Title: Perceptions and acceptability of SMS text messaging for diabetes care in primary care in Argentina: An exploratory study

Abstract

Background: Engagement in self-care behaviors that are essential to optimize diabetes care is challenging for many patients with diabetes. mHealth interventions have shown to be effective in improving healthcare outcomes in diabetes, however more research is needed on patient perceptions to support these interventions, especially in resource settings in low- and middle income-countries.

Objective: To explore perceptions and acceptability of a Short Message Service (SMS) text messaging intervention for diabetes care in underserved people with diabetes in Argentina.

Methods: A qualitative exploratory methodology was adopted as part of the evaluation of a program to strengthen diabetes services in primary care clinics located in low resource settings. The program included a text messaging intervention for diabetic patients. A total of 24 semi-structured telephone interviews were conducted with diabetic patients.

Results: Acceptability was considered adequate in terms of its actual use, frequency and role of SMS as a reminder. We found that SMS could be a "mediating device" in the patient’s learning processes. Also, being exposed to the SMS would seem to help bring about changes in risk perception and care practices and for psychosocial support. Another relevant finding was the role of the text message as a potential facilitator in diabetes care. In this sense, we observed a strong association between receiving text messages and having a better patient-physician relationship. Additionally, social barriers that affect diabetes care such as socioeconomic and psychosocial vulnerability were identified.

Conclusions: Our findings show positive contributions of the SMS intervention in the care of people with diabetes. We consider that the SMS strategy has potential to be replicated in other contexts. However, further studies are needed to explore its sustainability and long-term impact from the perspective of patients.

Keywords. Mobile phones; Short Message Service; Diabetes Mellitus; Public health; Qualitative research

Introduction

Background

Diabetes mellitus is a leading cause of death worldwide with marked regional variation, (1) resulting in a significant public health problem [2, 3] The global prevalence in adults was about 8.8% in 2015 and is predicted to rise to 10.4% by 2040 and 81.1% of undiagnosed persons live in low and middle-income countries [4]. In Argentina, the prevalence of diabetes increased from 8.4% to 9.8% between 2005 and 2013. In addition, an increase in diabetes mellitus-related deaths was observed in the group of people older than 25 years [5, 6].
Persons with diabetes are recommended to have periodic contacts with health providers and engage in self-care behaviors such as: following a diet, taking medications, engaging in regular physical activity, and blood glucose self-monitoring [7, 8]. These aspects of diabetes self-management are essential to optimize diabetes care, improve health outcomes and prevent long-term complications [9, 10]. However, many people find these behaviors difficult to achieve and maintain [11]. In fact, only 3.8% of Latin-American patients with type 2 diabetes included in the International Diabetes Management Practice Study (IDMPS) achieved the recommended treatment goals of A1c <7%, LDL cholesterol 100 mg/dl and blood pressure ≤130/80 mmHg [12]. Patients need support from health care professionals to achieve these goals and given the increasing prevalence of type 2 diabetes in low and middle-income countries (LMIC), there is a need for innovative and effective ways to deliver self-management support interventions[13] between clinical encounters in resource constrained health care systems. In this sense, interventions delivered via mobile phone text messaging have the potential to improve care with chronic diseases like type 2 diabetes [14-16] because unlike other technologies, mobile phones have a high penetration among low-income groups.

Although mobile health (mHealth) interventions have shown to be effective in improving healthcare outcomes in diabetes [17-20], evidence about the likely uptake, best strategies for patient engagement, efficacy or effectiveness, and costs should guide the adoption of new technologies. Research on mHealth implementation is limited, and further research into these issues is needed. Also, there are significant information gaps regarding long-term effects, participant and provider’s acceptance, behavioral outcomes, costs, and the risks of such interventions with a focus in low and middle-income countries [21].

Latin America is in the process of expanding Information and Communication Technologies (ICT), observing an increase in the mobile network penetration [22]. The high prevalence of mobile phone availability, access, and use in low resource settings offers a context in which it is possible to use these devices to improve health care delivery.

This study was conducted as part of a program to strengthen diabetes care in primary care clinics that include an mHealth intervention to support diabetes care for underserved populations [23]. To our knowledge, no study has been published in the region of diabetic patient experiences with an Short Message Service (SMS) intervention operating in routine clinical practice in low resource settings.

The aim of our study was to explore the perceptions and acceptability of a Short Message Service (SMS) text messaging intervention for diabetes care in underserved diabetic patients in Argentina.

**Diabetes Care Program**

The Diabetes Care Program was implemented in primary care clinics (PCCs) within the national public system network located in low-income settings from 5 departments of the province of Corrientes, Argentina [23]. The PCCs provide health care services and essential chronic care medication free of charge.
In November 2015, 20 clinics located in low resource settings launched a Diabetes Care Program. This program was developed by the Institute for Clinical Effectiveness and Health Policy (IECS), an academic organization, in collaboration with the Ministry of Public Health of the Province of Corrientes. The interventions implemented by the program included: a) primary care team training for the implementation of clinical practice guidelines (CPG), b) a Diabetes Registry to monitor and follow-up diabetic patients, and c) an SMS text messaging intervention tailored to patients’ features.

The SMS text messaging intervention
- One-way weekly SMS were sent to diabetic patients included in the Diabetes Registry during 24 months.
- SMS were previously developed and validated [24], and included reminders and educational messages designed to address issues related with adherence to anti-diabetic treatment, lifestyle modification, diabetes education, and facilitation of clinical encounters with the primary care team.
- SMS were tailored to the patient baseline characteristics addressed by primary care physicians at the clinics.
- A web-based platform was developed to deliver SMS.

Methods

Design and Participants
A qualitative and exploratory study of participants’ perceptions, experiences and, opinions on the SMS intervention was conducted during the implementation of the program.

We used a combination of convenience and saturation sampling to recruit participants from the program. Participants were selected if they complied with the following inclusion criteria: Type 2 diabetic patients attending selected clinics, to be registered in the Diabetes registry, recipients of the SMS text messaging intervention, and individuals diagnosed with type 2 diabetic mellitus, who received care at PCCs where the Diabetes Program was in place. We included participants from a variety of departments to guarantee geographical coverage.

No health care personnel were involved in the recruitment or interviewing process. Study participation was voluntary, and interviewed participants provided informed consent to participate in the study. The final sample size consisted of 24 informants between 45 and 65 years of age.

Data collection
We conducted semi-structured telephone interviews between March and October 2017, with selected diabetic patients using a conversation guide. Questions focused on the patient’s perceptions, experiences, and opinions regarding SMS acceptability, diabetes knowledge and meaning, psychosocial support effect of SMS, changes in the perception of risk, and changes in diabetes care practices.
The interview process was stopped when data saturation was reached, that is, when it was judged that no new significant or relevant information emerged from the interviews.

**Data analysis**

Written transcripts of the interviews, which constituted the unit of analysis, were classified and then codified according to the study objectives and the dimensions addressed, constituting a single corpus of information. The written transcripts were entered into ATLAS.ti version 7, combined with the manual technique of information coding.

From the analysis of participants’ discourse, we extracted the following dimensions: 1) General experience with the SMS intervention, 2) Acceptability of the SMS intervention, 3) Changes in diabetes knowledge after being exposed to SMS, 4) SMS contribution to psychosocial support, 5) Effects of the SMS intervention on changes in risk perception, 6) Effects of the SMS intervention on changes in diabetes care practices.

The analysis gave rise to a qualitative framework about contributions of SMS to diabetes care (Figure 1).

Finally, data were abstracted and interpreted. As part of the analysis, direct quotations representative of the participants’ opinions were selected and are included in this manuscript to illustrate our findings. In order to protect the identity of the informants we only provide information on age and gender.

**Ethics**

This study was reviewed and approved by the Institutional Review Board of the Hospital Italiano de Buenos Aires. All participants signed an informed consent and the confidentiality of the information was guaranteed.

**Results**

**Demographic characteristics of the population**

Twenty-four participants were interviewed, 13 women (54.2%) and 11 men (45.8%), between 39 and 66 years old. Selected participants had similar socio-demographic characteristics to those included in the Diabetes program (Table 1).
Table 1. Socio-demographic characteristics of the population under analysis (N=24)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n (%)</th>
</tr>
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<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13 (54,2%)</td>
</tr>
<tr>
<td>Male</td>
<td>11 (45,8%)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>39-60</td>
<td>16 (66,7%)</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>8 (33,3%)</td>
</tr>
<tr>
<td><strong>Level of education</strong></td>
<td></td>
</tr>
<tr>
<td>7 years of schooling or</td>
<td>13 (54,2%)</td>
</tr>
<tr>
<td>less</td>
<td></td>
</tr>
<tr>
<td>8-12 years of schooling</td>
<td>10 (41,6%)</td>
</tr>
<tr>
<td>&gt;12 years of schooling</td>
<td>1 (4,2%)</td>
</tr>
<tr>
<td><strong>Health coverage</strong></td>
<td></td>
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<tr>
<td>Yes</td>
<td>12 (50%)</td>
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</table>

**General experience with SMS intervention**

We explored perceptions about which messages were the most significant for the interviewees. We found that most memorable messages were related with foot care. Within this theme, it was observed that messages that most attracted the attention of participants were based on: diabetic foot prevention, physician visit, avoidance of infections, guidance on footwear, and adequate foot care hygiene recommendations.

It was also visualized that messages about eating were largely present in speeches; Participants preferred and referred to recommendations on the consumption of fruits and vegetables.

To a lesser extent, messages to promote medical visits, and foster compliance with diabetes medication and glycemic control were observed in the discourse. Messages about physical activity, however, were not present in the participants’ verbalizations.

Exploring the most significant messages for patients allowed this study to highlight the impact of diabetic messages with different content. This hierarchy, where informants gave some SMS more attention than others, could be associated with certain cultural, symbolic, and evaluative patterns around the disease and its consequences (Table 2).
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Categories</th>
<th>Characteristics/Descriptions</th>
<th>Verbatims</th>
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<tbody>
<tr>
<td>General experience with SMS intervention</td>
<td>The most remembered message</td>
<td>Hierarchy associated with certain cultural, symbolic, and evaluative patterns around the disease and its consequences</td>
<td>“Yes, a message that was about diabetic foot. It said that we have to footwear because it is a silent illness.” (Woman, 51 years)</td>
</tr>
<tr>
<td>Acceptability of SMS intervention</td>
<td>Usability</td>
<td>Read and saving</td>
<td>“If there is one that interests me I’ll write it in a notebook…I keep the ones that I like the most in a notebook, so that I don’t forget” (Woman, 52 years)</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>Weekly reception, being adequate</td>
<td>“Yes, yes I’ll gladly keep receiving the messages” (Man, 63 years)</td>
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<td></td>
<td>Reminder</td>
<td>The “reminder” function</td>
<td>“It makes me happy because of the diabetes. I forget, look at my cellphone, and the messages are there…I have them there…” (Man, 58 years)</td>
</tr>
<tr>
<td>Knowledge about diabetes changed after being exposed to SMS</td>
<td>Knowledge in diabetes</td>
<td>A &quot;mediating device&quot; possible in the learning processes.</td>
<td>“I read all the messages to know; there are things that I might not know and the messages could help me understand more about the illness” (Man, 61 years)</td>
</tr>
<tr>
<td>SMS contribution to psychosocial support</td>
<td>Feelings of accompaniment</td>
<td>The feeling of comfort, a sense of tranquility and compassion, and the presence of someone who remembers their illness and cares for them without personally knowing him</td>
<td>“I feel more accompanied, I feel calmer. At least, someone who always remembers me because when one receives something in their cellphone, in their phone, you feel more comfortable, more peaceful…” (Woman, 63 years)</td>
</tr>
<tr>
<td></td>
<td>Socialization processes</td>
<td>The family and social environment.SMS as an educational device for transferring knowledge and feedback</td>
<td>“Yes, I strongly agree. I always read it because my sister always has diabetes. When we drink mate, I receive the messages, and I show her. I tell her that they’re very useful for me…”(Woman, 53 years)</td>
</tr>
<tr>
<td>Effects of the SMS intervention on changes in risk perception</td>
<td>Perception of the risk</td>
<td>Associations between receiving messages with words and / or phrases such as “prevent”, “take care”, “control me”, “before I wait too long”, ”I thought it was nonsense”, &quot;I did not want to believe&quot;, &quot;I ignored&quot;, &quot;I am more conscious&quot;, “becoming aware”</td>
<td>“Yes almost all (the messages) because it makes me aware, careful and tells me how to take care of myself. We become conscious of what we have…” (Man, 59 years)</td>
</tr>
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</table>
Effects of the SMS intervention on changes in practices in care

<table>
<thead>
<tr>
<th>Practices in care</th>
<th>Facilitators in care</th>
<th>Barriers in care</th>
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<tr>
<td>These changes were mainly concentrated in six (6) constructs: healthy eating; control of medical indicators; medicines; physical activity; foot care; assistance to the medical consultation.</td>
<td>The relationship between the diabetic patient and the access to the health team.</td>
<td>The vulnerability situations such as material deprivation and difficulties in accessing healthy food or medical supplies or situations of psychosocial vulnerability linked to family disarticulation.</td>
</tr>
</tbody>
</table>

The truth is that now I am more conscious, now I go more often to the “salita,” before I had to get called, now I go alone. Besides, the girl in the “salita” tells me that I have to walk, watch what I eat, sometimes she tells me that she wants to check my feet, and she looks…” (Woman, 51 years)

“And in the message… I read and I go show and consult the doctor and she explains…” (Woman, 47 years)

“For me it’s fine, but the more support the better. You know why? Because I am a person that is mom and dad alone… understand…” (Woman, 47 years)

Acceptability of SMS intervention

A set of characteristics was used to assess acceptability of the SMS. Components that emerged from the speeches analyzed were: usability, frequency, and remindability.

As for usability, participants indicated that they always read the messages and they have no problems with opening the message and reading it. Some of them expressed that they saved them on their phone or transcribed them in notebooks. They also stated that messages were very useful, and that they felt happy and grateful to receive them. A weekly frequency of messages was perceived as adequate and well accepted. Additionally, a significant number of interviewees alluded to the “reminder” function of the diabetes-related text messages.

In addition, some factors were identified which would influence the sustainability of diabetes care, such as the relation established with the referring physician and proximity to the PCC (Table 2).

Knowledge about diabetes changed after being exposed to SMS

Subjective contents emerged related to some changes in the knowledge about diabetes before and after being exposed to SMS. The message could constitute a "mediating device" in the patient’s learning processes (Table 2).

SMS contribution to psychosocial support

All participants expressed accompanying feelings associated with SMS during the course of their disease. Some reported that SMS gave them a feeling of comfort, and tranquility, and valued the presence of SMS as a confirmation that somebody remembers their illness and cares for them without personally knowing him.

In addition, we observed that SMS influenced the process of socialization of diabetes. Furthermore, some interviewees reported that they shared text messages with a relative who also had diabetes highlighting the role of SMS as an educational device for transferring information (through oral communication and / or forwarding of messages) (Table 2).
Effects of the SMS intervention on changes in risk perception

Most of the interviewees referred some change in the perception of risk in diabetes after being exposed to text messages. This was reflected by highlighting some associations between receiving messages with phrases such as "before I wait too long…", "I used to think it was nonsense…", "I did not want to believe…", "I am more aware now…", among others (Table 2).

Effects of the SMS intervention on changes in practices in care

Some changes in preventive and curative diabetes care practices were highlighted. We observed some changes regarding health care behaviors related with diabetes that could be linked to receiving SMS.

These changes were mainly concentrated in six (6) constructs: healthy eating, weight loss; doctor visits; taking medication; physical activity; foot care; and attending medical supervision.

To a lesser extent, some patients stated that they were visiting their doctor more frequently. During these visits, they would show their doctors their registered sugar levels, have their feet checked, and have their vaccination scheme checked by their doctors or achieve greater control of glycemia, glycosylated hemoglobin, and blood pressure values.

Changes in physical activity practice, such as walking, were not much reflected in the perceptions of the interviewees.

Participants referred some barriers to implement diabetes care such as socioeconomic vulnerability and difficulties in accessing healthy food and medical supplies (such as test strips or glucose meter), and psychosocial vulnerability (tension, conflicts in the family).

Another relevant result is the role of the text message as a possible facilitator in diabetes care. There was a strong association between text messages and patient-physician relationship as well as the referent of the program in the PCCs. In this sense, some diabetic patients shared the messages they received with their physicians (Table 2).

Discussion

Principal Findings

Our findings showed that an SMS text messaging intervention within the framework of a diabetes program contributed positively to some aspects within the holistic approach of the care of people with diabetes.

Comparison With Prior Studies

In agreement with our findings, Leon et al. [25] showed that weekly SMS in groups of adult patients with chronic diseases were acceptable for persons with hypertension, observing also a positive attitude towards the intervention.

In our study, we found that diabetic participants referred an increase in their diabetes knowledge when exposed to SMS. This was in accordance with previous studies [17, 18], where SMS may act as a mediator in the patient learning processes, by facilitating the construction of significant learning [26].
Although the messages remembered by patients came from different domains of the design of the intervention, the SMS intended for foot care were the most remembered; this may be due to certain cultural valuations, previous knowledge and the connotations that the diabetic foot and its physical consequences [27-29] (amputation) have in our society.

The psychosocial support effect of SMS in diabetes was an important fact since it allows us to think about actions oriented towards a comprehensive approach to this chronic condition [30] and to contribute to the overall quality of life of the diabetic patient.

A distinctive fact that arises from this work and which has not been extensively addressed is based on the relationship between the SMS and the processes of socialization in diabetes.

Something similar was found by Kwan et al. in another study which postulates that SMS services may help recognize distress and understand its effects on diabetes control, quality of life and relationship with friends and family [19].

On the other hand, we found positive changes on risk perception in diabetic patients after being exposed to text messages. Risk perception is a critical determinant of health behavior [20].

There were other important elements that emerged in this work about perception of risk; this leaves an open space for future studies to explore in greater depth to which extent can the exposure to SMS around the construction of risk operate. The antecedents in this sense are insufficient and should be further explored in future studies from a psychosocial approach.

Implementing support through SMS for people with diabetes is not always easy, and barriers and enablers might affect the implementation and adoption of this intervention. A result to consider is the role of the SMS as a facilitator in the link between the diabetic patient and the healthcare team, and as a complement to traditional care. This role is not isolated since it can be thought that this SMS strategy was implemented within the framework of a diabetes program that also contemplated clinical follow-ups at the primary care level. A relation was observed between receiving SMS and interacting with the referring physician. Similarly, this association was found in another study aimed at patients with chronic diseases [25, 30].

However, the barriers sphere is diverse and contains variables which result in multiple intersections throughout the entire process of diabetic care, which leads to postulating that interventions through SMS should consider these obstacles from the design stage of the intervention, mainly in underserved populations with multiple social vulnerability situations.

Some of these barriers include lack of social support, and have also been identified in another study [19]. Additionally, several qualitative studies of cultural factors and diabetes found that social support may promote diabetes self-care but also may serve as barriers to diabetes management [27].

It is necessary, then, to design interventions with an eye towards the limitations and context in which they will be implemented. Thus, qualitative process research is a
critical step in designing and implementing effective, feasible, and sustainable interventions, which can be provided for diabetes patients’ optimal quality of life. Some studies have postulated that interventions with SMS in low and middle-income countries have a positive impact on the management of chronic diseases, including diabetes [14, 31-34]. However, a qualitative and holistic perspective that rescues the perception of patients, essential for the adoption and scaling up of these interventions, is limited [27, 35].

Other qualitative antecedents about interventions with SMS were directed to other chronic non-communicable diseases, such as hypertension, asthma, cervical cancer screening, weight loss, among others [25, 35-38], and not diabetes in LMIC. This leads to the need for greater knowledge production in this area, in particular from a broad patients’ perspective [30].

Strengths and Limitations
Among the limitations of this study may be those derived from qualitative research itself, such as lack of generalizability to other populations, and potential selection bias. However, during the qualitative research process, we tried to minimize these biases by including subjects of different ages, sex and place of residence. We were aware of the possibility of obtaining complacency bias as well. In order to minimize this bias, we used indirect and generic questioning, allowing respondents to project their own perspectives. Finally, one of the strengths of our study is the being able to explore subjective elements has made it possible to form a pragmatic, and explanatory approach to better understanding the experiential processes during the implementation of this type of intervention.

Conclusions
We identified subjective elements of the SMS-text message intervention, such as adequate acceptability, SMS as a source of knowledge and psychosocial support, and changes in risk perception and self-management behaviors. Although these findings show some contributions of SMS in the care of people with diabetes, more qualitative evidence is needed to show improvements in the medium and long term.

Acknowledgments
The authors deeply acknowledge the kind cooperation of the diabetic patients of the program "Strengthening health services for the care of people with diabetes in the province of Corrientes”, who have added their voices to this study. We are also grateful to the Ministry of Public Health of the Province of Corrientes for their collaboration and support.

Conflicts of Interest
No competing personal financial interests exist. This study was partially funded by a grant provided by the World Diabetes Foundation (WDF 14-937).
Abbreviations
LMIC: Low and middle-income countries
PCCs: Primary care clinics
SMS: Short message service

References