Usability and usage of an online eHealth module concerning dental hygiene for patients with bipolar disorder

A cross-sectional study

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ABSTRACT

Title: Usability and usage of an online eHealth module concerning dental hygiene for patients with bipolar disorder. A cross-sectional study.

Background: Bipolar disorder is a mood disorder with a life-time prevalence of 1.3% that is the sixth leading cause of disability worldwide. It causes recurrent episodes of depression and (hypo)mania, separated by intervals of normal mood. Patients with bipolar disorder have an increased risk for dental problems, which can be caused by symptoms of the disorder or the psychopharmaceuticals they use. Educating patients with bipolar disorder on oral care is essential. In general, eHealth interventions are accessible, convenient and cost-effective. However, uncertainty remains about whether emerging eHealth interventions are suitable for reaching individuals with serious mental illnesses including bipolar disorder. In 2018, an eHealth module concerning education of dental health care was developed for patients with mental disorders. The module is currently in its pilot phase.

Aim: The aim of this study was to evaluate the usability and usage of the online eHealth module 'Healthy Teeth' for patients with bipolar disorder using psychopharmaceuticals.

Method: The study has a cross-sectional design. Questionnaires were obtained among adult patients with bipolar disorder using psychopharmaceuticals, in treatment by a Dutch mental health care organisation. Log data of the module was collected.

Results: The module scores above average on usability (median=85.0, ICR=12.5). The actual usage of the module is low; 26 respondents completed the module. The time patients took to complete the module varied widely; from 6 minutes to 20 days.

Conclusion: This study suggests that the module 'Healthy Teeth' is usable for patients with bipolar disorder using psychopharmaceuticals. However, the actual usage of the module was low.

Recommendations: To increase the usage of the module there is a need to raise awareness amongst practitioners and patients on the benefits of the module and eHealth (interventions) in general.

K E Y W O R D S

usability, bipolar disorder, oral health, dental hygiene, eHealth

SAMENVATTING

Titel: Bruikbaarheid en gebruik van een online eHealth module over mondhygiëne voor patiënten met een bipolaire stoornis. Een cross-sectionele studie.

Achtergrond: De bipolaire stoornis is een stemmingsstoornis met een prevalentie van 1.3%, welke de zesde doodsoorzaak wereldwijd is. Het veroorzaakt terugkerende episodes van depressie en (hypo)manie, afgewisseld met periodes van neutrale stemming. Patiënten hebben een verhoogd risico op gebitsproblemen, veroorzaakt door de symptomen van de stoornis of door de psychofarmaca die patiënten gebruiken. Het is essentieel om patiënten met een bipolaire stoornis mondzorgeducatie te geven. EHealth-interventies zijn toegankelijk, eenvoudig en kosteneffectief. Er bestaat echter onzekerheid over de vraag of eHealth-interventies geschikt zijn voor personen met ernstige psychische aandoeningen zoals een bipolaire stoornis. In 2018 is er een eHealth module ontwikkeld met als doel patiënten met een psychiatrische aandoening te onderwijzen over mondhygiëne. Momenteel bevindt de module zich in de pilotfase.

Doelstelling: Het doel van deze studie was het onderzoeken van de bruikbaarheid en het gebruik van de online eHealth module ‘Een gezond gebit’ voor patiënten met een bipolaire stoornis die psychofarmaca gebruiken.

Methode: De studie heeft een cross-sectioneel design. Vragenlijsten werden afgenomen onder volwassen patiënten met een bipolaire stoornis die psychofarmaca gebruikten, in zorg bij een Nederlandse GGZ-organisatie. Gebruikersdata van de module werd verzameld.

Resultaten: De module scoort bovengemiddeld op bruikbaarheid (mediaan=85.0, interkwartielafstand=12.5). Het daadwerkelijke gebruik van de module is laag; 26 respondenten voltooiden de module. De tijd die respondenten nodig hadden om de module af te maken varieerde sterk: van 6 minuten tot 20 dagen.

Conclusie: Deze studie suggereert dat de module bruikbaar is voor patiënten met een bipolaire stoornis die psychofarmaca gebruiken. Echter, het daadwerkelijk gebruik was laag.

Aanbevelingen: Om het gebruik van de module te vergroten, is het nodig om bewustwording bij behandelaren en patiënten te creëren over de voordelen van deze module en eHealth (interventies) in het algemeen.

K E R N W O O R D E N

bruikbaarheid, bipolaire stoornis, mondzorg, mondhygiëne, eHealth

INTRODUCTION

Bipolar disorder (BD) is a mood disorder with a life-time prevalence of 1.3% that is the sixth leading cause of disability worldwide[1]. It causes recurrent episodes of depression and (hypo)mania, separated by intervals of normal mood[2,3]. A depressive episode is characterized by sadness, apathy, feelings of worthlessness and decreased energy and vitality. During manic episodes there is an increased, expansive mood, self-overestimation and increased energy and vitality. These episodes can occur simultaneously or separately, and both can be accompanied with psychotic symptoms[2,3]. There is large inter-individual variability in severity, duration and frequency of the episodes, as well as the course and recovery[4].

Patients with BD have an increased risk for dental problems. In a survey of 4,769 subjects diagnosed with mental illnesses (more than half was diagnosed with BD), 61% described the general oral health poor or reasonable and 34% had mouth problems which made eating difficult. These percentages were substantially higher than those reported for the control group without mental disorders, i.e. 42% and 27%, respectively[5]. The risk of dental problems is partly a consequence of the disorder itself. During depressive episodes, many patients exhibit a distinct decline in the level of oral hygiene, coupled with a rise in dental caries and periodontal disease[6]. A depressive episode can negatively impact oral health by alcohol or drugs abuse[7]. In manic periods, overzealous use of toothbrushes and floss can increase dental problems[6]. Furthermore, psychopharmaceuticals can play a role in dental problems[8]. These pharmaceuticals may cause dry mouth and an intense craving for carbohydrates. Patients often respond to cravings by drinking large quantities of cariogenic sweetened beverages[9]. As a result of the reduced salivary flow, there is a rapid increase in the degree of dental deterioration, mucosal dryness and difficulty in swallowing[6].

The dentist and patient's psychiatrist can play an important role in the prevention and treatment of dental problems. Before commencing any treatment, the dentist should consult with the patient's psychiatrist to verify the patient's medication history and diagnosis[6]. However, to our knowledge, it is unknown how often patients with BD visit their dentist, and to what extent patients talk to their psychiatrist and dentist about the use of psychopharmaceuticals. Thereby, in the Netherlands, people have to pay for dental insurance. These costs can be an obstacle to dental treatment for people with BD, because their income is relatively low[10].

To prevent this, it is essential to educate patients with BD on oral care[7,9]. To this end, eHealth interventions can be used. In general, eHealth interventions are accessible, convenient and cost-effective[11]. However, uncertainty remains about whether emerging eHealth interventions are suitable for individuals with serious mental illnesses (SMI) such as

BD, given their cognitive limitations and social challenges[12]. In addition, different characteristics within this population cause variation in the use of eHealth interventions. A review from 2019 found that higher age, lower income and lower education are associated with lower eHealth use[13].

In 2018 eHealth module ‘Healthy Teeth’ was developed in collaboration with patients, psychiatrists and dentists. The main goal of the module is educating patients with mental disorders using psychopharmaceuticals to improve their self-management in dental hygiene. The eHealth module is in its pilot phase, which leads to the question of its usability for patients with BD. Usability is one of the key factors in the successful implementation of eHealth interventions[14]. It is defined as ‘the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use’[15].

There is a need to ensure that health technologies are appropriately designed and targeted to the end-user’s needs before they are used as health interventions[16]. This can be achieved by applying robust methods of evaluation to ensure a high level of usability[14]. Conducting usability evaluation on eHealth applications is of great value for the patient, as better usability can lead to a number of benefits, including improved productivity, enhanced user well-being, avoidance of stress, increased accessibility and reduced risk of harm, as described in the International Standardization Organization (ISO) standard for Ergonomics of Human Computer Interaction[17].

AIM

The aim of this study was to evaluate the usability and usage of the online eHealth module ‘Healthy Teeth’ for patients with bipolar disorder using psychopharmaceuticals.

METHOD

Study design

A cross-sectional observational study was conducted. The design fits the purpose of this study, as it describes the status of the phenomena usability at one fixed point in time[18].

Population and domain

The source population consisted of adult patients living in The Netherlands with a clinical diagnosis of BD using psychopharmaceuticals. Data was collected from the accessible population of 466 patients under treatment by the bipolar team of a Dutch mental health care organisation. The bipolar team consists of a Specialist Centre for BD (Deventer) and three regional teams (Zwolle, Deventer and Almelo). In order to be eligible to participate in this study, a patient had to meet all of the following criteria: 1) be able to read and speak Dutch, 2) have regular Internet access and 3) is eighteen years of age or older. Patients with dentures were excluded to participate in the study.

A commonly used rule of thumb for sample size in usability testing is that 10±2 patients are sufficient to discover 80% of the usability problems[19]. However, for the present study no minimum sample size was determined because the study also included the purpose of evaluating the number of respondents using the module.

The intervention

The eHealth module ‘Healthy Teeth’ is online available and accessible after the patient’s practitioner has granted access to the patient. The patient receives an email with a hyperlink to gain access. The patient goes through the online module alone, i.e. without interaction with the practitioner. The results will only be sent to the practitioner once the patient agrees. The module consists of seven sessions that are displayed in Table 1. During the study, the module was only accessible for respondents participating in the present study.

[Table 1 Content of the online eHealth module ‘Healthy Teeth’]

Data collection

Data was collected by a two-part questionnaire sent to respondents who completed the module; the first part aimed to evaluate the usability of the eHealth module using the System Usability Scale (SUS), and the second part collected patient characteristics. Questionnaires are the most common method of evaluating usability of eHealth interventions[14]. In addition, log data from the module was collected.

Patient characteristics

The following patient characteristics were collected: age, gender, education level, mood, self-perceived assessment of the dental condition, frequency of dental visits, frequency of tooth brushing, presence of dental insurance policy, type of psychopharmaceuticals, informing the dentist about the use of psychopharmaceuticals, consultation with the prescriber of psychopharmaceuticals regarding its use and the duration of use. The characteristics were established following consultations with the research group and a recent review of the influence of demographic data on the use of eHealth interventions[13].

Usability

In this study, a modified SUS – a 10-item Likert scale instrument - was used. All items were to be answered, otherwise the dataset was excluded.

The following modifications to the original SUS were made: The term 'system' was replaced by the word 'module' to better fit the purposes of this study. Using other words rather than 'system' are not expected to change the results[20]. In addition, the first question was adjusted from 'I think that I would use this system frequently' to 'I would recommend this module to others', because it better fits this eHealth module. Face validity was conducted to the final version by the research group, to test if the questionnaire measures the target construct: usability[18].

Total SUS scores ranged between 0 and 100 providing an estimate of overall usability. Higher values reflect higher user satisfaction and interventions scoring 68 or above are regarded as above-average in terms of usability quality[21,22]. The SUS has a good score on reliability and validity; it has a high internal inconsistency with a Cronbach's alpha of 0.911, even with small sample sizes[20,23].

Log data

To provide objective insight in the usage of the module, real-life log data from respondents that went through the module was collected. Log data is defined as anonymous records of real-time actions performed by each user[24]. To measure usability, it is recommended to also utilize a more objective, automated method of usability[24]. The following log data was collected: the number of respondents that received access to the module by practitioners, the number of respondents that opened the module, the number of respondents that completed the module, the number of respondents that completed each specific session and the time these respondents took to complete the module.

Data analysis

Collected data was entered and analysed descriptively using the software Statistical Package for the Social Science (SPSS) version 24. The assumption of a normal distribution of data was assessed by the use of the Shapiro-Wilk test, suitable for samples <50 participants[18]. To evaluate the usability of the eHealth module the sum score of the SUS was analysed and is presented descriptively using range, median and Interquartile Range (ICR). The collected patient characteristics are presented as descriptive statistics using frequencies, percentages, median and ICR, to draw inferences about the external validity of the primary parameter results[18]. The collected log data was analysed and is presented descriptively using range, median and ICR.

Procedure

All patients in treatment by the bipolar team (466) received an information package including an invitation and information letter, Informed Consent Form (ICF), questionnaire and two return envelopes. The information packages were sent by the secretariat of the Specialist Centre for BD. Patients were informed by reading the information letter and posters in the waiting room and after reading they got the opportunity to ask questions. If patients were still interested and eligible after they were informed, they returned the signed ICF. The secretariat then contacted the respondent's practitioner to grant the respondent online access to the module. Thereafter, respondents had three weeks to complete the module and return the questionnaire. Due to the lack of response, two reminders were sent to the practitioners of the potential respondents. The purpose of the reminder was i) to remind practitioners to open the eHealth module for their patients, if applicable, and ii) to bring the study to the attention of their patients. After recruitment of patients and obtaining ICF, respondents officially participated in the study. From the moment a respondent received access to the module by their practitioner, log data was collected. At the end of the data collection, the executive researcher received the anonymised questionnaire data from the secretariat and the anonymised log data from the IT officer in a transformed file.

Ethical considerations

This study was conducted according to the principles of the Declaration of Helsinki[25]. The Medical Research Ethics Committee (CWO) of the organisation waived the full ethical review according to Medical Research Involving Human Subjects Act (WMO) and confirmed it does not apply for the current study. All respondents were given detailed information about the study and signed an ICF before their participation in the study. All data is treated according to the General Data Protection Regulation (AVG).

RESULTS

The information package was provided to 466 patients, of which 54 respondents were interested in study participation and returned a signed ICF (12.6%). Twenty-two (22) questionnaires were returned to the researchers, which makes the response rate 4.7%. Three (3) of the questionnaires were excluded. One dataset was excluded because the person indicated that he had cooperated in the development of the module, which may potentially result in recall bias. Another dataset was excluded because only one question of the SUS questionnaire was answered. A third dataset was excluded because the respondent did not use psychopharmaceuticals.

Patient characteristics

The median age of the respondents was 53 (ICR=25) years and more than half (55.6%) were female. In total, 57.9% of the respondents described their mood as neutral. More than half of the respondents (52.6%) used psychopharmaceuticals for over 10 years. In total, 47.4% indicated to visit the dentist twice a year and more than half of the patients (68.4%) indicated that their dentist knows about their use of psychopharmaceuticals. However, 57.9% of respondents indicate that there is no consultation on the use of medication between the psychiatrist and the dentist. Table 2 presents a summary of the patient characteristics data.

[Table 2 Patient characteristics of the study sample]

Usability

The median SUS score was 85.0 (ICR=12.5) where a score over 68 is considered above average[22]. Variations in scores existed with a minimum value of 52.5 and maximum score of 97.5.

Log data

Thirty-three (33) respondents received access to the module by practitioners and 26 respondents completed all sessions of the module. In total, 30 respondents opened sessions one and two, 29 respondents opened sessions three, four, five and six and 27 respondents opened the seventh session (but did not necessarily complete the module). The median time respondents spent on completing the module was 20.00 (ICR=758) minutes, with a minimum of 6 minutes and a maximum of 20 days (28,953 minutes).

DISCUSSION

Results from this study show that the module 'Healthy Teeth' scores above average on usability. At the same time the actual usage of the module is low. Of the 466 patients invited for this study, 54 respondents returned the ICF (11.6%) and 33 respondents received access to the eHealth module from their practitioner (7.1%). Furthermore, the module was opened by 30 respondents (6.4%) and fully completed by 26 respondents (5.6%). Only 22 persons returned the associated questionnaire (4.7%) and only 19 qualified for inclusion in the data analysis (4.1%). The time respondents took to complete the module varied widely: from 6 minutes to 20 days.

A striking finding of the present study is the fact that 38.9% of the respondents did not receive access to the module by their practitioner. This finding partly explains the low actual use of the module. It can be questioned whether there is a lack of eHealth readiness of the practitioners. For successful implementation of eHealth interventions, mental health professionals' readiness to support these interventions is crucial[26-28]. EHealth readiness among the practitioners can be limited by a lack of knowledge, support and unfamiliarity[29]. Previous research stated that it is needed to close the gap in knowledge on and experience with implementing eHealth tools[31,32].

The low usage of the module relative to the (higher) number of invited patients also raises questions about the eHealth readiness among patients. Other studies also report relatively high outage, despite the increasing evidence on the efficacy of eHealth when compared to face-to-face treatment[33,34]. The lack of eHealth readiness among patients is mentioned as one of the main contributing factors to the lower use of eHealth. Among other things, patients indicate that they experience eHealth as a less helpful mode of treatment compared to face-to-face treatment[34,35]. Perceived helpfulness is a component of performance expectancy affecting intentions to use, which in turn predicts actual usage[36].

Most respondents rated the module to have above-average usability and most of the respondents described their mood as neutral while going through the module. Although several studies conclude that psychoeducational interventions mainly perform when patients with BD are in a euthymic state[37,38], data are insufficient or absent to conclude whether the module is usable for patients having depressive, (hypo)manic or mixed symptoms.

Results show that more than half of the respondents have been using psychopharmaceuticals for over 10 years. Psychopharmaceuticals are known to have a bad influence on dental conditions[6,9,32]. Still, the current study found that 26.3% of respondents reported a poor dental condition while using psychopharmaceuticals, compared to 61.0% of a previous study of patients with mental illness[5]. However, subjective reports on dental condition may not necessarily reflect actual dental condition. Thereby, the present study

indicates that more than half (68.4%) of the respondents declared that their dentists know of their use of psychopharmaceuticals, and also more than half (57%) reported there is no consultation between dentist and psychiatrist regarding the use. Nevertheless, earlier research stated that consultation between the dentist and psychiatrist is relevant[6,32].

Strengths and limitations

The present study has several strengths. First, the combination of the validated SUS questionnaire, patient characteristics and log data gave broad insight in the usability and usage of this module for patients with BD using psychopharmaceuticals. Second, because data was collected from the whole accessible population, the sample aims to represent all adult Dutch patients with BD using psychopharmaceuticals. Third, personal features were included in the study design to increase response rate. For example, these personal features were handwritten envelopes send to patients, attractive posters in the waiting room and personal contact before and during data collection with the practitioners and other key figures within the organisation.

Despite the effort to increase response rate, the most important limitation of the study is the low response rate of 4.7%, which may indicate bias[39]. There are several factors that might clarify the non-response rate in this study. Firstly, it should be noted that this study was conducted during the COVID-19 pandemic. Practitioners and patients may have shifted their priorities (and tasks) in order to respond to the challenges of this pandemic, potentially preventing commitment to the study. Secondly, the non-response rate can be explained by the effort that was required from respondents to complete the different steps in the study: return the ICF, go through the online module and return the questionnaire. The non-responders in this study may have had other (less positive) experiences with usability of the module or had no interest in or knowledge about oral care. Unfortunately, this data from non-responders cannot be retrieved and compared with the responders. This shows high potential for non-response bias in the study: it suggests that results from responders cannot automatically be generalised to non-responders[40]. Thirdly, characteristics of the study population as a result of the disorder may have led to the low response rate. Previous research found that as a result of their symptoms patients with severe mental illnesses are less inclined to volunteer for research than individuals without these conditions[41].

Another limitation for this study is the fact that log data and questionnaire data could not be linked due to technical reasons and that the data was collected anonymously. The biggest dilemma here is whether log data and patient characteristics reliably correlate with the usability of the module ‘Healthy Teeth’[42].

Directions for future research

For future research it would be valuable to investigate whether log data and patient characteristics correlate with the usability of the module. Given the great promise in eHealth[43], the modest usage of the eHealth module needs to be further investigated. To cover aspects related to previous experience, intent and beliefs of the eHealth module, supplemental qualitative research is recommended[44]. Finally, the results of present and previous studies on eHealth readiness of practitioners demands further investigation on promises, pitfalls and practitioners' perceptions on eHealth interventions[31,45].

Clinical implications

This study highlights the need for improving the translation of eHealth evidence into clinical practice[34]. To ensure patients will actually use this particular module, policy makers should raise awareness among practitioners and patients on the presented evidence for this eHealth module.

CONCLUSION

In conclusion, this study suggests that the online module 'Healthy Teeth' is usable for patients with bipolar disorder using psychopharmaceuticals. However, the actual usage of the module was low. To increase the usage of the module there is a need to raise awareness amongst practitioners and patients on the benefits of the module and eHealth (interventions) in general.

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TABLES

Table 1 Content of the online eHealth module 'Healthy Teeth'

Session	Topic	Content
1.	General information	A homepage with general information on dental health and dental problems. The page describes the content of the module and gives information on the development of the module.
2.	Anatomy of the mouth	Explains the anatomy of the mouth. A patient can choose to read more about teeth, molars or saliva through a hyperlink.
3.	Costs dentist	Tells about the costs of a dentist appointment and how this differs per practice.
4.	Pharmacotherapy in relation with dental problems	Gives information about pharmacotherapy: the medication one can use and consequences for dental health. There are several hyperlinks that link to pages on various medications and side-effects. It also shows a patient's personal experience in the form of a video.
5.	Instructions on dental care	Instructs the participants: declaring which medication they use to their dentist, checking the presence of a dental health insurance, thinking about dental hygiene and their diet (eating and drinking).
6.	Checklist	Shows a checklist for patients to discover what they should do or have already done for their dental care. The checklist will be sent to the principal practitioner if the patient agrees and can optionally be discussed during an appointment with the patient.
7.	Dentist	A session that analyses if there is patient-dentist communication about medication and helps the patient reflect on good oral health.

Table 2 Patient characteristics of the study sample

Patient characteristics	Frequency (N=19)	%
Gender		
Female	10	55.6
Education level		
Basic	6	31.6
Moderate	7	36.8
High	6	31.6
Mood*		
Depressed	3	15.8
Neutral	11	57.9
Manic	5	26.3
Frequency of tooth brushing		
<1x per day	0	0.0
1x per day	6	31.6
2x per day	11	57.9
>2x per day	0	0.0
Variable	2	10.5
Dental condition		
Very poor	0	0.0
Poor	5	26.3
Average	6	31.6
Good	8	42.1
Excellent	0	0.0
Dental insurance		
Yes	15	78.9
No	3	15.8
Don't know	1	5.3
Frequency of dental visits		
<1x per year	3	15.8
1x per year	4	21.1
2x per year	9	47.4
>2x per year	2	10.5
Variable	1	5.3
Type of psychopharmaceuticals		
Mood stabilizers	12	63.2
Antidepressants	5	26.3
Antipsychotics	11	57.9
Benzodiazepines	6	31.6
Anticonvulsants	5	26.3
Informing dentist on psychopharmaceuticals		
Yes	13	68.4
No	2	10.5
Don't know	4	21.1
Consultation prescriber psychopharmaceuticals		
Yes	2	10.5
No	11	57.9
Don't know	6	31.6
Duration of use psychopharmaceuticals		
<6 months	0	0.0
1-5 years	8	42.1
5-10 years	1	5.3

>10 years	10	52.6
Age, median (ICR)**		
Years	53(25)	

***Mood was measured with the visual analogue scale of the Life-Chart method[37]: 0-49 = depressed, 50 = neutral, 51-100 = manic, **ICR= Interquartile Range