A novel approach to tailored communication

Optimizing online health information for older patients

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Publication date
2019

Document Version
Other version

License
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Chapter 7

Online information for newly diagnosed cancer patients: Effects of a tailored pre-visit web-based intervention on patient outcomes

This chapter is under review as: Nguyen, M. H., Smets, E. M. A., Bol, N., Loos, E. F., Tytgat, K. M. A. J., van Laarhoven, H. W. M., Geijsen, E. D., van Berge Henegouwen, M., & van Weert, J. C. M. Online information for newly diagnosed cancer patients: Effects of a tailored pre-visit web-based intervention on patient outcomes.

ABSTRACT

Many patients, including older patients (≥65 years), go online for health information to prepare for their doctor's visit. Especially older patients have varying needs regarding the mode in which information is presented online (e.g., via textual, visual or audiovisual modes) due to age-related sensory (e.g., impaired vision and/or hearing) and/or cognitive decline (e.g., reduced processing speed). Therefore, websites targeted at older patients (e.g., cancer patients) which are tailored to individual visual/auditory capabilities and preferences are more likely to be positively evaluated, benefiting health-related outcomes. This study tested the effectiveness of a website tailored to individual preferences for information modality (vs. non-tailored websites) and examined whether mode tailoring has added value for older patients. A randomized controlled trial (RCT) among newly diagnosed younger (<65 years) and older (≥65 years) cancer patients (N = 232) was conducted to test the effectiveness of a mode-tailored website (i.e., by self-selecting text, images and/or videos) versus non-tailored websites (i.e., with either text only, text with images, or text with videos). Patients received the website as preparation before their hospital consultations to discuss diagnosis and treatment. Online questionnaires were completed before the visit to assess website involvement, website satisfaction, communication self-efficacy and anxiety (T1). Patients' question-asking behavior was coded from videotaped consultations and anxiety was assessed by a questionnaire (T2). Telephone interviews were conducted to assess patients' knowledge before consultation (T1) and information recall after consultation (T3). The results show that younger patients who viewed the preparatory mode-tailored website were more satisfied and reported lower anxiety during consultation (vs. text only); this pattern was not found for older patients. The mode-tailored website yielded no other significant differences in patient outcomes at T1, T2, and T3, compared to the non-tailored websites. All websites were well used (M = 34 min). Higher perceived website involvement and satisfaction with the comprehension of the website were associated with higher levels of knowledge before consultation. In turn, knowledge before consultation, together with time spent on the website and whether patients watched videos on the website, predicted knowledge and information recall after the consultation. To conclude, health-related outcomes in younger patients can be improved by receiving mode-tailored online information (vs. non-tailored information), which was not the case for older patients. Providing patients with preparatory online information has added value, since more time spent online and higher knowledge before consultation can increase information recall after consultation. Future research is warranted to disentangle the active ingredients of preparatory websites for different patient populations, and further explore when, how, and for whom mode tailoring has an added value.

INTRODUCTION

Cancer often occurs in people of older age (≥65 years) and this number is expected to grow globally (Pilleron et al., 2018). Older cancer patients constitute the majority of the patient population, and are also most at risk for poor communication with healthcare providers due to age-related factors, such as decline in cognitive (e.g., working memory) and physical functioning (e.g., vision loss, hearing loss, co-morbidity; Brown & Park, 2003; Salthouse, 2004; Sparks & Turner, 2008; Williams et al., 2007). In general, older patients are less likely to express their information needs or preferences and participate less actively during consultations (Butow et al., 1994; Sparks & Turner, 2008). Moreover, they generally experience lower self-efficacy in obtaining relevant information from their healthcare provider (Maliski et al., 2004) and have more difficulty remembering information provided during consultations than younger patients (Jansen et al., 2008a; Nguyen, Smets et al., 2018). Therefore, particularly older patients could benefit from support in their communication with healthcare providers. This study investigates the value of tailored online health information for older and younger patients' health-related outcomes, including knowledge, website satisfaction, communication self-efficacy, anxiety, question asking, and information recall.

Online health information can be helpful for patients, including older patients. For many older adults, besides their healthcare provider, the Internet is one of the first preferred information sources when in need of health information (Hall et al., 2015; Medlock et al., 2015). Many patients specifically use online health information to prepare for their doctor's visit (Caiata-Zufferey et al., 2010; Flynn et al., 2006; Medlock et al., 2015). Using online information (e.g., a hospital website) before medical consultations may lead to better informed, more confident, and less anxious patients (Luck, Pearson, Maddem, & Hewett, 1999; McMullan, 2006). Moreover, the use of preparation tools can support patients to actively participate in consultations (e.g., by asking questions) and process and recall information from their healthcare provider (Brandes, Linn, Butow, & van Weert, 2015; van Weert et al., 2016). This might apply to older patients as well (van Weert, Jansen, Spreeuwenberg, van Dulmen, & Bensing, 2011).

Online health information distinguishes itself from traditional formats of health information (e.g., print materials) because of its possibility to integrate different modalities (i.e., modes), such as textual, visual and/or audiovisual information. Moreover, these information modes can be tailored to match individual preferences and abilities (e.g., age-related factors, literacy levels) and thus facilitate information processing (Smit et al., 2015). The rationale behind 'mode tailoring' is that

individuals vary in their processing styles (e.g., verbal vs. visual learners; e.g., Truluck & Courtenay, 1999) and information mode preferences (e.g., textual vs. audiovisual online information; e.g., Heo & Cho, 2009). Especially older adults have varying needs regarding modes of information presentation on health websites (Bolle et al., 2016). Most likely because older adults have to cope with age-related sensory (e.g., impaired vision and/or hearing) and cognitive decline (e.g., reduced processing speed) which can alter preferences regarding online information presentation (e.g., Loos & Romano Bergstrom, 2014; Ogozalek, 1994; Wright et al., 2008). Indeed, recent experimental research has shown that the evaluation, processing and recall of cancer-related information increased when users were able to self-tailor textual, visual, and/or audiovisual presentation of information on a website, particularly among older adults (Nguyen et al., 2017; Nguyen et al., 2018). Hence, mode tailoring is a particularly promising strategy to optimize online health information provision for the older population.

The present study extends mode tailoring research to a clinical population of newly diagnosed cancer patients who received a pre-visit website to prepare for their hospital consultations to discuss diagnosis and treatment planning. In a randomized controlled trial (RCT) we investigate both short-term and longer-term effects of exposure to a pre-visit website that can be tailored to the patient's information mode preferences (by self-selecting text, images and/or videos) compared to exposure to standardized, non-tailored websites (with either text only, text with images, or text with videos). First, we examine the effects of mode tailoring on website experience outcomes prior to the consultation (T1), which include patients' website involvement, satisfaction with the website, anxiety, self-efficacy in communicating with the provider, and knowledge. Second, we investigate whether mode tailoring effects extend to the consultation and beyond. These consultation experience outcomes include patients' question-asking behavior and anxiety during consultation (T2), and knowledge and information recall after the consultation (T3). For all outcomes, we hypothesize that the effects of mode tailoring will be stronger for older than for younger patients. Next, we provide insight into how patients use the preparatory mode-tailored and non-tailored websites before their consultation. Finally, we investigate how website experiences predict knowledge prior to the consultation, and how website experiences and consultation experiences predict knowledge and information recall after the consultation, while controlling for other factors that might explain knowledge and information recall (e.g., sociodemographics, medical background information, and information-seeking characteristics).

Mode tailoring: Catering to older patients' motivation and ability

Both the elaboration likelihood model (ELM) and the limited capacity model of motivated mediated message processing (LC4MP) state that information processing is highly dependent on an individual's motivation (e.g., attention) and ability (e.g., cognitive resources) to process information (Lang, 2006; Petty et al., 2002). For various reasons, including lower health literacy levels and computer skills and usage, older adults often see themselves as less able and are less motivated to use online health information (Bodie & Dutta, 2008). Moreover, many older adults who go online for health information are left dissatisfied (Rideout et al., 2005). This can partly be attributed to the fact that many available health websites insufficiently consider age-related factors in their design (Becker, 2004; Bolle et al., 2016). Providing different information modes (e.g., via text, visuals and videos) in a tailored manner can increase both the motivation and the ability to use and process online health information and may, therefore, be especially relevant for older users. For instance, when the mode of presentation matches with an individual's *preference* for how to consume online health information, this is likely to increase their motivation to attend to the information. Additionally, tailoring the mode of information presentation caters to variance in individual processing styles and abilities – including age-related declines in vision, hearing and cognition – which enables individuals to process information better. Thus, when online health information is tailored to individual preferences for delivery mode, these pre-conditions (i.e., ability and motivation) for successful processing can be considered more optimal. Consequently, mode-tailored online health information has a greater likelihood to reach and affect patients than standardized, non-tailored information, especially for older patients. Below we discuss the expected benefits of mode-tailored online health information for younger and older patients' health-related outcomes surrounding a hospital visit.

Effects of mode tailoring on website experience outcomes prior to the consultation: Involvement, satisfaction, anxiety, communication self-efficacy, and knowledge

A (potential) diagnosis of cancer usually involves high levels of anxiety (Bronner et al., 2017), which can hinder patients' ability to process and remember information provided by their provider (Nguyen et al., 2018). At the same time, patients express a high need for information during this uncertain phase (Jenkins et al., 2001; Rutten et al., 2005). Providing patients with additional online information tailored to their situation before their hospital visit is likely to decrease their level of anxiety, as they are better informed and prepared for what can be expected (Albada et al., 2012). In the early stages of cancer diagnosis and treatment planning, it can be overwhelming to receive information related to the disease (Rees & Bath, 2001). Providing patients with the option to tailor

the mode of information presentation to their own situation, enables them to absorb the information in a dosed manner (e.g., by reading the text first and saving a video for later; Nguyen et al., 2018). Moreover, information is expected to be more accessible to patients and processed better when it is presented in a way that matches their preferences and abilities. Therefore, it is expected that patients are more likely to involve with (i.e., website use and involvement), positively evaluate (i.e., satisfaction) and recall the information (i.e., knowledge) when tailored (Nguyen et al., 2017; Nguyen et al., 2018). Moreover, receiving tailored information prior to consultations may increase feelings of confidence in communicating with their provider (Jerant, Sohler, Fiscella, Franks, & Franks, 2011; Street Jr et al., 2010). In general, we expect that older patients will benefit relatively more from viewing a mode-tailored website than younger patients.

H1: Exposure to a preparatory mode-tailored website (vs. non-tailored websites) will have a positive effect on patients' website experience before the consultation (T1); including website involvement (H1a) and website satisfaction (H1b); anxiety (H1c); communication self-efficacy (H1d); and knowledge (H1e) before the consultation.

H2: These effects will be stronger for older patients (≥65 years) than for younger patients (<65 years) with respect to website involvement (H2a), website satisfaction (H2b), anxiety (H2c), communication self-efficacy (H2d), and knowledge (H2e).

Effects of mode tailoring on consultation experience outcomes: Question asking and anxiety

One could argue that combining online preparatory tailored information and interpersonal patient-provider communication, can reinforce its effectiveness and influence outcomes during consultation (e.g., patients' question-asking, anxiety). The above-mentioned effects of mode-tailored online information might therefore extend to the consultation and beyond. On one hand, viewing preparatory information may make patients aware of topics of information they would like to know more about or validate with their healthcare provider, causing them to be more actively involved during consultations by asking questions (Iverson, Howard, & Penney, 2008; Street Jr et al., 2010). On the other hand, patients who have viewed preparatory information prior to consultation may feel better informed and prepared for their visit, resulting in fewer questions asked during consultation (Jerant et al., 2011). Either way, providing preparatory information in a tailored manner could strengthen the effects in both directions (i.e., more or less questions), as mode-tailored information is expected to be processed better. As it is unclear how viewing mode-tailored online information

prior to consultation would affect patients' question-asking and how this might differ between younger and older patients, we formulated the following research questions:

RQ1: Does exposure to a preparatory mode-tailored online website (vs. non-tailored websites) lead to more or less questions asked by patients during consultation (T2)?

RQ2: Does the relation between exposure to a preparatory mode-tailored website and patients' question asking during consultation differ between younger (<65 years) and older patients (≥65 years)?

Previous findings of ours suggest that preparatory information may play a key role in limiting anxiety during cancer consultations, perhaps even more so for patients who tend to avoid information. Specifically, it was found that cancer patients characterized by a monitoring coping style (i.e., more information seeking) became less anxious from pre- to post-consultation after receiving their diagnosis and treatment plan (Bronner et al., 2017). The opposite relation was found for patients identified more as 'information avoiders'; this latter group became more anxious from pre- to post-consultation, especially when receiving bad news (Bronner et al., 2017). It is likely that high information seekers had already searched for information before their consultation and were prepared for the worst scenario. Thus, when hearing their diagnosis and treatment advice, they might have felt relieved when hearing relatively good news or were more prepared for bad news. This was in contrast to the 'less prepared' information avoiders who became more distressed after their consultation when receiving bad news. Since tailored information aligns with patients' preferences and needs, it is more likely to reach patients than non-tailored information and consequently decrease their anxiety.

Moreover, the effect of preparatory mode-tailored information on anxiety during consultation is expected to be especially visible in older patients. While cognitive functioning may decrease with age, emotion regulation is considered to improve as people grow older (Mather & Carstensen, 2005). The socioemotional selectivity theory posits that as people age, goals associated with emotional meaning and well-being become more salient, whereas knowledge-related goals to prepare for future events become less important (Carstensen & Mikels, 2005; Löckenhoff & Carstensen, 2004). Consequently, older adults generally process information in a such way that helps them regulate their emotions (e.g., putting them at ease). Relating this to mode-tailored information, older adults often prefer visual/audiovisual information (Ogozalek, 1994; Wright et al., 2008) and, such informa-

tion modes have been found to increase feelings of emotional support from online cancer-related information compared with text (Bol et al., 2015; Bol et al., 2013). Older patients may perceive more emotional gratification from information presented in visual/audiovisual modes because these modes often include more vivid and obvious personal elements (e.g., a patient video), that appeal more to their preferences and needs (i.e., more emotion-related goals). However, studies also show high variability in older adults' information mode preferences (Bolle et al., 2016; Soroka et al., 2006). Therefore, providing older patients with the option to select their preferred information modes, including visual and audiovisual elements, is more likely to fulfil their needs. For this reason, mode-tailored information is expected to be more useful in lowering older patients' anxiety during consultation as compared with younger patients.

H3: Exposure to a preparatory mode-tailored website (vs. non-tailored websites) will decrease anxiety during consultation (T2).

H4: The effect on anxiety during consultation will be stronger for older patients (≥65 years) than for younger patients (<65 years).

Effects of mode tailoring on knowledge and recall of information after the consultation

The effects of using an online tailored preparatory information tool can also extend beyond the consultation. Consulting online information prior to consultations could improve knowledge and information recall after the consultation in different ways. For instance, when patients are already informed about several topics prior to consultation, this will prime patients' attention to these and related topics when being discussed by the provider during consultation. Here, repetition could be the key to enhancing information recall in patients (Kessels, 2003). Furthermore, being informed and knowing what to expect beforehand could leave patients with more cognitive capacity to focus on and attend to new information that is discussed by the provider during consultation. Here, providing information in a dosed manner over multiple occasions allows patients to process important information at a slower pace which may benefit information recall. As particularly older patients have difficulty remembering medical information, it is expected that they will benefit relatively more from tailored preparatory information than younger patients.

H5: Exposure to a preparatory mode-tailored website (vs. non-tailored websites) will have a positive effect on knowledge from the website and information recall from the consultation (T3)

H6: The effect on knowledge from the website and information recall from the consultation (T3) will be stronger for older patients (≥65 years) than for younger patients (<65 years).

Besides the main effects of mode tailoring on health-related outcomes before, during and after the consultations, different website experience outcomes (i.e., website use, website satisfaction, anxiety before consultation, communication self-efficacy) may independently explain knowledge prior to the consultation (T1) and, together with consultation outcomes (i.e., question asking, anxiety during consultation), knowledge from the website and information recall from the consultation (T3). To date, few studies have examined which 'motivation' and 'ability'-related variables explain recall of information in cancer patients (Bol et al., 2018; Nguyen et al., 2018). To add to this body of knowledge, this study aims to gain insight into which website and consultation experience outcomes explain the added value of preparatory online health information on knowledge and information recall in cancer patients, as well as how these concepts relate to each other over time. Specifically, we formulated the following exploratory research questions:

RQ3: Which website experience outcomes (i.e., website use, website satisfaction, anxiety, communications self-efficacy) predict knowledge before the consultation (T1)?

RQ4: Which website experience outcomes (i.e., website use, website satisfaction, anxiety, communications self-efficacy, knowledge; T1) and which consultation experience outcomes (i.e., question asking, anxiety; T2) predict knowledge and information recall after the consultation (T3)?

METHOD

Design

A randomized controlled trial (RCT) was conducted to compare the effectiveness of a mode-tailored website (with text, visuals and videos) with three standardized, non-tailored versions with text only, text with visuals, and text with videos. Patients were stratified into a younger group (<65) and older group (≥65) and randomly assigned to view one of the four website versions. An age cut-off of 65

years was selected, as cancer more frequently occurs in adults above this age (Pilleron et al., 2018), and similar studies on older patients and online health information also used this cut-off age (Bol et al., 2015; Bol et al., 2013; Bolle et al., 2016). An a priori power analysis based on an ANOVA with 8 groups (condition × age group) revealed that a sample size of 237 was needed to detect a medium-sized effect ($f = 0.25$) with an observed power of 0.80 and an alpha level of .05.

Participants

Participants were patients who were suspected of having colorectal, stomach or esophageal malignancies or had received a preliminary cancer diagnosis (but were awaiting information on the tumor stage based on additional imaging, or came for a second opinion) who were referred to the Gastro-Intestinal Oncological Centre Amsterdam (GIOCA). Patients were recruited from December 2015 through September 2018. The GIOCA is an academic multidisciplinary outpatient clinic in the Netherlands that specializes in fast-track diagnosis and treatment planning within one day (Basta et al., 2016), referred to as the 'GIOCA day'. During the study, 691 patients visited the GIOCA; of these, 643 were approached by telephone 1-5 days before their visit, depending on the day they received their referral. We offered them access to a website containing relevant information about GIOCA procedures which could help them prepare for their visit, and informed them about the purpose of this study by telephone (i.e., to gain insight into information provision to cancer patients). Of the 517 patients who had Internet access and wanted to receive an email giving access to the website, 241 consented to participate. As nine of the included patients did not use the website, a total of 232 patients were included in the final analyses. An overview of participant inclusion, reasons for non-response, randomization procedure and dropout rates are presented in Figure 7.1.

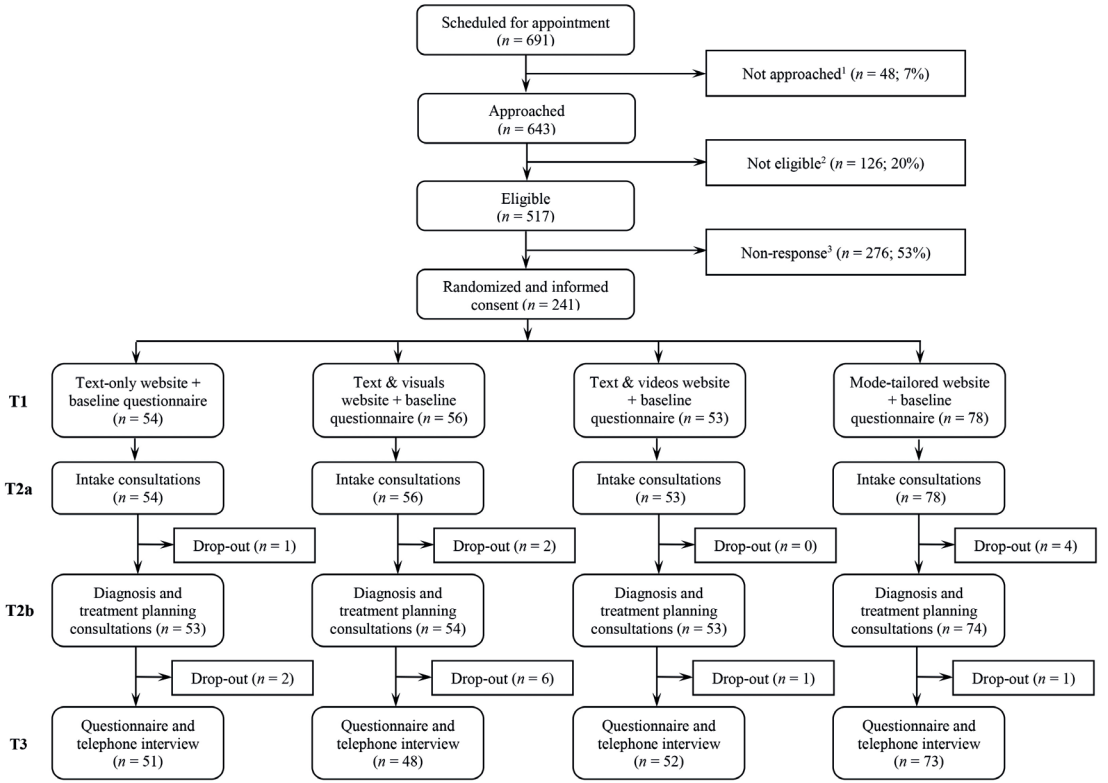

Figure 7.1. Participant recruitment and drop-out.

Notes. Another 9 patients were excluded from data analysis because they did not use the website intervention (final *N* = 232). [1]Unreachable before visit (*n* = 37), incomplete contact details (*n* = 11); [2]No computer or email address or not competent to work with computers (*n* = 74), insufficient Dutch language skills (*n* = 22), appointment cancelled (*n* = 6), hospitalized or cognitive impairment (*n* = 24); [3]No time or too burdensome (*n* = 108), privacy issues (*n* = 22), no interest in additional (online) information (*n* = 22), no specific reason given (*n* = 117), other (*n* = 7).

Stimulus materials

Four website versions were developed containing the same information but presented in different modalities (via text, images, and/or videos). The non-tailored website versions contained either text only, text with images, or text with videos. The text with videos version contained six videos featuring patients who narrated the textual information on the website (ranging from 1.5-3 min in length). Since the images and videos were based on the textual content they offered similar information. The information on the non-tailored websites was offered in a standardized manner and could not be adapted by patients. The mode-tailored website version allowed for patients to self-tailor the preferred mode of information presentation, at any moment during viewing.

The website contained different webpages with information about the fast-track clinic, how to prepare for consultations, and when to contact the clinic. Furthermore, the website contained information about the conditions (colorectal, stomach or esophageal cancer), medical tests, treatment options, and practical information, such as a list of healthcare providers, frequently asked questions, and contact and location information. The content on the websites was similar for both colorectal cancer patients and stomach and esophageal cancer patients, except for the information concerning the condition and treatment options. Details on the development and content of these websites are published elsewhere (Nguyen et al., 2018). Examples of the mode-tailored website and the non-tailored websites are given in Figure 7.2a and Figure 7.2b.

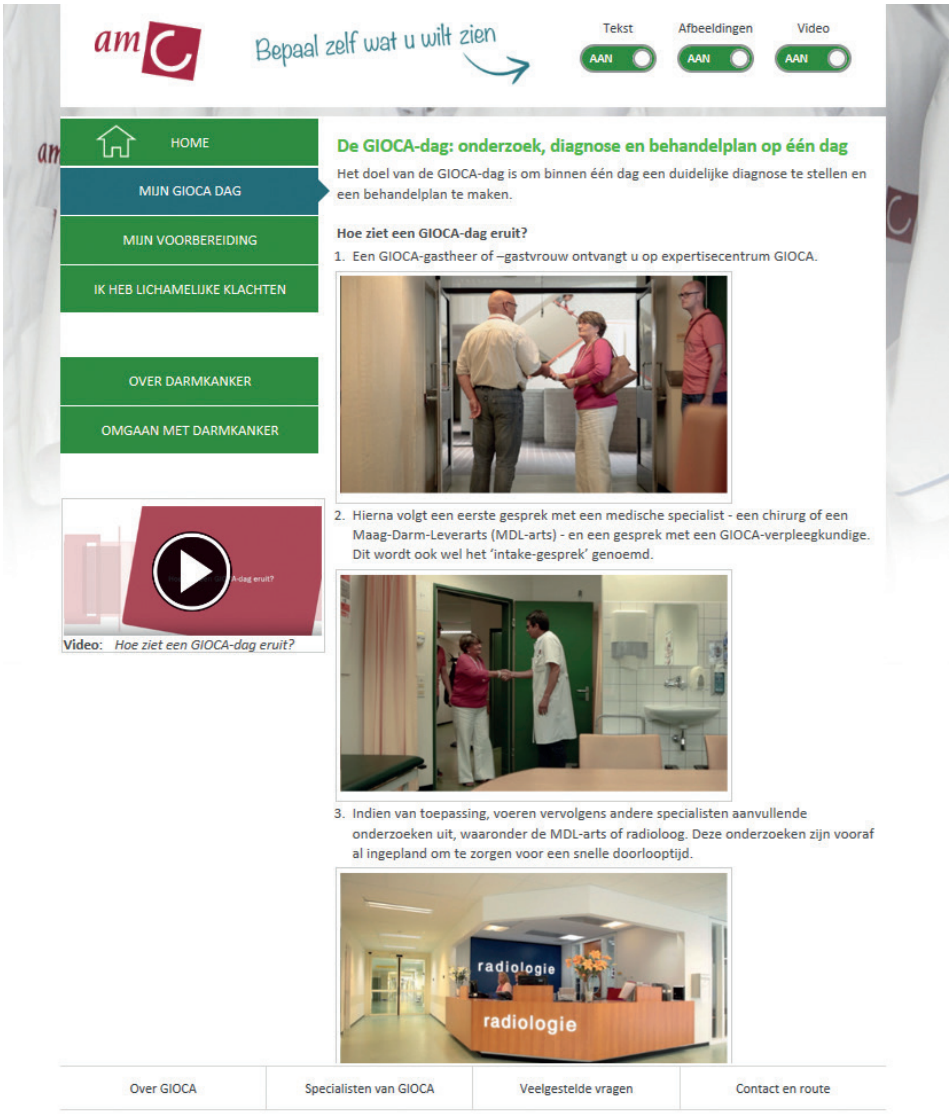

Figure 7.2a. Example of the mode-tailored website.

Figure 7.2b. Example of a non-tailored website with text and video.

Procedure

Patients were randomized and received a link to one of the four website versions by email. Patients were free to use the website as they wished (how often, how long, which pages). After viewing the website, consenting patients completed an online questionnaire to record website experience outcomes, and background variables such as sociodemographic information, medical background information, and information seeking characteristics (T1a). One day before their visit to the clinic,

patients' knowledge acquired from the website was assessed by telephone (T1b). On the day of the patients' visit to the clinic, a research assistant was present in the hospital to video record all consultations to assess question-asking during consultations (T2). The fast-track program (GIOCA day) started with two intake consultations (medical specialist and nurse) to evaluate symptoms and medical history (T2). At noon, a multidisciplinary team discussed the diagnosis and formulated a treatment plan. In the afternoon, the diagnosis and treatment advice were discussed with the patient by the physician and nurse who conducted the intake consultations (T2). Depending on the treatment plan, patients also visited a surgeon, oncologist, or radiation oncologist on the same day to discuss treatment details (T2). Patients usually had 4–7 consultations during the GIOCA day, all of which were video recorded for this study. Directly after the last consultation, a paper questionnaire measured anxiety (T2). Patients were contacted by telephone within 36–48 h after their visit to assess their knowledge from the website and information recall from the consultation (T3).

Website experience outcomes (T1)

Website use patterns were recorded using a built-in web tracker, which logged every action on the website (e.g., number of clicks, time spent on each page, video viewing behavior, mode selections, number of visits).

Website involvement was measured with 5 items, including "I was highly involved in evaluating the website" and "I carefully viewed the information on the website" (Dutta-Bergman, 2004). Answer options ranged from 1 (totally disagree) to 7 (totally agree), of which mean scores were calculated ($\alpha = .81$).

The 10-item version of the **Website Satisfaction** Scale was used to assess the degree to which patients were satisfied with the (a) attractiveness of (3 items, e.g., "the website looks nice", $\alpha = .86$), (b) comprehensibility of (3 items, e.g., "the website is understandable", $\alpha = .97$), and emotional support from the website (4 items, e.g. "the website helps me with my emotions", $\alpha = .92$; Nguyen et al., 2018; van Weert et al., 2011). Answer options ranged from 1 (totally disagree) to 7 (totally agree), of which mean scores were calculated.

Communication self-efficacy was measured with the short form Perceived Efficacy in Patient–Physician Interactions (PEPPI-5; ten Klooster et al., 2012). Five questions assessed the patient's confidence in their ability to communicate with their health care provider on a scale of 1 (very

confident) to 5 (not confident at all). A sum score was calculated, with higher scores indicating higher self-efficacy (possible range 5–25, α = .88).

Patients' current state of **anxiety** was measured with the 6-item version of the State-Trait Anxiety Inventory (STAI-6; Marteau & Bekker, 1992; van der Bij et al., 2003). Patients rated the degree to which they experienced the presence (tense, upset, worried) or absence (calm, relaxed, content) of anxiety at that moment with answer options ranging from 1 (not at all) to 4 (very much so). The total scores were recoded based on the guidelines to scores from 20–80, with scores >44 indicating high anxiety levels (α = .80; Bronner et al., 2017; Korfage, Essink-Bot, Janssens, Schröder, & De Koning, 2006).

Knowledge acquired from the website was measured using the protocol of the Netherlands Patient Information Recall Questionnaire (NPIRQ) via telephone interviews (Jansen et al., 2008b; Nguyen et al., 2017). We asked patients 12 standardized open questions based on the website content (e.g., about the goal and course of the fast-track program, which medical specialists they will see). Based on a pre-developed code book, for 9 questions patients could score 2 points, and for 3 questions the correct answers contained fewer or more elements and thus these questions accounted for 1, 2.5 and 3 points. Thus, the maximum knowledge score at T1 for 12 questions (9*2 + 1*1 + 1*2.5 + 1*3) was 24.5. A standardized score was calculated by taking the percentage correctly answered according to the NPIRQ guidelines. Fourteen patients were double coded, showing good intercoder reliability (mean κ = .737, p = < .001).

Consultation experience outcomes (T2)

Anxiety during consultation was measured in the same way as before the consultation (STAI-6; M = 41.45, SD = 11.76, Cronbach's α = .81).

To code **question asking behavior**, a pre-developed codebook was used (Zandbelt, Smets, Oort, Godfried, & de Haes, 2007). All questions during consultation were coded and divided into three groups, namely questions on: questions about 1) medical information, 2) practical information, and 3) paramedical information. Questions on medical information included expressions about the patients' disease, treatment (options), complications and side effects. Questions on practical information included expressions about logistics of treatment and follow-up appointments. Questions on paramedical information included expressions about psychosocial topics and consequences for daily life. All questions that were unrelated to the patients' condition (e.g., questions about the

weather, holiday, etc.) were not coded. All questions were summed into one total score. Sixteen consultations were double coded, which revealed good intercoder reliability (Krippendorff's α = .951).

Knowledge and recall of information after the consultation (T3)

Knowledge from the website and information recall from the consultation was measured with the NPIRQ (similar to measurement of knowledge prior to the consultation; T1). Regarding **information recall from the consultation**, each participant was asked 13 standardized open questions (e.g., about the proposed treatment plan, logistic planning of treatment, possible risks and side effects of treatment, recommendations for daily life). To improve the validity of the recall measure, a maximum of five additional open questions were formulated tailored to each patient's videotaped consultations (e.g., about details of treatment, additional medical tests). The correct answers were derived from the videotaped consultations. Each answer as provided by the participant during the interview was scored as not recalled (0), partially recalled (1), and completely recalled (2) based on a pre-developed code book. In theory, patients could receive a maximum of 18 questions (13 standardized + 5 tailored questions). However, as the content of consultations varied between patients, not all standardized open questions were applicable to all patients. Similar to T1, a standardized score was calculated by taking the percentage correctly recalled information, based on the patients' total sum score (1–23) and the maximum obtainable recall score (range 4–34; $M = 56.37$, $SD = 15.21$).

The websites contained information on 10 of the (total) 18 question asked. Hence, a separate **knowledge** score about topics on the website was calculated from these 10 questions. For this knowledge score, the website content was used as a guideline to score patients' answers (similar to knowledge at T1). Again, a standardized score was calculated by taking the percentage correctly answered, based on the total sum score (0–9) and maximum obtainable score (range 10–19; $M = 15.05$, $SD = 11.76$). Good intercoder reliability was established by double coding answers from 14 participants in a pilot study with the same code book (mean $\kappa = .816$, $p < .001$; Nguyen et al., 2018).

Manipulation check

The perceived level of tailoring was measured with two items. The items comprised "the way I viewed information on the website (via text; text with images; text with video; text, images, and/or video) corresponded to my preference to receive health information" and "the presentation of the information on the GIOCA website was tailor-made for me". The answer options ranged from 1 (totally disagree) to 7 (totally agree; Pearson's $r = .74$, $p < .001$).

Background variables

Sociodemographic information. Age, gender and education level were measured at baseline. Education level was divided into lower (i.e., primary education, general secondary education, middle vocational education) and higher education level (i.e., higher vocational education, university).

Medical background information. Medical background information included cancer type (colorectal cancer = 0, esophageal /stomach cancer = 1) and whether patients came in for a second opinion (no = 0, yes = 1). Patients' frailty (i.e., functioning in the physical, cognitive, social, and psychosocial domain) was assessed with the 15-item Groningen Frailty Indicator (GFI)(Schuurmans et al., 2004; Steverink et al., 2001). Quality of life was measured with two items from the EORTC Quality of Life Questionnaire (QLQ-C30; Aaronson et al., 1993) on a 7-point scale ranging from 1 (very bad) to 7 (excellent; Pearson's $r = .75$, $p < .001$). Finally, the treatment goal (palliative or unclear = 0; curative = 1) was derived from the medical file.

Information-seeking characteristics. Internet use was measured in hours per week. Monitoring coping style refers to the degree to which patients seek information in a threatening medical situation. This was assessed with an adapted version of the Threatening Medical Situation Inventory (TMSI; e.g., "I intend to get as much information as possible about my treatment"; Bronner et al., 2017; Miller, 1987; van Zuuren et al., 1996), using a 3-item, 5-point scale, ranging from 1 (not applicable to me at all) to 5 (very applicable to me; Cronbach's $\alpha = .83$). Information preference was measured with adapted item of the Information Satisfaction Questionnaire (Thomas et al., 2004), assessing whether patients prefer to receive "not all information (at once)" (0) vs. "as much information as possible, both positive and negative" (1). Finally, we assessed whether patients had received information about the fast-track clinic from other sources (e.g., health care providers, brochures) besides our website intervention (no = 0, yes =1).

Statistical analyses

Chi-square tests, t-tests and analyses of variance (ANOVAs) were conducted to check for unequal distribution of background variables over the conditions. Descriptive analyses were used to explore patterns of website use. To test the main and interaction effects of mode tailoring (H1-H6, RQ1-2), ANOVAs were conducted. Additional simple effects analyses were used to examine differences between conditions within age groups. The significance level was set at $p < .05$.

To test which website experience outcomes predicted knowledge before the consultation (T1), and how these, together with consultation experience outcomes (T2) predict information recall from the consultation (T3), and information recall from the website after the consultation (T3; RQ3-4), three multi-stage linear regression models were estimated. In all analyses we started with a baseline model (Model 1) with individual background variables (with age as a continuous variable). Website experience outcomes were added as predictors in Model 2. For information recall from the consultation and the website at T3, consultation experience outcomes were included as predictors in Model 3 (if applicable). To reduce the number of predictors, only variables which were at least marginally correlated with knowledge or information recall were included in the models ($p < .10$). Assumptions of linearity, normality, homoscedasticity, independent errors (Durbin-Watson values = 1.95, 1.89, and 1.75), and multicollinearity (VIF < 10) were met for all variables. Standardized coefficients (betas) are reported for comparisons of predictive power.

RESULTS

Patient characteristics

Participating patients were aged on average 63.50 years (*SD* = 9.06; range 36.21–86.33), with 46.1% aged ≥65 years. The majority were male (68.1%) and lived together with their spouse, children, or other family member (82.8%). The majority (*n* = 170, 73.2%) were advised a curative treatment plan, 13.4% (*n* = 31) entered a palliative trajectory, and the remaining 13.4% (*n* = 31) were scheduled for additional imaging studies to formulate a clear diagnosis and treatment plan. Of the 232 participating patients, 74 viewed the mode-tailored website, 53 the text-only website, 54 the text with images website, and 51 the text with video website. Background information of the patients is given in Table 7.1.

Perceived level of tailoring

Patients viewing the mode-tailored website version had equally high perceptions of the degree to which the information presentation was tailored to them as compared to those viewing the non-tailored versions (*M* = 5.24, *SD* = 1.22), $F(3, 225) = 0.19$, $p = .905$, $\eta p^2 = .002$.

Website use patterns of patients

Patients spent an average of 34 min and 45 s on the website (*SD* = 00:32:56; range 00:00:34–03:50:42). The majority of patients (62.1%) visited the website twice or more in the days before their visit (*M* = 2.78, *SD* = 2.28; range 1–22).

Table 7.1. Patient background characteristics

	Total *n*	Younger patients (*n* = 125)	Older patients (*n* = 107)	All patients (*n* = 232)
Sociodemographic information				
Age in years, *M* ±*SD*[a]***	232	56.81 ±6.18	71.44 ±4.23	63.50 ±9.06
Gender	232			
Male, *n* (%)		81 (64.3)	77 (72.6)	158 (68.1)
Female, *n* (%)		45 (35.7)	29 (27.4)	74 (31.9)
Education level	231			
Lower, *n* (%)		75 (59.5)	71 (67.0)	146 (62.9)
Higher, *n* (%)		50 (39.7)	35 (33.0)	85 (37.1)
Medical background information				
Cancer type[a]**	232			
Colorectal, *n* (%)		110 (87.3)	77 (72.6)	187 (77.9)
Esophageal/stomach, *n* (%)		16 (12.7)	29 (27.4)	45 (22.1)
Frailty[b], *M* ±*SD* (range)	182	2.69 ±2.05	2.19 ±1.86	2.46 ±1.98 (0–10)
Quality of life[c], *M* ±*SD* (range)	229	4.99 ±1.36	5.24 ±1.17	5.11 ±1.28 (2–7)
Second opinion	232			
No, *n* (%)		99 (78.6)	90 (84.9)	189 (81.5)
Yes, *n* (%)		27 (21.4)	16 (15.1)	43 (18.5)
Treatment goal	232			
Palliative, *n* (%)		18 (14.3)	13 (12.3)	31 (13.4)
Curative, *n* (%)		89 (70.6)	81 (76.4)	170 (73.2)
Unclear, *n* (%)		19 (15.1)	12 (11.3)	31 (13.4)
Information characteristics				
Internet use[d], *M* ±*SD***	229	17.98 ±17.74	12.02 ±10.30	15.27 ±15.10
Information coping style[e], *M* ±*SD* (range)	229	3.76 ±0.87	3.74 ±0.87	3.75 ±0.87 (1–5)
Information preference	229			
Not all information, *n* (%)		31 (24.8)	25 (24.0)	56 (24.5)
As much information as possible, *n* (%)		94 (75.2)	79 (76.0)	173 (75.5)
Additional information received	218			
No, *n* (%)		38 (31.4)	30 (30.9)	68 (31.2)
Yes, *n* (%)		83 (68.6)	67 (69.1)	150 (68.8)

Note. Not all cells add up to 100% due to missing data. No differences were found between conditions. *M*, mean; *SD*, standard deviation. [a]Significant differences between younger and older patients. [b]A higher score indicates higher frailty (max. range 1-15). [c]A higher score indicates higher quality of life (max. range 1-7). [d]Measured in hours per week. [e]A higher score indicates a higher information monitoring coping style (max. range 1-5).
** $p < .01$, *** $p < .001$.

Patients mostly consulted information about the GIOCA day (90.9%), how to prepare for their visit (86.6%), their condition (colorectal, stomach or esophageal cancer; 80.6%), and how to deal with cancer in daily life (i.e., nutrition, fatigue, psychosocial care; 67.2%), and with which symptoms to contact the hospital (65.1%). Almost half of the patients (40.5%) viewed information on diagnostic tests and frequently asked questions (48.3%). Least often consulted was contact information (27.2%), information about which medical specialists work at GIOCA (19.8%), and information on additional websites (25.0%). Patterns of website use are presented in Table 7.2.

Videos were available for patients in the text with video condition and mode-tailored condition (total n = 125). Of these patients, 41 (32.8%; $n_{tailored}$ = 18; n_{video} = 23) watched a total of 96 videos on the website. Within the conditions, 28.4% of patients in the tailored condition watched a video compared with 39.2% in the text with video condition. Within age groups, 29.6% of older patients watched a video compared with 35.2% of younger patients. These differences were not significant. Most patients who watched a video watched it almost completely (total video time M = 00:06:52, SD = 00:05:19, range 00:15–22:35). The majority of patients who watched videos watched more than one (61.0%; n = 25). The most often watched videos were: about the GIOCA day (20 times), practical information about their hospital visit (23 times), and how to prepare for their intake consultations with the medical specialist and nurse (19 times).

Patients in the mode-tailored condition spent an average of 43:07 min on the website, compared with 30:59 min for patients in the text condition, 33:52 min for patients in the text with images condition, and only 26:26 min for patients in the text with video condition. However, this difference was only marginally significant, $F(3, 224) = 2.52$, $p = .059$, $\eta p^2 = .033$. There were no differences between age groups in terms of time spent on the website, $F(3, 224) = 0.00$, $p = .957$, $\eta p^2 = .000$. All patients in the mode-tailored condition chose at least text, but the majority supplemented this with additional images or videos over multiple visits to the website. Most patients (n = 57, 77.0%) in the mode-tailored condition selected all three modalities (text, images and video); 12 patients (16.2%) chose text and images; 4 patients (1.7%) chose text only; and only 1 patient chose text with video. Regarding the first time on the website, most patients first chose text (n = 59, 79.7%); 10 patients first chose images (13.5%); and 5 patients first chose video. During subsequent web sessions, patients were more likely to choose images and video first. On average, patients took 01:15 min to select their first mode (SD = 02:10; 39.2% < 30 s, 66.2% < 1 min, 86.5% < 2 min). Regarding a second visit, the first mode was selected on average at 29 s (SD = 00:51; 84.2% < 30 s, 94.7% < 2 min).

Table 7.2. Patterns of website use

	Older adults		Younger adults		Total	
	n = 106		*n* = 126		*N* = 232	
	M	*SD*	*M*	*SD*	*M*	*SD*
Time spent on website (mm:ss)	34:27	32:09	35:00	33:42	34:45	32:56
Mode-tailored	41:35	40:55	44:14	43:01	43:07	41:53
Text-only	30:25	39:34	31:31	22:11	30:59	25:49
Text with images	34:09	30:34	33:35	35:23	33:52	32:51
Text with video	29:42	21:55	25:33	20:15	26:26	20:55
Webpages	*n*	%	*n*	%	*n*	%
The GIOCA-day	90	84.9	121	96	211	90.9
Preparing for the GIOCA-day	84	79.2	117	92.9	201	86.6
Information about cancer types	84	79.2	103	81.7	187	80.6
Diagnostic tests	49	46.2	45	35.7	94	40.5
When to contact the hospital	62	58.5	89	70.6	151	65.1
Daily life recommendations	65	61.3	91	72.2	156	67.2
Additional relevant websites	23	21.7	35	27.8	58	25.0
Frequently asked questions	48	45.3	64	50.8	112	48.3
Medical specialists at GIOCA	23	21.7	23	18.3	46	19.8
Contact information	31	29.2	32	25.4	63	27.2
Watched at least one video[a]	16	29.6	25	35.2	41	32.8
Mode-tailored website	9	29.0	12	27.9	21	28.4
Text with video website	7	30.4	13	46.4	20	39.2
Number of videos watched[b]	2.50[d]	2.50	2.24[e]	1.30	2.34[d]	1.84
Mode-tailored website	3.00[d]	3.28	2.50[e]	1.57	2.71[d]	2.39
Text with video website	1.86[g]	0.69	2.00[f]	1.00	1.95[f]	0.89
	M	*SD*	*M*	*SD*	*M*	*SD*
Number of mode actions[c]	2.97	7.27	2.72	6.26	2.84	6.72
Time until first mode (mm:ss)[c]	01:00	00:48	01:25	02:45	01:15	02:10
% First mode ≤ 1 min	64.5		67.4		66.2	
% First mode ≤ 2 min	87.1		86.0		86.5	
% First mode ≤ 4 min	100.0		95.3		97.3	
First mode chosen[a]	*n*	%	*n*	%	*n*	%
Text	27	87.1	32	74.4	59	79.7
Illustrations	4	12.9	6	14.0	10	13.5
Video	-	-	5	11.6	5	6.8
Mode combinations[a]						
All three modes	23	74.2	34	79.1	57	77.0
Text and illustrations	8	25.8	4	9.3	12	16.2
Text and video	-	-	1	2.3	1	1.4
Text only	-	-	4	9.3	4	5.4

Note. [a]Only applicable to patients viewing the mode-tailored website (*n* = 74) or text with video website (*n* = 51). [b]Only includes patients who watched at least one video. [c]Only applicable to patients viewing the mode-tailored website (*n* = 74). [d]Range = 1-11. [e]Range = 1-6. [f]Range = 1-4. [g]Range = 1-3.

Effects of mode tailoring on website experience outcomes prior to the consultation (T1)

We hypothesized that exposure to a mode-tailored website (vs. non-tailored websites) would positively affect patients' website involvement, website satisfaction, anxiety, communication self-efficacy, and knowledge before the consultation (H1). However, our data showed no significant differences between the conditions for any of these website experience outcomes. We also hypothesized differential effects of mode tailoring for younger and older patients, with stronger effects for older patients (H2). While no significant interaction effects were present, simple effects analysis did reveal that, in contrast to our hypothesis, for younger patients the mode-tailored website (M = 5.12, SD = 0.97, p = .022) and text-with-images website (M = 5.30, SD = 0.91, p = .009) resulted in higher satisfaction with the attractiveness of the website compared to the text-only condition (M = 4.46, SD = 1.08). In general, older patients reported lower knowledge (M = 22.70, SD = 12.57) than younger patients (M = 30.16, SD = 13.00), $F(3, 218) = 17.91$, $p < .001$, $\eta p^2 = .076$. Overall, the data showed no support for H1 and H2. Means and standard deviations are summarized in Table 7.3; details of the analyses are presented in Table 7.4.

Effects of mode tailoring on outcomes during the consultation (T2)

We explored whether exposure to a mode-tailored website would influence the number of questions asked by patients during consultations (RQ1), and whether this would differ between younger and older patients (RQ2). Results showed no significant differences between conditions and no interaction effects for the number of questions asked during consultations. We also hypothesized that exposure to a mode-tailored website (vs. non-tailored websites) would decrease anxiety during consultation (H3), with stronger effects for older patients (H4). While we found no main effect of condition, a significant interaction between condition and age group was revealed, $F(3, 204) = 3.16$, $p = .026$, $\eta p^2 = .044$. However, in contrast to our expectations, older patients reported higher anxiety in the mode-tailored condition (M = 44.14, SD = 12.62, p = .038) compared with the text condition (M = 37.36, SD = 10.86). On the other hand, younger patients reported lower levels of anxiety in the mode-tailored condition (M = 39.59, SD = 10.97, p = .046) compared with the text condition (M = 45.80, SD = 12.80). Overall, the data showed no support for H3 and contrasting results for H4. Means and standard deviations are summarized in Table 7.3; details of the analyses are presented in Table 7.4.

Effects of mode tailoring on information recall after the consultation (T3)

We hypothesized that exposure to a mode-tailored (vs. non-tailored) website would positively affect patients' information recall after the consultation (H5), with differential effects for younger and older

patients (H6). For both information recall from the consultation and from the website, we found no significant differences between condition and no interaction effects. In general, older patients recalled less information from the website (M = 11.78, SD = 9.88) than younger patients (M = 17.96, SD = 13.12), $F(1, 194) = 12.89$, $p < .001$, $\eta p^2 = .062$. Means and standard deviations are summarized in Table 7.3; details of the analyses are presented in Table 7.4.

What explains knowledge before consultation and information recall after consultation? (RQ3-4)

All regression models are presented in Table 7.5. Regarding knowledge before the consultation (T1), the baseline model with individual background variables as control (Model 1; n = 211) revealed age and education level to be significant predictors of knowledge. Specifically, younger age (β = –.23, p = .001) and higher education levels (β = .22, p = .002) were associated with higher knowledge. Patients who had received information about the clinic from other sources also reported higher knowledge (β = .13, p = .055); however, this effect was only marginally significant. None of the other control variables explained variance in knowledge before the consultation. Extending this model with website experience outcomes (Model 2) significantly improved the model (ΔR^2 = .06, p = .006; total adjusted R^2 = .17). Higher perceived website involvement (β = .15, p = .030) and higher satisfaction with the comprehension of the website (β = .15, p = .053; although the latter marginally significant), were associated with higher knowledge before the consultation.

Regarding knowledge from the website after the consultation (T3), the baseline model with control variables only (Model 1, n = 185) revealed age and education level to be significant predictors of knowledge. Specifically, younger age (β = –.18, p = .016) and higher education levels (β = .16, p = .030) were associated with higher knowledge. None of the other control variables explained variance in knowledge from the website after the consultation. Extending this model with website experience outcomes significantly improved the model (ΔR^2 = .19, $p < .001$; total adjusted R^2 = .27). Specifically, more time spent on the website prior to the consultation (β = .21, p = .002) and higher knowledge before the consultation (β = .39, $p < .001$) were associated with higher knowledge from the website after the consultation. Age (β = –.08, p = .233) and education level (β = .10, p = .123) became insignificant predictors of information recall. No consultation experience outcomes were associated with knowledge from the website.

Table 7.3. Means and standard deviations of outcome variables

	Mode-tailored		Text-only		Text with images		Text with video		Total	
	Younger *M*±*SD*	Older *M*±*SD*	Younger *M*±*SD*	Older *M*±*SD*	Younger *M*±*SD*	Older *M*±*SD*	Younger *M*±*SD*	Older *M*±*SD*	Younger *M*±*SD*	Older *M*±*SD*
T1: Website experience outcomes										
Website involvement	4.9±11.03	4.72±1.08	4.46±0.96	4.71±1.21	4.78±1.08	4.63±1.33	4.46±1.11	4.94±0.96	4.68±1.05	4.74±1.14
Website attractiveness	5.12±0.97*[a]	5.12±1.20	4.46±1.08	5.19±1.37	5.30±0.91**[a]	4.86±1.33	4.93±1.19	4.86±1.31	4.97±1.07	5.02±1.29
Website comprehension	6.36±1.42	6.24±0.77	6.15±0.74	6.04±1.19	6.57±0.50*[b]	5.95±1.31	5.96±1.42	5.83±1.40	6.27±0.90	6.03±1.16
Website emotional support	3.94±1.30	4.06±1.22	3.69±1.24	4.13±1.69	4.14±1.28	3.87±1.38	3.81±1.40	4.20±1.52	3.90±1.30	4.06±1.43
Self-efficacy	20.35±2.54	20.00±3.44	19.74±3.77	20.69±3.03	20.22±2.69	21.23±2.98	21.43±3.39*[a]	20.00±3.11	20.43±3.09	20.48±3.16
Anxiety	48.37±11.23	48.06±11.05	48.52±10.10	43.59±11.03	48.02±11.18	48.59±8.39	45.83±10.91	45.45±9.95	47.76±10.83	46.54±10.27
Knowledge	32.06±12.20	25.35±13.36	32.65±13.53	20.80±11.60	27.59±11.11	21.04±14.14	27.36±14.96	23.23±10.44	30.16±13.00	22.70±12.57***[c]
T2: Consultation experience outcomes										
Question asking	24.83±21.32	19.73±14.86	19.78±13.01	14.88±11.85	17.27±11.62	17.38±23.18	19.71±17.04	15.59±11.23	20.93±17.04	17.07±15.86
Anxiety	39.59±10.97*[a]	44.14±12.62*[a]	45.80±12.80	37.36±10.86	44.86±12.04	40.13±12.38	41.79±12.08	38.57±9.86	42.51±11.96	40.30±11.74
T3: Outcomes after consultation										
Knowledge from the website	19.14±12.10	12.42±10.77	21.22±13.36	12.85±10.88	13.06±11.17*[a]	11.14±9.44	17.37±15.34	10.38±8.27	17.96±13.12	11.78±9.88***[c]
Information recall consultation	57.36±11.40	56.23±15.16	51.91±13.36	55.19±18.77	57.27±16.60	55.40±15.47	62.56±15.16*[b]	54.26±17.10	57.29±14.15	55.35±16.33

Note. M, mean; *SD*, standard deviation. [a]Differs from text-only condition. [b]Differs from text with video condition. [c]Differs from younger patients.
*$p < .05$, **$p < .10$, ***$p < .001$.

Table 7.4. Analyses of Variance (ANOVA)

		n	*df*	*F*	*p*	partial η^2
T1: Website experience outcomes						
Website involvement	C	229	3, 221	0.44	.723	.006
	C × A		3, 221	1.42	.316	.016
Website attractiveness	C	229	3, 221	0.86	.464	.012
	C × A		3, 221	2.36	.072	.031
Website comprehension	C	229	3, 221	1.75	.159	.023
	C × A		3, 221	0.80	.493	.011
Website emotional support	C	229	3, 221	0.06	.980	.001
	C × A		3, 221	0.75	.521	.010
Anxiety	C	230	3, 222	0.97	.406	.013
	C × A		3, 222	0.74	.532	.010
Communication self-efficacy	C	229	3, 221	0.54	.656	.007
	C × A		3, 221	1.79	.150	.024
Knowledge	C	226	3, 218	1.36	.256	.018
	C × A		3, 218	0.83	.479	.011
T2: Consultation experience outcomes						
Question asking	C	218	3, 210	1.34	.262	.019
	C × A		3, 210	0.28	.837	.004
Anxiety	C	212	3, 204	0.33	.801	.005
	C × A		3, 204	3.16	.026	.044
T3: Information recall after consultation						
Information recall from the website	C	202	3, 194	1.60	.191	.024
	C × A			0.65	.582	.010
Information recall from the consultation	C	203	3, 195	0.82	.483	.012
	C × A			1.13	.339	.017

Note. C = condition, A = age group; *df* = the degrees of freedom of the effect and error term.

Regarding information recall from the consultation (T3), there were no individual background variables associated with information recall (Model 1, $n = 194$). Extending the model with website experience outcomes revealed that knowledge before the consultation ($\beta = .22$, $p = .003$), whether the patient had watched a video on the website ($\beta = .14$, $p = .073$), and communication self-efficacy ($\beta = .12$, $p = .089$) explained a significant additional proportion of variance in information recall from the consultation ($\Delta R^2 = .12$, $p = .001$; total adjusted $R^2 = .09$). The latter two variables were however only marginally significant related to information recall from the consultation. No consultation experience outcomes were associated with information recall from the consultation.

Table 7.5. Regression models

	Knowledge (T1), *n* = 211		Information recall consultation (T3), *n* = 194		Information recall website (T3), *n* = 185		
	Model 1 β, *p*-value	Model 2 β, *p*-value	Model 1 β, *p*-value	Model 2 β, *p*-value	Model 1 β, *p*-value	Model 2 β, *p*-value	Model 3 β, *p*-value
Individual background characteristics							
Age	-.23, .001	-.23, .001	-.08, .256	-.04, .585	-.18, .016	-.08, .233	-.08, .235
High education level	.22, .002	.22, .002	-.02, .840	-.05, .504	.16, .030	.10, .123	.10, .14
Internet use	-.02, .750	-.02, .720	-	-	.09, .220	.05, .484	.05, .489
Information coping style	.11, .106	.04, .608	-	-	-	-	-
Additional information received	.13, .055	.10, .110	-	-	-	-	-
Quality of life	-	-	-	-	-.13, .082	-.10, .152	-.10, .155
Website experience characteristics							
Website involvement		.15, .030		-		-	-
Website attractiveness		-.01, .865		.08, .323		-	-
Website comprehension		.15, .053		-.02, .776		-	-
Watched a video		.08, .222		.14, .073		-	-
Knowledge (T1)				.22, .003		.39, .000	.39, .000
Website emotional support				.07, .364		-	-
Communication self-efficacy				.12, .089		-	-
Time spent on website				.07, .362		.21, .002	.21, .002
Anxiety (T1)				-		.04, .518	.04, .521
Consultation experience characteristics							
Question asking							.00, .957
Adjusted R^2	.12	.17	.00	.09	.09	.27	.27
Δ R^2		.06		.12		.19	.000
Significance Δ *F*		.006		.001		.000	.957

Note. Only variables marginally significant ($p < .10$) that correlated with the predicted outcome variable were included in the regression models. Since no consultation characteristics correlated with information recall from the consultation (T3), only two models were predicted. Model 1 shows a simple linear regression model assessing the relationship between control variables and knowledge/information recall. Website experience characteristics were added to Model 2. Consultation experience were included in Model 3. R^2 indicates the adjusted explained variance of the model; Δ R^2 shows the change in R^2 by adding predictors in Model 2 and 3; Significant Δ *F* shows whether the difference in the *F*-value for model expansion is significant.

DISCUSSION

This randomized controlled trial (RCT) tested the effectiveness of a mode-tailored preparatory website (i.e., by self-selecting text, images and/or videos) versus non-tailored websites (i.e., with either text only, text with images, or text with videos) in a clinical population of older (≥65 years) and younger (<65) gastrointestinal cancer patients visiting a fast-track clinic for diagnosis and treatment planning. The main research question in this RCT was whether mode tailoring is of added value and thus more effective than non-tailored information on patient outcomes before, during, and after consultation. Moreover, we investigated whether older patients benefited proportionally more from mode-tailored information than younger patients. The results showed no differences between the mode-tailored and non-tailored websites in patients' involvement with the website, satisfaction with the comprehension of the website or emotional support from the website, communication self-efficacy, and knowledge prior to the consultation (H1). Furthermore, mode tailoring did not affect patients' question-asking during consultation (RQ1), nor did it affect knowledge and information recall after the consultation (H5). There was no evidence that older patients benefited more from viewing a mode-tailored website than younger patients (H2, H4, H6, RQ2). Interestingly, however, younger patients who viewed a mode-tailored website prior to their visit were more satisfied with the attractiveness of the website (H1) and felt less anxious during consultation (H3) than younger patients exposed to the website with text-only. Remarkably, across all website versions, patients who felt more involved with the website and were more satisfied with the comprehension of the website reported greater knowledge before consultation (RQ3). In turn, knowledge before the consultation, together with time spent on the website predicted information recall after the consultation (RQ4). In sum, our results suggest that providing patients with online health information before consultation increases their knowledge and consequently facilitates information processing during consultation. Moreover, offering this information in a mode-tailored way may benefit younger patients in terms of increased website satisfaction and reduced anxiety during consultation. The results and implications are discussed below.

Our data showed that the mode-tailored website was evaluated more positively by younger patients (compared to text only), but not by older patients. This result partly confirms previous experimental findings, which showed that mode tailoring increases satisfaction with online health information for both younger and older adults (Nguyen et al., 2018). In the present study, beneficial effects of mode tailoring were also found on younger patients' anxiety, as they reported lower anxiety during consultation after viewing the mode-tailored website (vs. text only). Older patients, however, reported

higher anxiety in the mode-tailored condition (vs. text only). Post-hoc analyses examining anxiety reduction from pre- to post-consultation (difference score), show a significant interaction effect between condition and age group, $F(1, 206) = 5.22$, $p = .023$, $\eta p^2 = .025$. Younger patients reported greater anxiety *reduction* after viewing the mode-tailored website compared to the non-tailored websites ($M_{difference} = 6.05$, $SE = 2.45$, $p = .014$). A reduction or increase in anxiety was not found for older patients in the mode-tailored condition. Although in contrast to our hypothesis, there might be an alternative explanation for these findings based on the socioemotional selectivity theory. Generally, younger adults pertain more to knowledge-related goals to prepare for future events (Carstensen & Mikels, 2005; Löckenhoff & Carstensen, 2004), while older adults attach greater importance to emotionally meaningful goals. It is possible that being able to view information in different (visual) modalities in a tailored manner accommodated to younger patients' information needs (i.e., knowledge-related goals), and thus supported them in lowering their anxiety (vs. text only). Although the finding might be incidental, as no effects were found on other outcomes, the results suggest that mode-tailored information can benefit younger patients.

Contrary to our expectations, this study did not find that mode tailoring proportionally benefitted older patients more than younger patients. A possible explanation is that older patients had more difficulty with using the mode tailoring functionality on the website, whereas this was more intuitive for younger patients, as a result of differences in Internet experience. Interestingly, however, post-hoc analyses revealed that viewing the mode-tailored website required comparable levels of cognitive load as the non-tailored versions ($M = 2.65$, $SD = 1.05$; range 1–7 with higher scores indicating higher cognitive load, $F(3, 229) = 0.23$, $p = .879$, $\eta p^2 = .003$). Moreover, within the mode-tailored condition, there were no differences in cognitive load between younger and older patients ($p = .490$). It could be that with more long term use and thus more experience with the mode tailoring tool, the mode-tailored website would become more beneficial for older patients as well. An alternative explanation is the age distribution within our patient population. In our total study sample, many patients were in their sixties (41.8%). Hence, despite the significant difference in the mean age of younger and older patients, many patients were aged around the cut-off of 65 years, which could explain why the two age groups did not differ on age-related background variables. In our study, older patients were not more frail than younger patients, which might explain why no age differences were found. In fact, the mean frailty score was 2.46 ($SD = 1.98$). Considering that scores of 4 or higher are only considered as (moderately) frail (Steverink et al., 2001), we can conclude that the majority of patients in our study were not frail. A recent study found that age-related factors (such as patients' frailty, health literacy and future time perspective) are more predictive of recall of online

cancer-related information than chronological age (Bol et al., 2018). Moreover, older adults are a highly heterogeneous group in fundamental domains such as biological, cognitive, and personality characteristics (Nelson & Dannefer, 1992; Stone et al., 2016), that could influence how online health information is used, processed and evaluated (Nimrod, 2013a; van der Goot, 2016). For this reason, when investigating website use behaviors and intervention effects on health-related outcomes, it might be meaningful to look at age-related variables as potential moderators of effects (e.g., future time perspective, which relates to the socioemotional selectivity theory). Whether this is indeed the case, requires further research.

Interestingly, we found that certain website experience outcomes, such as website involvement and satisfaction with the comprehension of the website, increased patients' knowledge prior to the consultation. In turn, increased knowledge combined with more time spent on the website, enhanced knowledge and information recall after consultation. This suggests that offering information to help patients prepare for their consultation may be important for their knowledge prior to consultation, and how they process information during the consultation and remember this afterwards. This is an important outcome, as knowledge is one of the key prerequisites for patients to be able to be involved in making treatment decisions and manage their illness (Elwyn et al., 2012; Gaston & Mitchell, 2005; Mills & Sullivan, 1999). Moreover, the website was widely used by patients, across all website conditions (M = 34 min). The majority of patients even used the website multiple times before their hospital visit. This underlines the need for information before a hospital visit, especially in vulnerable situations such as the diagnosis and treatment planning phase.

Although no differences were found on main outcome variables, our data showed that patients spent more time on the mode-tailored website than on the non-tailored website versions. Although this difference was only marginally significant, it suggests that mode tailoring may trigger patients to attend to the website information for a longer period, which in this study proved to be important for information processing during and after consultation. The results are in sync with earlier experimental findings that mode tailoring online information can increase attention to website information (i.e., time spent on the website), and consequently enhance information recall (Nguyen et al., 2017). Whereas it is possible that the extra time spent on the mode-tailored website was because patients needed more time to figure out how the mode tailoring tool worked, it is more likely that patients spent this time viewing the website content. Namely, the time range that patients needed to select their first mode does not weigh up to the extra time patients spent on the mode-tailored website (vs. the non-tailored websites). Moreover, post-hoc analyses showed that

viewing the mode-tailored website did not result in higher cognitive effort to process information from the website compared to the non-tailored versions *(M* = 2.65, *SD* = 1.05; range 1–7 with higher scores indicating higher cognitive load, $F(3, 229) = 0.23$, $p = .879$, $\eta p^2 = .003$). In sum, even though no clear differences were found between conditions on the hypothesized outcome variables, the mode-tailored website kept patients online for a slightly longer period of time, which is likely to be important for knowledge gain and information recall.

The added value of mode-tailored information (vs. non-tailored information) has not previously been tested in a clinical population. Therefore, with respect to null findings regarding other main outcomes (besides website evaluations and information recall), the results for website experience outcomes (such as anxiety and communication self-efficacy), or consultation-related outcomes (such as question-asking) cannot be compared. However, there are plausible reasons why mode tailoring (vs. non-tailored websites) did not produce differences in many of the examined outcomes before, during, and after the consultation. A first explanation is the high topic involvement of patients and thus high personal relevance of the website content, irrespective of how it was presented. The sample consisted of newly diagnosed patients who received a website about the specific clinic they were referred to, with information about their specific condition. This might explain why the website was well used across all conditions (with only 9 patients not viewing the website) and why the perceived relevance of information did not differ between conditions. Consequently, it is possible that information was processed equally well from all website versions, revealing no differences in outcomes between conditions. In comparison, in our previous experimental mode tailoring studies where participants were not emotionally involved in the topic, differences were found in perceived relevance when comparing tailored with non-tailored websites (e.g., Nguyen, Bol, & Lustria, 2018). Relatedly, it could also be that some patients in the non-tailored conditions received information presented in a way that coincidentally matched their preferences, attenuating effects of the mode-tailored website on outcomes. A previous tailoring study showed that when standardized information (by chance) corresponded to individual information needs, this was just as effective as tailored information (Kreuter et al., 2000). Alternative explanations could be the life-threatening nature of the disease (cancer), the emotionally charged moment (diagnosis), or a combination of these two, that elevated the perceived relevance and, consequently, website use. In the present study, patients received the information while awaiting a final diagnosis and treatment plan, which is a phase in which information needs are highest (Jenkins et al., 2001; Rutten et al., 2005). Future research could investigate whether mode tailoring effects would be different and

have added value for clinical patients with a less life-threatening disease (e.g., asthma, diabetes, hypertension).

The second explanation is the uncontrolled setting of a field trial. In experimental studies, participants are exposed to stimulus materials, such as websites, and asked about these materials immediately afterwards. In our field study, patients received a link to the website and the baseline questionnaire several days prior to their hospital visit. This allowed for patients to fill out the baseline questionnaire assessing website experience variables (e.g., website satisfaction, anxiety, communications self-efficacy) on different days prior to their visit. Moreover, patients varied in how often and how long they consulted the website. The variability concerning *when* their answers were recorded and *how* they used the website could have diluted the observable effects, if present. While it would have been ideal to standardize study procedures even more, this is difficult, and maybe even unethical, in a clinical field study with cancer patients.

In a similar vein, our sample consisted of a heterogeneous group of patients dealing with different cancer types (i.e., colorectal, esophageal, or stomach cancer) with varying health trajectories before their appointment at the outpatient clinic. Although we imposed a strict randomization procedure which showed that patients did not differ on patient background characteristics, the sample heterogeneity could have attenuated the observable effects. Although we managed to recruit a relatively large sample for a 'difficult to reach' clinical population, it is still possible that some of the hypothesized effects were undetectable in our sample (if present). As a solution, qualitative approaches (such as observations or interviews with patients who have used the website intervention) might give a more meaningful and in-depth analysis of how the website was used, by whom, and whether using the website created added value for patients. This might be especially true for health communication interventions where small effect sizes are expected and it remains difficult to obtain large, relatively homogeneous samples.

The present study design did not include a no-information control group. While a no-information control group would be useful to examine whether offering online preparatory information in general would have added value, we considered that including a no-information control group would add little insight into mode tailoring effects, but would significantly reduce the number of patients in each condition, further limiting statistical power to detect group differences. Although a no-information control group was not included, the results show that all the variables that predicted knowledge and recall were associated with the website (website involvement, website comprehension,

time spent on the website) and, therefore, imply that additional information sources surrounding the consultation can benefit patients.

Concluding remarks

This study is the first to translate mode tailoring research to a clinical population of cancer patients. Previous experimental (mode) tailoring studies among non-clinical populations have been useful in identifying which message features can yield effects on outcomes, as well as unravelling the theoretical mechanisms that explain these effects (Jensen et al., 2012; Lustria et al., 2016; Nguyen et al., 2018; Nguyen et al., 2017). However, these findings must be translated to clinical populations, to establish whether such interventions have added value in real-life settings. The results suggest that providing patients with online health information to prepare for consultations increases their knowledge which, consequently, facilitates information processing during and after medical consultations (i.e., information recall). Moreover, mode tailoring had small effects on patient outcomes (i.e., website satisfaction and anxiety) for younger patients (<65 years) but not for older patients (≥65 years), supporting the added value of mode tailoring. Future research should continue to explore the added benefit of providing online preparatory information to patients (e.g., in the form of hospital websites, patient portals), how specific features of the Internet (e.g., modality, interactivity, etc.) can be used to tailor information to patients, and whether different tailoring strategies are effective for patients regarding different types of health-related outcomes (e.g., evaluative, cognitive, psychosocial, behavioral) and in different patient populations (e.g., high emotionally charged settings, non-life-threatening chronic diseases).