International Journal of Industrial Engineering, 2018;2(2):31-35.
ISSN: 2456-8449.
http://ijie.gjpublications.com

Research Article

Short Message Service Based Health Appointment Management Application

F. Motende, S. Liyala, C. Ondiek

School of Informatics and Innovative Systems,
Jaramogi Oginga Odinga University of Science and Technology,
P.O. Box 210-40601, Bondo-Kenya.

*Corresponding author's e-mail: bnyaare@yahoo.com

Abstract

Patient follow-up in research settings is important for overall well-being of the particular patient. The main strategies of managing clientele follow-up appointments are based on home visitations and phone calls, but cases of missed appointments are still high. In this project, Short Message Service based Health Appointment Management Application for clientele follow-up was developed to take advantage of mobile messaging technology to supplement strategies of managing clientele follow-up appointments such as home visitations and phone calls with ultimate aim of improving appointment adherence. The results of this study show that the best time is between 9 and 12 noon. It was found out that automated Short Message Service texts can be used to supplement other strategies of managing clientele follow-up appointments and the Short Message Service application is suitable and acceptable for informing clients of their engagements with the study. In terms of policy, Short Message Service based Health Appointment Management Application can be used along-side other methods of managing appointment follow-up to improve appointment adherence in healthcare.

Keywords: Application; Health Appointment; Short Message Service; Management.

Introduction

Patient follow-up in research settings is important for overall well-being of the particular patient [1]. The main strategies of managing clientele follow-up appointments are based on home visitations and phone calls, but cases of missed appointments are still high [2]. In this project, SMS based Health Appointment Management Application (SMSBHAMA) for clientele follow-up was developed to take advantage of mobile messaging technology to supplement strategies of managing clientele follow-up appointments such as home visitations and phone calls with ultimate aim of improving appointment adherence [3]. Waterfall methodology was used in project development in Linux operating system that utilized Rapid SMS framework [4]. The Rapid SMS framework was configured to work with Kannel SMS gateway, Global System for Mobile communications (GSM) modem and Celery scheduler [5].

Coding was done using python programming language. Hypertext Markup Language (HTML), JavaScript Query (JQuery) and Cascading Style Sheets (CSS) were used to create customized user friendly web user interfaces. My Structured Query Language (MySQL) database was used as the backend and user friendly reports were generated by the system [6]. The entire project was developed using Model Template View (MTV) architectural design pattern. The research part of this project was cross-sectional where Nuva Ring participants, who were due for scheduled appointments between 10th and 24th February 2015 and had received appointment reminders from SMSBHAMA, were used to test the application and their response on suitability and acceptability of automated text messages was evaluated using a questionnaire. Data analysis was done using Stata statistical software [7]. 94% of clients (mean rating of 1.91) felt that SMS texts were suitable for informing them of their engagements with the study while 88% (mean rating of 3.93) felt that SMS texts were acceptable appointment follow up strategy. Therefore, the objective of the present work was to establish whether SMS can be used to

Received: 03.02.2018; Received after Revision: 10.02.2018; Accepted: 12.02.2018; Published: 21.02.2018.

supplement other strategies for clientele follow up appointments.

Research methodology

Waterfall methodology was used in project development in Linux operating system that utilized Rapid SMS framework [8]. The Rapid SMS framework was configured to work with Kannel SMS gateway, Global System for Mobile communications (GSM) modem and Celery scheduler. Coding was done using python programming language [9]. Hypertext Markup Language (HTML), JavaScript Query (JQuery) and Cascading Style Sheets (CSS) were used to create customized user friendly web user interfaces. My Structured Query Language (MySQL) database was used as the backend and user friendly reports were generated by the system.

The entire project was developed using Model Template View (MTV) architectural design pattern. Then Nuva Ring participants, who were due for scheduled appointments between 10th and 24th February 2015 and had received appointment reminders from SMSBHAMA, were used to test the application and their response on suitability and acceptability of automated text messages was evaluated using a questionnaire [10]. Celery scheduler was run together with celery beat which contains cron functions which enabled tasks to be defined and executed at a predefined time (9.00 am). Data analysis was done using Stata statistical software.

Results and discussion

The SMSBHAMA was developed with the aim of supplementing other strategies of managing clientele follow-up appointments. A good graphical web user interface was customized for use by activating django's admin user interface which was extensively used to manage users. Non SMS tasks like scheduling of client appointments and managing users were effectively managed through use of user friendly graphical web user interfaces. This research question was answered through implementation of CRUD functions to manage various modules in SMSBHAMA. This research question was also answered through sending of appointment reminders to clients who were due for appointments promptly. Up to 31 out of 32 clients that were sent appointment reminders before their scheduled appointments came on the scheduled date. When the attendance of these clients was looked at retrospectively, it was found out that 28 clients attended their previous visit on scheduled appointment date.

The SMSBHAMA made use of class based views which are generic. They also offer the ability to easily and flexibly duplicate code through class inheritance. The application also made use of template inheritance which makes reusable HTML layouts for a site. The language used in SMS texts was customized according to client preference i.e. it was made generic.

A cross-sectional research was conducted to answer the research question "How was the suitability and acceptability of the developed SMS application evaluated?" It was done by using a questionnaire.The questionnaire was made up of open and closed questions. Most of the questions had a rating between 1 and 5 where 1 represented "Strongly Disagree, whereas 5 represented "Strongly Agree". The questionnaire covered the following areas: demographics, suitability, acceptability, confidentiality, SMS content and timing.

Table 1. Client demographics

Characteristic	n	%
Age in Years		
20-24	7	21.88
25-29	20	62.5
30 and Above	5	15.63
Education		
Primary	19	59.38
Secondary	11	34.38
Post-Secondary	2	6.26
Marital Status		
Single	3	9.38
Married	29	90.63
Occupation		
Business	12	38.71
Student	1	3.23
Others	3	9.69
None	15	48.39

Table 1 shows the client demographics. Note that all clients who participated in the study were females. Majority of the clients were aged between 25-29 years. At least each client had a primary level of education. More than 90% of the clients were married and majority of them had no

occupation. Table 2 shows the client responses to the suitability, acceptability and confidentiality issues.

Table 2. Client Responses to Suitability, Acceptability and Confidentiality issues

Characteristic		Mean Rating	95%CI	Percentage, %
Suitability	Compromised Confidentiality	1.91	1.74 - 2.07	94
	Easy to Understand	3.97	3.91-4.03	97
	Timing Appropriate	3.91	3.80 - 4.01	91
Acceptability	SMS Acceptable	3.93	3.73 - 4.14	91
	SMS Frequency	1.21	0.95 - 1.48	87.5
Feasibility	Share Mobile	2.25	1.82 - 2.67	91
	Carry Mobile	3.34	2.88 - 3.81	91

Suitability

The 94% of clients (mean rating of 1.91) felt that the content of the SMS message did not compromise their confidentiality, 97% of the clients with mean rating of 3.97 thought that the content of the SMS message was easy to understand and 91% of clients felt that the timing of SMS message was appropriate as can be seen with mean rating of 3.91.

Acceptability

The 91% of clients (mean rating of 3.93) felt that the SMS technology is acceptable while 87.5% of them accepted that they at least send or receive more than one SMS message in a day (mean rating of 1.21).

Feasibility

The 91% of clients (mean rating of 2.25) disagreed that they share their mobile phones and 91% of them accepted that they always carry their mobile phones (mean rating of 3.34). Table 3 shows the time difference when the clients received and read their messages. This table shows that most of the SMS messages were read within 3 minutes with 25th percentile being 1 and 75th percentile being 9.

Table 3. Time difference

	Median (IQR)
Time difference	3 (1, 9)

Best time to send SMA text

Concerning the time to send SMS texts, table 4 shows the time clients felt that it is most appropriate to send appointment reminders using SMS texts. Majority of the clients (62.5%) preferred between 9 and 12 noon while 3.13% preferred between 6 and 9 am in the morning. However, 6.25% preferred texting any time. This study found out that the best time is between 9 and 12 noon. Other studies say that it is around 8 am .The best time to send SMS texts is not conclusive and issues like the occupation of the respondents need to be considered. The results show that using SMS technology as a tool to remind clients of their upcoming appointments is suitable and acceptable. This is in agreement with the study by [9], they found out that text message reminders are feasible means of reaching homeless veterans and users consider it acceptable and useful.

Figure 1 shows that majority of the clients preferred to be send appointment reminders using SMS texts between 9 and 12 noon (62.5%). This can be attributed to the fact that people are busy with other activities during other times of the day as opposed to this time interval.

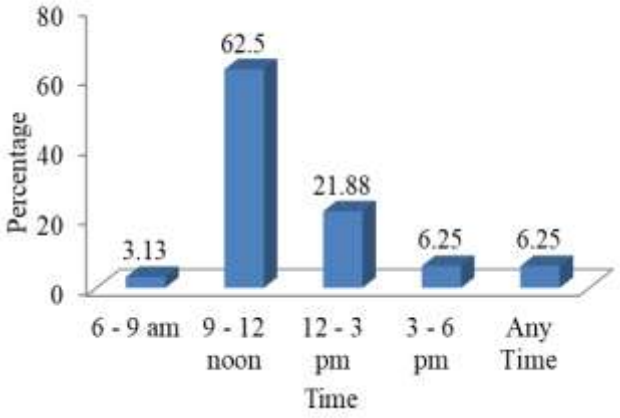

Figure 1. Best time to send SMS text

SMS sent appropriate

Figure 2 shows clients' response to whether using SMS message to remind them of their upcoming appointments is appropriate. As can be seen from Figure 20, 91% of respondents

strongly agreed that SMS texts can be used to remind them of their upcoming appointments.

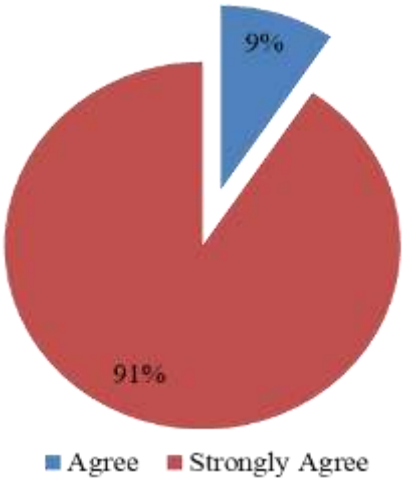

Figure 2. SMS sent appropriate

Best reminder date

Figure 3 shows that the best date to remind clients of their upcoming appointments is 2 days before the scheduled date with 66% preference, 94% of clients (mean rating of 1.91) felt that SMS texts were suitable for informing them of their engagements with the study while 88% (mean rating of 3.93) felt that SMS texts were acceptable appointment follow up strategy.

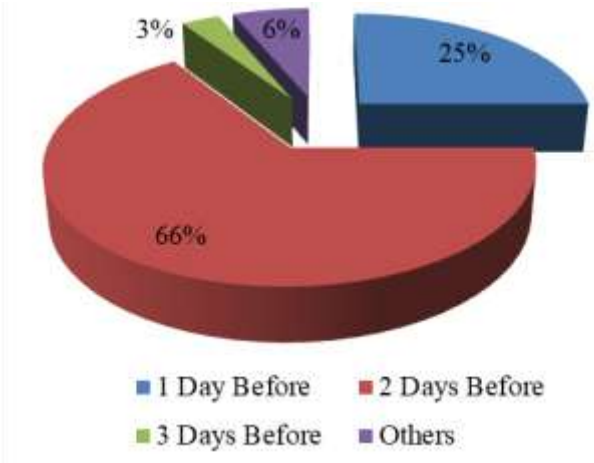

Figure 3. Best reminder date

The results show that the time to send SMS reminders was 2 days before appointment date which is consistent with other studies who found out that the best timing is between 1 and 3 days before appointment date. This is in agreement with studies by [5], they sent appointment reminders within a week and [7], they who found out that a longer lead time (5-10) days before appointment date increases the possibility of patients forgetting the appointment again after the reminder. The SMS language was customized according to customer's preference with the majority (72%) preferring the message in local language. This is in agreement with a study by [6], they found that respondents preferred local language and [10], they found out that 88% of the respondent preferred text in their own language. Concerning reading of the SMS texts, the study found out that most participants read the message within 3 minutes. In total, 94% of the participants had read the message. This is in agreement with a study by [11], they found out that 99% of the respondents had read the message.

Conclusion

The present study found out that automated SMS texts can be used to supplement other strategies of managing clientele follow-up appointments and the SMS application is suitable and acceptable for informing clients of their engagements with the study. In terms of policy, SMSBHAMA can be used alongside other methods of managing appointment follow-up to improve appointment adherence in healthcare. The application needs to implement a two-way communication system. This will enable clients to re-schedule their clinic appointments and confirm whether they will honor their clinic visits. The rate of sending SMS texts from the application to the client can be made quicker by having an SMS short code from mobile service providers. This being an m-health solution, care needs to be taken when sending SMS texts to clients for instance spouses where one is not aware that the partner is enrolled in a study and/or where a partner has not disclosed his status say HIV to the other partner. The clients who participated in this study were females only. It could be interesting to have both sexes included.

Conflicts of interest

The authors hereby declare that they have no conflict of interest.

References

[1] Aslamnajeebdeen K. How to fix apache could not reliably determine the servers' fully qualified name. Comp Eng. 2016;1(4):133-150.

[2] Barlow J. Mobile Communications for Medical Care: University of Cambridge; 2017.

[3] Battistotti A, Quaglini S, Cuoco E. Reducing dropouts in outpatient care

through an SMS-based system. Innovative Systems. 2017;14(4):935-940.

[4] Koshy E, Car J, Majeed A. Effectiveness of mobile-phone short message service (SMS) reminders for ophthalmology outpatient appointments: Observational study. Comp Eng. 2015;1(3):239-250.

[5] Hasvold M, Wootton W. Use of telephone and SMS reminders to improve attendance at hospital appointments: a systematic review. Software Engineering. 2017;5(4):23-50.

[6] Bangure D, Chirundu D. Effectiveness of short message services reminder on childhood immunization programme in kadoma,Zimbabwe-a randomized controlled trial. Reviews in Computer Engineering. 2015;5(1):44-57.

[7] Downer SR, Meara JG, Costa AC. Use of sms text messaging to improve outpatient attendance. Comp Eng. 2014;4(7):49-61.

[8] John PE, David R. Adaptation of telephone and SMS use for attendance at hospital visits. Systematic Software Engineering. 2016;5(8):424-457.

[9] Mcinnes DK. Retaining homeless veterans in outpatient care: a pilot study of mobile phone text message appointment reminders, Springer, Verlag New York; 2014.

[10] Thupae D. The feasibility of using short message service (sms) technology in the management of chronic diseases in 3 pilot clinics in bushbuckridge, mpumalanga. (Master of public health), Witwatersrand; 2018.

[11] Youssef A. Use of short message service reminders to improve attendance at an internal medicine outpatient clinic in Saudi Arabia:a randomized controlled trial. Electronic Engineering. 2014;20(5):29-37.

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