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The value of tailored communication in promoting medication intake behavior

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Chapter 7

1+1=3? The systematic development of a theoretical and evidence-based tailored multimedia intervention to improve medication intake behavior.

Nurse: "Shall we work through the list [the Question Prompt List] now?" Patient: "Yes, I think that will be the best […] It should be easier to work through this while we talk because the things I have the most questions about are on this list" (male, 66 years old, Colitis).

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Abstract

Objectives: To describe the development of a theoretical and evidence-based tailored multimedia intervention to improve medication intake behavior in patients with inflammatory bowel disease (IBD). The intervention integrates interpersonal and technology-mediated strategies with the expectation that this will work synergistically.

Methods: The development followed the Medical Research Council's framework. Three literature reviews and three pre-tests among 84 IBD patients and eight nurses were conducted to guide the development of the intervention. A feasibility study was carried out among four nurses and 29 patients.

Results: The components include: 1) an online preparatory assessment (OPA); 2) tailored interpersonal communication; 3) tailored text messaging. To support the development, the feasibility was tested. Results indicated that the OPA was comprehensive and could be a helpful tool for both patients and nurses to prepare for the consultation. The training was evaluated as being instructive and applicable with a mean mark of 8.5. Of the developed messages, 65.6% received positive evaluations and were used in the intervention.

Conclusion: By applying the framework, we were able to describe the logic behind the development of a tailored multimedia intervention to improve medication intake behavior. This study could serve as a guide for the development of other health interventions.

Introduction

The odds of a good health outcome for patients who are taking their medication as prescribed are, on average, 2.9 times higher than the odds of a good outcome for non-adherent patients (DiMatteo, 2004). Despite this strong association, poor medication intake behavior remains a significant problem. Although interventions to improve medication intake behavior are common, effective interventions are scarce. Reasons for the ineffectiveness of interventions include 1) lack of theoretical foundation; 2) failure to identify the types of non-adherent behavior; and 3) inability to support patients to overcome barriers to successful medication intake behavior over time (Van Dulmen et al., 2007).

First, according to previous literature involving medication intake behavior interventions, and especially technology-mediated interventions, are often developed in an ad-hoc manner without reference to a theoretical foundation (Chavannes, Sont, Van der Boog, & Assendelft, 2012; Elliott, Barber, & Horne, 2005; Haynes et al., 2008). Research conducted across diseases has demonstrated that a robust theoretical foundation contributes to the effectiveness of interventions (Gallant & Maticka-Tyndale, 2004). Given the number of ineffective interventions developed to promote medication intake behavior (Van Dulmen et al., 2007), the theoretical foundations and feasibility of these interventions should be established before other costly trials are initiated (Robinson et al., 2005).

Second, to improve medication intake behavior, it is important to address specific reasons for poor medication intake behavior. Patients may report both unintentional (the patient does not take the medication unconsciously) and intentional (the patient actively decides not to take the medication) reasons for poor medication intake behavior (Clifford et al., 2008; Gadkari & McHorney, 2012; Unni & Farris, 2011). In addition, both intentional and unintentional poor medication intake behavior can be the result of practical and/or perceptual barriers (Linn et al., 2012). Practical barriers could be memory barriers (difficulties remembering to take the medication) or daily routine barriers (difficulties integrating the medication regime in daily life). Perceptual barriers could be necessity barriers (a lack of belief in the necessity of taking the medication) or concern barriers (fears or concerns about the medication; Kane & Robinson, 2010; Linn et al., 2012).

Third, persuasive communication can be important to support patients in overcoming their barriers to successful medication intake behavior (Van Dulmen et al., 2007). In the marketing and advertising literature, synergy is an important concept when considering the effectiveness of persuasive communication. Synergy refers to the effect that occurs when the combination of multimedia exceeds the sum of their individual effects (Naik & Raman, 2003). When exposed to multimedia, two psychological processes - forward encoding and multiple source perception - are stimulated (Voorveld et al., 2011).

Forward encoding occurs when a message in the first medium 'primes' the interest for, and attention to, a message in the second medium. For example, when a patient reads instructions about medication use, this may prime their interest in the information provided during a consultation and stimulate deeper processing (Dijkstra, 2002). This suggests that patients may more deeply process the message offered during a consultation if they have been provided with some form of preparatory communication beforehand. Multiple source perception refers to the notion that a message conveyed via different media may make the message appear more convincing and credible (Voorveld et al., 2011). This suggests that the persuasive power of the message could be enhanced if a multimedia approach is used, i.e. the message is delivered across different media. In the past decade, numerous interventions designed to improve medication intake behavior have been developed and implemented. These interventions have been delivered across a variety of media, including the Internet (Linn, Vervloet, van Dijk, Smit, & Van Weert, 2011), interpersonal communication (Van Dulmen et al., 2008) and, mobile telephones (Vervloet et al., 2012). In line with the synergy concept, Sabaté (2003) suggests that these strategies are most effective when used as components of multimedia programs and implemented in a tailored matter.

This paper describes the development of a theoretical and evidence-based tailored multimedia intervention aimed at addressing patients' barriers to successful medication intake behavior. By using different media to provide tailored information, it is proposed that the psychological processes of forward encoding and multi-source perception may be stimulated, thereby increasing patients' medication intake behavior.

Methods

We used the Medical Research Council's (MRC) framework to guide the development of this intervention. This framework was chosen because it acknowledges the importance of a theoretical understanding of the likely process of behavior change by drawing on existing evidence and theory, supplemented if necessary by new primary research (Campbell et al., 2007). The MRC framework distinguishes the following four phases: 1) development, 2) feasibility/piloting, 3) evaluation, and 4) implementation (see Figure 1) (Craig et al., 2008). In this paper, we will focus on the development, feasibility/piloting and evaluation of the intervention. First, the methods of these separate phases will be described (see paragraph 2.1 to 2.3), next the results (see paragraph 3.1 to 3.3).

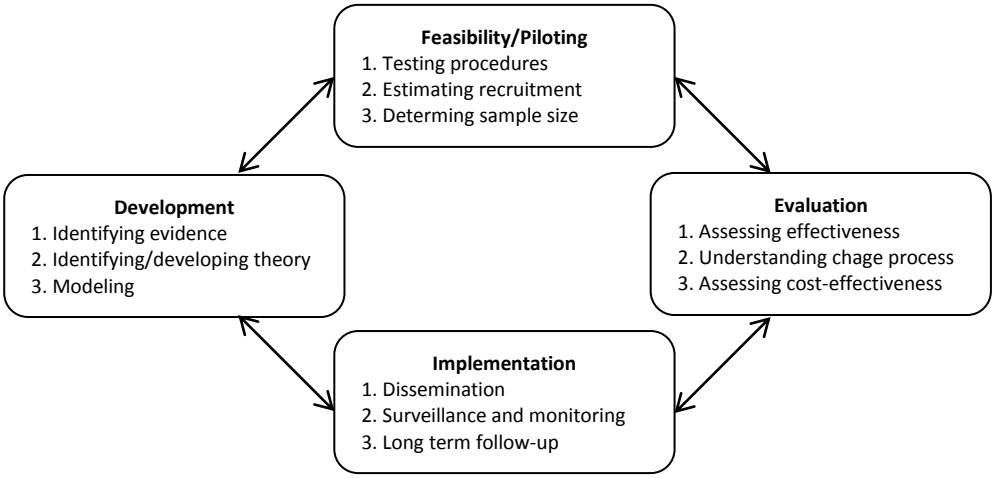

Figure 1. *Medical Research Council's evaluation Framework (MRC).*

Development

Identifying evidence

Because a theoretical understanding of the likely process of change was needed, we identified existing evidence and theory by conducting three reviews. To identify the available evidence concerning the effectiveness of interventions designed to improve medication intake behavior, two systematic literature reviews were conducted that investigated the effectiveness of tailored Internet-based interventions (Linn et al., 2011) and electronic reminders by mobile phones or electronic reminder devices (Vervloet et al., 2012) in improving medication intake behavior. We undertook comprehensive literature searches in PubMed, PsycINFO, EMBASE, CINAHL, and Communication Abstracts, following the guidelines of the Cochrane Collaboration. The search strategy included all possible search terms for Internet interventions or electronic reminders and medication intake behavior. In addition, a third literature review was conducted to gain more insight into what is known about communication in relation to medication intake behavior (Linn et al., 2012).

Identifying and developing theory

Because we believed that the existing evidence was not sufficient, we supplemented the existing evidence and theory with three pre-tests (Craig et al., 2008).

The Medical Ethical Committee of the VU Medical Center granted permission for these pre-tests and retrieved local feasibility statements (trial number NTR2892). The data were collected from September 2009 until March 2012. Patients with inflammatory bowel disease (IBD) were identified as a target population for the pre-tests as high rates of poor medication intake behavior among this patient group have been reported (Ediger et al.,

2007). In the pre-tests eight nurses of six different Dutch hospitals participated. Eligible patients were sent a letter with information about the study before the consultation. Written informed consent was obtained from both patients and nurses.

The intervention aims to support patients in overcoming their barriers to successful medication intake behavior. Since poor medication intake behavior can be the result of practical (memory and daily routine) or perceptual (concerns and lack of necessity) barriers, indicators of these barriers were needed. Concepts that are related to these practical and perceptual barriers are self-efficacy and beliefs. The importance of self-efficacy and positive beliefs towards the desired behavior in achieving health behavior change has been emphasized in a number of health psychology theories such as the Theory Planned of Behavior (TBP; Ajzen, 1991) and The Behavioral Model for Medication Adherence (Bruin et al., 2005). In the pre-tests two scales measuring patients' self-efficacy and beliefs were used as indicators for patients' barriers to successful medication intake behavior.

First, the Medication Understanding and Use Self-Efficacy (MUSE) was used. This scale consists of two four-item subscales assessing patients' self-efficacy of *understanding* (referring to memory barriers; $\alpha = 0.80$) and *using* prescribed medication (referring to daily routine barriers; $\alpha = 0.90$; Cameron et al., 2010). Responses to each statement were scored on a four-point Likert scale (1 = 'strongly agree' to 4 = 'strongly disagree'). Mean scores were calculated and a score of higher than two was considered as an indicator for practical barriers.

Second, the Beliefs about Medicine Questionnaire (BMQ) was used (Heijmans, 2006; Horne et al., 1999). This scale consists of five items assessing patients' beliefs about the *necessity* of prescribed medication (referring to necessity barriers; $\alpha = .75$) and five items assessing *concerns* about medication (referring to concern barriers; $\alpha = .67$) (Heijmans, 2006; Horne et al., 1999). Responses to each statement were scored on a five-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree'). Mean scores of the BMQ scales were calculated and the midpoint score of three or higher was considered as an indicator for patients' perceptual barriers (see Table 2). For the analysis in the pre-tests we used a significance level of $p = 0.05$.

With the results of the third literature review, the Practical and Perceptual Barriers to medication intake behavior-typology (PPB-typology) for effective communication was developed. Next, a pre-test was conducted to examine whether nurses communicated according to the typology. For this purpose, 80 educational consultations between nurses and IBD patients were videotaped and coded by independent observers using a codebook that was based on the PPB-typology. Subsequently, the relationship between the use of communication strategies according to the typology and barriers to successful medication intake behavior was examined (Linn et al., 2012). The verbal content of the consultations was analyzed using a coding system based on the PPB-typology. The MUSE (Cameron et al., 2010) and the BMQ (Horne et al.,

1999) were used as indicators of patients' barriers. The scores on the BMQ and MUSE were correlated with the scores for the communication categories using Pearson's bivariate correlations. To determine intercoder reliability, two observers both coded the same thirteen (16%) video recordings (Zandbelt et al., 2005). The intraclass correlation coefficients (ICC) ranged between 0.60 and 1.0, with a mean ICC of 0.90, which is considered good (Altman, 1991).

Previous studies indicated that patients' perceptual barriers are considered proximal determinants of medication intake behavior (Clifford et al., 2008; Horne & Weinman, 1999; Horne et al., 1999; Horne et al., 2009; Menckeberg et al., 2008; Schüz et al., 2011) and that patients' satisfaction about their providers' communication might be positively related to improved medication intake behavior (Bartlett et al., 1984). The aim of the second pre-test was therefore to explore the relation between patients' satisfaction and perceptual barriers (Linn, Van Weert, Van Dijk, Horne, & Smit, under review). Telephone interviews were conducted at the start of the treatment in which patients' perceptual barriers (Horne et al., 1999) and patients' satisfaction (Hendriks et al., 2005) were assessed (N=84). The BMQ was used as indicator for patients' perceptual barriers. Patients' satisfaction was measured with three subscales, i.e. satisfaction with general information about the disease and treatment (12 items; α = .85), with support regarding medication use (7 items; α = .67) and with affective communication (9 items; α = .82). In addition, patients were asked to indicate on a scale of 1 to 10 to what extent the consultation was tailored to their specific needs. Multiple regressions were used to measure the relation between satisfaction and perceptual barriers. Demographic variables were included as control variables.

Poor medication intake behavior can be a result of poor information recall, which is often assumed when complex information is given (Flocke & Stange, 2004; Kessels, 2003; Ley, 1976; Ley, 1979). It therefore seems important to explore this relation when developing an intervention aimed at improving medication intake behavior (Linn, Van Dijk, Smit, Jansen, & Van Weert, 2013). In total, 68 educational consultations concerning first-time medication use between nurses and patients were videotaped. Recall of information was measured using an adapted version of The Netherlands Patient Information Recall Questionnaire (NPIRQ; Jansen et al., 2008) and checked against the actual communication. Intercoder reliability was assessed and two observers randomly coded nine identical transcriptions (13%; Zandbelt et al., 2005). The mean intercoder reliability using Cohen's Kappa was .91 indicating a good intercoder reliability (Altman, 1991). Self-reported medication intake behavior was measured by asking patients to describe how precisely they took their medications as prescribed on a scale ranging from 1 to 10 (Hugen et al., 2002). Multiple regression was used to examine the relation between recall and medication intake behavior. Demographic variables were included as control variables.

Modeling

The different media studied in the literature reviews and pre-tests were 1) the Internet 2) interpersonal communication and 3) mobile phone. Based on the results, the different components of the intervention to be developed were determined: 1) an online component, i.e. Online Preparatory Assessment (OPA); 2) an interpersonal component, i.e. tailored interpersonal communication, learned during a communication skills training and 3) a text message component, i.e. tailored text messaging by mobile phone (see 3.1.3 for a more detailed explanation). The results of the reviews and pre-tests were also used to define each component of the intervention and to describe how each component of the intervention might alter behavior change (Craig et al., 2008).

Assessing feasibility and piloting methods

To test the feasibility of the online component, nurses (n=4) and patients (n=2) evaluated whether the various components of the OPA corresponded with the items discussed during educational consultations and barriers to successful medication intake behavior.

To test the feasibility of the interpersonal component, nurses (n=4) completed an evaluation questionnaire after the communication skills training. In addition, nurses were asked whether they perceived difficulties when integrating the intervention into their consultations.

The appropriateness and acceptability of the text message component was pilot-tested in IBD patients (N=29) and nurses (N=4). IBD patients were identified by an advertisement placed in the November 2011 online newsletter of the Dutch Crohn and Ulcerative Colitis association (CCUVN). Participants were asked to rate each of the 64 text messages on a four-point Likert scale (1 = 'extremely unhelpful' and 4 'very helpful'). Only the text messages that received an average rating of 'helpful' or 'very helpful' were selected for use. Nurses were asked during the training to reflect on the developed text messages and to think of alternatives.

Evaluating a complex intervention

After we established the theoretical basis, identified the main components of the intervention and pre-tested all the gathered evidence so far, a theoretically defensible and reproducible intervention was described. To objectify intervention effects several goals were formulated (see Table 1). The intervention will be implemented in a controlled setting. By exposing patients to either nurses who received the multimedia intervention (experimental condition), or to usual care (e.g., receiving standard information; control condition), the effectiveness of the intervention will be investigated. The primary outcome of interest is medication intake behavior, measured with pharmacy refill rates and self-reported measurements (Hugen et al., 2002).

Table 1.

Intervention Goals

Goals	Type of intervention	Component of the intervention
1. Improving communication skills (e.g. tailored information to the patients' needs and barriers, use affective communication, recall promoting behavior, promote patient participation)	Interpersonal and technology mediated	Communication skills training, OPA [a]
2. Encouraging the use of QPA	Interpersonal	Communication skills training
3. Identifying perceived barriers	Interpersonal and technology mediated	Communication skills training, OPA
4. Reducing patients' perceived barriers to successful medication intake behavior	Interpersonal and technology mediated	Communication skills training, OPA, text messages
5. Changing patients' medication beliefs	Interpersonal and technology mediated	Communication skills training, OPA, text messages
6. Improving patients' self-efficacy	Interpersonal and technology mediated	Communication skills training, OPA, text messages
7. Increasing recall of information	Interpersonal and technology mediated	Communication skills training, OPA
8. Improving satisfaction	Interpersonal and technology mediated	Communication skills training, OPA
9. Continuous support	Technology mediated	Text messages

[a] Online preparatory assessment

Results

Developing the intervention

Identifying evidence

The first systematic literature review (Linn et al., 2011) concluded that the Internet provides an optimal technology for implementing tailored interventions designed to improve medication intake behavior, because it has the capability to assess possible barriers.

The second systematic literature review (Vervloet et al., 2012) concluded that electronic reminders showed positive effects on medication intake behavior on the short-term. Intervention studies have mainly used text messages as reminders, focusing largely on patients who were unable to remember to take their medication as prescribed, i.e. patients that perceive memory barriers. However, new technologies make it possible to tailor text messaging content to address patients' individual barriers to successful medication intake behavior.

The third literature review lead to the development of the PPB-typology. The PPB-typology describes how to address patients' barriers to successful medication intake behavior with tailored communication. A detailed description of the PPB-typology is published elsewhere (Linn et al., 2012).

Identifying and developing appropriate theory

Results of the first pre-test demonstrated that nurses tended not to communicate according to the PPB-typology. Results also indicated that if communication strategies aligned to the PPB-typology were used, this was associated with less perceived barriers (Linn et al., 2012).

In the second pre-test (Linn et al., under review) we found that almost half of the patients perceived problems with believing that the medication was necessary and/or had concerns about the medication. Patients' satisfaction regarding nurses' communication and level of tailoredness was significantly related to a more positive attitude towards medication (β = .31, *p* = .012 resp. β =.25, *p* = .024).

In the third pre-test (Linn et al., 2013) a positive relation between patients' recall of information and medication intake behavior (β = .37, *p* = .007) was confirmed, indicating that higher recall of information relates to improved self-reported successful medication intake behavior.

Modeling

In this phase the components of the intervention are defined and described (Craig et al., 2008). Based on the first review, we concluded that the Internet may be a useful tool to alter patients' behavior. The first component of the intervention is therefore an OPA. This component may offer an opportunity for patients to prepare themselves for the consultation and nurses with tools to tailor information to patients' barriers to successful medication intake behavior. Information that is optimally tailored to the patients' barriers to successful medication intake behavior is expected to be more deeply processed, which might result in higher recall of information and, consequently, improved medication intake behavior (Linn et al., 2013).

The OPA consists of an online Question Prompt List (QPL) and two measurements: the MUSE (Cameron et al., 2010) and the BMQ (Horne et al., 1999) and is used to provide nurses with feedback on existing barriers and advices how to handle these barriers during the consultation. Patients received an email with a link to the OPA, varying between one week to two days before consultation. A QPL is a structured list with questions designed to aid patients' question asking behavior (Brown et al., 2001). By sending the QPL before the consultation, patients are leaving the time to read through the list and identify the questions they want to ask. The use of a QPL has been associated with a number of positive outcomes in previous research, such as, improved patient participation during consultation (Butow, Dunn, Tattersall, & Jones, 1994), improved patient empowerment (Dimoska, Tattersall, Butow, Shepherd, & Kinnersley, 2008), higher fulfillment of information needs (Van Weert et al., 2010), a shorter duration of consultation (Brown et al., 2001), reduced anxiety (Brown et al., 2001) and improved recall if information (Van der Meulen et al., 2008). The content of the QPL is based on a previous developed QPL in oncology (Van Weert et al., 2010) and items of the BMQ and MUSE. The QPL consists of 24

questions in total, divided in four main categories, corresponding with the four different types of barriers patients may encounter (i.e., memory barriers, daily routine barriers, necessity barriers and concern barriers). Statements include for instance 'I want more information about possible interferences in my daily life' (daily routine barriers) or 'I want to discuss my concerns about the side effects' (concern barriers). Patients are asked to identify the items they wanted to discuss by rating them on a four-point Likert scale (1 = 'not at all important' to 4 = 'very important'). There is also an opportunity for patients to add any additional questions. As soon as the patient completes the QPL, the nurse receives an email with the QPL. Patients can also print their own QPL and take it to the consultation.

To gain more insight into patients' barriers, patients fulfill the MUSE (Cameron et al., 2010) and the BMQ (Horne et al., 1999) directly after the QPL. If scores at that time (on baseline) indicate that a patient perceives barriers according to their scores on MUSE and/or BMQ, nurses are informed before the consultation by email with: 1) which barriers the patient perceives and 2) communication strategies that should be used in order to reduce or remove these barriers. The feedback about which communication strategies should be used, was based on the developed typology (see Linn et al., 2012 for a detailed description of the communication strategies). The execution of these communication strategies are trained during the communication skills training.

The second component of the intervention is interpersonal communication. Reviews have consistently concluded that communication is a powerful tool in promoting medication intake behavior (Zolnierek & DiMatteo, 2009) and that communication skills training often results in better communication behaviors among providers (Fellowes, Wilkinson, & Moore, 2001; Moore, Wilkinson, & Rivera Mercado, 2004). For this reason, a communication skills training with follow-up session was developed and executed. Nurses who participated in the pre-tests (N=8), were randomly assigned to the training (N=4). Prior to the training skills day, nurses received a complete reader by post containing a summary of the results of the pre-tests and practical exercises. The communication skills training was run by an experienced and qualified trainer. The first part of the training consisted of a presentation of the results of the three pre-tests. The second part of the training included a combination of learning methods such as role-play and reflection tasks. Afterwards the trainer discussed what the nurses learned. Twelve weeks after the communication skills training day, a half-day follow-up meeting was organized by the same trainer to provide the nurses with an opportunity to refresh and enhance the communication skills introduced during the training day. During follow-up nurses were also asked what the main changes where after the first day of training. Moreover, they discussed the successes and the barriers and received instructions about how to interpret the results of the OPA. As previous research indicates that the quality of healthcare interactions can be enhanced by the use of video-tapes and self-reflection (Marita, Leena,

& Tarja, 1999), the nurses were instructed to watch two video-taped consultations of their selves, recorded during the pre-tests, and to complete a self-reflection task. During the follow-up meeting, the self-reflection task was discussed.

The third component of the intervention is a tailored text message support system. Tailored text messages appear to offer promising possibilities for providing tailored feedback (Petrie et al., 2012). One of the advantages of text messaging is the ability to efficiently provide patients feedback over time. This may be especially relevant to patients living with chronic diseases that require the patient to engage in self-management behaviors over the longterm. Moreover, text messaging has the advantage of being inexpensive, easy to access and accessible to large populations (Petrie et al., 2012). For this reason, the third component of the intervention is a tailored text message support system. The development of these messages was based on the study of Petrie and colleagues (2012) and rewritten for patients with IBD receiving immunosuppressive or biological therapy. Patients receive one text message per week for six months, starting three weeks after the consultation. The type of text messages sent is determined by whether patients perceived barriers according to the scores on the MUSE and BMQ before and/or after the consultation. If a patient does not score high on one or more of the four targeted barriers, neither before nor after the consultation, the patient does not receive any text messages. If a patients scores high on one of the targeted barriers, before and/or after the consultation, he or she receives text messages from that specific barrier category. These text messages are chosen at random from that category that is designed to support patients with their barriers to successful medication intake behavior (see Table 2 for examples). If a patient scores high on multiple barriers, he or she receives text message chosen at random from the pool of messages for these barriers.

Assessing feasibility and piloting

To test the feasibility of the OPA, both nurses and patients reviewed the 24 items of the QPL. Results indicated that both nurses and patient thought that the items on the QPL corresponded with the items discussed during consultation and with patients' barriers, and that this was a helpful tool to prepare both nurses and patients before the consultation.

To test the feasibility of the communication skills training, participants completed a questionnaire. Results of the evaluation questionnaire indicated that all nurses evaluated the training as being instructive, practical, interesting and applicable. The training was evaluated with a mean mark of 8.5 (*SD* = 0.6), with 1 being not at all useful and 10 being extremely useful. The role-play with an actor was identified as the most meaningful component of the training.

Table 2.
Target barriers and text messages examples

Barrier	Measured with	Example of text messages
Memory barriers	MUSE patients' self-efficacy of understanding	"Put a note on the fridge or on the mirror above the sink. Replace the note occasionally or use a different color note, so it will stand out" "Think about your medication at regular intervals, for example, while brushing your teeth"
Daily routine barriers	MUSE patients' self-efficacy of using	"Keep some medication in your bag, purse or glove compartment in your car" "If you want to take an overseas trip, check with your IBD nurse if you need a doctor's statement to travel with your medication"
Necessity barriers	BMQ-Necessity	"Your medication helps to keep the inflammation in remission" "Your medication can help to enhance your quality of life"
Concern barriers	BMQ-Concerns	"Scientific research has shown that taking your medication is safe, even over a long period of time" "If you have questions about side effects, contact your IBD nurse"

In the beginning of the follow-up, nurses were asked what the successes were after the training. The nurses reported that they learned how to set transparent and structured agendas at the beginning of the consultation and were more likely to explore perceived barriers and to tailor their consultations to the patients' information needs and barriers. This resulted in more understanding and contact with the patient. The nurses also reported that they were more aware of the patient as an autonomous individual and felt the training gave them a better understanding of the patient. The nurses reported a number of difficulties that were addressed in the follow-up. These difficulties included integrating the communication skills into their consultations, working with patients who were not able to explicitly express their needs, managing consultations when the patient's agenda did not correspond with the agenda of the nurse and coping with workload. Some nurses indicated that in the beginning, when experimenting with the learned communication skills, they found it 'not natural' compared with their previous behavior.

Last, the feasibility of the text messages was tested. The four nurses reflected on the developed text messages during the follow-up training and believed that the tone of voice of some of the text messages was too positive. For example, they believed that text messages should not give false promises about the working of the medication. Instead, they suggested that the text messages should be more supportive, giving the patient advice what to do when they have, for instance, doubts about the effect of the medication. After adapting the text messages, 29 patients, i.e., eighteen with Crohn's disease and

eleven with Ulcerative Colitis (mean age of 26.6, *SD* = 8.1 with 85.0% being female), evaluated the text messages. In total 64 text messages were reviewed; 40 text messages (62.50%) received an average rating of 'helpful' or 'very helpful' (score $\geq$ 2.5) and were selected for use. In total 50 % of the messages targeting necessity, concerns and daily routine barriers were included and 62.50% of the messages targeting memory barriers. Patients had the possibility to add any comments about the text messages. Patients who were positive found the text messages useful, motivating or supportive. Some patients added that: 'The text message can help me with taking my medication, especially if the message are sent occasionally' or 'I like the text messages, especially how they are written: no difficult language, just simple and to-the-point'. Patients who were negative about the text messages reported: 'Some text messages are too positive, and therefore evoke resistance' or 'I do not believe in the text messages targeting my concerns, my fears are deeper than that'. Minor revisions in the selected text messages were made based on the recommendations of the reviews. Because we wanted 12 messages per barrier, we added new messages that were based on the evaluated messages that received high ratings, resulting in 48 text messages in total.

Evaluation

Outcomes will be measured after three weeks, six and twelve months. The results are expected to be available in December 2013 (see Table 3).

Discussion

This paper reports on the development of an innovative multimedia intervention to improve medication intake behavior. The strength of this intervention is that by following the guidelines of the MRC framework, we developed a good theoretical and evidence-based understanding of the likelihood that the intervention will be effective (Craig et al., 2008; Medical Research Council, 2000).

Each component of the intervention has its own specific value to improve medication intake behavior. This paper explained how technology-mediated and interpersonal communication can reinforce each other. The intervention integrated different media with their own specific value in tailoring the message with the expectation that this will work synergistically and thus will have added value as compared to stand-alone interventions. The OPA has the possibility to gain more insight into patients' barriers which assists in determining the most effective strategy to meet patients' specific barriers. This individual assessment gives providers more insight into patients' barriers and helps to provide tailored feedback during their consultations on both patients' barriers and patients' informational needs and concerns. We used new technologies to maintain support and send tailored text messages to assist patients with their medication intake in

daily routine. Recent research indicates that tailored messaging may be more effective than standard messaging at changing patient behaviors (Petrie et al., 2012).

Table 3.
Developing and evaluating the intervention according to the MRC framework

MRC: Feasibility and piloting/Development (September 2009 – October 2011)	
Systematic literature review: the effects of Internet interventions on medication intake behavior	
Systematic literature review: the effects of electronic reminders on medication intake behavior	
Development of the PPAB-typology	
Pre-tests	
Experimental group	Control group
3 hospitals, 4 nurses	4 hospitals, 5 nurses
Pre-test 43 IBD patients	Pre-test 43 IBD patients
MRC: Development	
Development intervention	
Pre-test text messages	
MRC: Implementation (November 2011 – January 2012)	
Experimental group	Control group
Intervention for nurses	Education as usual
Week 1: Communication skills training	
Week 2-11: Practice, reflection tasks	
Week 12: follow-up	
Intervention for patients	
OPA	
Text messages	
MRC: Evaluation (February 2012 – expected December 2013)	
Post-test	Post-test
3 hospitals, 4 nurses	4 hospitals, 5 nurses
43 IBD patients	43 IBD patients
Measurements:	*Measurements:*
Communication skills nurse	Communication skills nurse
Communication skills patient	Communication skills patient
Barriers medication intake behavior (Heijmans, 2006)	Barriers medication intake behavior
Recall	Recall
Satisfaction	Satisfaction
Anxiety	Anxiety
Background characteristics	Background characteristics

In adopting the multimedia approach this intervention capitalizes on the concept of synergy and the psychological processes of forward encoding and multiple source perception to enhance the persuasive power of the message. Empirical data is however needed to establish the effectiveness of a multimedia approach and future research should investigate the effects of this intervention.

A potential limitation of this intervention is the proposed design of this study. We chose to assign nurses and patients to the intervention group which is provided with the OPA, tailored interpersonal feedback and text messages. The control group continued receiving usual information. This was a practical consideration, because of the number of participating nurses (n=8). It would be interesting to assign nurses in the RCT to each of the separate components of the intervention. Although we assume that the integration of

these different modes of delivery may increase their effectiveness, it would also be interesting to test their effect in isolation to get insight in potential underlying mechanisms.

In this paper, the implementation phase of the MRC framework is not described. When implementing the intervention it is important to select people who are involved at the micro, meso, or macro level during the preparation, execution and/or continuation phase of the implementation, and who have insight into the factors that either impede of facilitate the implementation (Brug, van Assema, & Lechner, 2007). For example, nurses attended the training as a leisure activity. Although enthusiasm for the intervention can be an important facilitating factor for implementation (Meiland, Droes, de Lange, & Vernooij-Dassen, 2005), the imbedding of a communication skills training and activities to assure long-term continuation of the intervention requires commitment at organizational level.

Moreover, it is recommended to conduct a process evaluation during the implementation phase. Research conducted across diseases has demonstrated that a robust theoretical foundation contributes to the effectiveness of interventions (Gallant & Maticka-Tyndale, 2004) and helps to support the process evaluation of interventions. A process evaluation will gain valuable insights into the implementation process; whether the intervention was implemented according to plan and which adjustments are needed. This is critical when avoiding a Type III error and thus drawing incorrect conclusions about the effectiveness of a given intervention (Brug et al., 2007). For example, since our understanding of the facilitators and barriers to routinely use the OPA is still very limited, particularly in the IBD setting, without an appropriate process-evaluation this may result in incorrect conclusions about the ineffectiveness of the intervention (Brug et al., 2007). It can be recommended to use an implementation framework to conduct a process evaluation during the implementation phase. For instance, the Consolidated Framework for Implementation Research (CFIR) can be a useful framework to guide the exploration of the factors that positively or negatively influence the implementation (Damschroder et al., 2009).

Conclusion

By applying the MRC framework, we were able to describe the logic behind the systematic development and content of a feasible tailored multimedia intervention. In developing this intervention several study fields such as health communication, marketing and advertising were combined, which has led to an new view on how to address medication intake behavior.

Practical implications

While the pre-test is based on a sample of IBD patients, our intervention may be useful for all patients coping with chronic illness because the developed intervention is quite general and the content of the instruments could easily be applied to other diseases. This study could therefore serve as a guide for the development of other health interventions.