



CENTERIS - International Conference on ENTERprise Information Systems /
ProjMAN - International Conference on Project MANagement / HCist - International
Conference on Health and Social Care Information Systems and Technologies,
CENTERIS/ProjMAN/HCist 2018

Mobile solutions in depression: enhancing communication with patients using an SMS-based intervention

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Abstract

Mobile solutions, namely the ones based on the Short Message Service (SMS), can play an important role in enhancing communication with patients with depression, between consultations, allowing the delivery of supportive messages or reminders. This paper presents an overview on this topic and describes a 4-stage study aiming to better understand the mHealth scenario in depression, specifically regarding the use of messaging services. The four stages comprised: (i) a diagnosis of perspectives and practices; (ii) a 6-weeks SMS intervention plan; (iii) a prototype of a digital application to support patients' follow-up and interaction; (iv) and a survey with physicians on digital experience and predisposition to use the prototype. Results underline the potential of the use of messaging systems and digital solutions to improve communication with patients with depression and point the benefits of blended-interventions (combining personal contact and SMSs, as an adjunct/complement to regular treatment). Further researched is needed, particular regarding the adjustment of these solutions to specific target groups.

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Selection and peer-review under responsibility of the scientific committee of the CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies.

Keywords: mHealth; SMS; depression; patient-physician communication

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1. Introduction

Clinical communication faces new challenges in the current digital scenario. Mobile phones can be powerful tools to enhance interactions between physicians and patients, namely patients with symptoms of depression. These can benefit from digital technologies, which can help them to comply with medication, cope with the disorder, monitor symptoms and side effects and prepare doctor's visits, complementing traditional strategies [1]. Some studies even conclude that Internet-based interventions for depression are equally beneficial to regular face-to-face therapy [2] and others show that digital-based stress-management interventions can be effective and can potentially reduce stress-related mental health problems [3]. New media strategies and solutions are, most of the times, a path to support patients' needs and can enhance patients-physicians- in-person communication, namely when used between consultations. They can support the promotion of a cooperative relationship between patients and physicians and of a patient-centered communication style, so important in treatment of depression. Digital-based tools and applications can, therefore, promote the desired "personal bond" between patients and physicians and a "follow-up communication style" as they can increase and facilitate the regularity of the contact. This regular contact represents a powerful tool to help patients with depression to see the doctor as a more active element of their alliance [4].

Smartphones and mobile apps are pervasive and ubiquitous communication tools [5] and can play a very important role in enabling this regular contact. Patients with depression usually desire a more active and more collaborative communication style and show higher adherence outcomes when they receive specific educational messages about medication and treatment [6]. This can be assured using different approaches and interventions [7]: 1) illness self-management and relapse prevention; 2) promoting adherence to medications and/or treatment; 3) psychoeducation, supporting recovery, and promoting health and wellness; and 4) symptom monitoring. There is evidence that digital-based stress-management interventions can be effective and can potentially reduce stress-related mental health problems [3], and reviews show the impact and effectiveness of mHealth interventions in different health conditions [8], although more studies are needed namely regarding mental health.

2. Mobile phone interventions in depression

2.1. Digital media based-solutions potential

The suggestion to use digital resources to help patients with depression has been reported in several studies and in a more consistent way during the last years. Internet-delivered treatments for depression can take different forms and be supported by several formats, as text-based materials, computerized solutions or guidance by a therapist via e-mail or phone [9]. In 2015, depression was identified as the third field target for mobile health app publishers [10]. Back in 2004, web sites, alongside with pamphlets, videotapes and books were already proposed as resources to educate the patient with symptoms of depression [1]. In 2006, an interesting and pioneer work was published [11] on the use of "RecoveryRoad", an Internet-based program designed to augment the routine clinical treatment of depression. Results showed that adherence to the program was high; self-reported adherence to medication was over 90% and depression severity declined by the eighth session. Physicians and patients both reported satisfaction with the program and stated its impact in improving clinician-patient relationship. Physicians also stated that the program helped their patients to better manage depression.

Later, in 2010, results of a pilot study that evaluated the feasibility of an eHealth service to support collaborative depression care were described [12]. The service under analysis ("Improvehealth.eu") was described as a tool offering active patient engagement and collaborative care management using web and mobile-based solutions. The service was articulated with online and phone-based support offered by trained psychologists. The pilot compared a control group receiving usual treatment with the intervention group measuring patients' medication adherence and outcome measures; usage and perceptions of the intervention was also measure in the intervention group. Results showed that the intervention was well accepted and helped patients, proving to have an interesting potential to improve medication adherence and to reduce depression severity [12].

Recently, different smartphone applications for depression have been described [13], as "Intellicare" [14], among others, like Lantern. Despite this current scenario, and considering the specific case of clinical communication enhancement, it's of most importance to underline the relevance of "blended-interventions" [15]. These combine the

benefits of face-to-face and Internet approaches and are feasible and more effective compared with no treatment controls. Mobile solutions can play a very important role in implementing blending interventions.

2.2. Mobile Health and Mental Health Care

Mobile Health is not a new concept, although it has evolved recently considering last years' diverse domains of application [16]–[22]. According to the Global Observatory for eHealth of the World Health Organization [23] mHealth is a medical and public health practice supported by mobile devices (mobile phones, patient monitoring devices and other wireless devices), involving the use and capitalization of mobile phone's voice and short messaging services, as well as other functionalities and applications [23].

The demand for mHealth apps is increasing everyday, as documented in several studies. The estimated total downloads of mHealth apps has been growing and chronically ill people remain the main target group for mHealth app publishers [10]; it is, therefore, important to deepen knowledge on the potential of mHealth interventions in mental health care.

More accessible mental health care can be effectively used using mHealth to better inform consumers, more actively engage them in treatment, and to enhance care after formal treatment has concluded [24]. In the specific area of behaviour-change, mHealth solutions can have an important impact. The potential of mental and emotional self-help technology in behaviour-change has already been described [25]: a cross-sectional survey directed to 150 users of mental or emotional health apps demonstrated that participants reported an increase in perceptions, beliefs, and attitudes surrounding their mental and emotional health and associated this increase with perceived change in behaviour.

Behaviour-change in mental health can, indeed, be supported in an innovative manner when using mobile technologies. The use of personalized information, namely considering geo-localization of users, allows the development of solutions enabling patients to receive in-time messages, contextualized to their specific situations. There is already evidence of the effectiveness of these solutions in other areas, namely in health education and health promotion interventions, specifically when using SMSs [18]–[22]. In the specific case of mental health, there are already proposals of using mobile phone detection of semantic location of patients with depression and anxiety, allowing the delivery of recommendations, and other context-aware information, that can be used to facilitate and monitor relevant behavioural indicators needed to improve treatment [14].

3. Proposal of an SMS-based intervention targeting patients with symptoms of depression

3.1. Overview of SMS-based interventions

One of the possible strategies in designing an intervention using mobile technologies is the use of “supportive messages” or “reminders” that can be sent using SMSs. Interventions based on SMS create new opportunities to physicians and patients to interact in a more flexible way, opening the dialogue to new scenarios, besides the face-to-face set of the consultations. Indeed, SMS' mobile and asynchronous nature offers a great opportunity to bridge traditional barriers to care, represent a feasible and well-accepted format for interventions, and may serve as a simple, inexpensive adjunct therapy [26]. This time and space flexibility can also be beneficial considering that these digital interventions can target patients' everyday activities in a more contextualized way with their moods. The use of text-messaging programs can also have preventative benefits [27], improve patient engagement [28] and promote behaviour change [29].

Mobile apps can have a very important role in promoting behaviour change, namely through the use of reminders: when comparing different mobile solutions (dialogue with doctors, peer monitoring, user generated content, gamification, social monitoring, dashboards, personalized messages, and reminders), reminders (followed by personalized messages) are the one that are the easiest to implement and simultaneously the one that have the highest impact on behaviour change. When considering the patients' stages (prevention, seeking health information, diagnosis, treatment and follow-up monitoring) follow up monitoring (as part of the general treatment) is seen by 60% of mHealth practitioners as the most promising stage in terms of future impact [10]. We believe that reminders and personalized messages can have a distinctive role in follow-up monitoring.

The first published study on the use of SMSs in health care is reported to be from 2002 (as cited by [30]) and, since then, several works have been developed using this solution. To some authors, SMSs, as an inexpensive and instantaneous solution, are the easiest way to access mHealth applications [31]. When analysing the potential of this format to deploy interventions based on the role of reminders, it's interesting to observe a literature review concluding that, from the 60 studies included, SMSs were used as message reminders in 73% of the studies and connected to other interventions in 27% [32].

In 2015, an important systematic review on using mobile text messaging for health was described [33]; although this review did not include depression, results are interesting namely in what concerns future research directions that are pointed out, particularly regarding the need to assess the effectiveness of the SMS delivery characteristics (frequency of messaging, timing of delivery, duration of the intervention, interactivity of the intervention, communication modalities and impact of complementary interventions). Considering the specific field of mental health, an other review showed that SMSs are a pervasively form of communication and a promising tool in psychiatry [31]; according to this review, and considering the 36 studies analysed, there are four main reasons to use SMSs in depression: as reminders (14%), to send information (17%), as supportive messages (42%), and to allow self-monitoring procedures (42%). Combined applications were also identified. Overall, SMSs are characterized as having numerous benefits (increasing patient interactivity; encouraging treatment; connect patients and care services; help treatment adherence; support patient self-management; enhance social support; encourage patients to become more proactive in health care; and provide information to enhance health and well-being). In addition SMS are accessible and usable by populations with low access and usage of digital resources. Nevertheless these benefits, there are some risk of intrusiveness as some can view these interventions as a way of the care services entering the patient's personal space.

When designing SMS-based interventions is important to validate the content of the messages and to assess its adequacy to the target audience. Short, concise messages, a 6-week intervention and messages addressing motivation, self-efficacy, social influence and self-regulation were reported as adequate [29].

3.2. *Materials and Methods*

Inspired by the theoretical approach and overview above described, a four-stage study was conducted to better understand the role of a SMS-based intervention targeting patients with symptoms of depression.

In the first stage, a diagnosis of perspectives and practices was conducted. A sample of 36 patients and 11 health professionals was inquired using a questionnaire composed of the following scales: Autonomy Preference Index (API), Control Preference Scale (CPS), Hospital Anxiety and Depression Scale (HADS) [34] [35], and Digital Experience (DE). This last one was specifically build for the study. This exploratory stage was used as a basis for generating knowledge, helping to design the study's further stages.

During the second stage, a SMS intervention plan was designed, as an adjunct/complement to regular treatment. This 6-weeks intervention, composed of 12 SMSs, was applied to 15 patients with depression, followed by a questionnaire applied to measure messages' readability, language appropriateness, and perceived utility of each message and also patient's perspectives on the impact and usefulness of the intervention. The inconclusive nature of the results obtained in this follow-up questionnaire led to stages three and four.

In stage three, and in order to better understand how could this SMS-based intervention be improved, a digital application to support patients' follow-up and interaction was prototyped. The prototyped app allows the creation of personalized intervention plans and the scheduling of SMS sending, as well as other features described bellow.

Finally, in stage four, a survey with physicians on digital experience was conducted, aiming to collect data on their digital literacy and mobile practices, the utility they attributed to digital patient-physician communication between face-to-face consultations, as well as on their predisposition and willingness to use the prototyped app. The survey was applied to 143 physicians, 94 primary care physicians and 49 Psychiatrists, using an original questionnaire assessing: socio-demographic data; digital literacy; perspectives of physicians on the sources of information used by patients; and use of digital media in physician communication between consultations.

Participants (both patients and physicians) received written and verbal information about the study, in all stages, and signed an informed consent form. All the information was anonymized and coded to insure the privacy of the

data collected. The study was approved by the Ethical Committee of the Hospital of Magalhães de Lemos, Porto, Portugal.

3.3. Results and Discussion

Results were consecutively considered enabling the beginning of each new stage. Stages one and two were particularly important to leverage stages three and four.

Concerning stage 1 (diagnosis of perspectives and practices), namely Digital Experience, four scores were created aiming to analyze data regarding: access to digital media; usage of digital media (predigital – as TV and phone -, digital, and mobile); sources of information used; and communication between patients and health professionals. Generally, results show: low scores on both access and usage of digital resources; mobile phone/smartphone as the main resource for patients and psychiatrists (“everyday” use of SMS); access and use of digital resources correlated with education level; use of digital resources in the maintenance of a patient-doctor relationship correlated with the use of mobile and web resources; and, finally, use of digital resources and establishment/maintenance of a patient-doctor relationship by digital means both negatively correlated to the severity depressive symptomatology. These results strengthened our position towards the proposal of an intervention based on Short Message Service (SMS) as it seemed to be the most adequate solution considering the diagnosed perspectives and practices of both patients and physicians, and its possible benefits in managing the depressive disorder

Stage 2 main result was the proposal of a protocol to the SMS intervention plan: 12 SMSs during 6 weeks, and a follow-up. The protocol structured the plan in five main themes (Table 1). Some examples can be seen in Table 2.

Table 1. SMS Protocol

Main Theme	SMS #	Specific Theme
Welcome	1	Welcome
Depressive Disorder	2	General Information
	3	Symptoms
	4	Impact
	5	Side Effects
Treatment	7	Regularity / effectiveness
	8	Adherence difficulties
	9	Problem-focused
Coping	10	Emotion-focused
	11	Social support
Acknowledgements	12	Acknowledgements

Table 2. SMSs Examples

Message 2	Good afternoon #PatientName. Depression is a frequent health problem. However, with appropriate professional advice, it is a treatable condition. Gtgs, #PhysicianName
Message 6	Good morning #PatientName. When taking medication, you might feel the side effects first. Stick with the plan, as the initial discomfort only lasts the first few days. Gtgs, #PhysicianName
Message 9	Good afternoon #PatientName. We are sending these SMS for some time. Realizing that this is a phase and that you can count with our help, might give you the strength needed. Start today. Gtgs, #PhysicianName

Each SMS did not exceed 160 characters and was written and delivered according to previous studies [27]: no repetitive and personalized (enhancing patient engagement); delivery avoiding working hours, out off hours, weekends, and public holidays, and in specific times aligned with specific behaviours (as medication intake); avoidance of medical jargon and abbreviations; and inclusion of sender signature (physician). The results of the follow-up questionnaire, applied after the 6-weeks intervention, were somehow inconclusive, demanding further research to better understand if the intervention format was the most adequate, a larger sample was needed and also to collect data regarding the physicians’ perspectives and practices on the use of digital-based solutions in depression. This led to stages three and four.

Stage 3 was characterized by an interdisciplinary approach focusing on the conceptualization, design and development of a digital application to support patients' follow-up and interaction. The final prototype was this stage main result. Two integrated apps were developed: a mobile one, to patients, and a web one, to physicians. In this last one, physicians have access to registered patients, which can be monitored. It allows the configuration of personalized SMS-plans, targeting specific patients, enhancing follow-up between consultations through messages and notifications scheduled by the physician. For each intervention plan associated with a certain patient, physicians can see the associated progress as well as schedule the delivery of motivational messages or notifications. It also allows the registration of patient data/history of each patient, presented in an interactive timeline. In what concerns communication, and besides the SMS-plans, this web application also has a chat feature, which is also available in the mobile application. The use of chats, i.e., of synchronous text-based dialogue systems in mental health interventions has been proposed and analysed by other authors [36]. The mobile app is intended for patients and allows them to receive the messages and notification in an integrated interface. Patients can answer to small questionnaires and register symptoms. It also offers an annotations area, where patients can write notes that can be latter shared with the doctor. The Web application has a records area in which the annotations shared by the patients or private records of the doctor are displayed. The results of this stage allowed the creation of an integrated approach based on a more featured mobile solution and not using only a SMS based approach.

Stage 4 encompassed a survey with physicians on digital experience, aiming to better understand their digital and mobile practices, as well as on their predisposition and willingness to use the prototyped app. Results show that physicians use mobile phone calls, SMSs and e-mail very often, but not to so much to contact patients. Age and clinical experience correlate positively with the use of SMS and e-mail exchange with patients and negatively with the use of blogs/social networks and of health and wellness applications. Physicians consider that there is little benefit in social networks as a means of medical-patient communication between consultations, privileging personalized contacts by e-mail or phone call. In sum, this survey results' underline the idea that personal contact still plays a leading role and establish the basis where the more traditional media are the most used ones to contact patients. 77,9% of the inquired physicians stated their willingness to use a digital tool to assist the practitioner in monitoring patients with depressive disorder, which underlines the importance of continuing the work with the prototyped app.

4. Conclusions and Future Work

Enhancing clinical communication between patients and health professionals is a major demand, particularly in the case of mental health. Mobile solutions can play a very important role in this path, supporting innovative solutions to better develop personalized interventions for patients with depression. The effort needed to develop solutions like the ones described in this paper calls for an interdisciplinary approach, involving teams with different skills (health professionals, developers, patients, caregivers).

Despite the current pervasive nature of digital media in daily routines of patients and physicians, personal support and personal contact should not be neglected, as they have shown to have the higher impact in patient's decisions, compliance and recovery [37] [38]. Complementary approaches are the ones that can better suite the present digital profile of patients and physicians, and add relational and clinical benefits maintaining consultations and not invading its dynamics. Messages and notifications, namely using SMSs, can be effective tools to implement such a strategy, enabling the set up of mobile interventions that can reach patients in their everyday lives and be paired with the face-to-face support.

Effectiveness of adherence to eHealth interventions is enhanced by human support. The role of a trustworthy, benevolent and expert coach [39] – the health professional – cannot be ignored. Blended interventions [15] are, therefore, the best way to combine the strengths of face-to-face and digital-based approaches, building guided interventions (with personal support alongside the online intervention). These guided interventions, as an adjunct/complement to regular treatment, enable daily or weekly support via SMSs difficult to achieve in face-to-face support, allowing personalized feedback using motivational, educational and encouragement messaging services.

In the future, further studies will be developed aiming to better understand how can messaging services be used in depression, namely targeting specific age groups and prevention programs. University students, for instance, are

an important focus and there is already some preliminary work under-development towards the design of a prevention program using audio-visual content and messaging services. More mental health promotion and prevention interventions for adolescents and students in university settings are needed [40] - [43] and digital-based solutions, namely using messaging services and audio-visual contents, could play a very important role in promoting wellbeing and preventing mental health problems and depression in university students.

Acknowledgements

To patients and physicians collaborating in the study and to the dedicated team that developed the prototype: Vitor Amaral, Flávio Amaral and Romeu Pinho.

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