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The value of tailored communication in promoting medication intake behavior

Linn, A.J.

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Chapter 8

Summary and general discussion

Nurse: "How often are you taking your medication?" Patient: "Not at all anymore, I stopped taking them, I don't like them and I would not recommend them to anyone" (male, 45 years old, Crohn).

Summary

This dissertation aimed to develop a theoretical and evidence-based tailored multimedia intervention to improve medication intake behavior. In addressing this aim, this dissertation gained insight into patient barriers to successful medication intake behavior and investigated the various methods and types of media: the Internet (i.e., eHealth), mobile phones (i.e., mHealth) and interpersonal communication, that can promote successful medication intake behavior.

Chapter 1 provided an overview of the theoretical background. First, the importance of successful medication intake behavior was described. Second, an overview of the concepts used to describe whether patients take their medication (or not) and possible determinants of this behavior were presented. Last, different media and the way in which messages can be tailored to the specific barriers of patients were discussed.

The effectiveness of eHealth interventions on medication intake behavior was evaluated in **Chapter 2**. We conducted comprehensive literature searches in PubMed, PsycINFO, EMBASE, CINAHL, and Communication Abstracts following the guidelines of the Cochrane Collaboration. The methodological quality of the randomly controlled trials, clinically controlled trials, and methods for measuring medication intake behavior were independently reviewed by two researchers. The thirteen selected studies focused on a variety of chronic conditions and mainly employed self-reported measurements of medication intake behavior, such as questionnaires, interviews, and diaries. The review provided insight into the current developmental stage of these interventions, assessed the effectiveness of the studies on medication intake behavior, and investigated the degree of medication intake behavior as determined by the characteristics of the intervention and the characteristics of the study. The results indicated that eHealth may be effective in promoting medication intake behavior. The evidence is derived from five studies (three high-quality studies and two low-quality studies), which revealed a significant effect on medication intake behavior. Six other studies (four high-quality studies and two low-quality studies) reported a moderate effect on medication intake behavior, and two studies (one high-quality study and one low-quality study) exhibited no effect on medication intake behavior. The results indicated that, despite the advancements in this field, the development of high-quality studies on the effectiveness of Internet interventions has improved over time. The studies included in this review used moderately or highly sophisticated tailored interventions. We did not establish a clear relationship between the sophistication of the tailoring of the intervention and the extent to which the intervention was effective. This review yielded promising results for the effectiveness of Internet interventions in improving a patient's medication intake

behavior. However, more research is needed to investigate the level of tailoring and the effect of Internet interventions.

In **Chapter 3**, we aimed to synthesize and critically appraise existing evidence on the effectiveness of electronic reminders for improving a patient's medication intake behavior. Many patients experience difficulty with adhering to long-term treatment. Although a patient's reasons for not adhering to treatment are diverse, one of the most commonly reported barriers is forgetfulness. Reminding patients to take their medication may therefore be the solution. Electronic reminders (i.e., reminders sent automatically without personal contact between the provider and patient) are increasingly used to improve medication intake behavior. A comprehensive literature search was conducted in PubMed, Embase, PsycINFO, CINAHL and the Cochrane Central Register of Controlled Trials. The methodological quality of the studies was assessed using the Cochrane Collaboration guidelines. The studies focused on a variety of chronic conditions. We aimed to investigate whether the characteristics of electronic reminders were associated with their effectiveness. In total, thirteen studies were included: four studies evaluated SMS reminders, seven studies evaluated audiovisual reminders from electronic reminder devices and two studies evaluated reminder messages delivered to pagers. The best evidence synthesis revealed evidence of the effectiveness of electronic reminders. This evidence was provided by eight (i.e., four high-quality and four low-quality) studies that demonstrated significant effects on successful patient medication intake behavior. Of these eight studies, seven studies measured short-term effects (i.e., follow-up period < 6 months). Electronic reminders have the ability to improve short-term medication intake behavior, especially for patients who unintentionally do not take their medication as prescribed. We also concluded that, when stratified by type of electronic reminder, short-message services are promising media strategies for improving medication intake behavior. However, the long-term effects remain unclear. Technological advancements, such as the tailoring of timing (only when needed) and content (tailored messages), may lead to long-term improvements in medication intake behavior.

The aim of **Chapter 4** was to develop a new communication typology that addresses barriers to successful medication intake behavior and to examine the relationship between the use of the typology in relation to these barriers. We reviewed research concerning communication and medication intake behavior, which resulted in the practical and perceptual barriers to successful medication intake behavior-typology (PPB-typology) for effective tailored interpersonal communication. The PPB-typology addresses four potential barriers to successful medication intake behavior: 1) memory barriers; 2) daily routine barriers; 3) necessity barriers; and 4) concern barriers. We analyzed the verbal content of prescribing consultations using a protocol based on the developed typology. Eighty consultations concerning first-time medication use between nurses and

inflammatory bowel disease (IBD) patients were videotaped. The verbal content of the consultations was analyzed using a coding system based on the PPB-typology. The Medication Understanding and Use Self-Efficacy Scale (MUSE) and the Beliefs about Medicines Questionnaire (BMQ) were used as indicators of patient barriers and were correlated with PPB-related scores. The scores on these scales were correlated with the scores for the communication categories. The results of this study indicated that most of the communication strategies based on the PPB-typology were hardly used. However, we found that if nurses encouraged patients to ask questions, fewer memory barriers were perceived by patients. Moreover, summarizing information and the use of cartoons or pictures during the consultation were significantly associated with fewer perceived concern barriers. The results of this study suggest that the PPB-typology is a promising tool for the development of interventions aimed at addressing patient barriers to successful medication intake behavior.

In the Netherlands, nurses play an important role in educating IBD patients about immunosuppressive or biological therapy in prescribing consultations. **Chapter 5** provided more insight into the relationship between patients' satisfaction regarding their communication with nurses and their perceptual barriers about the immunosuppressive or biological therapy prescribed for IBD. Telephone interviews were conducted with 84 IBD patients at the beginning of treatment and after six months of treatment. Patients completed validated questionnaires that assessed their satisfaction regarding their communication with nurses during prescribing consultations and their perceptual barriers to immunosuppressive or biological therapy. To measure patient satisfaction, we used 29 statements associated with three scales concerning satisfaction with nurse's general information about their disease and treatment, satisfaction with nurse's support regarding medication use, and satisfaction with nurse's affective communication. Moreover, patients were asked to what extent they thought that their communication with nurses was tailored to their needs. The BMQ was used to measure patients' barriers to their specific prescribed medication. The results indicated that more than half of the patients had concerns or little personal need for medication, or both. However, concerns were most salient among patients. Patients' perceptual barriers remained consistent after six months. Patient satisfaction about the extent to which the communication during the consultation was tailored to their needs was significantly related to fewer barriers. In addition, patient satisfaction about the information given during the consultation was significantly related to fewer barriers to successful medication intake behavior. The results of this study highlight the significant role of patient satisfaction with provider communication and the value of tailoring in relation to perceived barriers. Interventions to improve medication intake behavior should therefore consider the communication skills of the provider.

When immunosuppressive or biological therapy is prescribed, nurses educate patients about the prescribed medication. Nurses are expected to inform the patients about the name of the medication, possible side effects, provide instructions on how to take the prescribed medication, and provide emotional support. These prescribing consultations often contain complex information. Poor medication intake behavior can be a result of poor information recall. In **Chapter 6**, we investigated the relationship between recall of disseminated information and medication intake behavior for IBD patients by comprehensively measuring recall of information. Eight nurses from six Dutch hospitals and 69 IBD patients participated in this study. Video-observations of nurse-patient prescribing consultations, supplemented with post-visit questionnaires to measure recall of medical information, were used directly after the consultation and again after a period of three weeks. Recall of information was compared with the actual communication in the video recordings of the consultations and assessed using an adapted version of The Netherlands Patient Information Recall Questionnaire (NPIRQ). This questionnaire was administered directly after the consultation and again after a period of three weeks. The information discussed in the videotapes was analyzed using an extensive observation checklist. First, coders assessed whether the topic was discussed in the visit. Second, each topic recalled was compared with the specific items mentioned by the nurse. Self-reported medication intake behavior was measured by asking patients to describe exactly how they took their medications. The results revealed that approximately half of the information was recalled by patients immediately after the consultation or after a period of three weeks. Information about the type of administration and the name of the medication were most accurately recalled. The information that was recalled most poorly was the impact of medication on the patient's daily life and advice about medication intake behavior. Patient recall of medical information was significantly correlated with self-reported medication intake behavior. The importance of information recall needs to be considered when developing educational interventions aimed at improving medication intake behavior.

The systematic development of a theoretical evidence-based tailored multimedia intervention

In **Chapter 2** and **3** we concluded that both eHealth and mHealth have the potential to reduce poor medication intake behavior. **Chapters 4, 5** and **6** showed that providers' communication is important in addressing patients barriers to successful medication intake behavior. Using these results, we developed a multimedia intervention to improve medication intake behavior. In **Chapter 7** we described the development of a theoretical evidence-based tailored multimedia intervention aimed at reducing or removing barriers to successful medication intake behavior. The intervention includes three different components: 1) an online preparatory assessment (OPA) including a Question Prompt List (QPL); 2) tailored interpersonal feedback and; 3) tailored text messaging. To support the

implementation of the intervention, a one-day communication skills training and follow-up session was conducted for the nurses. In addition, the feasibility of the intervention was tested among nurses and patients. We assumed that interpersonal and technology-mediated components are most effective when used as components of a multimedia program and implemented in a tailored manner. The integration of these different media may increase their effectiveness compared to their use in isolation. We anticipated that this intervention will result in measurable effects in barriers to successful medication intake behavior, improved communication skills (e.g., communication that is tailored to the patients' needs and barriers, the use of affective communication, recall promoting behavior, increased patient participation in the consultation) and positive changes in practical and perceptual barriers.

The value of tailored communication

In **Chapter 8**, we reviewed the findings of this dissertation and noted some ways in which the results may contribute to our understanding of how tailored communication may be effective in improving medication intake behavior. Directions for future research and practice were also outlined. Many interventions to improve medication intake behavior have been developed. However, effective interventions for improving medication intake behavior are scarce. One of the reasons for this may be that barriers responsible for poor medication intake behavior vary among patients and patient groups and across different situations. Interventions should therefore be tailored to patients' barriers to successful medication intake behavior. The use of eHealth and mHealth in the development of these interventions is increasing and seems promising. Tailored messages can also be useful in the context of interpersonal communication because, as shown in this dissertation, patients' satisfaction regarding the extent to which a consultation was tailored to their needs was significantly related to fewer perceptual barriers to immunosuppressive or biological therapy. In addition, tailored interpersonal communication can be effective in assisting patients in overcoming barriers to successful medication intake behavior. Moreover, recall of information is a predictor of self-reported medication intake behavior. Tailored messages receive more attention and thus are more thoroughly processed by patients and therefore it is expected that they will be better recalled. Based on these findings, we developed a theoretical and evidence-based tailored multimedia intervention to improve medication intake behavior. We assumed that interpersonal and technology-mediated components are most effective when used as components of multimedia programs and implemented in a tailored manner. Because each medium has its own value with respect to how it can tailor a message, the integration of different media may increase their effectiveness compared to their use in isolation.

General discussion

Now that we have provided an overview of the main results of the studies comprising this dissertation, we would like to discuss the main findings in an integrative way. This general discussion will be framed as an overview of the theoretical considerations. We will also take the opportunity to discuss some limitations of the study designs and measurements. The discussion will be concluded with implications for practice and recommendations for future research in this field.

Many chronically ill patients experience difficulties in taking their medication as prescribed. It is increasingly recognized that medication intake behavior is complex and that there is not one intervention that is effective for all patients (Steiner, 2012). Poor medication intake behavior can be unintentional (e.g., when a patient is not able to recall medical information due to memory problems) and intentional (when a patient decides not to take the medication because of fear of side effects). To improve medication intake behavior, it appears to be important to address the specific reasons why a patient is unable or unwilling to follow the treatment plan. From this perspective, interventions should be tailored to address the individual barriers to successful medication intake behavior.

This dissertation aimed to develop a theoretical and evidence-based tailored multimedia intervention to improve medication intake behavior. We investigated how various methods and types of media: the Internet (i.e., eHealth), mobile phones (i.e., mHealth) and interpersonal communication, can promote successful medication intake behavior. Two systematic literature reviews were conducted and examined the effectiveness of tailored Internet-based interventions and electronic reminders in improving medication intake behavior. A third literature review was carried out to gain more insight into what is known about tailored communication strategies in relation to medication intake behavior. Because we believed that the existing evidence was not sufficient to develop a theoretical and evidence-based tailored multimedia intervention for patients with inflammatory bowel disease (IBD), we supplemented the existing evidence and theory with three empirical studies.

Barriers to successful medication intake behavior

Before developing this intervention, we sought to gain additional insight into IBD patients' practical and perceptual barriers to successful medication intake behavior. According to the necessity–concerns framework (NCF), patients' perceptual barriers can be categorized as a combination of beliefs about the necessity of taking the medication and their concerns (Clifford et al., 2008). Using the NCF, we found that concerns were most salient in IBD patients, rather than a lack of belief in the necessity of taking medication. The results showed that more than half of the patients perceived high levels of concerns, low levels of personal need, or both, concerning their medication.

The importance of addressing perceptual barriers to the desired behavior—in this case, medication intake—has been emphasized in a number of theories such as the theory of planned behavior (Ajzen, 1991; Fishbein & Yzer, 2006), the integrative model of behavior prediction (Fishbein & Yzer, 2006) and NCF (Clifford et al., 2008). Previous empirical studies have also underlined the importance of taking perceptual barriers in IBD patients into account (Ediger et al., 2007; Horne et al., 2009). In these studies, perceived perceptual barriers were correlated with self-reported poor medication intake behavior. One study (Horne et al., 2009) found that patients who had concerns or doubts about the necessity of the medication were more likely to report poor medication intake behavior than patients who accepted the treatment.

Previous research in this area has been mostly cross-sectional. As far as we are aware, this is the first study to contribute new insight into the perceptual barriers perceived by IBD patients at the start of treatment and after six months of treatment using immunosuppressive or biological therapy. Our findings indicated that patients' perceptual barriers remained stable over time. This is in contrast with the results of other studies, in which patients' perceptual barriers were observed to change over time. In one such study, patients taking antidepressants perceived fewer perceptual barriers about their medication after six months (Aikens & Klinkman, 2012). In another study, patients perceived more perceptual barriers about medications for cardiovascular disease after twelve months (Allen LaPointe et al., 2010). Because different groups of patients may experience different perceptual barriers to different medications or to the same medication at different times (Clifford et al., 2008), it is difficult to compare the results. In addition, the beliefs in the previous mentioned studies and in our study population were not targeted. This might be due to the failure of health care providers to apply appropriate techniques to change those beliefs. The results reported in **Chapter 4** confirm that little communication was used that was considered appropriate for changing or decreasing barriers (see also below).

The results described in **Chapter 4** also suggest that patients perceived relatively few practical barriers (barriers in understanding and using prescriptions in their daily routines). In addition, there was not much variability in the perception of these barriers. A review involving factors associated with poor medication intake behavior in IBD, reported that practical barriers are a strong predictor of poor medication intake behavior. The barrier 'costs of medication' was an especially salient barrier, according to this review (Ediger et al., 2007). In the Netherlands, however, health insurance covers almost all medication costs. In addition, most of the patients in our study were highly educated and relatively young. This may partly explain why patients in our study perceived relatively few practical barriers. As an indicator of perceived practical barriers, we used a scale that measured patients' self-efficacy in understanding (i.e., memory barriers) and using (i.e., daily routine barriers) prescribed medication. In **Chapter 6**, patients' recall of information

was measured using video observations of nurse-patient prescribing consultations, supplemented with questionnaires. We found that IBD patients were able to reproduce approximately half of the information given during consultation. Important information that is needed to take the medication as prescribed, such as the impact of the medication on patients' daily lives and advice intended to promote successful medication intake behavior, were most poorly recalled. This information can be considered useless when poorly recalled by patients. To the best of our knowledge, this is the first study that has extensively measured recall of information in IBD patients who are educated about their newly prescribed immunosuppressive or biological therapy. Although patients' self-efficacy concerning understanding and taking the medication was relatively high, almost half of the information was not recalled. The differences in patients' reported and observed barriers may be related to the method used to measure these barriers. Self-efficacy is measured by self-reporting, while recall of information is measured more objectively. The relation between self-efficacy and recall of medical information should therefore be further investigated.

The value of tailoring in different media

We investigated how different media can be effective in improving successful medication intake behavior. The results indicated that the different media strategies examined can be useful in reducing barriers to successful medication intake behavior and improving medication intake behavior.

In the last few years, eHealth interventions have become more professionalized (Atkinson & Gold, 2002; Snoei, Van Bodegraven, Oldenburg, Stijnen, & Kaptein, 2009). Studies of various health behaviors have shown that computer-generated materials tailored to the unique needs and interests of individuals are more effective in, for instance, addiction relapse prevention and smoking cessation (Bull et al., 1999; Cortese & Lustria, 2012; Prochaska et al., 1993; Smit et al., 2012). Previous research involving eHealth interventions has been extended by showing that eHealth can also be effective in improving medication intake behavior. The Internet offers the possibility of assessing personal data related to health outcomes or determinants. In this way, the message can be tailored to the personal situation of the patient, and the most effective strategy for meeting patients' needs can be determined (Kreuter & Skinner, 2000). The review involving eHealth interventions showed that the majority of the interventions provided the opportunity to contact the health provider, signifying the additional value of the provider when using Internet interventions. All interventions in the review tailored the health messages to some extent to the personal situations of the patients. In examining the level of tailoredness and the effectiveness of the intervention, no clear relationship was found. However, because all interventions tailored the message to some extent, the messages were, to that extent, personally relevant. According to the elaboration likelihood model (ELM), information that is personally relevant is more likely to be deeply processed, which

may lead to better recall of information (Petty, Cacioppo, & Goldman, 1981; Petty & Cacioppo, 1986b). Higher levels of recall is important because forgetfulness is commonly reported as a barrier to successful medication intake behavior in various populations. In studies in which reminder packaging (pill boxes, blister packages, or bottles) has been used, modest improvements in medication intake behavior have been reported. Personal active reminders, which require an extensive time investment, have been shown to have positive effects on medication intake behavior (Mahtani et al., 2011; Zedler et al., 2011). This dissertation extended previous research by showing that electronic reminders can also be effective in reducing unintentional poor medication intake behavior.

While past research involving mHealth has mainly focused on reminding patients to take their medication, new technologies make it possible to tailor text messaging content to address both patients' practical and perceptual barriers to successful medication intake behavior. In a recent study, asthma patients who received tailored text messages based on content reported greater personal need for their medication, more perceived control and displayed more successful medication intake behavior than patients who did not receive those messages (Petrie et al., 2012). We conclude that with the increasing opportunities offered by new technologies, it is also advisable to tailor messages based on timing (i.e., only when needed), in addition to tailoring messages in content. A recent study used real-time medication monitoring (RTMM) combined with SMS reminders. These messages were sent only if patients forgot to take their medication. This study showed that sending messages only when needed improved medication intake behavior and especially the precision with which patients followed their prescribed regimen (Vervloet et al., 2011; Vervloet et al., 2012). This method may be more effective compared to sending messages at fixed time intervals. Text messages at fixed time intervals may cause annoyance and may eventually lead to loss of effectiveness when the automated reminders become a routine. Thus, mHealth strategies that combine tailored content and reminders only when needed may increase the effectiveness of tailored messages even more (Pop-Eleches et al., 2011).

Although tailoring is often associated with new technologies, tailored messages can also be delivered via interpersonal communication. Interpersonal communication provides excellent opportunities to tailor information to the characteristics and needs of a specific patient, assuming that the provider pays attention to the individual needs, preferences and wishes of that patient. While the evidence suggests that tailoring to patients' instrumental and affective needs seems to be more and more important (DiMatteo, 2004; Haynes et al., 2008; Nunes et al., 2009; Van Dulmen, 2011), reviews involving patient-provider communication have concluded that providers' communication is often not tailored to patients' needs (Hack et al., 2005; Ong et al., 1995). We found that nurses often failed to mention important elements of medication use, such as duration of intake, medication intake-related behavior, and the possibility of side effects. This may

result in unmet information needs of the patient. A previous study in oncology found that providers do not explore patients' information needs sufficiently (Posma et al., 2009). As a consequence, providers cannot tailor information to patients' needs, and an information gap may exist.

The results of our study demonstrate the important role that the level of tailoredness in interpersonal communication plays in reducing barriers to successful medication intake behavior. Greater patient satisfaction with the extent to which the consultation was tailored to the patient's personal situation and preferences was significantly related to fewer perceptual barriers to immunosuppressive or biological therapy. We also found that greater satisfaction regarding nurses' instrumental communication was significantly related to fewer perceptual barriers to immunosuppressive or biological therapy. A previous study showed that the quality of providers' interpersonal communication skills resulted in improved medication intake behavior (Bartlett et al., 1984). However, to the best of our knowledge, the relationship between the level of tailoredness of the providers' information provision and the extent to which the patient perceives perceptual barriers has not been studied before. Because perceptual barriers are found to negatively influence medication intake behavior (Horne et al., 2009; Wroe, 2002; Wroe & Thomas, 2003), this finding provides opportunities for practical recommendations on how to improve medication intake behavior. To prevent or reduce perceptual barriers, it appears that nurses should tailor information to patients' personal situations, preferences, and information needs.

How providers should tailor their communication is often not described (Barber et al., 2004; Bernstein et al., 2011; Ong et al., 1995). A meta-analysis by Zolnieriek and DiMatteo (2009) showed that patients of providers who communicate well have higher successful medication intake rates than patients whose providers do not communicate effectively. However, the studies reviewed in that meta-analysis mainly focused on the exchange of information during prescribing consultations and did not precisely identify which elements contributed to this effect and how. In our study, we have extended the existing literature by identifying the practical and perceptual barriers to successful medication intake behavior typology (PPB-typology). This typology provides tailored communication recommendations that are designed to meet patients' needs and assist providers in tailoring their communication to patients' barriers. The results of our study indicated that nurses generally do not address barriers to successful medication intake behavior in their communication with patients. This may be because nurses find it difficult to identify which barriers patients perceive and therefore are not able to tailor their communication (DiMatteo, 2004). The results also revealed that if nurses used tailored communication strategies that addressed patients' barriers to successful medication intake behavior, patients reported fewer perceived practical and perceptual barriers.

In conclusion, because IBD patients may have different reasons for their poor medication intake behavior, it is important that messages are tailored to patients'

individual barriers. New media strategies offer opportunities to tailor messages, and the effectiveness of these strategies is promising. In addition to eHealth and mHealth, tailored interpersonal communication can be a powerful tool in promoting medication intake behavior. For instance, effective communication that is tailored to patients' needs and preferences was found to be related to fewer perceptual barriers to medication intake behavior. Moreover, the importance of addressing barriers to successful medication intake behavior is emphasized. The proposed PPB-typology, which contains tailored interpersonal communication recommendations to reduce or remove barriers to medication intake behavior, has led to a unique view of *how* to reduce barriers to successful medication intake behavior in patients with chronic diseases.

The value of a theoretical and evidence-based tailored multimedia intervention

Finally, a theoretical and evidence-based tailored multimedia intervention was developed. This intervention enables providers to tailor their communication to patients' barriers to successful medication intake behavior. According to a review, interventions are often developed in an ad hoc manner without reference to a theoretical foundation (Elliott et al., 2005; Haynes et al., 2008). eHealth and mHealth interventions in particular are often lacking in theoretical foundations (Chavannes et al., 2012). Research conducted across diseases has, however, demonstrated that a theoretical foundation contributes to the effectiveness of interventions (Gallant & Maticka-Tyndale, 2004) and helps to support the process evaluation of interventions. **Chapter 7** described the development of a theoretically defensible evidence-based multimedia intervention aimed at addressing patients' barriers to successful medication intake behavior. The development followed the guidelines of the Medical Research Council (MRC) framework. Using the MRC framework, **Chapter 7** described the logic behind the systematic development and content of a new and innovative tailored multimedia intervention. This description could serve as a guide for other health care professionals when developing health interventions.

The value of tailoring in each medium has been discussed previously in this chapter, and it can be concluded that each medium has its own value in improving medication intake behavior. Computer technologies can be used to create tailored health messages derived from an individual assessment (**Chapter 2**), such as the Question Prompt List (QPL) described in **Chapter 7**. A QPL is a structured list with questions asked before the consultation, giving patients the time to read through the list and identify the questions they want to ask. Because patients are provided with some preparatory tools beforehand, they can prepare themselves for the consultation and gain more insight into what they want to discuss. Nurses who are given the results of this assessment are provided with information on potential barriers to medication intake behavior. Based on the results of this individual assessment, nurses can more easily provide tailored feedback during the consultation (**Chapter 7**). The ability to tailor interpersonal communication

(**Chapter 4**) may result in higher levels of satisfaction (**Chapter 5**), more personally relevant information, and higher recall of information (Kessels, 2003; Van der Meulen et al., 2008). The results of our study showed that recall of information was related to more successful self-reported medication intake behavior (**Chapter 6**). This finding supports Ley's cognitive model, based on his argument that patients' successful medication intake behavior is largely determined by patients' recall of medical information (Ley, 1979). Moreover, new technologies can be used to send tailored text messages to support patients in their medication intake behavior (**Chapter 3 and 7**). Recent research has indicated that tailored text messaging may be more effective than standard messaging in changing patient behaviors (Bull et al., 1999; Cortese & Lustria, 2012; Prochaska et al., 1993; Smit et al., 2012). One of the advantages of text messaging is the ability of the medium to efficiently support patients over time. This may be especially relevant to patients living with chronic diseases that require the patient to engage in self-management behaviors on the long term. Communicating tailored messages via eHealth, mHealth, and interpersonal communication might result in the messages being perceived as more convincing and trustworthy (Voorveld et al., 2011). The persuasive power of the intervention developed in this dissertation is expected to be stronger because a multimedia approach is used (i.e., the message is delivered across different media) and the message is tailored to patients' barriers. In developing this intervention, several study fields, such as health communication, health psychology, marketing and advertising, were combined. We expect that by combining interpersonal and technology-mediated strategies, this approach will work synergistically to enhance medication intake behavior in comparison to either one strategy applied in isolation. This will be tested in future research.

Strengths and limitations

Strengths of the study

The results of the studies described in this dissertation provide useful insights into *how* barriers to successful medication intake behavior can be addressed by using tailored technology-mediated and interpersonal communication, and our studies provide insight into *which* communication elements are related to fewer practical or perceptual barriers to successful medication intake behaviour, and *how* this can be applied in practice.

To the best of our knowledge, this is the first study that has analyzed IBD patients' barriers to successful medication intake behavior at the start receiving immunosuppressive or biological therapy and again after six months. Because the study was conducted in a naturalistic environment and combines video observations of nurse-patient prescribing consultations with pre- and post-visit questionnaires, it permitted a precise and accurate analysis of patients' and nurses' behavior.

The proposed PPB-typology provides concrete recommendations for *how* to reduce barriers to successful medication intake behavior with interpersonal communication in patients with chronic diseases. Moreover, the PPB-typology can be a useful tool in developing communication skills training that is targeted to patients' barriers to successful medication intake behavior.

Persuasive communication can be important in supporting patients in addressing their barriers to successful medication intake behavior. In the past decade, numerous interventions using different media have been designed and implemented to improve successful medication intake behavior. The MRC framework offers the opportunity to describe the development of an intervention structurally and ensures that every step needed to develop an intervention is completed. The description of the intervention described in this dissertation provides useful insights into how barriers to successful medication intake behavior can be addressed using different media, each of which has its own value in improving successful medication intake behavior. By combining techniques from several fields, medication intake behavior is placed in an interdisciplinary perspective at the interface of marketing and medicine.

Limitations

First, we focused on verbal communication because this type of communication is still of great importance in medical consultations. However, we did not include non-verbal communication in the scoring system. Essential elements of patient-provider communication include both verbal and nonverbal communication (Roter, Frankel, Hall, & Sluyter, 2006). As a review by Hall, Roter, Ehrlich, and Miller (2006) showed, nonverbal communication is associated with patient satisfaction. The results of this dissertation showed that patients' satisfaction with nurses' communication was significantly related to fewer perceptual barriers to successful medication intake behavior. Because we did not take nonverbal communication into account, it is unknown whether nurses' nonverbal communication would have influenced these results.

Second, the many methods used to measure medication intake behavior include physiological/biomedical measures, refill records, pill counts, electronic monitoring devices, and self-reported measurements (DiMatteo et al., 2012; Sluijs et al., 2006). The accuracy of each of these methods has been debated. In this dissertation, self-reporting was used to measure medication intake behavior. Self-measurements can contribute to overestimation of the effects of interventions (Nieuwkerk & Oort, 2005). This could be explained by the possibility that patients may forget that they missed a dose. The biases that appear to be most prominent in patients' estimating medication intake behavior using structured questionnaires are social desirability and social approval biases. In other words, studies relying on self-reporting may have a tendency to err on the optimistic side (Urquhart & Vrijens, 2005; Wetzels et al., 2006) with regards to medication intake

behavior, especially compared with more objective pill-counting studies. Although self-reported measurements may be affected by recall and self-presentation bias (Urquhart, 1994), a meta-analysis showed that self-reported medication intake behavior is likely to correlate with more accurate measurements such as pill counts (Shi, Liu, Fonseca et al., 2010). We used an one-item measurement to assess short-term self-reported medication intake behavior. A previous study, however, showed that this self-reporting measure was significantly related to a more objective method to measure medication intake behavior: the medication event monitoring system (Hugen et al., 2002). However, the use of objective measurements would support the validity of our findings. Our future research will include refill data obtained one year after start of the treatment to gain more insight into IBD patients' medication intake behavior and to compare patients' self-reported medication intake scores with their perceptual barriers.

Third, we had a relatively small, convenient, sample. Most of the patients who participated in the study were highly educated and relatively young. Non-response analyses showed no differences between participating and non-participating patients in terms of gender and age. Both Crohn's disease and ulcerative colitis typically manifest during late adolescence or early adulthood, with a peak onset between 15 and 30 years of age (Russel & Stockbrügger, 1996). Because memory problems in particular may be different in older and poorly educated patients, it is desirable to replicate this study among older and/or less educated patients in other patient samples. Moreover, it is plausible that patients who refused to participate in the study because they felt too sick, tired, overwhelmed, busy, or because they had cognitive deficits, are individuals who are likely to be more in need of effective communication strategies to improve medication intake behavior than the patients who agreed to participate in this study. It is therefore plausible that these results are not generalizable to all those in need. This may have contributed to an underestimation of the barriers.

Last, a potential limitation of the intervention developed in this dissertation, is the proposed design of this study. We chose to assign nurses and patients to the intervention group provided with the OPA, tailored interpersonal feedback and text messages. The control group continued receiving the 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.

Implications for clinical practice

This dissertation outlined some problems and challenges in educating IBD patients about their newly prescribed medications.

Exploring the opportunities of using eHealth in hospitals

With the introduction of applications for smart phones and tablets, it has become possible for patients to monitor their health, improve their treatment outside the hospital, and access health care services anytime and anywhere (Preuveneers & Berbers, 2008). eHealth is expected to contribute significantly to further development of health systems. Moreover, it offers the opportunity for providers to stay in contact with their patients without much extra effort. Hospitals should therefore investigate the opportunities of using eHealth in their usual care.

Enhancing active patient participation during consultation

Many patients report unmet needs. In the literature, it is often assumed that patients do not clearly express their information needs because patients assume that the provider has told them everything or because patients worry that they will appear foolish or take up too much time of the provider (Fallowfield & Jenkins, 1999). Moreover, patients tend to utter their questions and opinions more spontaneously and need their providers to encourage them to express concerns (Butow et al., 2002; Zandbelt, Smets, Oort, Godfried, & de Haes, 2007). Patients can use the developed QPL or any other form of preparatory communication beforehand to prepare themselves for the consultation. The developed QPL is a structured list of questions that serves to prompt the patient to ask specific questions but also raise concerns during a healthcare consultation. Previous research has demonstrated that exposure to a pre-visit website with a QPL empowered patients by making them more assertive (Dimoska et al., 2008). Moreover, a QPL stimulates patient participation during the consultation, such as increasing question-asking behavior (Brown et al., 2001). Obtaining information prior to the consultation can benefit the decision-making process (Ilic, 2010). Furthermore, it is important for patients to express whether they do or do not believe that the medication is necessary or whether they have concerns about the medication.

Communication skills training

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 et al., 2001; Moore et al., 2004). This dissertation notes some implications for developing

communication skills training and communicating effectively with patients when educating them about medication.

Effectively communicate critical elements

Many health communication theories consider knowledge a factor that can explain a large proportion of the variance of a behavior, such as medication intake behavior (Maibach & Cotton, 1995). In the Netherlands, IBD nurses play an important role in educating IBD patients about immunosuppressive and biological therapy during prescribing medication consultations. The importance of prescribing consultations was emphasized in a study by Tarn and colleagues (2006). They found that poor education about prescribed medication may contribute to an increase in misunderstandings about the prescribed medication (Tarn et al., 2006). Unfortunately, consistent with previous literature on provider-patient communication (Latter, Maben, Myall, Young, & Baileff, 2007; Tarn et al., 2006) this dissertation showed that IBD nurses often do not communicate critical elements of medication use. It is therefore important to mention important elements of medication use, such as duration of intake, medication intake-related behavior, and the possibility of side effects. Moreover, since recall of medical information was related to self-reported medication intake behavior, providers should consider recall-promoting techniques such as summarizing, categorizing, structuring, emphasizing, repeating medical information, providing patients with written (online) information, and using cartoons or pictures when explaining medical information. It is therefore advisable to communicate important need-to-know information to patients about their treatments, explore what patients want to know, tailor information to the individual needs of patients, and use recall-promoting techniques. These techniques should be prioritized in communication skills training.

Use of affective communication and adequate response to emotional cues

Literature on health communication emphasizes the importance of both instrumental *and* affective communication in promoting successful medication intake behavior (Ong et al., 1995; Zolnierek & DiMatteo, 2009). The ability to use affective communication is considered a necessary condition for adequate patient education as well as an important predictor of the success of a consultation (Bensing, 1991). Providers, however, often do not use affective communication during consultations (Heaven & Maguire, 1996). Consistent with previous research (Latter et al., 2010), the results of this study showed that IBD nurses mostly use instrumental communication; use of affective communication was hardly noted. Next to the lack of use of general affective communication, we found that nurses neglected one third of patients' emotional cues (e.g., by changing the subject), which has been recognized as an inhibiting response. Moreover, exploring patients' emotional cues, recognized in the literature as facilitative communicative behavior, was only incidentally found. Neglecting patients' emotional cues may lead to poorer patient recall (Jansen et al., 2009). An adequate response to patients' emotional cues may

encourage patients to more fully disclose their concerns (Butow et al., 2002; Mauksch, Dugdale, Dodson, & Epstein, 2008; Uitterhoeve et al., 2008), which may result in fewer concerns if adequately addressed. Thus, employing affective communication and responding adequately to patients' emotional cues are essential when communicating with patients who perceive perceptual barriers. For example, providers can create a nonjudgmental and safe environment, provide social support, show empathy, engage in social conversations, and make jokes.

Identify, explore, and address barriers to successful medication intake behavior

More than half of the patients starting to take a new medication perceive perceptual barriers. Moreover, half of the information given is poorly recalled. This suggests a need to address patients' barriers, especially because these barriers are associated with poor medication intake behavior. The results showed that nurses generally do not address barriers to successful medication intake behavior in their communication with patients. To identify patients' barriers, it is important that nurses ask patients whether they perceive barriers and that nurses respond adequately. Communication skills training for nurses should prioritize exploring, identifying, and addressing barriers. The PPB-typology can serve as a guide how to reduce these barriers.

Recommendations for future research

Measuring medication intake behavior

It is increasingly recognized that medication intake behavior is complex. Steiner (2012), for example, argues that medication intake behavior is a result of different determinants that interact with each other. Almost 200 different determinants have been studied, but none of them has been consistently related to poor medication intake behavior or has been found to be fully predictive (Donovan, 1995). This may be the reason why no gold standard for measuring medication intake behavior has been developed. For example, because different groups of patients may experience different barriers to different medications or to the same medication at different times, it does not seem logical to use one single scale for different groups of patients and different types of medication. A study in breast cancer patients using endocrine therapy found that a lack of personal need for the medication, measured using the Beliefs about Medicines Questionnaire (BMQ), was the best predictor for poor medication intake behavior (Grunfeld, Hunter, Sikka, & Mittal, 2005). However, a more recent qualitative study in breast cancer patients using endocrine therapy concluded that patients' beliefs, measured on the same scale (BMQ), appeared to be just as important as patients' own experiences and perceptions (Wouters et al., submitted). When measuring medication intake behavior, scholars are consistently using measurements that focus on only one or two determinants of a behavior. The advantage

of a more inductive approach, such as that used in a study by Wouters and colleagues (submitted), is that it may unravel more about people's experiences or reasons for poor medication intake. It is therefore recommended to use more qualitative approaches, such as interviews or focus groups, to gain more insight into the specific reasons for poor medication intake behavior that are relevant to a specific group. A scale to measure medication intake behavior should include several components and measure several determinants. Based on the interviews, one should choose the components of the scale that are most appropriate for that specific patient group, type of medication, and type of disease. This may result in more suitable and more predictive measures.

Multimedia tailoring

The combination of different tailored media is a relative new field in health communication. Future research should investigate the effectiveness of combining these strategies. Future research should also focus on the underlying processes of the effect of tailoring and the effects on various outcome measures, such as message processing (e.g., the role of involvement) and message factors (e.g., message content and style). In our review of the eHealth literature, we did not find evidence of a clear relationship between the level of sophistication of an intervention and the extent to which the intervention appeared to be effective. Future studies should be conducted with varying levels of tailoring to further test which characteristics of the tailored messages have the most positive effects on adherence. Moreover, it would be interesting to conduct tests to determine the optimal combination of different media and to determine for whom this combination may be most effective.

Refining the PPB-Typology

In this study, we made some first steps towards developing the PPB-typology, which should be refined and further developed in the future. Future research should include pre-measurements before consultations to measure perceived barriers regarding medication. Because we did not assess patients' barriers to successful medication intake behavior before the consultation, we were not able to measure possible changes in perceived barriers. This might also be an explanation for some findings that were not predicted by the typology developed. For example, checking whether the patient understood the information provided was associated with an increase in necessity barriers. It might be that nurses used these communication techniques to decrease those barriers but were not able to remove them. In other words, it is possible that patients still scored relatively high on these barriers after consultation, although less than before consultation. We believe that these results can contribute to the further refinement of our PPB-typology, and these communication strategies will be added to the PPB-typology. Moreover, further research should investigate whether nurses apply the communication strategies and whether this is related to fewer barriers.

New media strategies

The number of consumer health applications available for smartphone users is growing at an accelerated rate. For example, as of mid-April 2012, there were more than 13,600 consumer health apps available for the Apple iPhone (mobihealth news, 2012). However, until now, little research has investigated the effectiveness of these apps. Moreover, the applications are often developed in an unstructured manner, without any theoretical basis. With the introduction of applications for smart phones or tablets, it has become possible for patients to monitor their health, improve their treatment outside the hospital, and access health care services anytime and anywhere (Preuveneers & Berbers, 2008). It is important to know when patients have difficulties taking their medication as prescribed. With this information, providers can intervene at appropriate times. A recent study showed that interruptions in patients' daily routines, during weekends and holidays, may result in reduced intake of their medications and is an important risk factor for poor medication intake behavior (Vervloet, 2013). "Always on" and "always worn" mobile phones can provide an intimate and detailed picture of an individual's daily routines and offer affordable, proximate, personalized, and continuous measurement in context (Ramanathan et al., 2012). If it appears that a patient has an interruption in his or her daily routine, it will be possible, using these types of media strategies, to intervene at specific appropriate moments, which may result in better medication intake behavior. It would therefore be interesting to develop and systematically evaluate an evidence-based application for monitoring patients' health.

Concluding remarks

One of the proposed solutions for improving medication intake behavior is tailoring and it is important to address the specific reasons that a patient may be unable or unwilling to take medication as prescribed. Until now, not much was known about which medium should be used, how the message should be tailored and how the content should be adapted to the receiver. This dissertation showed that each medium (the Internet (i.e., eHealth), mobile phones (i.e., mHealth) and interpersonal communication) has its own value in tailoring the message. The results also indicated that many IBD patients starting receiving immunosuppressive or biological therapy perceive barriers to taking the medication as prescribed. To improve medication intake behavior, the message should not only be adapted to patients' perceptual and practical barriers but also to patients' information needs. This will increase patients' satisfaction and reduce perceptual barriers. Because recall of information is related to medication intake behavior, providers should provide information that is easy to understand and remember. Based on a theoretical foundation and empirical evidence, a tailored multimedia intervention was developed in this dissertation and implemented in a clinical setting. In the intervention developed, new

technologies are used to supplement prescribing consultations, with the expectation that this combination will work synergistically in increasing medication intake behavior.