


Text Messaging (SMS) Helping Cancer Care in Patients Undergoing Chemotherapy Treatment: a Pilot Study

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Abstract Cancer treatment is an extremely stressful life experience that is accompanied by a range of psychological, social, physical, and practical difficulties. Cancer patients need to receive information that helps them to better understand the disease, assists them in decision-making, and helps them deal with treatment. Patients are interested in receiving such information. The degree of satisfaction with the information received has been associated with positive health outcomes, specifically regarding quality of life, severity of side effects, and psychological well-being. This study investigates a method of guiding cancer patients, in relation to outpatient chemotherapy treatment, using SMS (short message service) text messaging. A smartphone application called cHEmoTHErApp was developed, and its primary function is to send out SMS text messages with guidance for self-care and emotional support for oncology patients undergoing chemotherapy. Thus, the main objective of this study is to evaluate the acceptance and perception of patients of the receipt of these SMS messages, as well as to evaluate the possible benefits reported by the participants. Adult patients diagnosed with cancer, who started the first outpatient chemotherapy treatment scheme between August and November 2016 at the School Hospital (HE) of the Federal University of Pelotas (UFPEL), were invited to participate in this pilot study. In total, 14 cancer patients were adherent to this study. Each of

these patients received a daily text message on their cell phone with some guidance on encouraging self-care and emotional support. Patients reported that, because of the SMS text messages they received, they felt more confident in their treatment, felt more supported and encouraged, and that the text messages facilitated self-care. In addition, patients reported that the SMS text messages they received helped them to take better care of themselves and to continue further treatment.

Keywords Intervention · Self-care · Text messages · Patient education · Cancer care

Introduction

Chronic diseases require constant monitoring and treatment [1], as well as incur the highest costs in health systems and the greatest reductions in productivity [2, 3]. Cancer represents one of the major public health problems in many countries, with more than 14 million new cases diagnosed and more than 8 million annual deaths [4]. In Brazil, this disease was responsible for over 189,000 deaths in 2013 alone, and it is the second leading cause of death, preceded by heart disease. The estimate for 2017 is of, approximately, 600,000 new cancer cases nationwide [5].

Chemotherapy is one of the principal options for the treatment of cancer, and it is used to eradicate neoplastic cells through the administering of drugs, and can be applied in combination with radiotherapy or surgery. However, the available antineoplastic drugs do not specifically act on tumor cells, which often causes the elimination of healthy cells [6]. Consequently, it can cause toxicity to the organs, inducing side effects such as fever, nausea, vomiting, fatigue, diarrhea, mucositis, pain, among others [2, 7–11]. The presence of at least one of these symptoms in medium or even severe degrees

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is almost universal among oncologic patients, and many of them present multiple symptoms [2, 10, 12].

Cancer patients are interested in receiving information that helps them better understand cancer, make decisions, and deal with their treatment [13]. Above all, patients wish to receive as much information as possible regarding the management of side effects [11]. Also, several studies have highlighted the need for emotional and psychological support for cancer patients as well [14–17]. The degree of satisfaction that oncology patients express about the information they receive has been associated with positive health outcomes, specifically regarding quality of life, performance status, side effects, and psychological well-being [18–23]. However, some studies report that patients received little information from the health team about the management of treatment-related side effects [2, 24].

The mobile phone is cited as the most widely adopted technology on the planet [25, 26]. The ubiquity and capabilities of this type of mobile telecommunication technology has spawned a rapidly growing line of research and practice in the health care field, called mHealth (mobile health). mHealth has the potential to transform the face of health service delivery across the globe [27], and can play an important part in managing and delivering care to cancer patients including managing side effects [28]. One of the most used features in mHealth is text messaging (SMS), since this technology is one of the most used functions in mobile phones, representing one of the most used communication methods in the world [29]. Several studies concluded that SMS text messages can serve as a tool to support patient self-management [30–32]. Also, SMS text message interventions are capable of producing positive change in the form of preventive health behaviors [33].

There is a need to build mHealth innovations with a focus on cancer care, particularly in low and middle-income countries [34]. This project is in line with mHealth practices, focusing on the development of a smartphone application called cHEmotHErApp, which has the primary function of sending out SMS text messages with self-care guidelines for cancer patients in outpatient chemotherapy. The main objective of this study is to evaluate the acceptance and perception of patients regarding the content of these SMS messages, and to verify possible reported benefits on receiving such messages.

Methodology

cHEmotHErApp

The app cHEmotHErApp was developed for the Android platform using Android Studio and Java, and its main feature is automatically sending text messages to patients with

guidelines that promote self-care and emotional support. The cHEmotHErApp requires Android 4.1.2 or higher.

For each patient, the app allows for the registration of their personal data, chemotherapy schedules and orientations that will be sent via SMS text messages. In the patient record, it is registered their name, gender and cell phone number. There is also an option to inactivate the messaging, which is necessary for situations in which the patient dies or completes the treatment.

To register a patient's schedule in the app, the patient is selected, followed by the indication of the date and hour of every outpatient chemotherapy schedule. In the registration of the orientations, the messages to be sent to the patients are parameterized, the orientations are described and the periodicity of the messaging is configured (initial day and final day are set in relation to how many days are left for scheduling). Once each patient is registered, cHEmotHErApp sends a text message to their cell phone, informing that they will receive daily guidelines on his treatment through free SMS messages.

The patients can access these text messages on their own cellphones, using the native SMS app. They will not need access to the Internet to receive the text messages, as the SMS technology does not require it.

The data model of cHEmotHErApp has 4 tables (Fig. 1). The patients table is used to store the patients' data. The patientSchedule table is used to store the patients' schedules data. The orientations table is used to store the messages that will be sent to the patients. The textMessageSent table is used to store all text messages that have been sent to the patients.

All SMS text messages sent by cHEmotHErApp are also stored in the native SMS app on the smartphone with cHEmotHErApp installed. In the case that any text message sent by cHEmotHErApp is not received by the patient, an error sign is shown in the native SMS app. This way, it is possible to resend the message not received to the patient. Additionally, a team member of this research project was registered as a patient on cHEmotHErApp to verify if the messages were being received daily, however he was not included in the analysis of patients in this study.

Algorithm for sending text messages with orientations about the treatment

The algorithm for sending text messages is based on the scheduling date of each patient (Fig. 2). Every day, for each registered and active patient, cHEmotHErApp verifies how many days are left for scheduling, then randomly selects one of the messages recorded in the register that are configured to be sent in the remaining days before schedule. In addition, cHEmotHErApp does not repeat the same message within a span of 45 days.

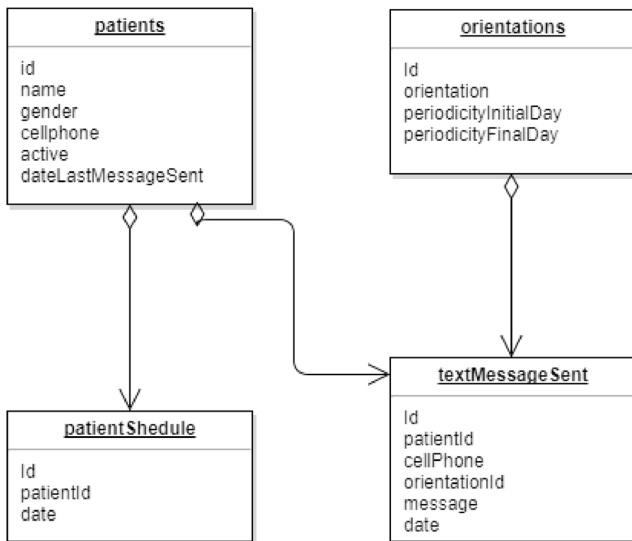


Fig. 1 Data model of cHEmoTHERapp

Elaboration of the text messages

The text messages containing the orientations sent to the patients were elaborated in simple, clear, and objective language, in order to facilitate interaction with the patients. These messages were based on guidelines from the National Cancer Institute [5], as well as international cancer manuals [35] and

were prepared by a multidisciplinary team, with the support of the medical and nursing team of the oncology service of the School Hospital (HE) of the Federal University of Pelotas (UFPeL). The messages elaborated have guidelines on water intake, hygiene care, food, and physical activity. In addition, text messages were elaborated that focused on emotional support and prevention and management of the side effects such as: nausea, vomiting, diarrhea, intestinal constipation, loss of appetite, and altered taste. Many of the elaborated text messages contained words of support, encouragement and caring, providing emotional support to the patients in this study (Fig. 3).

The text messages are tailored, as cHEmoTHERapp has been programmed in a way that it is possible to automatically customize the message to contain the patient’s name. When including a message in the registry of orientations to be sent to patients, a signal (#name) is used to indicate the app that it has to be replaced by the patient’s name. This way, when the app sends the patient a message that contains #name, the app replaces #name with the patient’s name. Another customization that the app contemplates is checking the current day of the week and thus wish the patient, for example, a good weekend (when it is Saturday or Sunday), or a good Monday (when Monday).

Tailored messages are more effective than untailored messages, because the patient feels special, being addressed by his or her own name [36].

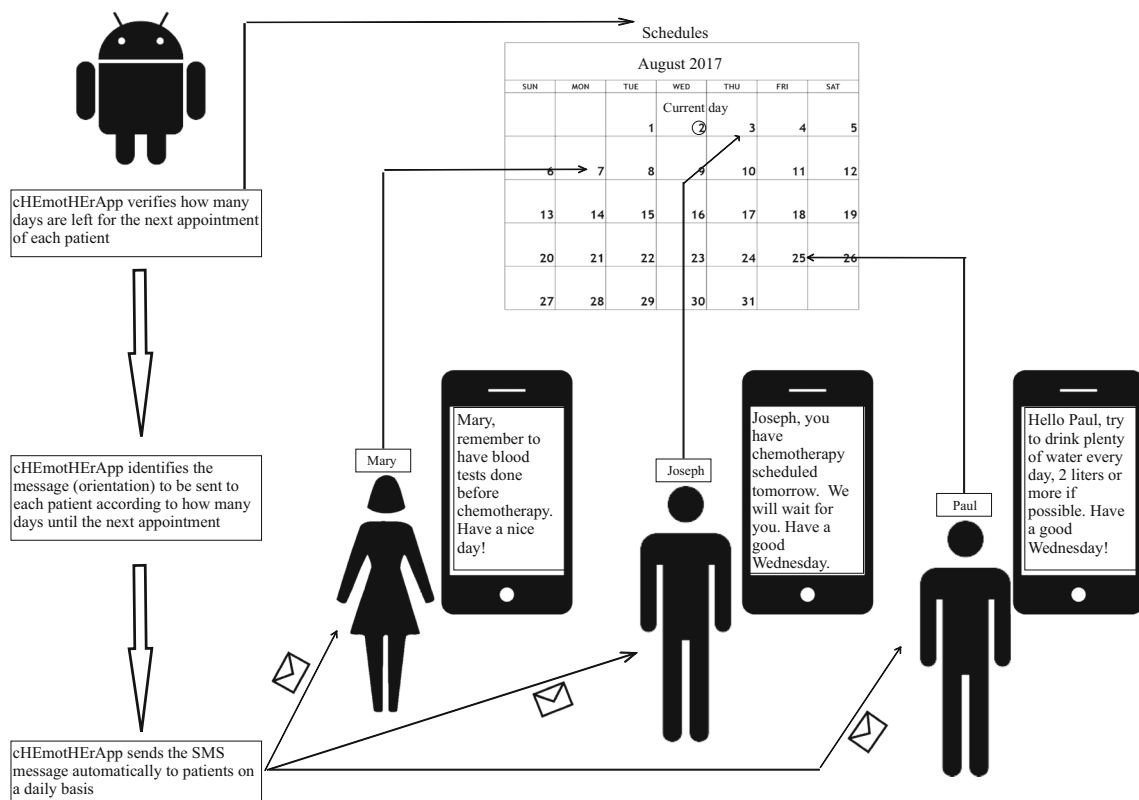
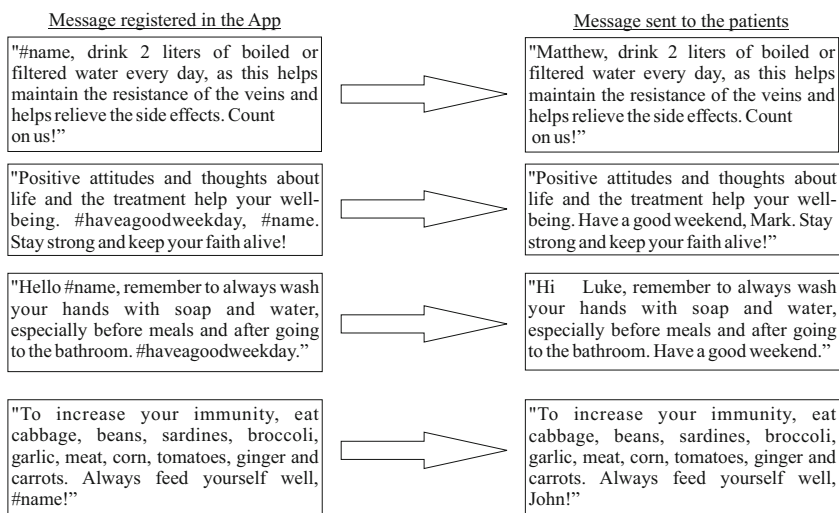


Fig. 2 Example of the algorithm for sending text messages

Fig. 3 Examples of text messages sent to the patients



Characteristics of the study site

Pelotas is a municipality located in the southern region of the state of Rio Grande do Sul in Brazil, with a population of approximately 343,000 inhabitants it is considered the third most populous city in the state. The present study was performed at the Oncology Service (Chemotherapy) of the HE/UFPel. This hospital has full capability to execute projects related to new actions and policies directed to SUS (Unified Health System), since it is a reference in the area of oncology and it is supported 100% by SUS, as well as characterized as a sentinel hospital. In addition, HE/UFPel serves patients from 22 municipalities.

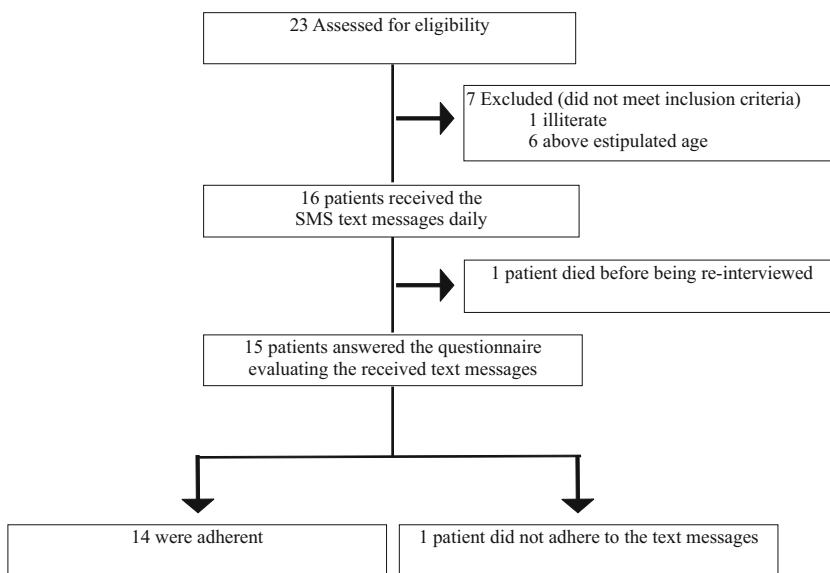
Adult patients (18 to 70 years of age) diagnosed with cancer, who started the first outpatient chemotherapy treatment scheme between August and November of 2016 in HE/UFPel, were invited to participate in the study (Fig. 4). Participants

needed to have their own cell phone, be literate and be able to speak and read in Portuguese. All participants also needed to sign the Free and Informed Consent Form. The study was enrolled in ClinicalTrials.gov with the identification number: NCT03087422.

Questionnaires and interview with patients

To achieve the study’s objectives, a questionnaire was developed to identify patients’ perceptions regarding the received text messages. The questions in this questionnaire were to identify the following items: whether the patient read the messages received on a daily basis (yes or no), whether they understood the message guidelines (yes or no), whether they had difficulty implementing the orientations (yes or no), followed all the orientations (yes or no), if the messages were considered to be helpful in their treatment (yes or no): the reason the

Fig. 4 Flowchart of enrollment, and follow-up of study participants



messages helped the treatment (open answer), if the messages were considered to have any benefit (yes or no); and the benefit of messages (open answer), and the level of satisfaction of the messages received (very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied).

The first interview with each patient of the study was performed at the time of the first chemotherapy session. In this interview, the research project was explained to the patient, informing that they would receive daily instructions regarding the treatment through SMS text messages. The patients then answered the socio-demographic questionnaire (age, sex, schooling, and marital status) as well as signed the Free and Informed Consent Term of the research. The type of cancer of each patient was verified directly in the medical records of the HE/UFPEL Oncology Service. The patients were re-interviewed after completing 1 month of treatment, responding to the questionnaire evaluating the text messages.

Results

Fourteen patients were adherent to the messages participating effectively, reporting that they had read the received text messages daily and followed all the orientations received. A patient over 60 years old did not adhere to the text messages. According to her, the reason for not having joined was having been hospitalized after starting the treatment. In addition, she reported that she only used cell phones sporadically. However, a few months later the patient was encountered by the researcher and she reported having read all the messages. However, she was not counted among the adherents, because at the time of the interview she reported not to have been reading the text messages during the study.

The profile of each adherent patient is shown in Table 1. The average age of participants on the study was 44 years old. The majority of participants were female (64%). All adherent patients reported having understood the content of the messages, without difficulty in executing them. All participants in this study considered that the text messages received helped them to cope with treatment, as they felt that these messages benefitted them (Table 2).

When asked why messages helped and provided benefits, some patients reported that they felt more confident in treatment, felt supported and encouraged, and that messages facilitated self-care. Other patients reported that, through text messages, they received new information about self-care, and that the messages helped them to take better care of themselves. Some patients also reported that they received certain orientations solely through the text messages, not receiving them personally by the treatment team. In addition, some patients reported that they were helped psychologically by receiving text messages.

Regarding the satisfaction in receiving the messages, 13 patients reported being very satisfied, and one patient reported being satisfied. In addition, the 14 adherent patients reported that they would recommend these text messages to other patients initiating chemotherapy for cancer.

Discussion

Several approaches using the method of text messaging (SMS)-based communication have been used on cancer, both in preventive measures [37–40] and in clinical care situations [41, 42]. However, only one study using the SMS-based communication method to guide cancer patients on chemotherapy

Table 1 Characteristics of the adherent patients

Patient	Sex	Age	Marital status	Educational level	Cancer type
1	F	27	Married	Higher, complete	Hodkin’s lymphoma
2	F	28	Married	Primary, incomplete	Cervical
3	F	38	Single	Primary, incomplete	Cervical
4	F	48	Divorced	Primary, incomplete	Breast
5	F	51	Married	Primary, complete	Pulmonary
6	F	53	Single	Primary, incomplete	Ovarian
7	F	54	Married	Higher, complete	Ovarian
8	F	54	Widowed	Secondary, complete	Hodkin’s lymphoma
9	F	68	Married	Primary, incomplete	Breast
10	M	21	Single	Higher, incomplete	Testicular
11	M	24	Single	Primary, incomplete	Testicular
12	M	49	Married	Primary, incomplete	Cervical
13	M	50	Married	Secondary, complete	Head and Neck
14	M	56	Married	Primary, incomplete	Tongue

Table 2 Reports of patients regarding the incoming text messages

Patient	Reports from patients about the benefit of incoming text messages
1	Some guidelines were received only through the text messages. The text messages I received helped me stay more informed.
2	The text messages I received helped me psychologically, and they reminded me to do things.
3	The received text messages made me feel more confident in the treatment, and to face it without fear. The text messages also helped me remember the orientations. I wrote down all the text messages I received and passed it to a friend who had already done chemotherapy treatment for cancer. She liked the text messages a lot, and said that, at the time she did the treatment, she did not have this text message project.
4	I feel encouraged and stimulated when I receive the text messages.
5	The text messages helped me take better care of myself, and act better.
6	I received new information through the text messages. Text messages helped guide me.
7	I was encouraged by receiving the text messages. The text messages also reminded me of self-care orientations.
8	By receiving the text messages I felt advised, supported and encouraged. I received new information through the text messages.
9	The text messages reminded me to drink water, and other orientations. I received a lot of information solely through text messages, not being personally received from the treatment team.
10	The text messages reminded me to implement the orientations, and facilitated self-care and treatment.
11	The text messages I received reminded me of all the orientations.
12	Received text messages clarify doubts and are informative. The text messages give me self-esteem and security. I try to follow all the directions received the same day.
13	The received text messages do not let us forget anything, they are informative.
14	The received text messages helped me to remember things, and explain why to do these things.

treatment regarding the management of side effects was found in the existing literature. Yap et al. [41] developed a teleoncology service using SMS text messages to monitor the symptoms of nausea and vomiting of cancer patients in a Singapore hospital. These symptoms were monitored daily for 5 days after chemotherapy, through questions sent to the patient by text messages. The text messages contained several options related to the frequency and intensity of nausea and vomiting which patients were required to respond to by indicating the number of the option that best represented the symptom being experienced. According to the patient's response message, new information was sent via text messages, orientating the patient to take specific medication, if that was what was called for. Depending on the intensity of the indicated symptom, the teleoncology service developed would alert a pharmacist to communicate with the patient. Most of the patients participating in this study considered the information sent by SMS useful, especially those patients with a low level of formal education or no experience in chemotherapy. In addition, the majority of patients were satisfied regarding the monitoring of nausea and vomiting symptoms via SMS.

The present work differs from the work of Yap et al. [41] for three main reasons. Firstly, our project sends daily text messages with a preventive and management approach in relation to several side effects. The work presented by Yap et al. [41] had no preventive focus and only monitored the symptoms of nausea and vomiting. Secondly, this paper, in addition

to sending text messages focused on prevention and management of side effects, also sends emotional support messages to the patient, making them feel more welcomed and accompanied by the service, as noticed on their reports (Table 2). Finally, this project has implemented an app that sends daily text messages automatically. The teleoncology service presented by Yap et al. [41] was not implemented by an automated system, which makes it difficult to implement it on a large scale.

Limitations to our pilot study design include a small sample size and a lack of a control group. However, the purpose of conducting a pilot study is to examine the feasibility of an approach that is intended to be used in a larger scale study [43]. A potential limitation to the use of SMS text-message-based interventions is the potential marginalization of certain populations, such as those that are illiterate. Reduced visual acuity could be a potential limiting factor, making reading the text messages difficult. Also, unfamiliarity with SMS text messaging technology is another limitation, particularly in senior citizens.

Modern communication technologies can help promote well-being [44]. This work presented cHEmotHErApp, an app that contributes in the form of a tool based on mHealth to guide cancer patients throughout chemotherapy treatment, especially in relation to emotional support, management and side effect prevention. The results indicated acceptance of the patients of the messages received. In addition, all patients who

received the text messages reported that the messages received helped them to cope with their treatment. Thus, the text messages received on a daily basis made them feel more cared for, accompanied and safe during their treatment process.

Conclusions

This work presented an evaluation of a pilot study using cHEmotHERApp, an application that sends SMS text messages daily to cancer patients, with orientations that help in chemotherapeutic treatment. All patients participating in the study reported that receiving text messages helped them cope better with treatment because they received useful self-care information about treatment through text messages.

The main goal of cHEmotHERApp is to serve as a tool to support patient education regarding their treatment, with daily orientations regarding self-care and emotional support. The proposal presented in this study is unique, and was well accepted, thanked and congratulated by all adherent patients, since they felt more oriented, encouraged, welcomed and accompanied. Communication via SMS text messaging is appropriate as a tool for improving health services, as this communication medium is of low cost and available on the vast majority of mobile phones.

In future work, our team will investigate through a randomized controlled trial using cHEmotHERApp if the text messages will help reduce the side effects and the levels of anxiety and depression in patients. The intervention will be proposed for use in other hospitals, if it proves to be effective, giving more educational support to oncological patients in outpatient chemotherapy through orientation via SMS text messages.

Compliance with Ethical Standards

Conflict of Interest Authors have no conflict of interest to declare.

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