

Use of a Semi-Automatic Text Message System to Improve Satisfaction with Wait Time in the Adult Emergency Department: A Cross-Sectional Survey Study

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Submitted to: JMIR Medical Informatics
on: October 26, 2021

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Abstract

Background: Many factors influence patient satisfaction during an emergency department (ED) visit, but the perception of the waiting time plays a central role. A long wait time in the waiting room increases the risk of hospital-acquired infection, as well as the risk of a patient leaving before being seen by a physician, particularly those with a lower level of urgency who may have to wait for a longer time.

Objective: We aimed to improve the perception of waiting time through the implementation of a semi-automatic text message (SMS) system that allows patients to wait outside the hospital and facilitates the recall of patients closer to the scheduled time of meeting with the physician.

Methods: We performed a cross-sectional survey to evaluate the system using a tailored questionnaire to assess the patient perspective and the Unified Theory of Acceptance and Use of Technology questionnaire (UTAUT) for the caregiver perspective. We also monitored the frequency of system use with logs.

Results: In total, 110 usable responses were collected (patients, 100; caregivers, 10). Findings revealed a very high level of patient satisfaction (97%), with most patients waiting outside the ED, but inside the hospital. Caregiver evaluation showed that it was very easy to use, but adoption of the system was more problematic because of the perceived additional workload associated with its use.

Conclusions: Although not suitable for all patients, our system allows those with a low severity sign to wait outside the waiting room and to be recalled according to the dedicated time defined in the Swiss Emergency Triage Scale. It not only reduces the risk of hospital-acquired infection, but also improves the patient experience and was perceived as a real improvement. Further automation of the system needs to be explored in order to reduce caregiver workload and increase its utilization.

(JMIR Preprints 26/10/2021:34488)

DOI: <https://doi.org/10.2196/preprints.34488>

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Keywords: emergency, patient satisfaction, service-oriented health care, quality of care

Introduction

Patients triaged with low priority in the emergency department (ED) are likely to have a long wait before being seen by a physician as those with life-threatening and serious conditions are prioritized over less acute patients [1]. A side-effect of long waiting times is the risk that patients leave the ED without being seen by a physician, with this risk increasing significantly after a one-hour wait [2]. It has also been shown that long waiting times can result in staff interruptions by frustrated patients and lead to violent behavior [3,4]. Additionally, it has been reported that a long waiting time increases the risk of contracting hospital-acquired infections [5]. As an example, Beggs et al. showed that the number of new cases of airborne infections increased dramatically with time spent in the waiting room and the number of people waiting [6]. However, reducing overcrowding in the ED waiting room is not a simple task [7]. The space available is often limited and the nature of the ED does not allow for a control on its occupation, which varies significantly over the course of a single day [8,9]. In an attempt to reduce ED congestion and the perception of waiting time, we developed a semi-automated message (SMS) system that allows patients to wait outside the emergency waiting room and to be recalled closer to the actual time of the medical consultation. In this study, we explore the perceptions of this system by patients and caregivers.

A Semi-Automatic SMS System

The system was initially developed at the pediatric department of Geneva University Hospitals (Geneva, Switzerland) [10], then adapted for the adult setting and deployed in September 2017, and finally introduced in the gynecology and obstetrics setting in 2019. It aims at improving patient flow in EDs by providing caregivers with a system to monitor the flow and ED occupancy. The system allows triaged patients with a low severity grade to wait outside the ED and to be called back by a semi-automatic recall text message (SMS) system shortly before they are to be seen by a physician. A screen available to nurses provides real-time occupancy of the emergency rooms and wait times by triage level (Figure 1).

Once triaged, each patient can be registered in the SMS system by a nurse. A screen displays the patient's key administrative information, allowing the administrative clerk to verify the validity of the patient's telephone number. The nurse estimates the length of the wait and validates the patient's registration in the system. The patient then receives a confirmation message and can leave the ED while remaining virtually in the queue. Independently of being physically present or not, all patients are moved forward normally in the queue and recalled based on their arrival time and emergency level. All registered patients waiting outside the ED are visible on a screen with a time bar individually associated with them and showing the expected time to being seen by a physician. The time bar progressively changes color on time elapsed and actions that need to be taken by the caregiver responsible for calling the patient back. A green bar indicates that no recall is needed yet since the meeting with the physician is still distant. The bar turns orange 20 minutes before the patient's scheduled return, suggesting to the triage nurse to call the patient back, without being mandatory. If the scheduled return time has passed, the bar turns red.

Dispatch of the first recall SMS is left to the discretion of the triage nurse in order to determine the most opportune time to return for the visit. If the patient does not arrive within 20 minutes of the first SMS, the system is automated to send reminder messages every 20 minutes (total of four SMS). At any time, the nurse has the possibility to interact with the system by sending a predefined message to the patient indicating that the visit is postponed due to a strong influx of patients or imminent, or that the situation has improved and an early return is possible. If the patient does not arrive despite three reminder SMS, a final fourth SMS is sent to inform him/her that the position in the queue is no longer guaranteed, but the visit still possible.

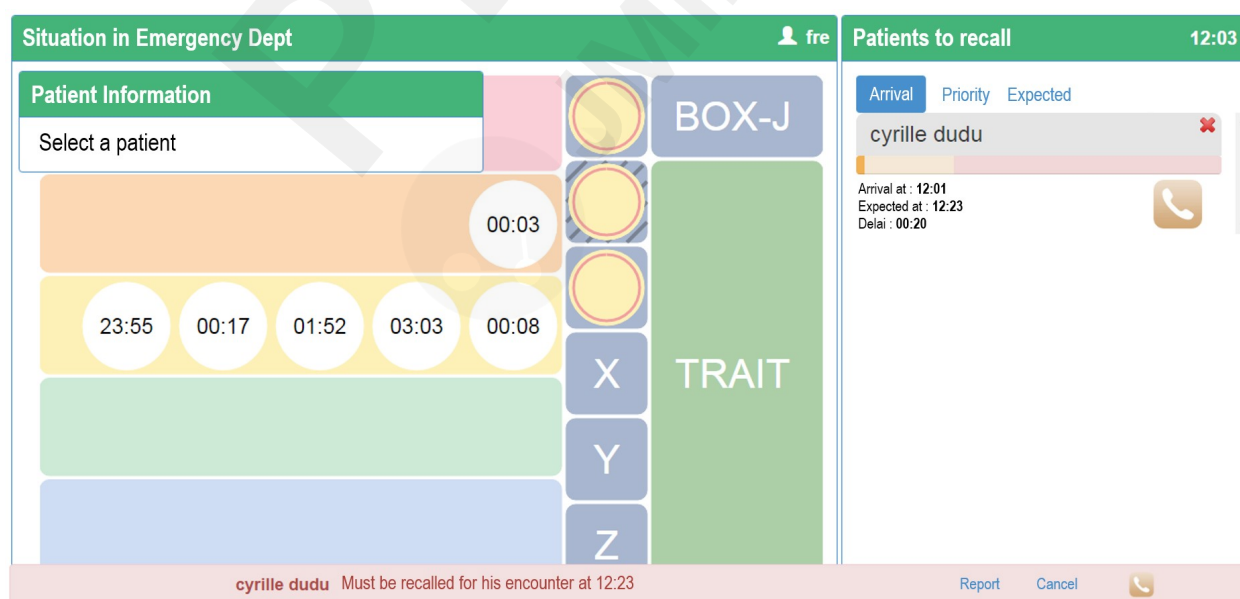


Figure 1. Main screen of the SMS recall system.

The left-hand side represents the waiting queue in the ED waiting room, with each line representing the emergency level and each circle a patient currently waiting. The vertical middle row represents the emergency rooms and their occupancy, with each patient also

represented by a circle. The right-hand side is the SMS recall system. Each patient enrolled is presented with information on his/her arrival time and expected meeting time with the physician.

Methods

Study Design

A cross-sectional, descriptive study relying on a mixed-method methodology, including an assessment of the patient experience of their wait in ED through a tailor-made questionnaire, analysis of the system log to understand the usage trend, and an assessment of nurses' acceptance of the SMS recall system. The survey was conducted between 13 March and 28 April, 2017, at the 24-hour ED outpatient unit at Geneva University Hospitals, the largest public hospital in Switzerland with 70,000 patient admissions each year.

ED Setting: Emergency Outpatient Unit

Medical and traumatic pathologies are treated in 12 consultation rooms. Patients wait in a semi-enclosed waiting room with seating, a television, water and newspapers. The staff (clinicians and nurses) are the same for the entire unit. The median length of stay is 3.5 hours, with a median waiting time of 1.5 hours.

When a patient arrives at the main ED entrance, s/he is first seen by a triage nurse who decides whether the patient is a candidate for the outpatient unit, based on the Swiss Emergency Triage Scale [11]. Level 1 is a life-/limb-threatening situation where the patient must be seen immediately by a physician. Level 2 has to be seen within 20 minutes, level 3 within 120 minutes, and level 4 is considered as non-urgent. Eighty percent of patients who come to the ED are classified as level 3 and 10% as level 4. After triage, the patient goes through an administrative registration process and is then directed to one of the subunits by following colored lines on the floor. These lead to a nurse's desk where a nurse escorts the patient to the waiting room. Whenever possible, the nurses inform patients of the estimated waiting time. As soon as a consultation room and physician are available, the patient is taken to the room by the nurse. After the medical visit, the patient can either go home or may have to undergo an additional examination and return to the waiting room. A small percentage of patients (8%) are hospitalized and 5% leave the unit without being seen by a physician.

Study Participants

Patients presenting to the ED outpatient unit were invited to participate to the study if they were at least 16 years old and French-speaking. Exclusion criteria were patients not capable of discernment (e.g., unconscious, drug users, suffering from extreme trauma, or with cognitive impairment), unable to read/understand French, with vision problems, individuals with severe pain or overly aggressive, and those who had already completed the questionnaire.

Measurement Instruments

Patient Satisfaction Questionnaire

A 12-item questionnaire was designed to assess the patient experience among those who had benefited from the SMS system. It contained an item aiming to determine the minimum waiting time that patients would like to benefit from. It also explored where the patient waited until being taken care of, whether the advertised waiting time matched the actual waiting time, and whether the content of the SMS was clear. Users were asked if they felt stressed during the wait, if they had enough time to come back to the emergency room, and if they were satisfied with the system overall.

Caregiver Acceptance Questionnaire

The 21-item Unified Theory of Acceptance and Use of Technology (UTAUT) questionnaire is a unified technology acceptance model formulated by Venkatesh et al. [10] as a conceptual framework to understand users' intended use and acceptance of new information technologies, which can be determined by 5 constructs: 1) performance efficiency (4 questions); 2) effort expectancy (4 questions); 3) social influence (4 questions); 4) facilitating conditions (4 questions); and 5) behavioral intention to use the system in the future (3 questions). Each question is scored on a 7-point Likert scale. The questionnaire was distributed anonymously to all nurses working with the system.

System Usage Logs

System use was assessed by analysis of the system usage logs. A log, including a time stamp, was generated each time a caregiver entered a patient into the SMS system, as well as each time a SMS was sent.

Procedure and Ethical Considerations

The Geneva institutional ethics committee approved the study protocol. Patient participation in the study was voluntary and oral consent was obtained prior to the intervention. After verification of the inclusion criteria, the nurse asked the patient if s/he agreed to benefit from the SMS recall system. Information about the study and confidentiality were given verbally. If accepted, the patient was allowed to wait wherever s/he wanted (i.e., in or outside the ED). We did not verify where the patient waited, as it would have been difficult to trace. We arbitrarily decided to set the number of questionnaires to be completed at 100.

Once back in the ED, the patient was immediately installed in a consultation room. The patient was given the study questionnaire by a nurse while waiting for the physician. The nurse remained available for any questions and to assist the patient in completing the questionnaire if necessary. Instructions were given to the medical staff to see the patients immediately after completion of the questionnaire. Once completed, questionnaires were collected by nurses and placed in a dedicated box in a secure room. Questionnaires were collected each morning by a scientific collaborator and responses entered into an Excel file. To link the questionnaire data to data extracted from the hospital clinical information system, we used a mapping file linking the questionnaire ID to the patient ID. Once all data were included in the Excel file, only the questionnaire ID was retained to ensure anonymous analysis.

Statistical Analysis

Patient satisfaction questionnaires were analyzed using Stata/IC 14 software [30] and an ANOVA was performed using IBM SPSS Statistics 26 software. Descriptive statistics were generated to describe the demographic and medical characteristics of participants. Variables assessed using a 5-point Likert scale were recoded into three categories: 'disagree', 'neither agree nor disagree', and 'agree'. In addition, the actual waiting time for each patient who completed the questionnaire was extracted from the hospital clinical information system. The caregiver acceptance questionnaire was analyzed by computing the proportion of each response for a given item. System logs were analyzed using the report of the number of SMS sent during the observation period. UTAUT scores were reported as the average score given to all items of a given dimension for all participants.

Results

Demographics

Patient questionnaires were distributed between March 13 and April 28, 2017, by a total of 20 nurses during two different shifts: 7h30 am to 4h00 pm and 3h00 pm to 11h30 pm. The total number of collected questionnaires was 110 (patients, 100; caregivers, 10). One patient was excluded because he visited the unit twice during the study period. The questionnaire took on average 10 minutes to be completed. Baseline patient demographics and data related to their medical encounter are shown in **Table 1**. Most respondents (87.9%) were classified with an emergency level of 3; 12.1% were classified in level 4. No patients were classified as levels 1 or 2 as these acuity triage levels require immediate care.

Table 1. Demographics of participants and information on their medical encounter.

		Mean (SD), N=100
Age (years)		38 (14.75)
Sex		
	Male	60
	Female	40
Triage level		
	3	87
	4	12
	Missing	1
Wait time		
	<1h	32
	1h-2h	45
	2h-3h	14
	3h-4h	8
	>4h	1

Patient Satisfaction Questionnaire

Table 2. Questionnaire results.

		n (%), N=100
Where did you spend your time while waiting?		
	At home	2 (2)
	Outside the hospital	13 (13)
	Inside the hospital	80 (80)
	Other	6 (6)
How do you rate your actual wait time compared to the wait time announced by the nurses?		
	Superior	25 (25)
	Inferior	49 (49)
	Equal	25 (25)
	Not informed	1 (1)
The SMS content was clearly understandable?		
	Totally agree	72 (72)
	Partly agree	23 (23)

	Neither agree nor disagree	4 (4)
	Partly disagree	1 (1)
	Totally disagree	0
Did you experience a feeling of stress linked to your absence from the emergency waiting room?		
	Totally agree	8 (8)
	Partly agree	10 (10)
	Neither agree nor disagree	11 (11)
	Partly disagree	22 (22)
	Totally disagree	50 (50)
Did you have enough time to return to the emergency room after receiving the recall message?		
	Totally agree	59 (60)
	Partly agree	33 (33)
	Neither agree nor disagree	4 (4)
	Partly disagree	2 (2)
	Totally disagree	0 (0)
How did you return to the emergency room after receiving the recall message?		
	On foot	86 (86)
	Public transport	8 (8)
	Private transport	2 (2)
	Other	4 (4)
Are you satisfied with the SMS recall service?		
	Totally agree	75 (75)
	Partly agree	22 (22)
	Neither agree nor disagree	3 (3)
	Partly disagree	0
	Totally disagree	0
Were you satisfied with your waiting time?		
	Totally agree	28 (28)
	Partly agree	28 (28)
	Neither agree nor disagree	20 (20)
	Partly disagree	12 (12)
	Totally disagree	11 (11)

Results show that 97% of patients were satisfied with the SMS system. Among these, approximately 75% were totally satisfied with their waiting time and 56% were satisfied. Most patients waited outside the ED, but inside the hospital (79%) as the facility offers the possibility to wait in pleasant places such as the cafeteria, adjacent green spaces, and the meditation room. The fact that patients waited close to the ED is confirmed by the fact that 87% of patients returned to the ED on foot. Therefore, all patients had sufficient time to return to the ED once recalled (94%). Ninety-five percent of patient considered that the SMS was clear and 72% did not feel particularly stressed waiting outside the ED.

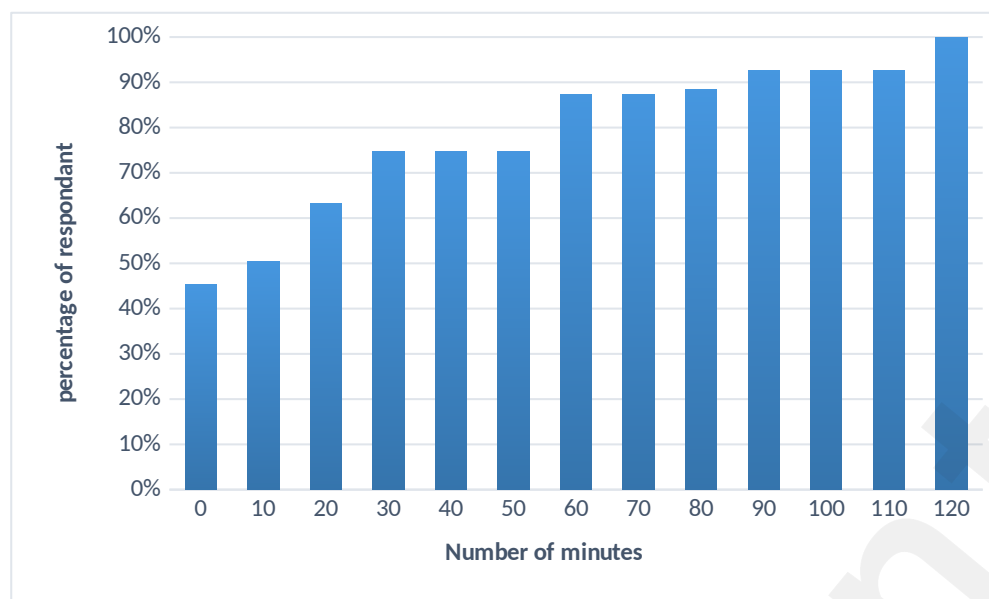


Figure 2 Percentage of participants interested in benefiting from the SMS system after n minutes.

Regarding the minimum amount of time before benefiting from the system (**Figure 2**), we found that almost one-half of patients (45%) were interested in the system, regardless of the waiting time. After 30 minutes of wait time, 75% of the participants were interested in the system and 87% after 1 hour.

Satisfaction and Waiting Time

To determine whether waiting time influenced the level of patient satisfaction with the SMS system, we assessed whether the differences in mean waiting time across the five wait time satisfaction modalities (i.e., totally disagree, partly disagree, neither agree nor disagree, partly agree, totally agree) were statistically significant (**Table 3**). Since the homogeneity of variance using Levene's test was not statistically significant ($P=.42$), meaning that the variances were equal across groups, an ANOVA was performed. We found no differences between wait time means as a function of wait time satisfaction ($P=.32$).

Table 3. Average wait duration according to user satisfaction with waiting time.

Satisfaction with waiting time	Average wait, min	N	Standard deviation
Totally disagree	86.9091	11	64.28
Partly disagree	105.0833	12	58.78
Neither agree nor disagree	101.5000	20	58.06
Partly agree	98.3929	28	47.88
Totally agree	75.0357	28	46.22
Total	91.9495	99	53.10

Caregiver Acceptance Questionnaire

The UTAUT questionnaire distributed to all nurses using the system was completed by 10 nurses (20% participation rate) (**Table 4**). Nurses emphasized the good ergonomics of the system as they rated 'effort expectancy' with an average score of 6.0. This was also confirmed by the 'facilitating condition' dimension, including the resources and knowledge necessary to use the system, which were ranked above 5. 'Behavioral intention' was high as most users intended to use the system frequently in the future on a daily basis. The expected gain on 'performance' was less obvious for

respondents. Although most users found the system useful (4.5), they did not find that the system increased their productivity (3.2) or speed at work (3.0). Hedonic motivation ranked below 4 as users did not find the system enjoyable to use or fun. Finally, social influence scored the lowest (2.3) as all users did not observe a positive influence of their peers or hierarchy towards the use of the system.

Table 4 Score distribution for each UTAUT dimension.

UTAUT dimension	1	2	3	4	5	6	7	AVG
Performance expectancy	3%	39%	12%	12%	15%	12%	6%	3.6
Effort expectancy	0%	7%	0%	7%	14%	20%	52%	6.0
Social influence	63%	0%	0%	21%	11%	0%	5%	2.3
Facilitating condition	2%	7%	2%	15%	27%	15%	32%	5.3
Hedonic motivation	21%	21%	13%	17%	8%	8%	13%	3.5
Behavioral intention	0%	7%	10%	13%	20%	20%	30%	5.3

Log analysis

Figure 3 shows the number of unique patients entered into the SMS system since its introduction on 1 October 2017 to 31 August 2019. Although not always continuous, there was a clear trend of an increase in system use over time, ranging from 46 patients enrolled in November 2017 to 546 in July 2019.

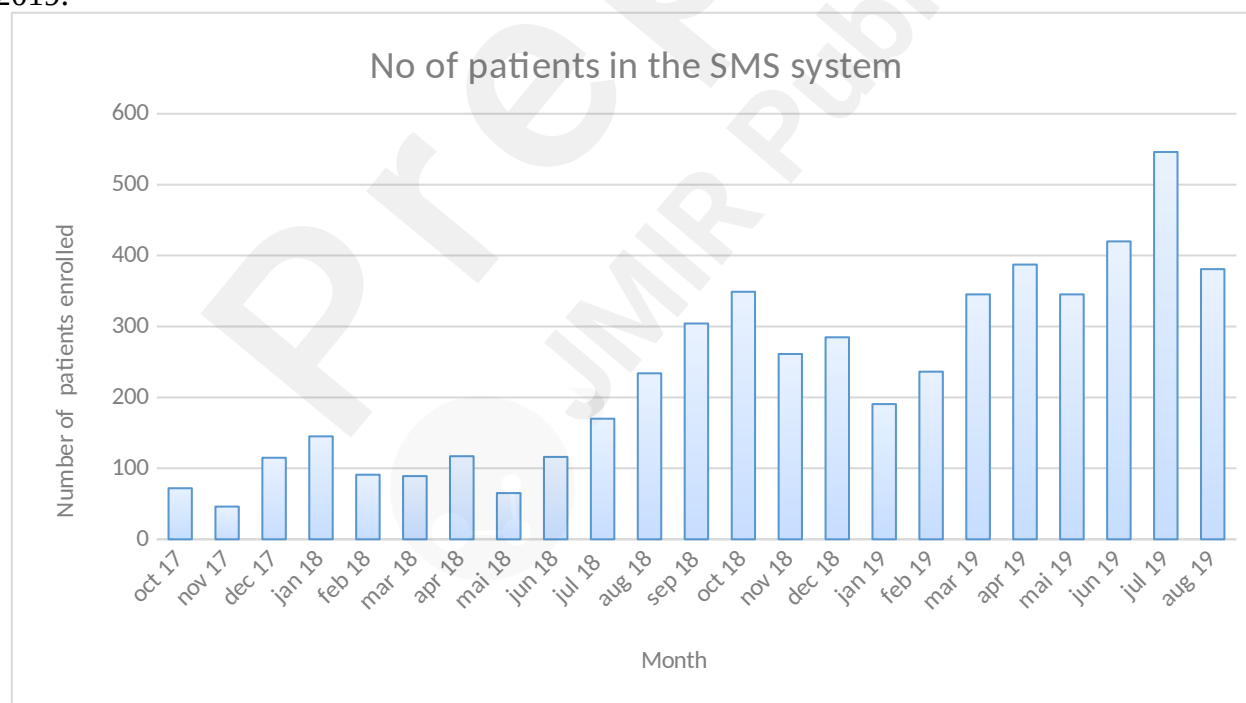


Figure 3 Number of unique patients enrolled into the SMS system each month (1 October 2017 to 31 August 2019).

Discussion

In this study, we found that the majority (87%) of patients with low-to-moderate urgency were interested in waiting outside the ED waiting room when the expected waiting time was 1 hour or more. In a previous study, we observed that patients perceived the wait to be acceptable if it did not

exceed 1 hour [13]. After 2 hours, they preferred to leave the ED before seeing a physician [14]. We observed that waiting outside the emergency room was perceived as a source of stress for <20% of participants, possibly related to the perceived reduced control over the situation when outside the room. Indeed, patients waiting outside the waiting room have no view on the current situation and can easily imagine being forgotten by ED staff [15]. Patients may also be concerned that their condition may worsen [16]. Thus, it may be worthwhile to send a recall message at regular intervals to indicate the patient's current place in the waiting queue in order to reassure them about their position and progression of the ED process [17]. This type of concern has already been highlighted in another report showing that some patients want to remain visible to the caregiver so as to avoid being 'forgotten' [18].

We also observed a reduced influence of the average waiting time on patient satisfaction, whereas we might have expected that longer waiting times would lead to significantly less satisfied patients [19]. This may indicate that patients are less concerned about the length of wait if they can wait in another location than in a waiting room where they have little to do but remain seated until they are taken care of. This well correlates with our results indicating that most patients were willing to use the system if the wait was longer than 1 hour.

Use of the system by the nursing staff began at low frequency, but increased steadily over time. Nurses' initial reaction to the system was negative or neutral [20,21] and they initially perceived the tool as an additional burden to their workload. Use of the system by some early adopters demonstrated the benefits of the tool, such as reduced interruptions due to impatient patients and reduced aggressive behavior in the waiting room [22]. However, informal feedback from nurses using the system highlighted the difficulty of using it when the ED was crowded. This is probably due to the fact that busy nurses have less time to use the system in addition to regular duties. This results in a contradictory effect that prevents the system from being used when it would be most useful. There are two solutions that can be considered to deal with this problem. Either the system can be used by administrative staff or the system can be automated. At our institution, the drive to develop this system has been a top-down process and we plan to hire administrative workers to offload these tasks from nursing staff.

Limitations

The selection of patients on the basis of their interest in using the SMS system must be taken into account as it certainly has an impact on the high satisfaction rate, as well as on the low stress rate related to a wait outside the ED. Indeed, a patient with a high stress level could refuse to benefit from the system. Unfortunately, we did not record the acceptance rate of the system and it would have been interesting to see how many patients refused the system and preferred to stay in the waiting room. The low participation rate of nurses is also a limitation and it will be useful to conduct a further survey following training of administrative staff to take over tasks.

Conclusions

Waiting in the emergency waiting room is a source of frustration for the patient. In addition to the increase of an aggressive attitude in some patients when the ED waiting room is crowded, it also puts patients at risk of hospital-acquired infections. We observed a high level of satisfaction with our semi-automatic SMS recall system allowing a wait outside the ED, but a more difficult adoption by nurses. Relying on further automation of the system may be an interesting solution to reduce caregiver workload, but this must be done with caution given the high unpredictability of the ED waiting process.

Acknowledgments We are grateful to Rosemary Sudan (freelance technical editor) for providing editorial assistance.

Authors' Contributions All authors contributed to the conception, design, analysis, and interpretation of data for this work. All authors contributed to drafting, revising, and approving the final version of the manuscript.

Conflicts of Interest None declared.



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Figure legends

Figure 4. Main screen of the SMS recall system.

The left-hand side represents the waiting queue in the ED waiting room, with each line representing the emergency level and each circle a patient currently waiting. The vertical middle row represents the emergency rooms and their occupancy, with each patient also represented by a circle. The right-hand side is the SMS recall system. Each patient enrolled is presented with information on his/her arrival time and expected meeting time with the physician.

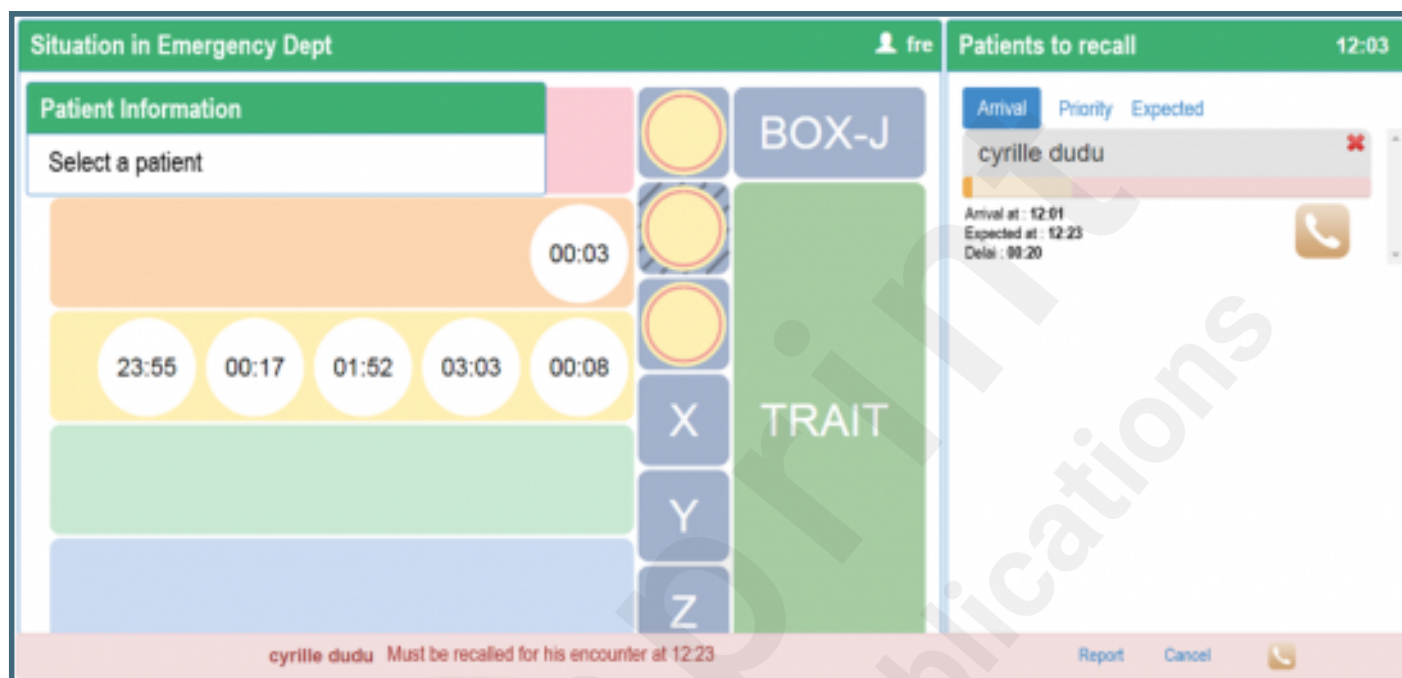
Figure 5 Percentage of participants interested in benefiting from the SMS system after n minutes.

Figure 6 Number of unique patients enrolled into the SMS system each month (1 October 2017 to 31 August 2019).

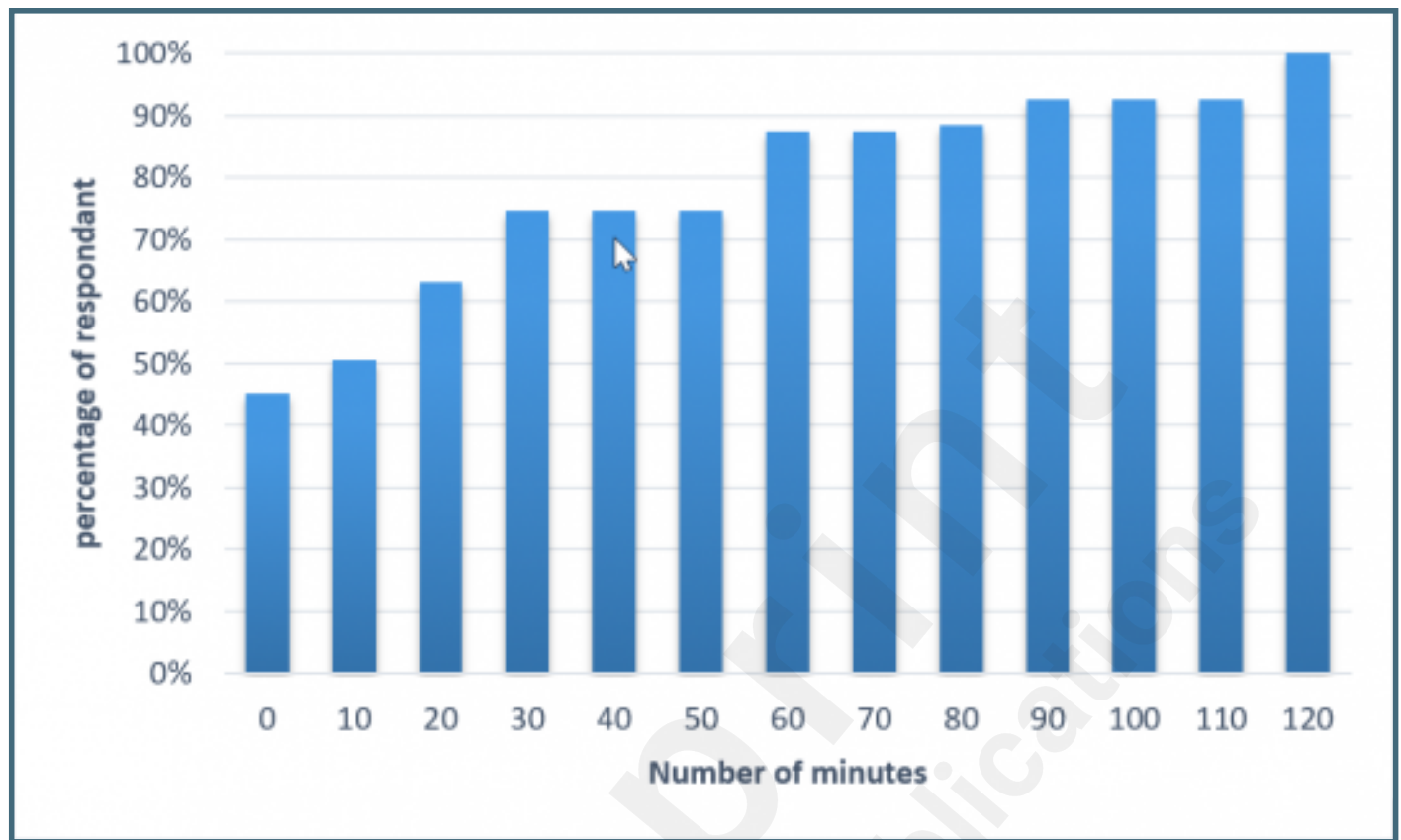
Supplementary Files

Figures

Main screen of the SMS recall system. The left-hand side represents the waiting queue in the ED waiting room, with each line representing the emergency level and each circle a patient currently waiting. The vertical middle row represents the emergency rooms and their occupancy, with each patient also represented by a circle. The right-hand side is the SMS recall system. Each patient enrolled is presented with information on his/her arrival time and expected meeting time with the physician.



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