

## RESEARCH ARTICLE

## Reminder System as a Strategy to Improve Patient's Adherence on Medical Appointment

Agus Sugiharto,<sup>1\*</sup> Levina C. Khoe,<sup>1</sup> Boy S. Sabarguna,<sup>1</sup>  
Ajeng Pramastuty<sup>2</sup>

<sup>1</sup>Department of Community Medicine Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

<sup>2</sup> Faculty of Engineering Universitas Indonesia, Jakarta, Indonesia

\*Corresponding author: agussugiharto96@yahoo.com

Received: 9 January 2019; Accepted: 1 April 2019

DOI: 10.23886/ejki.7.10303.

### Abstract

*Medical appointment non-adherence affects health outcomes and costs. Evidences have shown that nearly 40% patients did not adhere to their treatment, fail to keep appointments or follow doctor's recommendations. Sending reminders via e-mail and text message is one common intervention to enhance patient's adherence. The aim of the study is to provide an effective reminder system to improve patient's adherence on medical appointment. Using the input-process-output-outcome scheme, we developed a reminder system through web-based and mobile phone application. This reminder system facilitates the communication between patient and clinic staff. We tested this application among programmers and patients in a primary clinic. The reminder system was applicable to be used by medical staff in a primary clinic. Patients could easily download the application and put in appointment schedule; while clinic staff could check and set reminder system for patients. This reminder system is useful for patient to set medical appointment and to be reminded of their appointment one week, three days, and one day before. The reminder used email notification and SMS gateway to increase the effectiveness.*

**Keywords:** reminder system, patient's adherence; medical appointment.

## Sistem Pengingat sebagai Sebuah Strategi untuk Meningkatkan Kepatuhan Pasien terhadap Perjanjian Konsultasi Medis

### Abstrak

*Ketidakpatuhan terhadap perjanjian konsultasi medis dapat memengaruhi luaran kesehatan dan biaya. Bukti ilmiah menunjukkan bahwa 40% pasien yang tidak patuh terhadap pengobatannya, gagal mengikuti perjanjian medis atau instruksi dokter. Mengirimkan pengingat melalui surat elektronik dan pesan merupakan salah satu intervensi umum untuk meningkatkan kepatuhan pasien. Studi ini bertujuan untuk menyediakan sistem pengingat yang efektif dalam meningkatkan kepatuhan pasien terhadap perjanjian konsultasi medis. Dengan menggunakan skema input-proses-output-outcome, peneliti mengembangkan sistem pengingat berbasis situs web dan aplikasi telepon genggam. Sistem pengingat tersebut menjembatani komunikasi antara pasien dan staf klinik. Peneliti menguji coba aplikasi ini pada ahli pemrograman dan pasien di klinik. Sistem tersebut dapat digunakan oleh staf medis di klinik layanan primer. Pasien dapat mengunduh aplikasi dengan mudah dan memasukkan jadwal perjanjian dan petugas klinik dapat mengecek serta menetapkan sistem pengingat kepada pasien. Sistem pengingat bermanfaat bagi pasien untuk menentukan jadwal konsultasi dan mengingatkan perjanjian satu minggu, tiga hari, dan satu hari sebelum jadwal. Sistem ini memanfaatkan notifikasi surat elektronik dan pesan singkat telepon untuk meningkatkan efektivitas.*

**Kata kunci:** sistem pengingat, kepatuhan pasien, perjanjian medis.

## Introduction

Patient's adherence is a complex issue that burden the healthcare system. As many as 40% patients were reported having non-adherence to their treatment regimen.<sup>1,2</sup> Besides medication, patient's non-adherence includes failure to follow doctor's instructions in changing their lifestyle or to keep their medical appointments. The causes are varied, for instance, patients are unable to correctly interpret doctor's instruction, forget the detail instruction, or simply ignore the medical advice.<sup>3,4</sup> Study revealed that the majority of patients leaving clinics without knowing the follow-up actions even after meeting the doctors.<sup>5</sup>

The health consequences of medication non-adherence are huge. In the United States, it caused more than 100,000 annual deaths, and around 10% to 25% admitted to hospital or nursing home.<sup>6</sup> Missing medical appointments had been associated with higher risk of complications, hospitalizations, and premature deaths, especially for patients with chronic illnesses. A study on diabetic patients showed the increase risk of mortality and poor metabolic control among patients with higher rate of clinical non-attendance.<sup>7</sup> Another study among African-American patients found that about 20% of respondents missed more than 30% of their appointments. Data showed that affordability was the main culprit, however, one-third of the respondents mentioned forgetfulness as their common reason.<sup>8</sup> In Indonesia, about 44.29% of patients with chronic illnesses visited primary healthcare facilities less than ten times in two-year time.<sup>9</sup> These conditions reflect the low utility of healthcare service for chronic disease patients that would affect the health outcomes.

Atreja et al.<sup>10</sup> proposed several common interventions that could be applied to improve patient's adherence, i.e. simplifying regimen characteristics, imparting knowledge, modifying patient beliefs, patient and family communications, leaving the bias, and evaluating evidence (SIMPLE). Among these interventions, in this study we are focusing on one type of intervention, i.e. patient

and family communications. This includes sending reminders to patients via mail, electronic mail, or telephone. There are several reasons for clinic non-attendance, e.g. patients felt better with symptomatic medications, difficulty in getting transportation, and forget the follow-up schedule.<sup>11,12</sup> In order to lessen the probability of patient's forgetfulness, we aim to develop patient's reminder on their medical visits. Sending mails or making phone calls to patients consume more time, costs, and human resources than electronic system.

Nowadays, almost every person has smartphone. It has become basic necessity for people, especially those who resided in urban areas. Indonesia is one of the biggest market for smartphone, with 65.2 million users, much higher than its neighboring countries, e.g. Malaysia, Philippines, and Thailand.<sup>13</sup> The use of patient reminder system has been extensively studied. A systematic review on patient reminder system found many studies supported the use of reminders in increasing attendance at medical appointments. However, it should be noted that reminder system via phone calls also promote the cancellation or rescheduling rates.<sup>14</sup> The usability, feasibility and acceptability of a reminder system are affected by the population characteristics, type of tools, literacy abilities, and connectivity issues.<sup>15,16</sup>

## Methods

### Study Design

This was an action research to develop a web-based and smartphone-based application and test the application to the users. We used the framework of input-process-output-outcome, as follow (Figure 1):

- Input: patient's data (preferably those who required routine medical visits).
- Process: software development, transforming patient's data into reminder system.
- Output: reminder system via SMS gateway, email, or Whatsapp application.
- Outcome: low rate of missed medical appointments, short waiting time for patients.

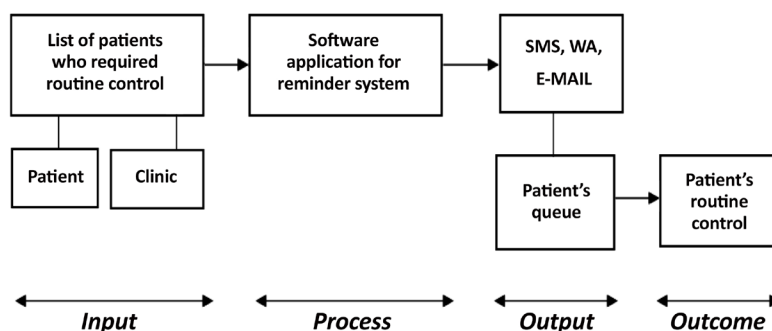


Figure 1. Diagram Process of Workflow

As input, we received patient's database from the clinic and identified patients who required routine control, preferably patients with chronic illness, e.g. hypertension or diabetes mellitus. The list of patients and data format were used as basis to develop the reminder system. In the process, we collaborated with application developer and tested the reminder system among programmers. This system requires participation from both clinic staff and patients. For regular patients, clinic staff could directly input into the reminder system and the text message would automatically pop-up on patient's smartphone. Patients could also actively involve by requesting the schedule for medical appointment through smartphone application or web-based application. The output was a reminder system through SMS gateway, email, or Whatsapp, which set the patient's schedule. Eventually, the goal of this application is to reduce patient's waiting time in the clinic and improve patient's attendance in their routine medical visits.

### Study Subjects

We tested this application for programmers, clinic staff, patients and selected three programmers to test the system. In regards to clinic staff, we

selected registration staff, administration staff, and staff in medical record to test the reminder system. For direct users, which were patients, we purposively selected twelve patients with inclusion criteria as follow patients registered at the designated clinic and with chronic illness (e.g. diabetes mellitus and/or hypertension).

### Location and Time

The trial took place at a primary healthcare clinic, located in Central Jakarta. The clinic provides services for general health, dental health, maternal and child health. Overall duration of this study is ten months, with the first six months for software development, and the rest for evaluation.

### Software Development

During software development, we used patient's data format as basis to develop the framework. There were three model application development, i.e website application, android application, and SMS Gateway application. In web application (Figure 2), the process of data flow includes system activation, data process, patient registration, and process for calling out the registration number.

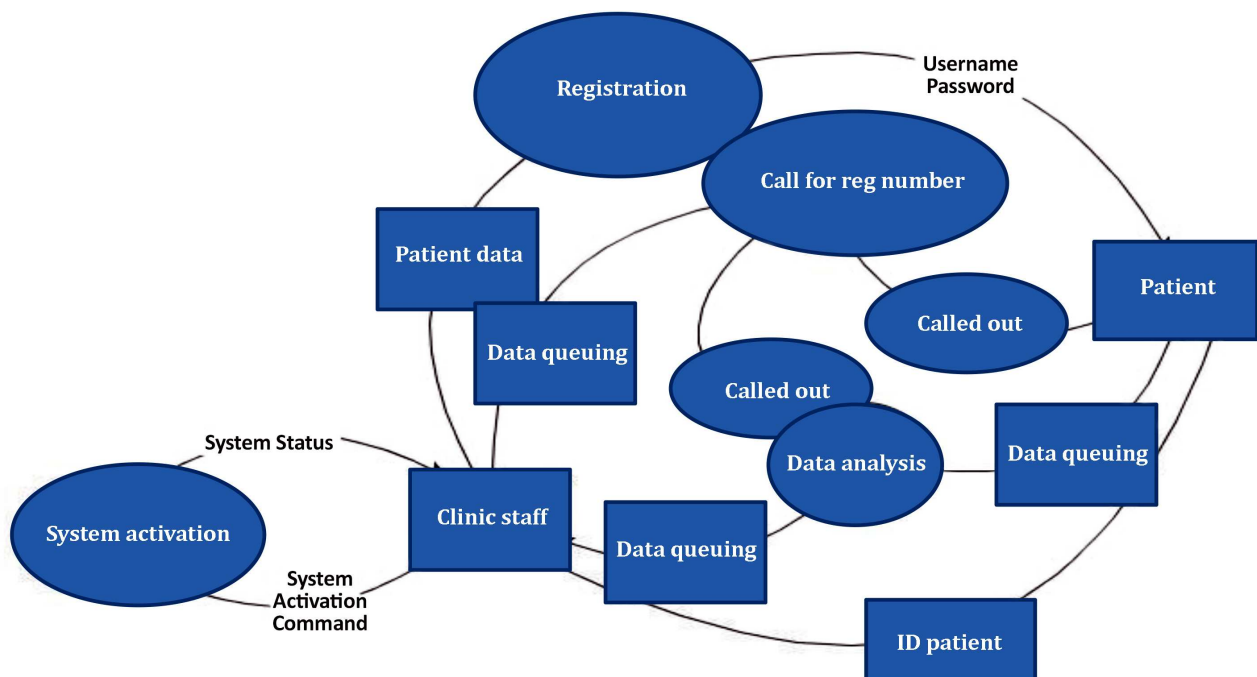


Figure 2. Data Flow for Web Application

In android application, data process is starting from data analysis of patients' control schedule, setting registration number, and cancellation procedure. The focus is more on patient's perspective. While in SMS gateway application,

we process data from patient's schedule and setting for registration number. The output was SMS notification to patient's mobile application. It would be centralized by the system, but individually received and adjusted to each patient.

### Evaluation of Reminder System

We asked programmers to evaluate the appearance, function, accessibility, logical system, and the applicability. A set of questionnaires was used to measure general features, reminder function, and control function. Programmers would give score 1 to 4 for each component, with score 4 as the most satisfied and 1 as the least satisfied. We also asked clinic staff using the same set of questionnaires. Before ask for their evaluation, we provided training to the clinic staff on how to use the application. Last, we did the pilot testing to patients. The clinic staff, who had been trained, taught patients about the application. Furthermore, we asked patients on the benefit and barriers of using the reminder application.

### Results

#### Reminder System

The reminder system consists of two parts, i.e. web based and android application. On the

web based, we could read about the clinic profile, structure of organization, and doctor's schedule. Patients could check the schedule and registered to the services. They can also request for the date.

For administrative purpose, the clinic staff entered different web address and login as administration staff. The staff could check the number of patients, number of medical appointments, number of reminder notifications, and number of doctors. Besides checking and monitoring for patient's schedule, the staff could also update the clinic profile or news to be placed on the website.

Admin staff could check the patient's control schedule. The reminder was set for three times, i.e. a week, three days, and one day before the medical appointment (Figure 3). Patients would automatically receive SMS or email notification from their mobile phone.

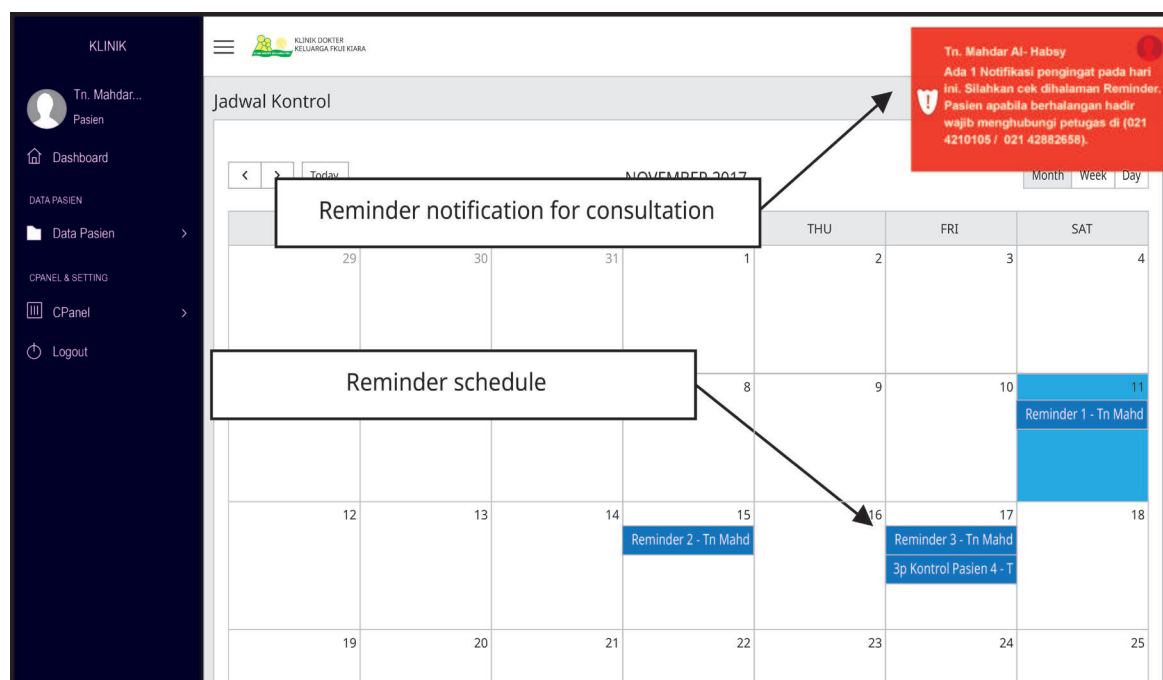


Figure 3. Display of Reminder Schedule

### Evaluation Result

Three programmers were selected to test the application and fill in the questionnaires. The Table 1. summarizes the result. Overall score, both from programmers and clinic staff, showed moderate satisfaction. There were some inputs from programmers, especially on the filling order and system process in the reminder system. They suggested the tab menu to be more user-friendly

and followed the data process. From clinic staff perspective, they were more concerned on how to input the data. There was a slight different format in patient database. The system used a single code for each patient, while in this clinic, each code also represents the patient's family. When the clinic staff accessed using the single code, they could merely find one patient's name (head of the family) but could not find the other family members.

Table 1. Evaluation Result from Programmers and Clinic Staff

Question	Mean Score of Programmer	Mean Score of Clinic Staff
General Features		
Access to find the web address/ location	3.0	3.3
Speed access	3.0	3.3
General appearance	3.3	3.3
Logic of the program	3.3	3.3
Main menu	3.0	3.3
Reminder System Features 3.0		
Logic system	3.3	3.3
Filling order	3.0	3.3
Input data	3.7	3.0
System process	3.3	2.3
Appearance of reminder system	3.0	3.3
Features of Patient's Schedule		
Logic system	3.3	3.3
Filling order	3.3	3.3
Input data	3.3	3.0
System process	3.0	2.7
Appearance of patient's schedule	3.7	3.3

We also conducted a pilot on patients (Table 2). Twelve patients were selected consecutively. Before we started the pilot, we did training to the clinic staff and provided a manual book for the staff. The staff explained to the patients and asked them to download the application from the Google Play Store. They tried to select the preferable date and time through web application and checked the

schedule from their mobile application. The main problem found in the applicability of this reminder system was the access to application. The majority of patients in this clinic were elderly, therefore, it was difficult for them to understand about the mobile application. However, with the help from their family members, who usually accompanied them to the clinic, patient could access the application.

Table 2. Patient's Compliance after Reminder System

Message Delivery Status	Visit Status						Total	
	On Schedule		Not On Schedule		Not Visit			
	n	%	n	%	n	%	n	%
Sent Message	9	75	1	8.33	0	0	10	83.33
Not Sent	0	0	0	0	2	16,67	2	16.67
Total	9	75	1	8.33	2	16,67	12	100

## Discussion

Worldwide, there are many available reminder systems for patients. These includes reminder for taking medication, healthy lifestyle (diet or fitness tracking application), and reminder for medical visits. In United States, popular digital applications exist to help patients with self-booking system,

e.g. Sagenda and Appointy. It works for patients and doctors within the system network. Patients could book the schedule and choose the doctors registered in the application. Some applications are available free for the users, however with limited functions. Other applications are more comprehensive but not free.

In Indonesia, there are also some mobile application for patient reminder. Unfortunately, they are still limited to a certain clinic and merely use text message notification.<sup>17</sup> It has not integrated with the clinic system and used one-time notification. Our application provides more reminder channels through electronic mail and text message notification. Moreover, the clinic staff could monitor the patient's compliance. The application could serve patients who are actively book schedule (self-booking system) and patients who are ignorant. The clinic staff could check for any follow-up medical visits from the medical record and input the schedule into the system by themselves (clinic booking system). Another strength of this system was the frequency of reminder system. Once the data is being inputted, the system would automatically send reminders one week, three days, and one day before appointment. These would help reducing the patients' no shows at the clinic.

From the perspective of users, clinic staff and patients, the application was quite helpful. The clinic staff could enter the patient's schedule only one-time and the system would notify the patient automatically. While among twelve patients, the no-show up cases were 16.67% (2/12), in which these two patients did not receive email or SMS notification. All patients who received notification did attend the medical visits, with only one patient who did not follow the schedule. In a systematic review of eight trials, patients who received reminder had 11.9% higher adherence compared to patients without reminder (95% CI: 0.8-22.4%).<sup>18</sup> Other studies also revealed that text message reminders could improve patient's attendance rates, e.g. a study in pediatric clinic found 14.6% higher attendance rate in group with text reminder versus non-text reminder.<sup>19-21</sup>

In spite of the usefulness of this application, there are some limitations. The reminder system applies specifically to the appointed clinic and requires patients to actively download from Google Play Store. Since, it is a mobile application, it would be easy to use for young generation. However, most patients with chronic illnesses are elderly. Therefore, they may require other family members to download the application. Providing training to use the application for family members might necessary in this community. Another limitation is no previous data on attendance rate in the clinic, therefore, it was inconclusive whether the reminder system could increase the patient's compliance or not.

## Conclusion

Reminder system is one strategy to improve patient attendance to the clinic. It was made to

bridge the communication between patients and clinic staff. The system was developed smoothly and there were no major obstacles in the development process. However, the format of patient database should be adjusted to the clinic situation.

Another consideration was the main target of this application, i.e. patients with chronic illness. We should be aware that most patients were elderly and therefore, we should re-consider whether the web and mobile application would be effective for this target group.

This system is helpful for patients to remind their medical appointments. This is a pilot study to develop the system and test the logic system and data process. Further studies are necessary to evaluate the effectiveness and feasibility of this reminder system.

## Acknowledgements

This study was made possible by a grant from Universitas Indonesia. We thank Mr. Darsono to provide assistance in developing web and mobile application. We are also grateful for programmers, all clinic staff in KDK Kiara and patients for their valuable input. We are thankful for Department of Community Medicine, Faculty of Medicine, Universitas Indonesia to provide assistance in this study.

## References

1. Dunbar-Jacob J, Burke LE, Puczynski S. Clinical assessment and management of adherence to medical regimens. In: Nicassio M, Smith T, editors. Managing chronic illness: a biophysical perspective. Washington DC: American Psychological Association;1995.
2. Haynes RB, McDonald H, Garg AX, Montague P. Interventions for helping patients to follow prescriptions for medications. Cochrane Database Syst Rev 2002; 2: CD000011.
3. Burkhart PV, Sabate E. Adherence to long-term therapies: evidence for action. J Nurs Scholarsh. 2003;35:207.
4. Hamilton W, Round A, Sharp D. Patient, hospital, and general practitioner characteristics associated with non-attendance: a cohort study. Br J Gen Pract. 2002;52:317-9.
5. Davenport S, Goldberg D, Millar T. How psychiatric disorders are missed during medical consultations. Lancet. 1987;2:439-41.
6. Smith DL. Compliance packaging: a patient education tool. Am Pharm. 1989; NS29:42-53.
7. Currie CJ, Peyrot M, Morgan CL, Poole CD, Harrison LB, Lingvay I. Appointment and medication non-adherence is associated with increased mortality in insulin-treated type 2 diabetes. Evidence-based Medicine. 2012;18:112-3.

8. Nwabuo CC, Dy SM, Weeks K, Young JH. Factors associated with appointment non-adherence among African-Americans with severe poorly controlled hypertension. *PLoS One*. 2014;9:e103090.
9. Kusuma EW. Program pengelolaan penyakit kronis (Prolanis) – BPJS Kesehatan. 2014.
10. Atreja A, Bellam N, Levy SR. Strategies to enhance patient adherence: making it simple. *MedGenMed*. 2005;7.
11. Koshy E, Car J, Majeed A. Effectiveness of mobile phone short message service (SMS) reminders for ophthalmology outpatient appointments: observational study. *BMC Ophthalmol*. 2008;8:9.
12. Neal RD, Hussain-Gambles M, Allgar VL, Lawlor DA, Dempsey O. Reasons for and consequences of missed appointments in general practice in the UK: questionnaire survey and prospective review of medical records. *BMC Fam Pract*. 2005;6:47.
13. EMarketer. How Southeast Asia uses smartphones. Feb 17<sup>th</sup> 2016. Retrieved February 8, 2017. Available from: <https://www.emarketer.com/Article/How-Southeast-Asia-Uses-Smartphones/1013595>.
14. McLean SM, Booth A, Gee M, Salway S, Cobb M, Bhanbro S, et al. Appointment reminder systems are effective but no optimal: results of a systematic review and evidence synthesis employing realist principles. *Patient Prefer Adherence*. 2016;10:479-99.
15. Hamine S, Gerth-Guyette E, Ginsburg AS. Impact of mHealth chronic disease management on treatment adherence and patient outcomes: a systematic review. *J Med Internet Res*. 2015;17:e52.
16. Liu Q, Abba K, Alejandria MM, Sinclair D, Balanag VM, Lansang MAD. Reminder systems to improve patient adherence to tuberculosis clinic appointments for diagnosis and treatment (review). *Cochrane Database Syst Rev*. 2014;11.
17. Sari JN. Aplikasi pengingat jadwal kontrol rutin ke dokter berbasis mobile. *Jurnal Teknik Elektro dan Komputer*. 2013;1:29-33.
18. Fenerty SD, West C, Davis SA, Kaplan SG, Feldman SR. The effect of reminder systems on patients' adherence to treatment. *Patient Prefer Adherence*. 2012;6:127-35.
19. Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments. *The Cochrane Database of Systematic Reviews*. 2013;12CD007458.
20. Robotham D, Satkunanathan S, Reynolds J, Stahl D, Wykes T. Using digital notifications to improve attendance in clinic: systematic review and meta-analysis. *BMJ Open*. 2016;6(10).
21. Lin C, Mistry N, Boneh J, Li H, Lazebnik R. Text message reminders increase appointment adherence in a pediatric clinic: a randomized controlled trial. *Int J Pediatr*. 2016;2016:8487378.