the study. Still, for good reasons, we still need to provide details regarding the constructs or the relationships being investigated. Furthermore, we informed respondents that only their aggregated information would be used in the study while assuring them that their information would only be used for scientific analysis. Similarly, we told respondents that there were no right or wrong answers to the questions asked, and that participation was voluntary. This study also used different response anchors ranging from very unlikely to very likely, very low to very high and strongly disagree to strongly agree. Besides this, we also examined evidence about CMB by employing Harman's factor technique, and our finding revealed the most dominant factor's variation to be about 23.75%. Several factors equally emerged from the analysis whose eigenvalues exceeded 1. Furthermore, we used the full collinearity approach as an additional benchmark for evaluating the presence of CMB; our results based on Kock's (2015) recommendation revealed that none of the VIF values, at the manifest item or construct level, exceeded the conservative figure of 3.3. Thus, we conclude that CMB does not pose any risk to the interpretation of research results.

3.4 Analytical approach

Statistically, our research objective is to maximize explained variance in the targeted construct(s) and, in this context, use intentions and resistance to use MCTA, which according to researchers, notably Hair *et al.* (2020), is more suited for component-based SEM, which is a reason we further employed ADANCO software (Henseler, 2017).

4. Results

4.1 Measurement model assessment

Before assessing the structural model, we evaluated the quality criteria of the outer model. Considering this, we followed the usual recommendations in the literature (Hair *et al.*, 2020) by assessing first factor loadings, and our results indicate that all factor loadings are above 0.707 except for PST 3, which has a loading of 0.652 (Table 2) and are all statistically significant at $p < 0.001$. We then assessed the Cronbach's alpha (CA) coefficient, composite reliability (CR) and average variance extracted (AVE) scores. The results supported the convergent validity of measurement variables (Table 2); in particular, the scores for CA, CR and AVE all met the conservative thresholds used in evaluating them in the literature (for details, see Hair *et al.*, 2020).

Furthermore, we followed the recommendations by Fornell and Larcker (1981) and Henseler *et al.* (2015) to assess whether the measurement variables are conceptually distinct, i.e. test for discriminant validity. Our results based on Fornell and Larcker's approach,

Constructs/items	Loading	Mean	Var	CA	CR	AVE
Intention to use				0.914	0.960	0.921
USE1	0.957	3.278	1.601			
USE2	0.962	3.335	1.561			
Attitude				0.860	0.935	0.877
ATTI	0.933	3.289	1.222			
ATT2	0.940	3.608	1.193			
Perceived disease severity				0.798	0.886	0.727
PDS1	0.933	3.345	1.429			
PDS2	0.940	3.438	1.678			
PDS3	0.652	3.711	1.388			
Perceived disease vulnerability				0.842	0.903	0.757
PDV1	0.875	3.227	1.482			
PDV2	0.895	3.443	1.419			
PDV3	0.840	3.103	1.399			
Perceived barriers of taking action				0.853	0.932	0.872
PBT1	0.933	2.964	1.486			
PBT2	0.935	3.041	1.470			
Information Privacy				0.877	0.918	0.789
IPC 1	0.878	3.345	1.429			
IPC 2	0.858	3.438	1.678			
IPC 3	0.927	3.711	1.388			
Personal norms				0.905	0.940	0.840
PNM1	0.885	3.412	1.321			
PNM2	0.952	3.516	1.153			
PNM3	0.912	3.598	1.309			
Subjective norms				0.903	0.939	0.837
SBN1	0.892	3.010	1.347			
SBN2	0.932	3.258	1.436			
SBN3	0.919	3.268	1.348			
Perceived behavioral control				0.737	0.847	0.649
PBC1	0.825	3.727	0.873			
PBC2	0.812	3.407	1.103			
PBC3	0.779	3.407	1.217			
Resistance to use				0.834	0.900	0.750
RES1	0.886	2.381	0.963			
RES2	0.883	2.237	1.021			
RES3	0.827	2.392	1.006			

Note(s): Var. (Variance); Cronbach's alpha (CA); Composite reliability (CR); Average variance extracted (AVE)
Source(s): Author's own, 2023

Table 2. Measurement model's descriptive statistics and convergent validity assessment criteria

support discriminant validity (Panel A, Table 3). We also have support from the heterotrait–monotrait (HTMT) correlational approach (Henseler *et al.*, 2015), especially as none of the HTMT values exceeded 0.9 (see Panel B in Table 3) (see also Benitez *et al.*, 2020; Franke and Sarstedt, 2019). Moreover, based on HTMT inference, we find that none of the values included one (see also Benitez *et al.*, 2020; Osakwe, 2019); it can be concluded, therefore, that there is evidence for discriminant validity. Additionally, although unreported due to space constraints, visual inspection of the cross-loadings showed that all loadings were loaded primarily into their given constructs, as no significant cross-loadings were clear. Taken together, our measurement model meets all reasonable quality criteria, and thus, we can subsequently move to the assessment of the structural model.

4.2 Structural model assessment

Based on the recommendations of researchers such as Benitez *et al.* (2020), we examined the fit indices for both the estimated and saturated models. Results generally indicate adequate model fit (see Table 4), especially as the standardized root mean squared residual (SRMR), unweighted least squares (euclidean) distance (dULS) and the geodesic distance (dG) values were within reported acceptable limits in the literature (see Benitez *et al.*, 2020 for details). In other words, Table 4 implies that our model cannot be rejected and further indicates that the proposed theoretical model is potentially useful for accounting for the impact of the TPB and

Construct	1	2	3	4	5	6	7	8	9	10
Panel A: Fornell-Larcker criterion										
1. Perceived severity	0.727									
2. Perceived vulnerability	0.181	0.757								
3. Attitude	0.038	0.109	0.877							
4. Subjective norms	0.004	0.075	0.226	0.837						
5. Personal norms	0.034	0.125	0.515	0.166	0.840					
6. Resistance use	0.001	0.029	0.054	0.034	0.020	0.789				
7. Information Privacy	0.000	0.032	0.188	0.031	0.164	0.000	0.750			
8. Barriers to taking action	0.002	0.000	0.006	0.007	0.000	0.023	0.094	0.872		
9. Intention to use	0.041	0.091	0.635	0.133	0.330	0.017	0.181	0.000	0.921	
10. Perceived behavioral control	0.034	0.129	0.160	0.061	0.169	0.147	0.015	0.000	0.0730	0.649
Panel B: HTMT criterion										
1. Perceived severity										
2. Perceived vulnerability	0.529									
3. Attitude	0.242	0.384								
4. Subjective norms	0.058	0.303	0.537							
5. Personal norms	0.224	0.405	0.807	0.451						
6. Resistance use	0.032	0.165	0.248	0.176	0.131					
7. Information Privacy	0.005	0.205	0.507	0.204	0.460	0.003				
8. Barriers to taking action	0.058	0.020	0.093	0.103	0.018	0.153	0.349			
9. Intention to use	0.237	0.336	0.899	0.394	0.624	0.128	0.484	0.018		
10. Perceived behavioral control	0.237	0.436	0.493	0.272	0.498	0.456	0.145	0.037	0.317	

Note(s): The diagonal elements in Panel A indicates square roots of AVEs. CV stands for control variable
Source(s): Author's own, 2023

Table 3.
Discriminant validity results

HBM constructs and information privacy and personal norms on use intentions and resistance to using MCTA.

Next, we assessed the coefficient of determination (R^2) and significance of the path coefficients based on bootstrapping procedure of 4,999 resampled. The R^2 indicated that the model could explain 65.1% of use intentions. Further, the model explains 35.2% variation in resistance to using MCTA. According to Table 5, of the proposed predictors of use intentions of MCTA, only attitude toward MCTA emerged as the most positive and significant predictor of use intentions of MCTA and thus providing statistical support for H1a. Amongst the most important predictors of resistance to the use of MCTA were attitude, perceived barriers to taking action and personal

	Saturated model			Estimated model			Conclusion
Discrepancy	Value	HI_{95}	HI_{99}	Value	HI_{95}	HI_{99}	
SRMR	0.057	0.045	0.069	0.057	0.046	0.070	Supported
d_{ULS}	1.503	0.958	2.230	1.514	0.975	2.295	Supported
d_G	0.846	1.294	1.809	0.848	1.290	1.812	Supported

Note(s): Standardized root mean squared residual (SRMR); Euclidean distance (d_{ULS}) and the Geodesic distance (d_G)
Source(s): Author's own, 2023

Table 4.
Results of the overall model fit statistics

Relations	B	Std. Err	*T-value*	*p*-value	Supported	Cohen's f^2	R^2
ATT → USE	0.832	0.075	11.099	0.000	✓	0.815	USE = 65.06%
ATT → RES	−0.415	0.092	−4.523	0.000	✓	0.110	RES = 35.21%
PNM→ USE	−0.004	0.068	−0.063	0.475	x	0.000	
PNM→ RES	−0.178	0.095	−1.871	0.031	✓	0.021	
PBT→ USE	−0.046	0.048	−0.978	0.164	x	0.005	
PBT→ RES	0.334	0.067	4.998	0.000	✓	0.152	
PDS→ USE	0.052	0.048	1.081	0.126	x	0.006	
PDS → RES	0.098	0.085	1.147	0.140	x	0.011	
PDV → USE	0.031	0.055	0.563	0.287	x	0.002	
PDV → RES	−0.074	0.080	−0.925	0.177	x	0.005	
PBC → USE	−0.071	0.051	−1.403	0.080	x	0.009	
PBC → RES	0.112	0.0816	1.375	0.085	x	0.012	
SBN → USE	−0.005	0.043	−0.123	0.451	x	0.000	
SBN → RES	0.032	0.078	0.409	0.341	x	0.001	
IPC → USE	−0.045	0.054	−0.831	0.203	x	0.004	
IPC → RES	0.054	0.075	0.723	0.235	x	0.003	
Control variables							
Age→ USE	0.009	0.051	0.173	0.862	x	0.000	
Age → RES	0.028	0.076	0.366	0.714	x	0.001	
Edu → USE	0.039	0.039	0.054	0.475	x	0.003	
Edu → RES	−0.081	0.076	−1.074	0.283	x	0.006	
Gen → USE	0.055	0.032	1.740	0.082	x	0.008	
Gen → RES	−0.091	0.095	−0.960	0.337	x	0.012	

Note(s): ATT-Attitude; USE –Intention to use; PBT – Perceived barriers of taking action; PDS – Perceived disease severity; PDV – Perceived disease vulnerability; PBC –Perceived behavioral control; IPC – Information Privacy; SBN-Subjective norms; RES – Use resistance; Edu-Education; Gen – Gender. Control variables were based on a two-tailed *t*-test, while hypothesized relationships were derived using a one-tailed *t*-test. f^2 = effect size. Bootstrap analysis with 4,999 subsamples used to generate t-values. ✓ = Supported, x = not supported
Source(s): Author's own, 2023

Table 5.
Results of hypothesized paths

norms. Thus, our model also provides statistical support for H1b, H4b and H7b. Surprisingly, we find no statistical support for the influence of subjective norms, perceived behavioral control, perceived severity, perceived vulnerability and information privacy on either intention to use or resistance to MCTA within the study context. Significantly, attitude was the most influential predictor of intention to use and resistance to using MCTA (Table 5).

5. Discussion and conclusions

5.1 Discussion of findings

In this study, we analyzed individuals' acceptance of and resistance to MCTA. First, we analyzed the relationship between the three TPB constructs (attitude, subjective norm and perceived behavioral control) and intention to use MCTA. Second, we analyzed the relationship between the same TPB variables with our second-dependent variable resistance to using MCTA. Third, we analyzed the relationship between HBM constructs (perceived disease severity, perceived barriers to taking action and perceived disease vulnerability) to use. Fourth, we assessed the relationship of the HBM variables with resistance to the use of MCTA. Again, we examined the relationship between contextual variables (personal norms and information privacy) and intention to use. Finally, we evaluated the relationship between contextual variables (personal norms and information privacy) and resistance to using MCTA. Structural validation of these integrated models shows that the variance explained ($R^2 = 65.06\%$) for the acceptance of MCTA was superior to the variance explained ($R^2 = 35.21\%$) for the resistance of MCTA. This implies that the proposed integrated model could predict intention to use better than resistance to use MCTA.

Our results confirm that the relationship between attitude and intention to use MCTA was positive and significant. This finding lends credence to the results of previous studies (Abbas and Mohtar, 2016; Birkmeyer *et al.*, 2021; Yuen *et al.*, 2020). For instance, Yuen *et al.* (2020) found that attitude was the most important predictor of public acceptance of autonomous vehicles. In contrast, Abbas and Mohtar's (2016) results show that attitude strongly influences customers' resistance to innovation. As such, in the current study, our results have demonstrated that attitude does not only positively affect acceptance but also negatively influences resistance to use MCTA. Contrary to expectation, our results indicate that perceived behavioral control contributes to neither acceptance nor resistance to using MCTA. Thus, this result alienates previous research findings (AlBar and Hoque, 2019; Cobelli *et al.*, 2021). For instance, in AlBar and Hoque's study on E-health services in the Kingdom of Saudi Arabia, it was found that perceived behavioral control is not directly related to behavioral intent. Consequently, acceptance or resistance to the use of MCTA does not depend on perceived behavioral control, probably due to the nature of the COVID-19 pandemic. This means that given the pandemic context, the public was not concerned about whether they had control over the use of the MCTA. Again, surprisingly, our results also show that subjective norms do not influence acceptance or resistance to the use of MCTA. This result coincides with recent research findings on adopting innovation (Cobelli *et al.*, 2021; Ifinedo, 2018). For instance, the current research evidence bears some semblance to the study by Ifinedo (2018), which shows in the Canadian telehealth context that subjective norm is an insignificant predictor of behavioral intent. However, the result deviates from extant studies on the influence of subjective norms on acceptance and resistance of new technology (Fortes and Rita, 2016; Hsieh, 2015; Matsuo *et al.*, 2018; Van Offenbeek *et al.*, 2013; White Baker *et al.*, 2007; Zhao *et al.*, 2018).

The analysis of the HBM model indicates that perceived disease severity and perceived disease vulnerability have no influence on the intention to use or resistance to using MCTA. This finding, which deviates from previous studies (Carpenter, 2010; Lu *et al.*, 2019; Sulat *et al.*, 2018; Yu *et al.*, 2021) means that individuals are not moved by the severity and highly infectious nature of COVID-19 in their decision to accept or resist the use of MCTA. However,

in line with our expectation, the results demonstrated that the perceived barrier to taking influences individuals' resistance to using the MCTA. The result is consistent with findings from previous studies (Sulat *et al.*, 2018). Additionally, we found that the perceived barrier to taking action has no influence on behavioral intention to use MCTA. These results contradict findings from previous studies (Walrave *et al.*, 2020).

The results confirm our prediction that personal norms will negatively affect the intention to use MCTA, but surprisingly reject our hypothesis that personal norms will positively influence the intention to adopt MCTA. The negative influence of personal norms on resistance to using MCTA corroborates with previous studies (Kim, 2018; Maity *et al.*, 2019; Udo *et al.*, 2016), whereas the insignificant positive association between personal norms and intention to use MCTA contrast with previous research (Ateş, 2020; Juraskova *et al.*, 2012; Maity *et al.*, 2019; Roos and Hahn, 2017, 2019). Accordingly, our study implies that in deciding to use MCTA, particularly in a pandemic period, one's moral obligation does not matter. Still, the same moral obligation plays a seminal role in resistance to using MCTA.

Meanwhile, the negative influence of information privacy on the intention to use MCTA and the positive influence of information privacy on the resistance to use MCTA within the context under study were confirmed, although they were statistically insignificant. This research finding deviates from the previous research works on users' acceptance of health technologies literature (Dhagarra *et al.*, 2020; Fox and Connolly, 2018), including an additional study on MCTA showing the significant negative influence of information privacy on behavioral intent (Kaptchuk *et al.*, 2020). However, within the context of health technology, the current investigation is not alone in reporting the minimal influence of information privacy on attitudinal and behavioral responses (cf. Sergueeva *et al.*, 2020). Besides, a recent systematic review of the literature on health information technology acceptance reveals that the relationship between privacy and user acceptance is inconclusive (for details, see Kavandi and Jaana, 2020). Our findings lend to Fox *et al.* (2021) indicate information privacy as one of the precursors of MCTA acceptance or rejection; this study, domiciled in a less digitalized prone environment, does not automatically rule out the significance of information privacy as a forebear in the adoption/Rejection of MCTA. We argue that a clear invasion of individuals' privacy is of paramount concern to individuals devoid of geographical location. Consequently, this finding ignites the call by governments, specifically within the developing economy to address information privacy concerns by mapping a well-cut-out campaign with privacy concerns and protection for the citizenry whiles championing the significance of information disclosures, personal privacy rights, transparency and vivid explanations of the use of MCTA. Whiles we concur with previous research works on privacy concerns resulting in mixed findings towards the adoption of emerging digital technology (e.g. Conger *et al.*, 2013; Jamil and da Silva, 2021; Majumdar and Bose, 2015; Xu and Gupta, 2009). In the context of efficient implementation of MCTA, our research implies that given the minimal impact of information privacy on public attitudes and use intentions of MCTA, individuals, especially in Ghana, may be willing to share their personal information without considerable concerns about their information privacy.

5.2 Implications for research

Our study provides several implications and contributions for other researchers. A primary theoretical contribution is integrating TPB, HBM and contextual factors (personal norms and information privacy) to examine the individual determinants of acceptance and resistance to MCTAs in a pandemic situation. Reflecting on the works of Horvath (2019), as in the case of this study, obvious fusion assists researchers in creating an inferential connection between elements of a component of different theories, producing a new supposition synthesized from them, which this study has sought to achieve. Accordingly, we provide theoretical insights for future researchers that may assist in encouraging individuals' intention to use the MCTA.

Second, most studies on new technology explored adoption or acceptance at the expense of factors contributing to the resistance to innovation (Claudy *et al.*, 2015), thereby creating a vacuum in innovation resistance research. Hence, by incorporating or studying resistance in addition to the acceptance of MCTA, we have heeded various calls, which advise the research community to give some attention to the resistance component of new technology studies. By extension, we have reduced the research deficit in innovation resistance literature.

Third, our findings advance the body of knowledge because unlike extant research (e.g. Hsieh, 2015), this investigation shows that perceived behavioral control and subjective norm, while directly contributing to positive influence on attitudes towards MCTA, are not enough to lead to use or reject intentions of MCTA directly. Likewise, the influence of perceived severity and perceived vulnerability as a basic concept of the HBM model on gauging the use and rejection intent of MCTA was disputed. These findings, however, are divergent from the prior research findings (Birkmeyer *et al.*, 2021), which found that perceived disease threat positively affects attitude toward mobile health.

Further, it is worth noting that our study findings differ from previous research (Walrave *et al.*, 2020) in two ways: The first relates to the differences in the geographic scope. Second, our findings revealed that the most salient predictors of intention to resist MCTA were attitude, perceived barriers to taking action and personal norms, which were quite disparate with previous research findings in telehealth studies (Kim *et al.*, 2021; Williams *et al.*, 2021; Saqlain *et al.*, 2020). These findings open a debate to broaden the horizon of acceptance/rejection of MCTA in the study context, considering a myriad of factors. It is therefore not gainsaying that by including contextually relevant factors in the study, such as personal norms and information privacy, of which the latter factor seems to be more influential in the study, the current article advances existing research on the integrated theoretical model adopted to map out the intent to un(use) MCTA which could support the manual contact tracing efforts in the fight against the spread of SARS-CoV-2 and its associated COVID-19 pandemic.

Finally, this is the first work to gauge public attitudes and intentions to un(use) MCTA based on an integrated theoretical model. This study, therefore, contributes to the burgeoning literature on four different theoretical perspectives; thus TPB, HBM, (personal norm and information privacy-contextual relevant cases) by validating the theoretical model in the novel but the surreal context of COVID-19 pandemic of voluntary adoption/rejection of MCTA, which conforms to WHO's a provisional recommendation to nations.

5.3 Policy implications

Given that our research particularly shows that attitude is critically related to use intentions and resistance to the use of MCTA, health policymakers, along with other important stakeholders such as the media and other opinion-molders of the society, have an important role to play in this regard. Importantly, these stakeholders may need to redouble their efforts in ways that can motivate members of the public to have a strong and positive attitude toward the use of MCTA and complimentary COVID-19 mitigation measures. We should also note that attitudes can only be strongly influenced when the public is well aware of the potential benefits of using MCTA; thus, providing reasonable information using the media is imperative. In summary, our study implies that it is imperative for national governments across the world, especially those who will soon rollout MCTA, to design well-tailored messaging through the media that can resonate well with opinion-molders of the society who, in turn, can influence those who look up to them for advice and other forms of guidance.

5.4 Limitations and future research

The major limitation of this study is that, even though the proposed theoretical model can be applied in other contexts, the findings are impacted by the fact that the experimental dataset

used in testing the model was from a single country. As such, this calls for an additional examination of the proposed theoretical model in other national contexts, especially because this will help to enhance the understanding of this model. Moreover, it will also be good for future research to extend the proposed theoretical model to other areas, such as vaccine acceptance or hesitancy. There is also room for improvement of the current model by including relevant situational influences, such as institutional distrust and cultural factors that may serve as boundary conditions in several of the proposed relationships in the model. The above suggestions could assist in resolving the inconclusive findings in the study area.

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References

Abbas, M. and Mohtar, S.B. (2016), "Factors influencing consumer resistance to innovation: relationship between relative advantage, attitude towards existing product, social influence and self-efficacy", *Researchers World*, Vol. 7 No. 1, p. 70.

Ajzen, I. (2011), "The theory of planned behaviour: reactions and reflections", *Psychology and Health*, Vol. 26 No. 9, pp. 1113-1127.

AlBar, A.M. and Hoque, M.R. (2019), "Patient acceptance of e-health services in Saudi Arabia: an integrative perspective", *Telemedicine and e-Health*, Vol. 25 No. 9, pp. 847-852.

Al-Metwali, B.Z., Al-Jumaili, A.A., Al-Alag, Z.A. and Sorofman, B. (2021), "Exploring the acceptance of COVID-19 vaccine among healthcare workers and general population using health belief model", *Journal of Evaluation in Clinical Practice*, Vol. 27 No. 5, pp. 1112-1122, doi: 10.1111/jep.13581.

Alsaad, A. and Al-Okaily, M. (2021), "Acceptance of protection technology in a time of fear: the case of Covid-19 exposure detection apps", *Information Technology and People*, Vol. 35 No. 3, pp. 1116-1135, doi: 10.1108/ITP-10-2020-0719.

Armitage, C.J. and Conner, M. (2001), "Efficacy of the theory of planned behavior: a metaanalytic review", *British Journal of Social Psychology*, Vol. 40, pp. 471-499.

Ateş, H. (2020), "Merging theory of planned behavior and value identity personal norm model to explain pro-environmental behaviors", *Sustainable Production and Consumption*, Vol. 24, pp. 169-180.

Barattucci, M., Pagliaro, S., Ballone, C., Teresi, M., Consoli, C., Garofalo, A., Giorgio, A.D. and Ramaci, T. (2022), "Trust in science as a possible mediator between different antecedents and COVID-19 booster vaccination intention: an integration of health belief model (HBM) and theory of planned behavior (TPB)", *Vaccines*, Vol. 10 No. 7, p. 1099.

Bélanger, F. and Crossler, R.E. (2011), "Privacy in the digital age: a review of information privacy research in information systems", *MIS Quarterly*, Vol. 35 No. 4, pp. 1017-1041.

Benitez, J., Henseler, J., Castillo, A. and Schuberth, F. (2020), "How to perform and report an impactful analysis using partial least squares: guidelines for confirmatory and explanatory IS research", *Information and Management*, Vol. 57 No. 2, 103168.

Birkmeyer, S., Wirtz, B.W. and Langer, P.F. (2021), "Determinants of mHealth success: an empirical investigation of the user perspective", *International Journal of Information Management*, Vol. 59, 102351.

Bish, A., Sutton, S. and Golombok, S. (2000), "Predicting uptake of a routine cervical smear test: a comparison of the health belief model and the theory of planned behaviour", *Psychology and Health*, Vol. 15 No. 1, pp. 35-50.

Braithwaite, I., Callender, T., Bullock, M. and Aldridge, R.W. (2020), "Automated and partly automated contact tracing: a systematic review to inform the control of COVID-19", *The Lancet Digital Health*, Vol. 2 No. 11, pp. e607-e621.

Carpenter, C.J. (2010), "A meta-analysis of the effectiveness of health belief model variables in predicting behavior", *Health Communication*, Vol. 25 No. 8, pp. 661-669.

CGTN Africa (2020), "Ghana develops app to help track COVID-19 patients", available at: https://africa.cgtn.com/2020/04/24/ghana-develops-app-to-help-track-covid-19-patients/

Chan, E.Y. and Saqib, N.U. (2021), "Privacy concerns can explain unwillingness to download and use contact tracing apps when COVID-19 concerns are high", *Computers in Human Behavior*, Vol. 119, 106718.

Chatzidakis, A., Kastanakis, M. and Stathopoulou, A. (2016), "Socio-cognitive determinants of consumers' support for the fair trade movement", *Journal of Business Ethics*, Vol. 133 No. 1, pp. 95-109.

Claudy, M.C., Garcia, R. and O'Driscoll, A. (2015), "Consumer resistance to innovation—a behavioral reasoning perspective", *Journal of the Academy of Marketing Science*, Vol. 43 No. 4, pp. 528-544.

Cobelli, N., Cassia, F. and Burro, R. (2021), "Factors affecting the choices of adoption/non-adoption of future technologies during coronavirus pandemic", *Technological Forecasting and Social Change*, Vol. 169, 120814.

Conger, S., Pratt, J.H. and Loch, K.D. (2013), "Personal information privacy and emerging technologies", *Information Systems Journal*, Vol. 23 No. 5, pp. 401-417.

Cooper, S., van Rooyen, H. and Wiysonge, C.S. (2021), "COVID-19 vaccine hesitancy in South Africa: how can we maximize uptake of COVID-19 vaccines?", *Expert Review of Vaccines*, Vol. 20 No. 8, pp. 921-933, doi: 10.1080/14760584.2021.1949291.

Deng, Z. (2013), "Understanding public users' adoption of mobile health service", *International Journal of Mobile Communications*, Vol. 11 No. 4, pp. 351-373.

Dhagarra, D., Goswami, M. and Kumar, G. (2020), "Impact of trust and privacy concerns on technology acceptance in healthcare: an Indian perspective", *International Journal of Medical Informatics*, Vol. 141, 104164.

Duan, S.X. and Deng, H. (2021), "Hybrid analysis for understanding contact tracing apps adoption", *Industrial Management and Data Systems*, Vol. 121 No. 7, pp. 1599-1616.

Ellen, P.S., Bearden, W.O. and Sharma, S. (1991), "Resistance to technological innovations: examination of the role of self-efficacy and performance satisfaction", *Journal of the Academy of Marketing Science*, Vol. 19 No. 4, pp. 297-307.

Evans, R.I. and Getz, J.G. (2003), "Social inoculation", in *Encyclopedia of Primary Prevention and Health*.

Fan, C.W., Chen, I.H., Ko, N.Y., Yen, C.F., Lin, C.Y., Griffiths, M.D. and Pakpour, A.H. (2021), "Extended theory of planned behavior in explaining the intention to COVID-19 vaccination uptake among mainland Chinese university students: an online survey study", *Human Vaccines and Immunotherapeutics*, Vol. 17 No. 10, pp. 3413-3420, doi: 10.1080/21645515.2021.1933687.

Fornell, C.G. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Fortes, N. and Rita, P. (2016), "Privacy concerns and online purchasing behaviour: towards an integrated model", *European Research on Management and Business Economics*, Vol. 22 No. 3, pp. 167-176.

Fox, G. (2020), "'To protect my health or to protect my health privacy?' A mixed-methods investigation of the privacy paradox", *Journal of the Association for Information Science and Technology*, Vol. 71 No. 9, pp. 1015-1029, doi: 10.1002/asi.24369.

Fox, G., Clohessy, T., van der Werff, L., Rosati, P. and Lynn, T. (2021), "Exploring the competing influences of privacy concerns and positive beliefs on citizen acceptance of contact tracing mobile applications", *Computers in Human Behavior*, Vol. 121, 106806.

Fox, G. and Connolly, R. (2018), "Mobile health technology adoption across generations: narrowing the digital divide", *Information Systems Journal*, Vol. 28 No. 6, pp. 995-1019.

Franke, G. and Sarstedt, M. (2019), "Heuristics versus statistics in discriminant validity testing: a comparison of four procedures", *Internet Research*, Vol. 29 No. 3, pp. 430-447.

Garrett, P.M., White, J.P., Lewandowsky, S., Kashima, Y., Perfors, A., Little, D.R., Geard, N., Mitchell, L., Tomko, M. and Dennis, S. (2021), "The acceptability and uptake of smartphone tracking for COVID-19 in Australia", *Plos One*, Vol. 16, e0244827.

Gerend, M.A. and Shepherd, J.E. (2012), "Predicting human papillomavirus vaccine uptake in young adult women: comparing the health belief model and theory of planned behavior", *Annals of Behavioral Medicine*, Vol. 44 No. 2, pp. 171-180.

Guillon, M. and Kergall, P. (2020), "Attitudes and opinions on quarantine and support for a contact-tracing application in France during the COVID-19 outbreak", *Public Health*, Vol. 188, pp. 21-31.

Hair, J.F., Howard, M.C. and Nitzl, C. (2020), "Assessing measurement model quality in PLS-SEM using confirmatory composite analysis", *Journal of Business Research*, Vol. 109, pp. 101-110.

Hassandoust, F., Akhlaghpour, S. and Johnston, A.C. (2021), "Individuals' privacy concerns and adoption of contact tracing mobile applications in a pandemic: a situational privacy calculus perspective", *Journal of the American Medical Informatics Association*, Vol. 28 No. 3, pp. 463-471.

Henseler, J. (2017), *Adanco 2.0. 1-User Manual*, Composite Modeling GmbH & Company, Kleve.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modelling", *Journal of the Academy of Marketing Science*, Vol. 43 No. 1, pp. 115-135.

Horvath, I. (2019), July, "Combining unmergeables: a methodological framework for axiomatic fusion of qualitative design theories", *Proceedings of the Design Society: International Conference on Engineering Design*, Cambridge University Press, Vol. 1, No. 1, pp. 3591-3600.

Hsieh, P.J. (2015), "Physicians' acceptance of electronic medical records exchange: an extension of the decomposed TPB model with institutional trust and perceived risk", *International Journal of Medical Informatics*, Vol. 84 No. 1, pp. 1-14.

Huang, X., Dai, S. and Xu, H. (2020a), "Predicting tourists' health risk preventative behaviour and travelling satisfaction in Tibet: combining the theory of planned behaviour and health belief model", *Tourism Management Perspectives*, Vol. 33, 100589.

Huang, Y., Sun, M. and Sui, Y. (2020b), "How digital contact tracing slowed COVID-19 in East Asia", *Harvard Business Review*, Vol. 15 No. 04, available at: https://hbr.org/2020/04/how-digital-contact-tracing-slowed-covid-19-in-east-asia

Ifinedo, P. (2018), "Empirical study of Nova Scotia nurses' adoption of healthcare information systems: implications for management and policy-making", *International Journal of Health Policy and Management*, Vol. 7 No. 4, p. 317.

ITU News (2020), "Ghana launches COVID-19 tracker app", available at: https://news.itu.int/ghana-launches-covid-19-tracker-app/

Jamil, G.L. and da Silva, A.R. (2021), "Emerging technologies in a modern competitive scenario: understanding the panorama for security and privacy requirements", in *Handbook of Research on Digital Transformation and Challenges to Data Security and Privacy*, pp. 1-16.

Janz, N.K. and Becker, M.H. (1984), "The health belief model a decade later", *Health Education Quarterly*, Vol. illl, pp. 1-47.

Joo, J. and Shin, M.M. (2020), "Resolving the tension between full utilization of contact tracing app services and user stress as an effort to control the COVID-19 pandemic", *Service Business*, Vol. 14, pp. 461-478.

Jose, R., Narendran, M., Bindu, A., Beevi, N., Manju, L. and Benny, P.V. (2021), "Public perception and preparedness for the pandemic COVID 19: a health belief model approach", *Clinical Epidemiology and Global Health*, Vol. 9, pp. 41-46.

Juraskova, I., O'Brien, M., Mullan, B., Bari, R., Laidsaar-Powell, R. and McCaffery, K. (2012), "HPV vaccination and the effect of information framing on intentions and behaviour: an application of the theory of planned behaviour and moral norm", *International Journal of Behavioral Medicine*, Vol. 19, pp. 518-525, 2012.

Kaptchuk, G., Goldstein, D., Hargittai, E., Hofman, J. and Redmiles, E. (2020), "How good is good enough for COVID19 apps? The influence of benefits, accuracy, and privacy on willingness to adopt", available at: https://arxiv.org/pdf/2005.04343.pdf

Kavandi, H. and Jaana, M. (2020), "Factors that affect health information technology adoption by seniors: a systematic review", *Health and Social Care in the Community*, Vol. 28 No. 6, pp. 1827-1842.

Kim, H.S. (2018), "The role of legal and moral norms to regulate the behavior of texting while driving", *Transportation Research Part F, Traffic Psychology and Behaviour*, Vol. 52, pp. 21-31.

Kim, H. (2021), "COVID-19 apps as a digital intervention policy: a longitudinal panel data analysis in South Korea", *Health Policy*, Vol. 125 No. 11, pp. 1430-1440, doi: 10.1016/j.healthpol.2021.07.003.

Kim, J. and Park, E. (2020), "Understanding social resistance to determine the future of Internet of Things (IoT) services", *Behaviour and Information Technology*, Vol. 41 No. 3, pp. 547-557, doi: 10.1080/0144929X.2020.1827033.

Kim, M.J., Hall, C.M. and Bonn, M. (2021), "Does international travel frequency affect covid-19 biosecurity behavior in the United States?", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 8, p. 4111.

Kock, N. (2015), "Common method bias in PLS-SEM: a full collinearity assessment approach", *International Journal of E-Collaboration*, Vol. 11 No. 4, pp. 1-10.

Li, T., Cobb, C., Baviskar, S., Agarwal, Y., Li, B., Bauer, L. and Hong, J.I. (2021), "What makes people install a COVID-19 contact-tracing app? Understanding the influence of app design and individual difference on contact-tracing app adoption intention", *Pervasive and Mobile Computing*, Vol. 75, 101439.

Lin, J., Carter, L. and Liu, D.E. (2021), "Privacy concerns and digital government: exploring citizen willingness to adopt the COVIDSafe app", *European Journal of Information Systems*, Vol. 30 No. 40, pp. 389-402.

Litan, R.E. and Lowy, M. (2020), *Freedom and Privacy in the Time of Coronavirus*, The Brookings Institution, available at: https://www.brookings.edu/research/freedom-and-privacy-in-the-time-of-coronavirus/

Lu, J., Luo, M., Yee, A.Z.H., Sheldenkar, A., Lau, J. and Lwin, M.O. (2019), "Do superstitious beliefs affect influenza vaccine uptake through shaping health beliefs?", *Vaccine*, Vol. 37 No. 8, pp. 1046-1052.

Lu, X., L. Reynolds, T., Jo, E., Hong, H., Page, X., Chen, Y. and A. Epstein, D. (2021), May, "Comparing perspectives around human and technology support for contact tracing", *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, pp. 1-15.

Maity, M., Bagchi, K., Shah, A. and Misra, A. (2019), "Explaining normative behavior in information technology use", *Information Technology and People*, Vol. 32 No. 1, pp. 94-117.

Majumdar, A. and Bose, I. (2015), December, "Privacy calculus theory and its applicability for emerging technologies", in *Workshop on E-Business*, Springer, Cham, pp. 191-195.

Mani, Z. and Chouk, I. (2017), "Drivers of consumers' resistance to smart products", *Journal of Marketing Management*, Vol. 33 Nos 1-2, pp. 76-97.

Mani, Z. and Chouk, I. (2019), "Impact of privacy concerns on resistance to smart services: does the 'big brother effect' matter?", *Journal of Marketing Management*, Vol. 35 Nos 15-16, pp. 1460-1479.

Matsuo, M., Minami, C. and Matsuyama, T. (2018), "Social influence on innovation resistance in internet banking services", *Journal of Retailing and Consumer Services*, Vol. 45, pp. 42-51.

McClenahan, C., Shevlin, M., Adamson, G., Bennett, C. and O'Neill, B. (2007), "Testicular self-examination: a test of the health belief model and the theory of planned behaviour", *Health Education Research*, Vol. 22 No. 2, pp. 272-284.

McGuire, W.J. (1964), "Inducing resistance to persuasion: some contemporary approaches", *Advances in Experimental Social Psychology*, Vol. 1, pp. 191-229.

Mou, J., Shin, D.H. and Cohen, J. (2016), "Health beliefs and the valence framework in health information seeking behaviors", *Information Technology and People*, Vol. 29 No. 4, pp. 876-900.

Munzert, S., Selb, P., Gohdes, A., Stoetzer, L.K. and Lowe, L. (2021), "Tracking and promoting the usage of a COVID-19 contact tracing app", *Nature Human Behaviour*, Vol. 5, pp. 247-255.

Mutimukwe, C., Kolkowska, E. and Grönlund, Å. (2020), "Information privacy in e-service: effect of organizational privacy assurances on individual privacy concerns, perceptions, trust and self-disclosure behavior", *Government Information Quarterly*, Vol. 37 No. 1, 101413.

Ntsiful, A., Kwarteng, M.A. and Inegbedion, H.E. (2022), "How health-related messaging increase intentions to download and use mobile contact (COVID-19) tracing apps: preliminary findings", *Cogent Social Sciences*, Vol. 8 No. 1, 2035912.

Oldeweme, A., Märtins, J., Westmattelmann, D. and Schewe, G. (2021), "The role of transparency, trust, and social influence on uncertainty reduction in times of pandemics: empirical study on the adoption of COVID-19 tracing apps", *Journal of Medical Internet Research*, Vol. 23 No. 2, e25893.

Osakwe, C.N. (2019), "Understanding customer-perceived quality in informal stores", *Journal of Services Marketing*, Vol. 33 No. 2, pp. 133-147.

Otu, A., Osifo-Dawodu, E., Atuhebwe, P., Agogo, E. and Ebenso, B. (2021), "Beyond vaccine hesitancy: time for Africa to expand vaccine manufacturing capacity amidst growing COVID-19 vaccine nationalism", *The Lancet Microbe*, Vol. 2 No. 8, pp. e347-e348, doi: 10.1016/S2666-5247(21)00126-9.

Reuters (2021), "Vaccine hesitancy slows Africa's COVID-19 inoculation drive", available at: https://www.reuters.com/world/africa/vaccine-hesitancy-slows-africas-covid-19-inoculation-drive-2021-05-04/(accessed 01 August 2021).

Roos, D. and Hahn, R. (2017), "Does shared consumption affect consumers' values, attitudes, and norms? A panel study", *Journal of Business Research*, Vol. 77, pp. 113-123.

Roos, D. and Hahn, R. (2019), "Understanding collaborative consumption: an extension of the theory of planned behavior with value-based personal norms", *Journal of Business Ethics*, Vol. 158, pp. 679-697.

Rosenstock, I.M. (1974), "Historical origins of the health belief model", *Health Education Monographs*, Vol. 2 No. 4, pp. 328-335.

Rosenstock, I.M., Strecher, V.J. and Becker, M.H. (1988), "Social learning theory and the health belief model", *Health Education Quarterly*, Vol. 15 No. 2, pp. 175-183.

Rowe, F. (2020), "Contact tracing apps and values dilemmas: a privacy paradox in a neo-liberal world", *International Journal of Information Management*, Vol. 55, 102178, doi: 10.1016/j.ijinfomgt.2020.102178.

Saqlain, M., Munir, M.M., Rehman, S.U., Gulzar, A., Naz, S., Ahmed, Z., Tahir, A.H. and Mashhood, M. (2020), "Knowledge, attitude, practice and perceived barriers among healthcare workers regarding COVID-19: a cross-sectional survey from Pakistan", *Journal of Hospital Infection*, Vol. 105 No. 3, pp. 419-423.

Saw, Y.E., Tan, E.Y., Liu, J.S. and Liu, J.C. (2021), "Predicting public uptake of digital contact tracing during the COVID-19 pandemic: results from a nationwide survey in Singapore", *Journal of Medical Internet Research*, Vol. 23 No. 2, e24730.

Schwartz, S.H. and Howard, J.A. (1981), "A normative decision-making model of altruism", in *Altruism and Helping Behavior*, pp. 189-211.

Sergueeva, K., Shaw, N. and Lee, S.H.M. (2020), "Understanding the barriers and factors associated with consumer adoption of wearable technology devices in managing personal health", *Canadian Journal of Administrative Sciences*, Vol. 37, pp. 45-60.

Shmueli, L. (2021), "Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model", *BMC Public Health*, Vol. 21, p. 804, doi: 10.1186/s12889-021-10816-7.

Sisay, O.B. (2021), *The Challenge of Covid-19 Vaccine Hesitancy in Africa*, Tony Blair Institute for Global Change, available at: https://institute.global/advisory/challenge-covid-19-vaccine-hesitancy-africa

Sulat, J.S., Prabandari, Y.S., Sanusi, R., Hapsari, E.D. and Santoso, B. (2018), "The validity of health belief model variables in predicting behavioral change: a scoping review", *Health Education*, Vol. 118 No. 6, pp. 499-512.

Sun, Y., Wang, N., Guo, X. and Peng, Z. (2013), "Understanding the acceptance of mobile health services: a comparison and integration of alternative models", *Journal of Electronic Commerce Research*, Vol. 14 No. 2, pp. 183-200.

Taylor, D., Bury, M., Campling, N., Carter, S., Garfied, S., Newbould, J. and Rennie, T. (2006), *A Review of the Use of the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Trans-theoretical Model (TTM) to Study and Predict Health Related Behaviour Change*, National Institute for Health and Clinical Excellence, London, pp. 1-215.

The Economist Intelligence Unit [EIU] (2021), "Africa faces major obstacles to accessing Covid vaccines", available at: https://www.eiu.com/n/africa-faces-major-obstacles-to-accessing-covid-vaccines/

The New York Times (2021), "Africa's Covid crisis deepens, but vaccines are still far off", available at: https://www.nytimes.com/interactive/2021/07/16/world/africa/africa-vaccination-rollout.html (accessed 01 August 2021).

Tomczyk, S., Barth, S., Schmidt, S. and Muehlan, H. (2021), "Utilizing health behavior change and technology acceptance models to predict the adoption of COVID-19 contact tracing apps: cross-sectional survey study", *Journal of Medical Internet Research*, Vol. 23 No. 5, e25447.

Traberg, C.S., Roozenbeek, J. and van der Linden, S. (2022), "Psychological inoculation against misinformation: current evidence and future directions", *The ANNALS of the American Academy of Political and Social Science*, Vol. 700 No. 1, pp. 136-151.

Trang, S., Trenz, M., Weiger, W.H., Tarafdar, M. and Cheung, C.M.K. (2020), "One app to trace them all? Examining app specifications for mass acceptance of contact-tracing apps", *European Journal of Information Systems*, Vol. 29 No. 4, pp. 415-428, doi: 10.1080/0960085X.2020.1784046.

Udo, G., Bagchi, K. and Maity, M. (2016), "Exploring factors affecting digital piracy using the norm activation and UTAUT models: the role of national culture", *Journal of Business Ethics*, Vol. 135, pp. 517-541.

van Offenbeek, M., Boonstra, A. and Seo, D. (2013), "Towards integrating acceptance and resistance research: evidence from a telecare case study", *European Journal of Information Systems*, Vol. 22 No. 4, pp. 434-454.

Venkatesh, V. and Bala, H. (2008), "Technology acceptance model 3 and a research agenda on interventions", *Decision Sciences*, Vol. 39 No. 2, pp. 273-315.

Viktor, V.W., Sebastian, B., Edouard, B., Alan, P.M., Marcel, S., Theresa, S., Carmela, T., Effy, V. and Nicola, L. (2020), "A research agenda for digital proximity tracing apps", *Swiss Medical Weekly*, Vol. 150, w20324, doi: 10.4414/smw.2020.20324.

Villius Zetterholm, M., Lin, Y. and Jokela, P. (2021), July, "Digital contact tracing applications during COVID-19: a scoping review about public acceptance", *Informatics*, Vol. 8 No. 3, p. 48, MDPI.

Walrave, M., Waeterloos, C. and Ponnet, K. (2020), "Adoption of a contact tracing app for containing COVID-19: a health belief model approach", *JMIR Public Health and Surveillance*, Vol. 6 No. 3, e20572.

White Baker, E., Al-Gahtani, S.S. and Hubona, G.S. (2007), "The effects of gender and age on new technology implementation in a developing country: testing the theory of planned behavior (TPB)", *Information Technology and People*, Vol. 20 No. 4, pp. 352-375.

Williams, S.N., Armitage, C.J., Tampe, T. and Dienes, K. (2021), "Public attitudes towards COVID-19 contact tracing apps: a UK-based focus group study", *Health Expectations*, Vol. 24 No. 2, pp. 377-385.

World Health Organization [WHO] (2020), "Ethical considerations to guide the use of digital proximity tracking technologies for COVID-19 contact tracing: interim guidance", available at: https://apps.who.int/iris/handle/10665/332200

Xu, H. and Gupta, S. (2009), "The effects of privacy concerns and personal innovativeness on potential and experienced customers' adoption of location-based services", *Electronic Markets*, Vol. 19 No. 2, pp. 137-149.

Yu, Y., Lau, J.T., She, R., Chen, X.i., Li, L. and Chen, X. (2021), "Prevalence and associated factors of intention of COVID-19 vaccination among healthcare workers in China: application of the Health Belief Model", *Human Vaccines and Immunotherapeutics*, Vol. 19, pp. 1-9.

Yuen, K.F., Chua, G., Wang, X., Ma, F. and Li, K.X. (2020), "Understanding public acceptance of autonomous vehicles using the theory of planned behaviour", *International Journal of Environmental Research and Public Health*, Vol. 17 No. 12, p. 4419.

Zhao, Y., Ni, Q. and Zhou, R. (2018), "What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age", *International Journal of Information Management*, Vol. 43, pp. 342-350.

Further reading

Amnesty International (2020), "Bahrain, Kuwait and Norway contact tracing apps among most dangerous for privacy", available at: https://www.amnesty.org/en/latest/news/2020/06/bahrain-kuwait-norway-contact-tracing-apps-danger-for-privacy/

Henseler, J. and Dijkstra, T.K. (2020), "ADANCO 2.2. Kleve: composite modeling", available at: http://www.compositemodeling.com

Appendix

Construct	Indicator	Description	Adapted from
Attitude towards MCTA	ATT1	I am happy to download and use COVID-19 contact tracing apps	Sun *et al.* (2013)
	ATT2	I believe using COVID-19 contact tracing apps is a good idea	
Intention to use	USE1	It is very likely that I would use COVID-19 contact tracing apps	Same as above
	USE2	Using COVID-19 contact tracing apps on my mobile phone is something I would do	
Perceived behavioral control	PBC 1	I should have control over using the COVID-19 contact tracing apps	Same as above
	PBC 2	I have the resources necessary to use the COVID-19 contact tracing apps	
	PBC 3	I have the knowledge necessary to use the COVID-19 contact tracing app	
Subjective norms	SBN1	I will be happy to use COVID-19 contact tracing apps if people who influence my behaviour think that I should use it	Venkatesh and Bala (2008)
	SBN2	If people who are important to me think that the contact tracing apps is good then I will consider using it	
	SBN3	Overall, using contact tracing apps will depend heavily on peers' and family members' influence	
Personal norms	PNM1	I feel that I have an ethical/moral obligation to support the use of COVID-19 contact tracing apps	Chatzidakis *et al.* (2016)
	PNM2	I personally feel I should support the use of the COVID-19 contact tracing apps	
	PNM3	Supporting the COVID-19 contact tracing app would be the right thing for me to do	
Information privacy	IPC 1	I'm concerned about data collected by the COVID-19 contact tracing apps without my permission	Mani and Chouk (2019)
	IPC 2	I'm concerned about the use of my personal data without my consent	
	IPC 3	In general, I'm concerned about threats to my personal privacy	
Perceived barriers of taking action	PBT1	I am concerned that I might forget to use the COVID-19 contact tracing app whenever I go outside of my house/ compound	
	PBT2	I am concerned that I might be too busy to use the contact tracing app	Deng (2013)
Perceived disease severity	PDS1	If I suffer from COVID-19 disease, it would be severe	
	PDS2	If I suffer from the COVID-19 disease, it would be serious	Sun *et al.* (2013)
	PDS3	It will be devastating to be diagnosed with coronavirus	
Perceived disease vulnerability	PDV1	I am at risk of been exposed to the COVID-19 disease pandemic	
	PDV2	It is likely that I will suffer the stated disease if I am not careful	Same as above
	PDV3	It is possible for me to suffer the stated disease (COVID-19)	
Resistance to use	RES1	I have a negative opinion about the use of COVID-19 contract tracing apps	
	RES2	I'm not in favor of using the COVID-19 contact tracing apps	Mani and Chouk (2019)
	RES3	I have a bad judgement on the use of the contact tracing apps	

Source(s): Author's own, 2023

Table A1. Constructs and underlying items with literature sources

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