Enhancing patient participation among older and migrant cancer patients through eHealth

Yılmaz, N.G.

Publication date
2020

Document Version
Other version

License
Other

CHAPTER 4

Testing the effects of modality and narration style on patients' information use in a hospital report card for breast cancer patients

This chapter has been submitted as: Yılmaz, N. G., Timmermans, D. R. M., Portielje, J., van Weert, J. C. M., Damman, O. C. (2020) Testing the effects of modality and narration style on patients' information use in a hospital report card for older versus younger breast cancer patients. [Manuscript submitted for publication]. Department of Public and Occupational Health. Amsterdam UMC, Vrije Universiteit Amsterdam.

ABSTRACT

Background Hospital report cards (HRCs) are usually presented in a textual and factual format, likely not attracting attention and hampering information processing, which can contribute to a low uptake. We aimed to investigate the effects of alternative information presentation formats, namely audiovisual and narrative information, in HRCs on breast cancer care, and to test differences in effects between older and younger patients.

Methods A 2 (Modality: textual vs audiovisual) x 3 (Narration style: factual vs process narrative vs experience narrative) online experiment among disease-naïve women (N=631; M_{age}=56.06, SD=16.43) was conducted. Process narratives focus on the cognitive axis of decisions, while experience narratives focus on the experiential axis of decisions. Age (younger [<65 years] vs older [≥65 years]) was included as a potential effect modifier. Outcomes were: (1) perceived cognitive load, (2) satisfaction with information, (3) information comprehension, (4) information recall, and (5) decisional conflict. Data were analyzed by AN(C)OVAs.

Results Audiovisual information, compared to textual information, resulted in higher satisfaction with the attractiveness of and emotional support from the information across age groups. In older women, audiovisual information was associated with lower information comprehension as compared to text, but this interaction disappeared when we controlled for level of education or health literacy. Several interaction effects were found between narration style and age for the satisfaction measures, suggesting that information in an experience narrative was especially beneficial for older women, while for younger women using a narrative was not effective. A three-way interaction effect was found for satisfaction with the comprehensibility of the information, suggesting that older women were supported by audiovisual factual information, while younger women were supported by audiovisual process narrative information.

Conclusions Our study mainly yielded beneficial effects of modality and narration style on satisfaction measures, which did not translate into differences in information comprehension, recall and decisional conflict. Altogether, it can be recommended to incorporate audiovisual information in HRCs in order to increase satisfaction with information. For narrative information, no definite recommendations can be made yet.

INTRODUCTION

Recently diagnosed breast cancer patients are increasingly expected to make informed decisions about their options in healthcare, such as the hospital where they will get treatment (Lewis & Pignone, 2009). As this decision is considered sensitive to patients' own values and preferences, hospital report cards (HRCs) have been developed and published in many countries to support patients in making those decisions (Emmert & Wiener, 2017). HRCs are online decision support tools that can be used to compare and choose hospitals that best match patients' preferences concerning provided services and quality (Emmert et al., 2014; Faber et al., 2009). Research shows that if HRCs are used, they can have a significant influence on hospital choice (Emmert et al., 2019). However, their use remains low among patients (Bhandari et al., 2019; Lako & Dortant, 2014).

Previous literature suggests several factors contributing to the low uptake of HRCs. One of these factors is that, despite consumer-friendly formats such as star ratings are being used (Damman et al., 2016), the content of HRCs publicly available today is overall still abstract and difficult to use in multi-attribute decisions, easily leading to cognitive overload (Hussey et al., 2014; Kurtzman & Greene, 2016; Schlesinger et al., 2014; Zwijnenberg et al., 2012). For example, prior research showed that quality indicators in HRCs are difficult to comprehend (Damman et al., 2016), because they are usually described through large amounts of text (Schlesinger et al., 2014; Zwijnenberg et al., 2012), and fairly technical language (Hussey et al., 2014). Moreover, quality indicators and hospital scores are often presented in a factual style. As a result, existing HRCs likely do not attract much interest and are still rather cognitively burdensome (Bhandari et al., 2019; Donelan et al., 2011; Emmert et al., 2014; Zwijnenberg et al., 2012), hampering patients' motivation to engage with the information.

In order to enhance information processing when provided with HRCs, recent studies investigated alternative information presentation formats, which can trigger engagement with information, and simultaneously reduce cognitive load. One potentially fruitful strategy is to present information in an alternative modality, e.g. as audiovisual information (such as animated videos) instead of text. The assumed beneficial effect of audiovisual information is related to its ability to attract attention and foster interest in information, as has been shown in health communication studies in general (Bol et al., 2013; Bol et al., 2015; Meppelink et al., 2015). As proposed by the Cognitive Theory of Multimedia Learning (Mayer, 2002), audiovisual information is also known to induce a specific modality effect (Dunn et al., 2004; Ginns, 2005; Sparks et al., 2013), entailing that more information can be processed before cognitive overload occurs, because verbal and visual information can be divided over multiple processing channels (i.e. both auditory and visual) (Leahy & Sweller, 2011; Mayer, 2002). An audiovisual format – compared to

text – has been associated with higher satisfaction with the information (Bol et al., 2013), better comprehension (Brown & Park, 2003), and enhanced recall (Bol et al., 2013; Bol et al., 2015; Meppelink et al., 2015). As audiovisual modality is expected to contribute to better comprehension and information recall, indirectly it is also likely that it might reduce patients' decisional conflict (Kaplan et al., 2014).

Another interesting presentation format for HRCs is a narrative narration style instead of a factual narration style (Agnisarman et al., 2018; Finucane et al., 2018; Kreuter et al., 2007). Narratives are stories of other patients' experiences with a particular topic, in this case a healthcare choice (de Graaf et al., 2016; Greene et al., 2019). Using narratives – compared to factual information – can support information processing by activating intuitive and deliberative reasoning simultaneously (Finucane et al., 2018). It is known that patients often base their provider choice, at least partly, on anecdotal information (e.g. experiences of other patients; intuitive reasoning), and not solely on information from HRCs (deliberative reasoning) (Agnisarman et al., 2018; Madathil & Greenstein, 2018). This illustrates the potential of narrative information to enhance interest and involvement with information (Agnisarman et al., 2018; Finucane et al., 2018; Kreuter et al., 2007; Volk et al., 2008), a process called 'immersion' (Kreuter et al., 2007; Shaffer et al., 2018). The literature further suggests that narratives aimed at supporting decision-making can entail features that enable patients specifically in information processing (Kreuter et al., 2007) and multi-attribute decision-making (Finucane et al., 2018; Greaves et al., 2014; Schlesinger et al., 2015). Altogether, narratives can result in higher satisfaction (Bol et al., 2013), better comprehension (Khangura et al., 2008), enhanced recall (Bekker et al., 2013; Bol et al., 2013), and less decisional conflict (Osaka & Nakayama, 2017).

However, the effectiveness of incorporating narratives in decision-support tools remains rather unclear (Bekker et al., 2013; Holmes-Rovner et al., 2007; O'Connor et al., 2007; Winterbottom et al., 2008). One explanation for previously demonstrated inconsistent findings concerning narratives' effectiveness might be the fact that different types of narratives exist and that not all types might be equally beneficial to actually support information processing and decision-making (Shaffer et al., 2018; Shaffer & Zikmund-Fisher, 2013; Woudstra & Suurmond, 2019). Hence, it is important to distinguish between different types of narratives. A taxonomy of narratives in the field of decision-making distinguishes narratives into outcome, process, and experience narratives (Shaffer & Zikmund-Fisher, 2013). Outcome narratives contain information about the physical and psychological outcomes of decisions (e.g. what effects did a treatment have) (Shaffer & Zikmund-Fisher, 2013), and are hypothesized to cause changes in healthcare choices. Process narratives focus on the cognitive axis of decisions (e.g. how to identify important decision dimensions) (Shaffer & Zikmund-Fisher, 2013), and are expected to mainly have an effect on information processing and the ability to answer knowledge

questions. Experience narratives focus on the experiential axis of decisions (e.g. what visceral experiences and feelings did the diagnosis induce) (Shaffer & Zikmund-Fisher, 2013), and are hypothesized to influence affective forecasting and increase knowledge. The current study aimed to study effects on information processing, and not to cause changes in healthcare choices. Therefore, this study only distinguished between a process narrative and an experience narrative. As both an audiovisual modality and a narrative style (compared to a textual modality and factual style, respectively) are expected to have positive effects on information processing in HRCs, their combination can be expected to yield the most optimal effects.

Testing the effects of modality and narration style is especially crucial in older adults such as older cancer patients, which is an ever-growing group of patients worldwide (Nolen et al., 2017). A previous study showed that especially older patients seem to be nonusers of HRCs (Lako & Dortant, 2014), which might be (partly) related to the issues of disinterest and cognitive overload outlined above. Older people are at risk of suboptimal information processing due to age-related declines in working memory capacity and in the ability to process, comprehend and recall information (Baker et al., 2000; Bopp & Verhaeghen, 2005; Brown & Park, 2003; Crome & Lally, 2011; Delgado-Guay et al., 2013; Jansen, van Weert, et al., 2008; Posma et al., 2009; Sparks & Nussbaum, 2008). The modality effect can thus be more paramount for older adults compared to younger adults (van Gerven et al., 2003). Decision strategies are also known to change with older age. It has been suggested that older adults, compared to younger adults, rely more on intuitive and affective decision strategies (Finucane et al., 2002; Peters, Hess, et al., 2007). Besides, according to the Socio-emotional Selectivity Theory, older adults' motivation to process information becomes highly selective, and older patients focus on emotionally meaningful information (Carstensen, 2006; Carstensen et al., 2003; Carstensen et al., 1999). This focus on intuitive reasoning and emotional information might lead to suboptimal decision-making in older patients, because both intuitive and deliberative reasoning need to be integrated for optimal decision-making (Peters et al., 2008; Peters, Hess, et al., 2007). Narratives can compensate for suboptimal decision-making by inducing both intuitive and deliberative information processing. Hence, older patients might benefit more from audiovisual and narrative (especially experience narrative) information (compared to textual and factual information, respectively) than younger patients.

This study aimed at answering the following research questions:

- RQ1a: *Does audiovisual information (compared to textual information) about quality indicators in an HRC increase users' satisfaction with information, information comprehension, and information recall, and decrease perceived cognitive load and decisional conflict?*
- RQ1b: *Are the effects [RQ1a] greater in older people compared to younger people?*
- RQ2a: *Does process and/or experience narrative information (compared to factual information) about quality indicators in an HRC increase users' satisfaction with information, information comprehension, and information recall, and decrease perceived cognitive load and decisional conflict?*
- RQ2b: *Are the effects [RQ2a] greater in older people compared to younger people?*
- RQ3a: *Does the combination of audiovisual and narrative information about quality indicators in an HRC, compared to other combinations of modality and narration style, increase users' satisfaction with information, information comprehension, and information recall, and decrease perceived cognitive load and decisional conflict?*
- RQ3b: *Are the effects [RQ3a] greater in older people compared to younger people?*

METHODS

Design

This study contained a between-subjects factorial 2 (modality [text vs audiovisual]) x 3 (narration style [factual vs process narrative vs experience narrative]) experimental design in which the manipulations were performed in the descriptions of the quality indicators (i.e. the aspects on which the hospitals are compared) in an HRC. We chose to manipulate specifically this information, because the indicators in fact form the basis of the hospital comparison and are used to choose a hospital.

Age (i.e. young [<65 years] versus old [≥65 years]) was included as a potential effect modifier. Participants were stratified by age, and subsequently randomly assigned to one of the six experimental conditions via automatic randomization (allocation ratio = 1:1:1:1:1:1). The Medical Ethics Committee of Amsterdam UMC, location VUmc, approved the study (2016.587). The study was preregistered as well (see https://osf.io/kxmgc/?view_only=9a6f6f06d4024e498ce9c7d940ecc193). Written consent was obtained from all participants.

Materials

All provided information contained fictitious but realistic information in an HRC (i.e. based on a real Dutch HRC for breast cancer patients; https://borstkanker.nl/nl/monitor-borstkankerzorg-0) about four hospitals (*MC Oost, St Nathaniel, Noordhaven Ziekenhuis,*

and *IJssel MC*) and six quality indicators (*Figure 5*). Prior to data collection, three textual scripts were developed: 1) factual, 2) process narrative, and 3) experience narrative. The first script contained factual information and started with information about the aim of the HRC. Next, information was provided about the process of evaluating different hospitals before making a choice, and explained the three categories of quality indicators registered for Dutch hospitals (i.e. 'organization of healthcare', 'process within healthcare', and 'results of healthcare').

Figure 5. Stimulus material.

Monitor Borstkankerzorg

		MC Oost	St Nathaniel	Noordhaven Ziekenhuis	IJssel MC
	Organization of healthcare				
1	**Choice for direct-to-implant breast reconstructions**	Yes	No	Yes	Yes
2	**Structure of weekly multidisciplinary meeting** *Structure according to the requirements of BVN*	Yes	Yes	No	Yes
	Process within healthcare				
3	**Waiting time diagnosis-treatment** *Average number of days between diagnosis and treatment*	40 days	53 days	33 days	43 days
4	**Discussing consequences of treatment** *% of patients with whom the consequences of possible treatment options were discussed*	63%	45%	78%	52%
	Results of healthcare				
5	**Remaining cancer tissue** *% of patients who are left with remaining cancer tissue after breast sparing surgery (Norm = maximum of 15%)*	8%	3%	6%	5%
6	**Recommendation by patients** *% of patients who recommend this hospital (score of 9 or 10)*	67%	93%	76%	85%

The second and third script contained exactly the same information as the factual version but were written in a narrative style. Hence, in all scripts, the basic content was identical. For the second script, the basic information from the factual script was enriched with contextual information, turning the script into a process narrative (Shaffer & Zikmund-Fisher, 2013), by letting a female character diagnosed with breast cancer tell her story about choosing a hospital for her treatment. When telling about the process of comparing hospitals based on the three categories of quality indicators, the female character told what aspects she perceived to be 'important to evaluate when choosing a hospital' for each category of quality indicators. Hence, the process narrative concentrated on the cognitive process of comparing hospitals and weighing quality indicators, as would be a characteristic of a normative decision-making model (Shaffer & Zikmund-Fisher, 2013) (see red colored text in *Appendix D*).

The third script elaborated on the exact same information as in the second script. This script was written as an experience narrative (Shaffer & Zikmund-Fisher, 2013). In addition to the cognitive information in the process narrative, experiential (including emotional)

context concerning the process of choosing a hospital was added (see blue colored text in *Appendix D*). The experience narrative was expected to be perceived as 'more emotional' than the process narrative, based on a previous study that investigated the effects of process narratives compared to experience narratives on treatment decision-making in breast cancer care. This study concluded that experience narratives were associated with a greater ability to imagine the experiences with treatment (Shaffer, Hulsey, et al., 2013).

The scripts described above were the basis of the textual and audiovisual conditions. In the textual conditions, participants received one of the scripts (i.e. either factual, process narrative, or experience narrative) to read. For the audiovisual conditions, the three textual scripts were recorded as voice-overs (female voice) and used in animated videos (i.e. 'simulated motion picture depicting movement of drawn (or simulated) objects' (Mayer & Moreno, 2002, p. 88)). For the animated videos, 16 visuals depicting information elements from the scripts were pilot-tested among five disease-naïve women aged 65 years or older. Based on this pilot test, 11 visuals were finalized and used in the animations. The animations themselves were not pre-tested since the content of the animations was a combination of the pre-tested materials. Ultimately, three animations were developed: (1) factual information, (2) process narrative information, (3) experience narrative information. A link to the animations, in Dutch, can be found in *Appendix E*.

Participants

Participants were women aged 18 years and older who had no (history of) breast cancer (i.e. disease-naïve). Recruiting so-called analogue patients was chosen in order to avoid that participants would have prior knowledge about the quality indicators. Actual new cancer patients who have to make a hospital choice generally have this knowledge neither. Using analogue patients has been shown to be a valid approach in experimental communication research, indicating that they can be considered as proxies for clinical patients (van Vliet et al., 2012). Participants were included if they had sufficient mastery in both reading and speaking Dutch. Participants were recruited through an online research panel called Flycatcher Panel, which is ISO20252 and 26362 certified. An a priori sample size calculation in G*Power for a 2x3 factorial design with a small to medium effect size of .20 (Cohen's f) and a two-sided significance level of .05 showed that at least 619 participants needed to be included for sound power (.95). Ultimately, 631 participants were included in the study.

Procedure

Flycatcher sent participants a link to an online survey. Through the link, participants were first informed about the content and aim of the study, the confidentiality of data, and voluntary participation. Next, participants gave informed consent. Participants were randomly assigned to one of the six conditions. After reading/watching the provided

information, participants were directed to the survey. For examining the data quality, Flycatcher checked completed surveys on answers to open questions (e.g. information recall), consistency in answers, straight lining, and time spent to complete the survey.

Measures

The survey covered our dependent variables (see below). Moreover, socio-demographic and medical variables (i.e. age, level of education, comorbidity, quality of life and diagnosis), and control variables (i.e. health literacy, numeracy, transportation, and identification) were included in the survey. Comorbidity was defined as having two or more health problems, and quality of life was measured by two items (i.e. *"How would you rate you overall health during the past week?"* and *"How would you rate your overall quality of life during the past week?"* (Fayers & Bottomley, 2002)). Health literacy was measured by the Newest Vital Sign-D (Fransen et al., 2014), containing six questions. Answering four or more questions correctly was considered as 'adequate' health literacy (Fransen et al., 2014). Numeracy was measured by the single-item Berlin Numeracy Test (Cokely et al., 2012), and answering the question correctly was considered as 'adequate' numeracy. Transportation (i.e. being cognitively, emotionally, and imaginary involved in the text/video) was measured by eight items (e.g. *"I wanted to know how the story from the texts/videos ended"*; α=.73) (Green & Brock, 2000). Identification was measured by three items (e.g. *"In my imagination, it was like I was [character in stimulus material]"*; α=.95) (Visser et al., 2016). All items consisted of a 7-point Likert scale (*1 = totally disagree* to *7 = totally agree*).

Perceived cognitive load

Four items measured on a 7-point Likert scale (*1=strongly disagree* to *7=strongly agree*) developed by Eveland and Dunwoody (2001) were used to measure perceived cognitive load (α=.82).

Satisfaction with the information

Twelve items measured on a 7-point Likert scale (*1=totally disagree* to *7=totally agree*) from the Website Satisfaction Scale were used to measure satisfaction with the information *(*α=.94) (Bol et al., 2014). Both a total scale score and scores for three subscales were calculated. Three items related to the subscale 'Satisfaction with the attractiveness' *(*α=.89*)*, five items to 'Satisfaction with the comprehensibility' *(*α=.92*)*, and four items to 'Satisfaction with emotional support' *(*α=.95*)*.

Information comprehension

Information comprehension was measured by fifteen multiple choice questions (Reyna, 2008). An example of an information comprehension question was: *"For Nina, it is not important that she can receive a direct-to-breast implant after surgery. Which hospital would be the best choice for her?"* Answer options for this question were: *(a) MC Oost, (b)*

St Nathaniel, (c) Noordhaven Ziekenhuis, (d) IJssel MC, (e) It does not matter, (f) I don't know. For each question, one or two response options could be correct. Participants were enabled to revisit the stimulus materials while filling in comprehension questions. The final score was the sum of correct answers and ranged from 0 to 15.

Information recall

Fourteen open-ended questions based on the Netherlands Patient Information Recall Questionnaire were used to measure information recall (Jansen, van Weert, et al., 2008). All questions related to the information about the quality indicators. Participants were not able to revisit the stimulus materials while filling in the questions. Before starting data analysis, a preliminary codebook, including scores for correct answers, was developed by the researchers (NGY and OCD). This codebook was used by the two researchers to independently score five questions (35.7%). Agreement ranged from 60.0% to 79.2%. After the first round, the researchers discussed their scores, and adapted the codebook accordingly. The adapted codebook was used by the researcher (NGY) to re-score the answers. To ensure validity of the scores, the two researchers discussed the new scores for a second time. Agreement then ranged from 85.5% to 98.0%. At the end of this iterative process, the final codebook was developed, and the researcher (NGY) went through all answers and scores once more. The maximum score for a correct answer differed per questions and ranged from 0 to 2 points. Sum scores ranged from zero to 18.

Decisional conflict

Sixteen items measured on a 5-point Likert scale from the Decisional Conflict Scale (O'Connor, 1995) were used (α=.94). Both a total scale score as well as scores for five subscales were calculated. Three items related to 'Informed' *(α=.86)*, three items to 'Values clarity' *(α=.87)*, three items to 'Support' *(α=.74)*, three items to 'Uncertainty' *(α=.87)*, and four items to 'Effective decision' *(α=.91)*.

Pilot tests for development stimulus materials

Prior to data collection, a pilot test of the stimulus materials and survey was conducted. For the textual conditions, the scripts were pre-tested among 42 women (M_{age} = 60.95). These women were recruited through PanelCom (www.panelcom.nl), and were randomly assigned to the factual (n=14), process narrative (n=14), or experience narrative (n=14) textual script. The two narrative texts were perceived as more narrative compared to the factual text (p<.001). Using a factor analysis, three subscales were constructed for use as manipulation check in the survey, with three items belonging to the subscale 'Factual' *(α=.84)*, three items to 'Process narrative' *(α=.93)*, and three items to 'Experience narrative' *(α=.92)*. All items were measured on a 7-point Likert scale (*1=totally disagree* to *7=totally agree*).

Manipulation check

Factual information was perceived to be significantly more factual (M=15.31, SD=3.06) than process narrative information (M=13.27, SD=3.60), $t(404)$= 6.12, $p < .001$, 95% CI [1.38 ; 2.69]. Moreover, process narrative information was perceived to be significantly more narrative (M=14.90, SD=4.12) than factual information (M=9.58, SD=4.19), $t(404)$= -12.90, $p < .001$, 95% CI [-6.13 ; -4.51]. Hence, it can be concluded that the manipulation 'factual vs process narrative' was successful. Factual information was also perceived to be significantly more factual (M=15.31, SD=3.06) than experience narrative information (M=12.65, SD=3.57), $t(423)$= 8.19, $p < .001$, 95% CI [2.02 ; 3.29]. Furthermore, experience narrative information was perceived to be significantly more narrative (M=14.70, SD=3.93) than factual information (M=9.23, SD=4.29), $t(423)$= -13.74, $p < .001$, 95% CI [-6.26 ; -4.69]. Hence, it can be concluded that the manipulation 'factual vs experience narrative' was successful. Process narrative information was perceived to be significantly less narrative (M=14.90, SD=4.12) than experience narrative information (M=15.96, SD=3.74), $t(429)$= -2.79, p=.005, 95% CI [-1.80 ; -0.31]. Besides, experience narrative information was perceived to be significantly more narrative (M=14.70, SD=3.93) than process narrative information (M=12.84, SD=4.22), $t(429)$= -4.73, $p < .001$, 95% CI [-2.63 ; -1.09]. Hence, it can be concluded that the manipulation 'process narrative vs experience narrative' was successful.

Statistical analyses

Data analysis was conducted using SPSS, version 26. Differences between conditions and between younger and older women in control (i.e. health literacy, numeracy, transportation, identification) and background variables (i.e. age, level of education, comorbidity, quality of life and diagnosis) were tested using one-way ANOVAs. The effects of modality, modality*age, narration style, narration style*age, modality*narration style, and modality*narration style*age on the dependent variables were tested using two-way ANOVAs. Post-hoc analyses were performed to analyze the differences between the conditions. We adopted an age cut-off of 65 years to categorize participants into 'younger' (18-64 years old) and 'older' (65 years or older) participants, which is generally accepted in studies that investigate the effects of aging on health-related outcomes (Jorgensen et al., 2012). To adjust for the effects of multiple hypothesis testing, a Bonferroni correction was applied.

Descriptive statistics showed that younger women were significantly higher educated, and had higher health literacy and numeracy than older women (see *Results* and *Table 8*). In order to properly analyze the interaction effects of the manipulations with age (RQ1b, RQ2b, and RQ3b), level of education, health literacy, and numeracy were taken into account as a confounder in additional ANCOVAs. As the three variables highly correlated, three separate ANCOVAs were conducted. All findings with $p \leq .05$ were considered to be significant.

RESULTS

Sample characteristics

Table 8 describes the sample characteristics. In the final sample, women were aged between 19 and 95 years old. On average, participants rated their quality of life as moderate (M=10.76, SD=2.26; range= 4–14). The majority of all participants showed an adequate level of health literacy (81.3%), but less than half of them (37.3%) answered the numeracy question correctly. Younger participants were significantly higher educated than older participants, and had higher health literacy and numeracy levels. Transportation into the story was moderate (M=33.58, SD=7.04; range= 12-53), while identification with the character from the narratives was quite low (M=8.93, SD=4.48; range= 3-21). There were no differences between older and younger participants in transportation and identification.

Appendix F provides an overview of the mean scores on the control and outcome measures per experimental condition. This overview shows that no significant differences exist between conditions in control variables, and outcomes measures, except for overall satisfaction with the information and satisfaction with the attractiveness of information. For readability purposes, the F-test statistics per research question can be found in *Appendix G*.

RQ1: Effects of modality and interaction between modality and age

We found a significant main effect of modality on four outcome measures. Post-hoc analyses showed that women who received audiovisual information were more satisfied with the information in general (M_{dif}=3.39, p=.001, 95% CI [1.40 ; 5.38]), and particularly with the attractiveness of the information (M_{dif}=1.93, p < .001, 95% CI [1.03 ; 2.83]) and emotional support from the information (M_{dif}=0.97, p=.028, 95% CI [0.11 ; 1.84]) than women who received textual information. However, the effect for comprehension was in the other direction, with women receiving audiovisual information comprehending the information worse (M_{dif}= -0.68, p=.042, 95% CI [-1.34 ; -0.03]).

A significant interaction between modality and age was found, showing that older women who received textual information, compared to older women who received audiovisual information, had significantly higher information comprehension (M_{dif}=1.44, p=.002, 95% CI [0.53 ; 2.34]). Within younger women, no interaction effects were found. After adjusting for level of education or health literacy in ANCOVAs, the interaction between modality and age for comprehension was no longer existent. In contrast, after adjusting for numeracy, the interaction effect remained intact.

Table 8. Sample characteristics.

	Total sample (*N*=631)	Younger patients (*n*=334)	Older patients (*n*=297)
Sample characteristics			
Age (*M* ± *SD*)	56.06 ± 16.43	43.60 ± 12.63	70.07 ± 4.77 ***
Level of education *(n; %)*			
Low	188 (29.8)	56 (16.8)	132 (44.4) ***
Moderate	266 (42.2)	174 (52.1)	92 (31.0)
High	177 (28.1)	104 (31.1)	73 (24.6)
Comorbidity *(% yes)*	72.6	70.7	74.7
Quality of life *(M ± SD; range=4–14)*	10.76 ± 2.26	10.89 ± 2.17	10.61 ± 2.36
Diagnosis *(% yes)*			
Lung	0.5	0.0	0.9
Colorectal	0.6	0.3	1.0
Gynecological	1.1	0.6	1.7
Urological	0.2	0.0	0.3
Skin	1.7	0.9	2.7
Other	1.3	0.8	2.4
Control variables			
Health literacy *(M ± SD; range=1–6)*	4.84 ± 1.53	5.30 ± 1.22	4.32 ± 1.67 ***
Numeracy *(% correct)*	37.3	49.3	23.0 ***
Transportation *(M ± SD; range=12-53)*	33.58 ± 7.04	33.68 ± 7.26	33.47 ± 6.79
Identification *(M ± SD; range=3-21)*	8.93 ± 4.48	8.62 ± 4.60	9.29 ± 4.31
Outcome measures			
Perceived cognitive load *(M ± SD; range=4–28)*	13.38 ± 4.75	12.49 ± 4.65	14.38 ± 4.66 ***
Decisional conflict			
Low (%)	13.8	11.7	16.2
Moderate (%)	29.8	29.9	29.6
High (%)	56.4	58.4	54.2
Comprehension of information *(M ± SD; range=0–15)*	10.88 ± 4.20	12.15 ± 3.34	9.45 ± 4.60 ***
Information recall *(M ± SD; range=0–18)*	3.63 ± 3.11	4.35 ± 3.28	2.81 ± 2.70 ***
Satisfaction with information *(M ± SD)*			
Attractiveness *(range=3–21)*	12.11 ± 3.74	12.09 ± 3.64	12.13 ± 3.86
Comprehensibility *(range=5–35)*	25.26 ± 5.51	25.72 ± 5.39	24.76 ± 5.71 *
Emotional support *(range=4–28)*	15.14 ± 5.55	14.94 ± 5.32	15.36 ± 5.79

*** $p < .001$ ** $p \leq .01$ * $p \leq .05$

RQ2: Effects of narration style and interaction between narration style and age

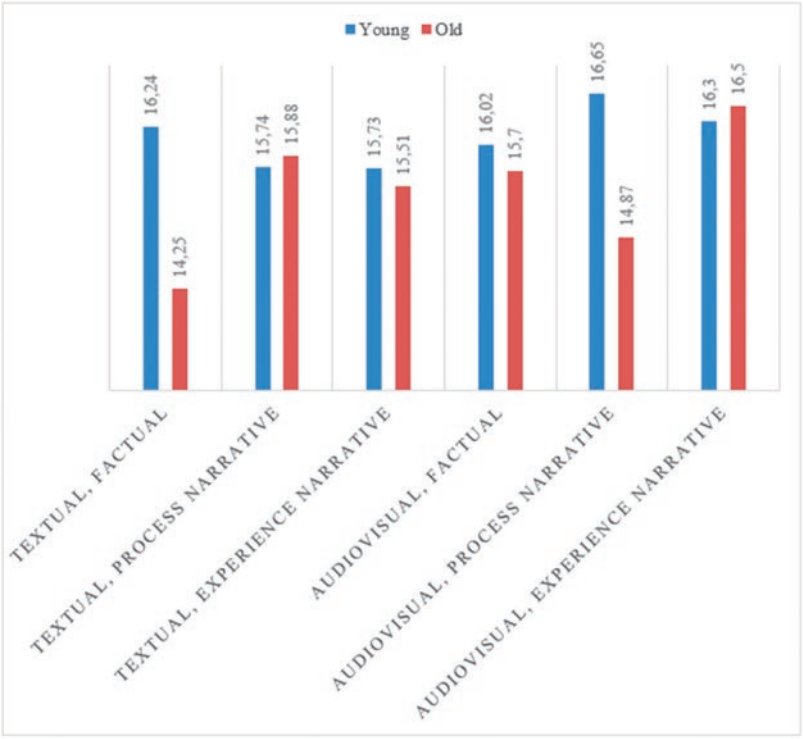
We did not find any significant main effects of narration style on our outcome measures. However, significant interaction effects were found between narration style and age. In older women, experience narrative information, compared to factual information, was associated with higher overall satisfaction with the information (M_{dif}=4.95, p=.018, 95% CI [0.65 ; 9.25]), and specifically higher satisfaction with emotional support from the information (M_{dif}=2.11, p=.020, 95% CI [0.25 ; 3.97]). In contrast, among younger

women, no significant differences were found. Furthermore, older women who received experience narrative information, compared to younger women who received experience narrative information, were significantly more satisfied with emotional support from the information (M_{dif}=2.22, p=.003, 95% CI [0.77 ; 3.67]). After adjusting for level of education or health literacy in two additional ANCOVAs, the interaction effects remained intact. After adjusting for numeracy, the interaction effect between narration style and age on satisfaction with emotional support from the information remained intact, but the effect on overall satisfaction with the information was no longer existent.

RQ3: Interaction effects of modality and narration style, and between modality, narration style, and age

No significant two-way interactions between modality and narration style were demonstrated. However, we did find a significant three-way interaction for satisfaction with the comprehensibility of information (see *Figure 6*). Older women who received audiovisual factual information, compared to older women who received textual factual information, were more satisfied with the comprehensibility of the information (M_{dif}=1.44, p=.035, 95% CI [0.10 ; 2.78]). The same was found for older women who received textual process narrative information compared to textual factual information (M_{dif}=1.62, p=.050, 95% CI [-0.00 ; 3.24]). These effects were not found for younger women. Younger women who received audiovisual process narrative information (M_{dif}=1.79, p=.008, 95% CI [0.46 ; 3.11]) or textual factual information (M_{dif}=1.99, p=.003, 95% CI [0.70 ; 3.27]), compared to older women who received the same information, were more satisfied with the comprehensibility of the information. After adjusting for level of education, health literacy or numeracy in an additional ANCOVA in three separate models, the interaction effect on satisfaction with the comprehensibility remained intact. After adjusting for numeracy, also the interaction effect on overall satisfaction with the information and on making informed choices (subscale of decisional conflict) became significant.

Figure 6. Interaction effect of modality * narration style * age on satisfaction with the comprehensibility of information (range = 5 – 35; *p*=.025).



DISCUSSION

The results of this study showed that audiovisual information resulted in higher satisfaction with the attractiveness of and emotional support from the information about quality indicators in a breast cancer hospital report card (HRC) across age groups. In older women, however, audiovisual information was associated with lower information comprehension as compared to text, but this interaction effect disappeared when we controlled for level of education or health literacy. This seems to suggest that the detrimental effect of audiovisual information on information comprehension in older women can, at least for a great part, be attributed to their low level of education and lower health literacy. Narration style did overall not influence women's information use. However, interaction effects suggested that information in an experience narrative was especially beneficial for older women, while for younger women the narration style of information did not play a great role. The effect of an experience narrative on overall satisfaction with the information among older women disappeared after adjusting for numeracy, though, suggesting that the beneficial effect of experience narrative information in older women can, at least partly, be attributed to their lower level of numeracy. Finally, the three-way interaction effect for satisfaction with the

comprehensibility of the information seemed to imply that older women were especially supported by audiovisual factual information or by textual process narrative information. In contrast, for younger women the audiovisual process narrative information and the textual factual information increased their satisfaction with the comprehensibility.

Our first research question related to the effectiveness of audiovisual information, compared to textual information, in enhancing information evaluation and processing measures. In terms of satisfaction with (several aspects, such as the attractiveness of) the information, audiovisual information seemed to have benefits over textual information. However, this effect did not translate into better information processing in terms of, for instance, perceived cognitive load, comprehension, or recall. In older women with lower educational level or health literacy, audiovisual information even led to lower comprehension. Hence, although audiovisual information seems to be a promising approach in terms of increasing satisfaction with the information in HRCs, it should be questioned under what conditions it would also be effective for information processing outcomes. One point to consider is how the content of the HRC should be formed. In our study, an existing HRC was highly simplified but the content of the HRC had a rather classic format and contained percentages. This kind of numerical formats seem less effective than graphical of evaluative presentations (Kurtzman & Greene, 2016). The negative effect of audiovisual information on comprehension might mean that the content of the simplified HRC was still too difficult to process, even when presented in audiovisual modality. Another point to consider is the user options of the HRC. From the field of health literacy, we know that people with lower health literacy in general need more time to process information (von Wagner et al., 2009). Being able to absorb information at your own pace (i.e. self-pacing), also in audiovisual materials, has been shown to contribute to higher comprehension in other studies (Callahan et al., 2003; Meppelink et al., 2015). In our study, women were not able to self-pace the absorption of information in the audiovisual materials, which may be problematic for those who might need extra time to absorb and process information. Altogether, the negative effect of audiovisual information on information comprehension might indicate that the content of the HRC should be further adjusted by, for instance, including graphical formats (Damman et al., 2016; Damman et al., 2012; Sander et al., 2015), or providing the audiovisual information in a format that enables for self-pacing. A third point should be kept in mind, however: providing information in audiovisual modality also knows some practical downsides. For instance, audiovisual information, or more specifically the visuals accompanying the relevant parts of the text, cannot be easily provided in a leaflet. In terms of costs, developing audiovisual material is also more expensive than developing textual material.

Our second research question related to the effectiveness of narrative information, compared to factual information, in enhancing information evaluation and processing

measures. The Narrative Immersion Model postulates that first interest should be captured and engagement should be induced before the effect of narratives, i.e. immersion, occurs (Shaffer et al., 2018). The overall lack of effects of narration style in our study, combined with the finding that narrative information – compared to factual information – did not result in higher transportation or identification (see *Appendix F*), might mean that despite the benefits mentioned in the literature, narration style does not induce the transportation effect, and ultimately the immersion effect, for information on quality indicators in HRCs. Hence, the factual information might have been enough to make sense of the importance of using HRCs, with no additional value of narratives. The results might have been different in an actual patient population because the topic is more relevant for them.

Despite a lack of overall effects of narration style, the interactions with age showed that information in an experience narrative was associated with higher satisfaction among older women, especially with the emotional support from the information, even after adjusting for level of education, health literacy, or numeracy. It is interesting that including experiential/emotional contextual information to materials induced higher satisfaction with emotional support in older women. Older adults, in general, are supposed to be more in need of emotional support in information provision (Carstensen, 2006; Peters et al., 2008). As such, providing older women with experience narrative information might enhance their ability to imagine experiences with choices, in turn fulfilling their need for emotional support. However, this effect did not translate into beneficial effects on information comprehension or information recall, something what would have been expected based on the Socio-emotional Selectivity Theory and a previous study (Bol et al., 2014; Carstensen et al., 2003; Carstensen et al., 1999). A possible explanation might lie in the type and form of information we provided. A previous study about adding static illustrations to textual health information about treatment showed that when illustrations were added to textual information, older adults were more satisfied with emotional support from the information than younger adults, and that this increased satisfaction resulted in better information recall (Bol et al., 2014). In our study, we did not present information about treatment, but rather about the process of choosing a hospital. It should be kept in mind that a treatment and a hospital choice are different types of choices. For example, for treatment choices, several benefits and harms of treatment options need to be weighed, probably making the choice more 'relevant' to be made than a hospital choice. A treatment choice – compared to a hospital choice – is more likely to have an effect on one's quality of life. Moreover, especially in the Netherlands, the overall quality of care is relatively high. Therefore, information in an HRC might not have been perceived as highly relevant.

Our study has some limitations. Firstly, due to inherent characteristics of types of narratives, the narrative conditions (and especially the experience narrative condition) contained more information than the factual condition. We intentionally chose to keep

the basic information identical in our experimental conditions and to add contextual information to the narrative conditions. A limitation related to this choice is that the difference in length might partly explain why the narratives did not contribute to enhanced cognitive outcomes, such as information recall. It has been shown before that providing more information leads to less recall (Jansen, Butow, et al., 2008). Besides, especially older adults are known to experience difficulties in distinguishing between main and side issues (Brown & Park, 2003). However, it could also be questioned how much informational value the contextual information in the narratives has, and, thus, causes cognitive load. Also, our choice to keep the basic content identical can be perceived as a strength of the study because effects found during the analyses can only be attributed to the type of information respondents received, and not to differences in basic content. Nevertheless, this limitation calls for future research that provides insight into how to best study the effects of narratives. For example, should the length of narratives be kept identical and the content be diverse, or should the content (at least the basic content) be identical and the length be diverse? Secondly, we adopted an age cut-off point of 65 years. This cut-off is often used in health-related studies to investigate the effects of aging (Jorgensen et al., 2012). Nevertheless, such cut-offs always remain arbitrary, and audiovisual and narrative information might have different effects on information processing in the oldest-old. In our sample, however, adopting an age cut-off of 70 years did not result in other findings than reported. Finally, recruiting participants who had no breast cancer might have led to a sample of relatively less motivated participants to process the stimulus materials. Hence, HRC-users from the actual target population might be more motivated. Also, adjusting for (especially) health literacy and numeracy, variables that are highly correlated with level of education, might mean that we were correcting too much.

Conclusion

Our study mainly yielded beneficial effects of audiovisual and narrative information on satisfaction measures, which did not translate into differences in information processing (e.g. information comprehension and information recall). It can be recommended to incorporate audiovisual information in HRCs in order to increase satisfaction with information. However, given the limited effects on the other study outcomes, it should be investigated whether and when adding audiovisual information to HRCs is of real added value in practice. Narrative information cannot necessarily be recommended for broad groups of patients, but the effects of narratives in older women suggest that this strategy might have potential. We recommend elaborating on the effects of experience narratives in different groups of older patients in future research.