SEDAR MOBILE APPLICATION FOR ANTIBIOTIC RESISTANCE AWARENESS

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Abstract

The advancement and frequent usage of smartphones have penetrated everyday life to a point that mobile apps become one of the essential tools of conduct. Even now, the application of mobile apps has shown its significance in the mHealth fields to help overcome many health-related problems. Hitherto, one of the global health issues that are terrorizing the public health is the emergence of antibiotic resistance. Yet, the public awareness on this matter is significantly low, suggesting that the awareness programs were slow to show their effectiveness. Thus, this study highlighted the need to develop an awareness mobile app, known as SEDAR, which is short for ‘Stop and End the Drastic Antibiotic Resistance’. In addition, the aim of this paper is to convey and describe the development of the SEDAR awareness app and convey the results of the preliminary testing of the app. SEDAR app was developed on the Android platform and consisted of two parts: the quest and the feedback. The quest evaluated the users’ responses on antibiotic-based situations and portrayed the feedback in the form of scores. Based on the preliminary testing of the SEDAR app, more than 60% of participants showed likeability to repeat the quest and 90% out of the participants who repeated the quest improved their scores. This inevitably demonstrated that the SEDAR app showed potential in encouraging the public to learn and understand more about antibiotic resistance issues, to which the conventional awareness programs had limitations.

Keywords: Android app, Gamification, mHealth, Public Health, Points

I. Introduction

Bacterial infection has commonly been treated using antibiotics. Nevertheless, improper handling of antibiotics by patients and health practitioners has contributed to the rise of antibiotic resistance. Some of the consequences of these
actions are a lack of effective treatments and an increase in medication costs. Furthermore, treatable diseases today may soon turn fatal. Notwithstanding this, the quest to discover new antibiotics to combat antibiotic resistance is a challenge, as new classes of antibiotics have not been found for over 40 years [I]. Unfortunately, despite this alarming situation, public awareness of antibiotic resistance is almost non-existent. Thus, this research aims to outline the design of the proposed awareness app towards developing an effective gamified mobile app named ‘SEDAR’.

Antibiotic is a type of antimicrobial with the ability to kill or inhibit the bacterial growth that causes diseases [XIV] and Malaysia was ranked as one of the highest users of antibiotics in the world [III]. This condition is worrying since the National Surveillance of Antibiotic Resistance (NSAR) reported a rise in antibiotic resistance cases involving common pathogens between 2014 and 2015 in Malaysia [XV]. Surveys by [IX] exposed common public habits on antibiotics such as usage of antibiotics for viral diseases, incomplete antibiotic consumptions and self-treatment using antibiotics among family members. Without awareness, this situation will encourage speedy antibiotic resistance occurrences.

In addition, [XIX] reported that the awareness campaign success depended heavily on human support and whether there was an enduring gap between common practices and suggested actions. Even campaigns such as ‘Get Smart about Antibiotics’ and the European Antibiotic Awareness campaigns [II] that began a few years back were slow in instilling the necessary awareness among the public members. Moreover, the tool used for these campaigns were mainly educational material in the forms of printed copies such as pamphlets or brochures as well as online materials. Since these did not appeal much to the public [VIII], there is a need to find better communication channels to obtain more engagement on this issue of antibiotic resistance.

In this digital era, information communication and technology (ICT) has been the most rapid and effective approach in disseminating massive information and new knowledge to the digital citizen [XVII]. Smartphones, for example, are now an indispensable tool for most people, especially the youths [XVIII]. Due to this, this study has opted to develop a gamified mobile app to bridge the existing knowledge of antibiotics and its resistance to the targeted users, which in this case, are the public members. To add, this app also applied selected gamification techniques to help engage users to a more serious issue such as antibiotic resistance.

Gamification is defined as the implementation of the game's elements into a non-game context [IV]. For example, research by [V] revealed that a gamified alarm clock improves sleep quality. These had shown that a gamification is an effective approach to enhance habit or behaviour changes, to develop motivation and drive user engagement from doing mundane tasks into something interesting [XIII]. Therefore, the fusion of scientific knowledge with the informatics technology showed promising effects in increasing the users’ awareness of many difficult issues.

II. Background

The rise in antibiotic resistance is alarming [XXI] as it highly affects the common medical procedures such as surgeries and transplantations, thus exposing us
to higher chances of acquiring infections. By definition, antibiotic resistance occurs when the bacteria can overcome the effect of the antibiotic that normally kills or inhibits their growth [XXIV]. As there is a low probability of finding novel antibiotics, it is best for us to ensure that the antibiotic resistance is kept under control. This can be done by exercising vigorous efforts on the correct antibiotic handling practices among its users, which are mostly the public members and the health practitioners [XII].

A quick search on Google Trend subjected to Malaysia, ranging from five years back, using keywords such as ‘antibiotics’, ‘antibiotic resistance’, ‘antibiotics resistance awareness’ and ‘antimicrobial resistance’ unfortunately revealed a low public awareness level on antibiotic resistance issue in Malaysia (see Fig. 1). Although the search on ‘antibiotics’ was escalating year by year, the search using the other 3 keywords remained aloof. This finding was also in par with the findings from surveys conducted by [VI].

**Fig. 1:** Google trends view in Malaysia using related antibiotic keywords

In addition, an exploration in all available app repositories demonstrated that Google Play Store contained the most antibiotic-related apps (51) followed by Windows Mobile (11), Apple App Store (8) and Blackberry World (4). However, none of the apps was developed for the purpose to improve public awareness of antibiotic resistance issues. Instead, the majority of the apps served the function to provide guidelines, the listing of antibiotics, calculate antibiotic dosage and as pill reminder. Thus, this study intends to answer the following research question on how we can use the mobile app as an awareness tool to improve the low public awareness of antibiotic resistance.

The mobile application has shown to be the tool of choice in addressing many health-related issues in this digital era [XXI]. For example, [XX] revealed that the advancement in the mHealth apps not only allowed for personalized patient care but also offer a self-monitoring platform. Moreover, [XXIV] also reported that mobile applications helped health practitioners for the betterment of health management. Since the mobile application promises better engagement to the users, this justified the usage of mobile applications as the awareness tool in this study. In addition to
that, this study also includes an additional technique to intensify the commitment of
the user to the app by applying gamification [VII].

III. Methodology

The methodology to develop the SEDAR awareness app follows the SDLC workflow (software development life cycle) as shown in Fig.2. The design and development were based on the findings from requirement gathering in Phase I and requirement analysis conducted in Phase II. In Phase I, an online survey was conducted with the intention of getting insight into the users’ requirements and expectations of the SEDAR app. The online survey consists of a set of questionnaires with automated data collection to reflect the users’ actual behaviour and preferences. Then, in Phase II, the key issue to be addressed is identified through the requirement analysis, which was the importance to educate the public that antibiotic is only effective against bacterial infection and not a viral infection as well as the need to finish the antibiotics regime when subscribed to deter the emergence of antibiotic-resistant bacteria strains. From the survey, we also identify the suitable gamification element to be incorporated into the app, which is ‘points’.

Design and Development of SEDAR App

The design and development of the SEDAR app are focused on Phase III and IV. This is to ensure that the final product will be able to meet the objectives while conforming to the demand by various users. In Phase III, emphasis will be placed on the design of the user interface and the app features. These include personalization (username), motivation (to improve points/scores), learner’s engagement (feedback) as well as achievement (points, progress bar).

In addition, in Phase IV, SEDAR app development will be based on Agile methodology. Preliminary testing on the selected target group will be conducted to assess the initial version of the app before the app can be improved based on the feedback. For this pilot testing, the app was tested on 30 people within the age group of 20 to 30 years old. The reason behind this was this target group represented the age group for the highest smartphone users in Malaysia [X]. The assessment was conducted to identify the likeability for the user to repeat the antibiotic quest, to determine the differences between the scores after subsequent repeat, to ensure the suitability of the app features and to obtain other feedbacks such as the use of language, the difficulty level to understand the app content and many more.
IV. Results and Discussion

SEDAR App Design and Development

SEDAR app was developed on the Android platform using Android Studio. For this initial stage, the app was created in the English version, using the laymen's terms that were more relatable to the target users. SEDAR app design was based on the outcome of the requirement gathering conducted through an online survey. Two key points were addressed in this app; to educate the public that antibiotics only work on bacterial diseases (not viral diseases) and the public needs to finish their antibiotic consumption to complete their treatment. The main gamification element chosen was ‘points’. The reasons behind this were due to easy evaluation, engagement and expansion. Easy evaluation is explained in a way that awareness level can be evaluated through the scores of correct responses, while easy engagement is portrayed through the ability to provide feedback and comparison of the users’ progress. Moreover, for future expansion, ‘points’ can be reflected in high scores and leader boards.

The app consisted of two parts; which were the quest (see Fig. 3) and the feedback (see Fig. 4). In the quest part, the user will need to select for the most appropriate response in each of the 15 situations given. The user was given 30 seconds to respond and they will be informed on whether their response was correct or vice versa. Yet, the scores will still be calculated to provide them with the final feedback.
Preliminary App Testing on Target Group

The app was tested to a target group of 30 participants, chosen randomly, but within the age of 20 to 30 years old. The purpose of this preliminary app testing is to obtain feedback on the SEDAR app functionality and usability. This evaluation can also help to determine the number of errors that occurred when the mobile app was tested. Table 1 displayed the findings from the pilot testing of SEDAR on the target group.

Table 1: Pilot testing of SEDAR app on the target group

| Participant | Score 1 | Score 2 | Score 3 | Average score | Likeability to play again |
|-------------|---------|---------|---------|---------------|--------------------------|
| 1           | 10      | 12      | 12      | 11            | Y                        |
| 2           | 10      | 10      | 12      | 11            | Y                        |
| 3           | 8       | 10      | -       | 9             | Y                        |
| 4           | 7       | -       | -       | 7             | N                        |
| 5           | 5       | 7       | -       | 6             | Y                        |
| 6           | 3       | 7       | -       | 5             | Y                        |
| 7           | 5       | 7       | -       | 6             | Y                        |
| 8           | 2       | 8       | -       | 5             | Y                        |
| 9           | 3       | 6       | -       | 5             | Y                        |
| 10          | 5       | -       | -       | 5             | N                        |
| 11          | 6       | 8       | -       | 7             | Y                        |
| 12          | 9       | 10      | -       | 10            | Y                        |
| 13          | 3       | 7       | 12      | 7             | Y                        |
| 14          | 5       | 9       | -       | 7             | Y                        |
| 15          | 8       | -       | -       | 8             | N                        |
| 16          | 10      | 9       | -       | 10            | Y                        |

| Score | Indication |
|-------|------------|
| 0-5   | Limited knowledge of antibiotics and its resistance. |
| 6-10  | Sufficient knowledge of antibiotics and are more aware of antibiotic resistance. |
| 11-15 | Possess good knowledge of antibiotics and a good awareness of antibiotic resistance. |

Fig. 4: Display of SEDAR app feedback page
Scores 1, 2 and 3 reflected the number of times that the user repeated the quest. Based on the average scores, 6 users (20%) obtained the score between 0 to 5, 18 users (60%) with a score between 6 to 10 and another 6 users (20%) achieved the score between 11 to 15. A higher score indicates better knowledge and awareness that the users’ have on antibiotic resistance. In addition, the majority of the users that repeat the quest had increased their score (90%). Indirectly, this can be translated that repeated use of the app can lead to a better understanding of the issue, thus better awareness can be achieved.

Moreover, the usage of ‘point’ as the gamification element also showed success in intrinsically motivating the user to play the app again. Nevertheless, 11 out of 30 participants did not choose to play again since they only had Score 1. Nonetheless, it was found that the reason for not repeating the quest was due to the lack of interactive media in the quest as well as less understanding of the terms used in the questions. A suggestion was made to include some interactive media such as .gif, sound or video files that provide more appeal factors.

Among the feedbacks were the request to have the app in Malay language version, improvement in terms of the bigger fonts and more contrast background, to highlight the key points in the questions and to provide longer response time for each situation. Although the users with high scores mentioned that the quest is quite easy, the difficulty level seemed enough at this point as the majority of the users’ scores fell in the medium score category.

V. Conclusions

Over the years, we have seen the development of many mobile applications. Nevertheless, it is rare to see the utilization of mobile applications to improve

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awareness. This study is unique compared to other studies as it incorporates gamification elements to strengthen the users’ engagement with the mobile application.

The findings from the preliminary app testing on the target group will direct us towards better revision and improvement to the app prototype with respect to the content and strategies. Some of the considerations that can be taken into account include addition of social media connections to expand the app coverage [XXIII], creation of ‘awareness goal’ in the app in which each member can contribute by performing certain task such as sharing the antibiotic information to others [XI], incorporation of data analytics to measure selected parameters which relate to the outcome and impact of the mobile application [XVI].

The proposed parameters to be measured will comprise of (i) engagement which will be measured via the level of integration of the mobile application into social media, (ii) awareness which will be measured via post-assessment surveys or the number of users pledges to perform good antibiotic practices and (iii) data analytics will also measure the mobile application usage by analysing the average number of daily/monthly users and the percentage of users who repeated the quest after the first exposure.

The overall success in this study will not only benefit locals in Malaysia, but the tools created within the study can be applied to generate a better level of awareness of antibiotic resistance within the global community. Furthermore, this mobile application awareness model can potentially be used as a foundation to tackle and resolve other community-related issues using information technology.

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