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Consumer reporting of suspected adverse drug reactions: modelling the acceptance of mobile phone caller tunes to raise awareness

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Abstract

Objectives Our main aim was to identify the factors that may influence consumers' acceptance of mobile phone caller tunes to increase awareness of consumer reporting of suspected adverse drug reactions (ADRs). Mobile phone caller tunes — the songs or messages callers hear — are popular in Africa and Asia but have not been used to aid reporting of adverse drug reactions (ADRs). We also aimed to evaluate the psychometric properties of a survey instrument adapted for caller tunes and ADRs.

Methods A cross-sectional survey based on the technology acceptance model (TAM) was conducted among 486 non-ADR-themed caller tune users and 470 mobile phone users with no caller tunes in Accra, Ghana. Participants were purposively recruited from voluntary blood donation sites. After testing the validity and reliability of TAM constructs, a structural equation modelling approach was used to evaluate the factors that could influence the acceptance of caller tunes for increasing awareness of consumer reporting of ADRs.

Key findings Perceived usefulness and perceived ease of use had significant positive effects on consumers' acceptance of caller tunes for increasing awareness of consumer reporting of ADRs. However, whereas free of cost had significant positive effects on the acceptance of caller tunes among those with non-ADR-themed caller tunes ($\beta = 0.15$, $P = 0.006$), it was not so for those lacking caller tunes ($\beta = 0.05$, $P = 0.229$). The survey instrument met acceptable validity and reliability criteria.

Conclusions Our findings show that consumers would generally accept caller tunes on ADRs — if created — to aid consumer reporting of suspected ADRs, but there are research and practice considerations.

Keywords mobile phone caller tunes; adverse drug reactions reporting; technology acceptance model

Introduction

Spontaneous reporting of adverse drug reactions (ADRs) is a statutory requirement in most countries in the world and critical for monitoring drug and vaccine safety. Spontaneous ADR reporting requires strong pharmacovigilance systems as a core function of the national drug regulatory authority. Unfortunately, in many low- and middle-income

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countries (LMICs), particularly those in Africa, pharmacovigilance systems are weak or non-existent.^[1,2] The result is that ADR reporting rates in LMICs are very low.^[3]

Because of under-reporting of ADRs by healthcare professionals, there have been increasing calls for patient or consumer reporting of ADRs.^[4–10] Increased consumer reporting of ADRs also ensures that the perspectives and rights of patients in health care are valued.^[11,12]

While many high-income countries such as the United States, Canada, Netherlands, Denmark and the United Kingdom have strong programmes for consumer reporting of ADRs, consumers in LMICs contribute little to ADR reporting. For example, in Ghana, patient reporting of ADRs from 2001 to 2014 contributed just 0.3% of more than 3000 spontaneous reports^[13] compared to about half of the reports in the US FDA Adverse Events Reporting System (FAERS) public dashboard.^[14] Ghana's Food and Drugs Authority (FDA) officially launched patient reporting of ADRs initiative in June 2016.^[13] However, a cross-sectional survey a few months after the launch showed that only 1.6% of patients were willing to report ADRs directly to the FDA's National Pharmacovigilance Centre because of lack of sustained awareness.^[15]

Barriers to patient reporting of ADRs include poor awareness^[16–22] and confusion as to who reports ADRs, and to whom.^[17,23,24] These barriers could be addressed through the use of mobile phone-based technologies including apps.^[25,26] Recent developments in mobile penetration worldwide have led to increased number of mobile health (mHealth) interventions. For example, a review of mobile health (mHealth) interventions in Africa identified several projects, including one that focused on reporting of drugs' secondary effects.^[27] Some studies have also explored the use of mobile phones to aid consumer reporting of ADRs. A study assessed the impact of a system named Pharmacovigilance Raid Alert System for Consumer Reporting (PRASCOR) and implemented in Nigeria to improve ADR reporting by consumers using mobile phones, and found the system as having the potential to contribute to ADR reporting.^[28] In 2017, mobile apps were launched in Burkina Faso and Zambia to aid consumer reporting of suspected ADRs.^[29]

Studies are needed to explore the design of mobile phone-based interventions to encourage consumer reporting of ADRs in LMICs.

Appeal of mobile phone caller tunes

Mobile phone caller tunes give subscribers a more personalised mobile phone service by allowing their callers to hear a chosen song or message whenever they call instead of just hearing the standard ringing tone.^[30] This service has grown in popularity in emerging markets such as Africa and Asia for promoting religious messages and popular songs.^[31] However, in high-income countries, caller tunes are less popular. There is a major difference between caller tunes, also called ringback tones, and ringtones. Whereas mobile phone callers hear caller tunes, called parties hear ringtones^[30] assuming the called parties' phones are not in silent mode.

The World Health Organization (WHO) Patient Safety Programme calls for use of culturally appropriate information technology to promote patient safety in developing countries^[32] because technologies that work in the developed world may not necessarily work in developing countries. Sub-Saharan Africa is the region that continues to rise faster than any other region in terms of mobile phone penetration.^[33] In 2017, mobile phone penetration rate for countries in Sub-Saharan Africa ranged from 9% in Eritrea to 69% in Botswana, Gabon, Mauritius and Seychelles, with Ghana having mobile phone penetration rate of 67%.^[33]

Mobile phone caller tunes and ADRs: demonstration and theoretical foundation

Currently, existing caller tunes in Ghana do not have ADR themes. Should ADR-themed caller tunes be created, this is how they could help increase awareness of ADRs: Let us assume that two consumers — John and Mary — have caller tunes on ADRs. John's caller tune is a song and Mary's caller tune is a message. Both caller tunes have the information 'If you are taking a medicine and you develop side effects, dial 011 to help us promote drug safety'.

Thus, all callers — including patients on medications — to mobile phone numbers of John and Mary will get the ADR message or song instead of the typical ringing sound with no message or song on ADR. As shown by this demonstration, mobile phone caller tunes present an opportunity for consumers such as John and Mary to increase the awareness of consumer reporting of ADRs in developing countries.

But for consumers such as Mary and John to accept mobile phone caller tunes to increase the awareness of consumer reporting of ADRs, they may need to perceive that it is easy to have the caller tunes. They should also perceive caller tunes to be a useful technology. The technology acceptance model (TAM) is among some theories that can help explain these two critical factors. According to TAM, intention to use a technology is influenced by perceived ease of use and perceived usefulness.^[34] Although a person's attitude to technology could serve as a mediator between beliefs and intention, attitude as a construct was dropped to form the original TAM because it was found to be a weak construct.^[35,36] TAM has widely been applied in healthcare settings.^[37] Some scholars have called for the extension of TAM to include other variables to enrich its explanation and predictive ability.^[37,38]

Current knowledge on mobile phone caller tunes acceptance for increasing ADR awareness

The acceptance of mobile phone caller tunes for increasing awareness of consumer reporting of ADRs is a relatively new concept. In a qualitative study among Ghanaian consumers, respondents were generally positive in having mobile phone caller tunes to increase consumer reporting of ADRs.^[38] However, they suggested the need for having the caller tunes in both local languages and English, and for making them available for free. Currently, those who use caller tunes pay the equivalent of about 15 US cents a month.

To the best of our knowledge, no study has quantitatively explored the factors that could influence consumers' acceptance of mobile phone caller tunes for increasing consumer awareness of suspected ADRs.

Goals and objectives

The aim of this study was to quantitatively explore the determinants of consumers' intention to use mobile phone caller tunes on ADRs to increase awareness of consumer reporting of ADRs in Accra, Ghana, using the original and a modified TAM.

Specifically, this study assessed and compared the original TAM and a modified TAM. In this study, we operationalised consumers' acceptance of ADR-themed caller tunes to replace their behavioural intention to use the caller tunes on ADRs when they eventually become available, as indicated in a previous TAM study on electronic health records when the technology was already not in use.^[39]

Because caller tunes on consumer reporting of ADRs do not exist in Ghana, we did not assess effective use of ADR-themed caller use to increase awareness of consumer reporting of ADRs in this study. We also aimed to assess the psychometric properties of a survey instrument adapted for studying caller tunes and ADRs.

Methods

Conceptual model and research hypotheses

We adopted original TAM for this study with a focus on three constructs: perceived ease of use, perceived usefulness of caller tunes and behavioural intention to use mobile phone caller tunes on ADRs, if they become available. We included 'free of cost' as an additional construct to extend the original TAM (see Table 1 for definitions of these constructs and Figure 1 for the model).

We tested the following hypotheses:

Hypothesis 1: Perceived ease of use will have a positive effect on perceived usefulness of ADR-themed caller tunes among consumers already using or not using other caller tunes

Hypothesis 2: Perceived ease of use will have a positive effect on behavioural intention to use ADR-themed caller tunes among consumers already using or not using other caller tunes

Hypothesis 3: Perceived usefulness will have a positive effect on behavioural intention to use ADR-themed caller tunes among consumers either using or not using other caller tunes

Hypothesis 4: Making ADR-themed caller tunes free to use will have positive effect on intention to use among consumers already using or not using other caller tunes

Study design and population

A cross-sectional study design with the aid of interviewer-administered, locally piloted questionnaires was used to collect data from respondents who were present at voluntary blood donation sites such as higher educational institutions and workplaces in Accra, Ghana. Blood donors at such sites do not get paid for donating blood. Ghana's National Blood Service organised mobile blood donation drives at the sites.

Consumers represented by blood donors and nonblood donors were the targets of this study because our goal was to assess whether members of the public (as illustrated by John and Mary in the hypothetical example) will be interested in having ADR-themed caller tunes to increase awareness of consumer reporting of ADRs, if made available.

The interviewers were trained to limit the potential of influencing respondents' answers to help avoid bias. This study formed part of a larger project that explored the determinants of intention among blood donors and nonblood donors to use caller tunes for increasing awareness of blood donation and other behaviours. The respondents had to be at least 18 years, understand English and be present at a blood donation site (e.g. higher educational institutions and workplaces) on the day of the interview. Respondents answered TAM-related questions on blood donation, adverse drug reactions, and medication adherence. Thus, those who responded to the blood donation questionnaires were the very same people who answered the questionnaire items on adverse drug reactions and medication adherence.

Because it was practically impossible to have a list of respondents at these sites, purposive sampling was used rather than random sampling. The detailed method has been published elsewhere with a focus on blood donation.^[40]

A total of 956 respondents (99.1%) took part in the ADR study from October 2016 to December 2016, out of the 965 eligible respondents who were approached to be interviewed. The nine did not complete the questionnaires because they had to leave the blood donation sites. Participation in the study was voluntary and written informed consent was obtained. Respondents received 5 Ghana cedis (about 1US\$) each to compensate them for their time for participating in the survey.

Measures

In addition to characteristics such as age, gender and self-reported health status, the survey questionnaire included TAM constructs items adapted from previous studies (see online

Table 1 Constructs tested for assessing the acceptance of mobile phone caller tunes for increasing awareness of consumer reporting of ADRs

Construct	Definition
Perceived Ease of Use	The extent to which respondents feel it is easy to download caller tunes onto a mobile phone to increase awareness of consumer reporting of ADRs
Perceived Usefulness	The perception by respondents that caller tunes could be useful for increasing awareness of consumer reporting of ADRs
Intention to use	Should caller tunes on ADRs be created, respondents will accept them to increase awareness of consumer reporting of ADRs
Free of cost	Making caller tunes free of cost to those who intend to download them for increasing awareness of consumer reporting of ADRs

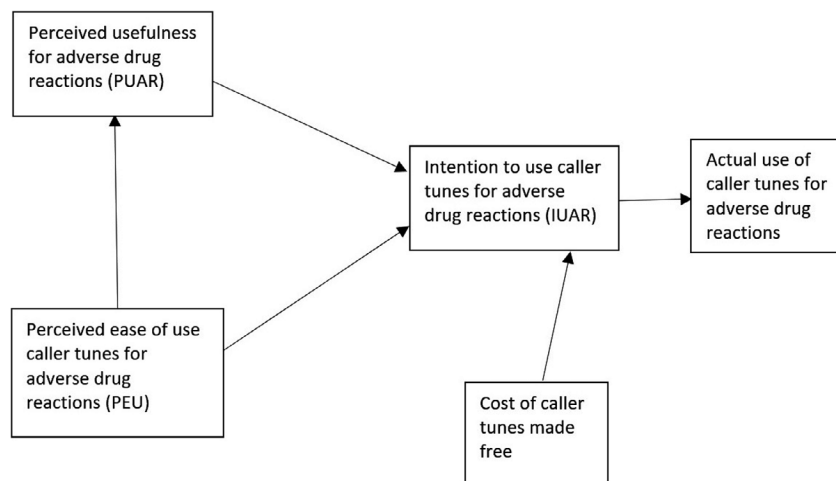


Figure 1 Technology acceptance model for caller tunes and ADRs.

Table S1): perceived ease of use^[36,41–46] perceived usefulness^[41,43] and intention to use.^[44,45] We included ‘free of cost’ as one-item additional construct.^[47] See online Supporting information for items that make up the constructs (Table S1). We did not assess actual use of caller tunes for increasing awareness of consumer reporting of suspected ADRs because such caller tunes do not exist.

The proposed model for those already using other caller tunes and the proposed model for others not using caller tunes contained items describing four latent constructs: perceived usefulness (seven items), perceived ease of use (seven items for those with caller tunes and three items for those without caller tunes), intention to use caller tunes (one item) and free of cost (one item).

Seven-point Likert scales were used to test the items (1 = Strongly Agree and 7 = Strongly disagree). See online Supporting information for questionnaire.

Data analysis

Data from the survey were divided into two groups: consumers already using other caller tunes ($n = 486$) and participants who do not use caller tunes ($n = 470$). The data were then analysed using descriptive statistics, exploratory factor analysis and structural equation modelling. The associations between the selected sociodemographic characteristics and the current status of use of caller tunes were examined using a chi-square test. We computed the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity to examine the appropriateness of conducting factor analysis. The criteria for the KMO measure and Bartlett’s test of sphericity were set to ≥ 0.5 (~ 0.6 as mediocre, > 0.9 as exceptional) and significance ($P < 0.001$) respectively.^[48] Factor analysis was appropriate for the data with acceptable to exceptional sampling adequacy (range: 0.69–0.90) and Bartlett’s test ($P < 0.001$).

Scales consisting of multiple items were evaluated for internal consistency (Cronbach’s alpha), composite reliability, and average variance explained. The acceptable criteria for reliability and validity were set: Cronbach’s alpha > 0.7 ,

the composite reliability score > 0.7 and the average variance extracted > 0.5 .^[49]

For hypothesis testing, we constructed two models: the current users of caller tunes and the nonusers of caller tunes. The ratio of chi-square to its degrees of freedom (χ^2/df), Tucker–Lewis index (TLI), comparative fit index (CFI) and root mean square error of approximation (RMSEA) were used for goodness-of-fit indices. The criteria used were $\chi^2/df < 5$, TLI ≥ 0.95 , CFI ≥ 0.95 , and RMSEA < 0.08 .^[50] The robust maximum likelihood (RML) estimation was employed in structural equation modelling due to non-normal distribution and high values of kurtosis.^[51] The RML is a robust method against violations of assumptions of maximum likelihood (ML) estimation, which is suitable for large samples (> 400).^[52] The endogenous variables in this study were treated as continuous data because the ordinal variables have five or more categories.^[53] We performed descriptive statistics and exploratory factor analysis using SPSS Version 24 (IBM SPSS Statistics) and structural equation modelling using Mplus 8.^[54]

Results

Table 2 shows the characteristics of participants who completed the study questionnaires. Most of the respondents were male (66.6%), of age 18 to 30 years (88.5%) and rated their health status as either very good or excellent (78.7%). Moreover, 50.8% of respondents already had caller tunes and most had received at least senior high school education. However, those with caller tunes were statistically different from those without caller tunes in terms of age ($P < 0.001$) and education ($P < 0.001$), but not gender and self-rated health status.

In general, most respondents agreed to the items as shown by the low mean values (Table 3).

Reliability and validity

Results of factor analysis of the constructs showed that composite reliability scores were all well above the 0.7 level threshold (range: 0.89–0.93), and Cronbach alpha scores were also well above 0.7 (range: 0.81–0.90) for those with caller tunes

Table 2 Demographic characteristics of participants with or without caller tunes

Characteristic	Caller tunes (<i>n</i> = 486)		No caller tunes (<i>n</i> = 470)		χ^2 (<i>P</i> value)
	Frequency	Percentage	Frequency	Percentage	
Gender					
Male	318	66.1	315	67.2	0.08 (.783)
Female	163	33.9	154	32.8	
Age in years					
18–20	222	45.9	143	30.5	30.06 (<.001)*
21–30	197	40.7	272	58.0	
31–40	46	9.5	39	8.3	
41–50	15	3.1	11	2.3	
>51	4	0.8	4	0.8	
Self-rated health					
Excellent	194	40.1	192	40.9	0.91 (.823)
Very good	191	39.5	173	36.9	
Good	88	18.2	94	20.0	
Fair or poor	11	2.2	10	2.1	
Education					
Primary	12	2.5	7	1.5	35.53 (<.001)
Middle school	3	0.6	8	1.7	
Junior high school	39	8.1	29	6.2	
Senior high school	213	44.1	132	28.1	
Above senior high school	216	44.7	293	62.5	

*Age groups were recategorised (<20, 21–30, 31–40, >40) to meet the assumption of Chi-square test, at least 5 observations for each category.

Table 3 Means and standard deviations of the constructs for participants with or without caller tunes

Construct	Participants with caller tunes (<i>N</i> = 486) mean (SD)	Participants with no caller tunes (<i>N</i> = 470) mean (SD)
Intention to use caller tunes for promoting for adverse drug reactions	1.82 (0.90)	1.96 (1.06)
Perceived ease of use caller tunes for adverse drug reactions	1.94 (1.23)	2.11 (1.34)
Perceived usefulness for adverse drug reactions	2.00 (1.10)	1.98 (1.00)
Free of cost	2.35 (1.54)	2.83 (1.71)

Seven-point Likert scales were used to test the items (1 = Strongly Agree and 7 = Strongly disagree).

and those without caller tunes (see online Supporting information Tables S2 and S3). Discriminant variability, which is assessed by the average variance extracted (AVE) that indicates the mean variance shared between a given construct, was established with the AVE values larger than 0.50 for both models (range: 0.58–0.80; see online Tables S2 and S3).

Model fit

The research models of those with caller tunes and those with no caller tunes both had good fit to the data by meeting the criteria of recommended values (Table 4).

Hypothesis testing

The results of structural equation modelling mostly support the proposed hypotheses (Figures 2 and 3).

As shown in Figure 2, for the model involving those with caller tunes, perceived ease of use had a positive effect on perceived usefulness of caller tunes (Hypothesis 1) and intention to use caller tunes (Hypothesis 2).

This was also true for those not already using caller tunes (Figure 3).

Also, perceived usefulness had a positive effect on intention to use caller tunes to increase awareness of consumer reporting of suspected ADRs (Hypothesis 3) among those with caller tunes (Figure 2) and those without caller tunes (Figure 3).

However, whereas free of cost had significant positive effects on intention to use caller tunes among those with caller tunes ($\beta = 0.15$, $P = 0.006$; Figure 4), it was not so for those without caller tunes ($\beta = 0.05$, $P = 0.229$; Figure 5) (Hypothesis 4).

Intention to use caller tunes

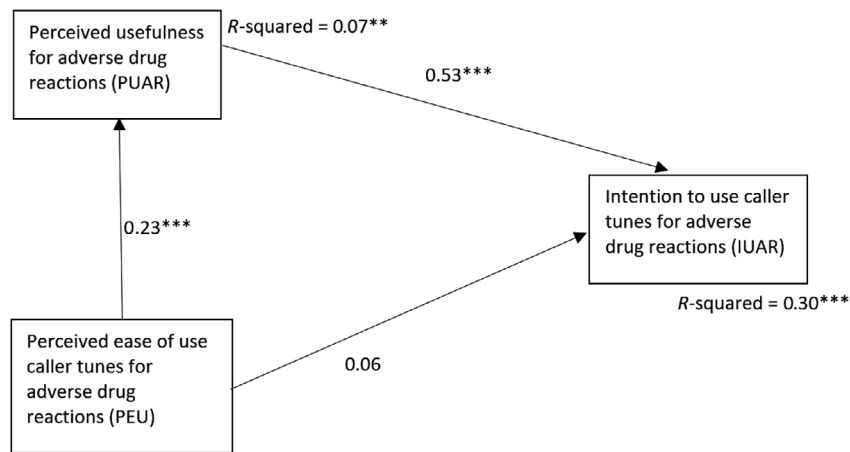
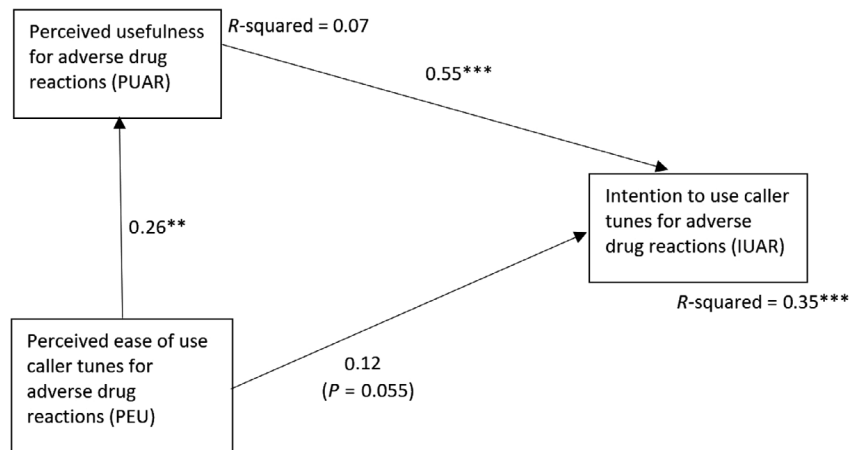
Among those with caller tunes, perceived ease of use and perceived usefulness accounted for 30% of the variance in intention to use caller tunes for increasing awareness of consumer reporting of suspected ADRs (Figure 2). This increased significantly to 31% when free of cost construct was added (Figure 4).

Among participants without caller tunes, perceived ease of use and perceived usefulness accounted for 35.0% of the variance in intention to use caller tunes (Figure 5). Unlike participants with caller tunes, free of cost did not significantly increase the variance in intention to use caller tunes

Table 4 Model fit indices for participants with or without caller tunes

Model or Fit Index	Participants with caller tunes (<i>n</i> = 486)	Participants with no caller tunes (<i>n</i> = 470)	Recommended value	Reference
χ^2 (df)	117.444 (100)	75.47 (50)		
<i>P</i> value	0.112	0.012		
χ^2 to <i>df</i> ratio	1.17	1.51	<5.00	50
TLI	0.99	0.98	≥ 0.95	50
CFI	0.99	0.98	≥ 0.95	50
RMSEA (90% CI; <i>P</i> value)	0.02 (0.00–0.03; 1.0)	0.03 (0.02–0.05; .98)	<0.08	50

CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation; TLI, Tucker–Lewis index.

**Figure 2** Path model for participants with caller tunes ***P* < 0.05, ****P* < 0.001.**Figure 3** Path model for participants with no caller tunes ***P* < 0.05, ****P* < 0.001.

for increasing awareness of consumer reporting of suspected ADRs, and thus, it remained at 35.0% (Figure 5).

Discussion

This study aimed to assess the determinants of intention among consumers to use mobile phone caller tunes to increase awareness of consumer reporting of ADRs in

Ghana. It additionally sought to assess the determinants among those who already use mobile phone caller tunes lacking ADRs messages or songs and those who did not have mobile phone caller tunes. To the best of our knowledge, the current study is the first to quantitatively assess the acceptance of using mobile phone caller tunes to increase awareness of consumer reporting of ADRs. Because the survey instrument met satisfactory validity and

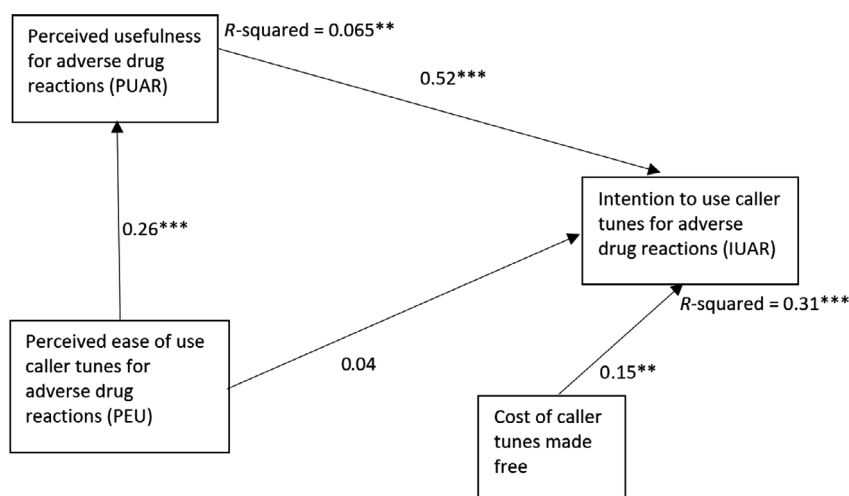


Figure 4 Path model for participants with caller tunes with the addition of free of cost ** $P < 0.05$, *** $P < 0.001$.

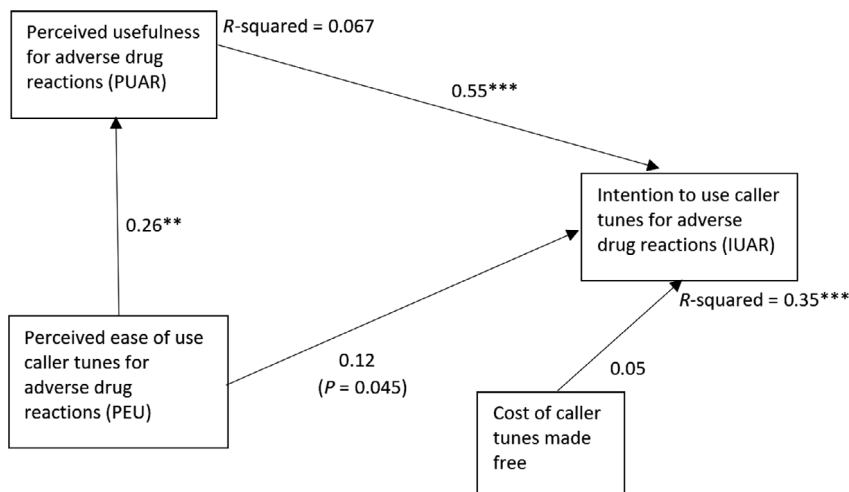


Figure 5 Path model for participants with no caller tunes (free of cost added) ** $P < 0.05$, *** $P < 0.001$.

reliability criteria (see online Supporting information), its use in future studies on ADRs and caller tunes may be desirable.

Most of the findings are consistent with previous TAM studies involving other technologies. The statistically significant findings are consistent with previous TAM studies indicating that perceived ease of use has significant effect on perceived usefulness^[36,41,43,55,56], and on intention;^[57] perceived usefulness has significant effect on intention,^[41,43,58] and cost has significant effect on intention.^[47]

It was surprising that for the model involving those who do not already use caller tunes, making caller tunes free of cost did not significantly affect their intention to use caller tunes to increase awareness of consumer reporting of ADRs. But for those who use and thus pay for the caller tunes, making them free to use significantly increased their intention to use caller tunes for increasing awareness of consumer reporting of ADRs. A potential reason for this

finding could be that because those who do not use caller tunes do not pay for caller tunes, even making caller tunes free to use did not seem relevant to them. Other considerations beyond the cost of caller tunes such as the potential for some people to delay the adoption of technology could also be responsible for such findings.

This study suggests that when testing the feasibility of using mobile phone caller tunes to increase awareness of consumer reporting of suspected ADRs, it will be important to consider the views of respondents who already use caller tunes and those who do not use them.

Research and practice implications

Our study has implications for research and practice regarding use of mobile phone caller tunes to increase awareness of consumer reporting of ADRs in Ghana and similar settings.

Consumers, patients and healthcare providers could be potential targets for future research involving use of caller tunes for increasing awareness of consumer reporting of suspected ADRs. For example, there is a need to test the acceptance of mobile phone caller tunes among pharmacy staff and other healthcare workers to increase the awareness of consumer reporting of suspected ADRs. This is because caller tunes could generate discussions between callers and the call recipients.^[38] Pharmacists and other pharmaceutical care workers, as experts of drug safety issues, would be able to explain the need for reporting suspected ADRs if callers to mobile phones with ADR-themed caller tunes ask about them.

Our expectation is that increasing awareness of consumer reporting ADRs could result in actual reporting of ADRs by consumers. However, because awareness and intention do not always lead to actual behaviour,^[59] studies that actually test the use of mobile phone caller tunes by patients, consumers, healthcare providers or others are needed. Such studies could establish the efficacy of using ADR-themed mobile phone caller tunes to increase consumer reporting of suspected ADRs. The intended consequence of increased ADR awareness is likely to be increased reporting. Thus, institutions including Ghana's Food and Drugs Authority mandated to collect ADRs reports may need to have systems developed to manage the calls including the transcription, triaging, and documentation.

In sum, key stakeholders such as drug regulators, telecommunication networks, researchers, communication professionals and patient groups may need to work together to create and promote use of mobile phone caller tunes to increase awareness of consumer reporting of ADRs. Caller tunes messages and songs should aim at educating people about the importance of consumer reporting of ADRs and where to report ADRs.

Study limitations

The current study relied on the perspectives of the general public and did not identify respondents already on medications, thus limiting the potential of getting the perspectives of those who might have suffered ADRs. Our objective was to use a cross-sectional study to seek the opinions of consumers in regards to their intention to use mobile phone caller tunes to increase awareness of consumer reporting of ADRs, if caller tunes on ADRs were to be created.

We exclusively focused on members of the public at voluntary blood donation sites such as higher educational institutions and workplaces in Accra, Ghana. The target respondents were mobile phone users and not necessarily those who use medications. Thus, there is a need to replicate this study among members of the public in other settings, especially among consumers who may not be as health-conscious as blood donors. Although our results demonstrate construct validity of the measurement instrument, behavioural intention only had a single item. Such a single-item measure of behavioural intention has been used in prior TAM studies, especially to help limit the number of questions for respondents^[60] as was in this study. Nevertheless, subsequent studies on this subject may need to

consider having multiple items for assessing behavioural intention. The payment of the Ghana cedi equivalent of US \$1 may have swayed the opinion of the respondents although in general such a small incentive may serve as a compensation for the time spent in answering long surveys, as was in this case, which also had questions on medication adherence and blood donation.

Moreover, given that intention does not always lead to actual behaviour,^[59] implementation studies on using caller tunes to increase awareness of consumer reporting of ADRs are urgently needed in Ghana and similar settings.

Conclusions

This study provides evidence to support the potential use of mobile phone caller tunes to increase awareness of consumer reporting of suspected ADRs in Accra, Ghana. In making caller tunes on ADRs available for mobile phone users, practitioners may need to consider tailor-made promotional information for those who already use caller tunes and those who do not use caller tunes. Furthermore, if such caller tunes were to be created, there is a need to consider making them free to use to help promote their uptake and consumer reporting of ADRs in Ghana. Further research to understand the acceptance of mobile phone caller tunes by others such as patients and healthcare providers including pharmacists for increasing awareness of consumer reporting of suspected ADR reporting would be beneficial.

Declarations

Conflict of interest

The authors declare that they have no conflicts of interest to disclose.

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Author Contribution

BA conceived the study. BA, LAA and DAA facilitated data collection. BA wrote the draft with AY and ES. AY and BA performed statistical analysis. LAA, DAA, IAK, AG, JN, ANOD, DMD and AR provided critical revisions and feedbacks. All authors approved the manuscript.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Operationalization of constructs and items tested.

Table S2. Factor analysis, reliability, and validity of measures for participants with caller tunes.

Table S3. Factor analysis, reliability, and validity of measures for participants with no caller tunes.

Table S4. Path coefficients for participants with or without caller tunes (with CFDAR).

Appendix S1. Questionnaire focusing only on adverse drug reactions and caller tunes.