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Pictures in health information and their pitfalls: Focus group study and systematic review

Bilder in Gesundheitsinformationen und ihre Tücken: Fokusgruppenstudie und systematische Übersichtsarbeit

Julia Lühnen[1,*], Anke Steckelberg[2], Susanne Buhse[1]

[1] *Universität Hamburg, MIN Fakultät, Gesundheitswissenschaften, Hamburg, Deutschland*
[2] *Martin-Luther-Universität Halle-Wittenberg, Medizinische Fakultät, Institut für Gesundheits- und Pflegewissenschaft, Halle (Saale), Deutschland*

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ABSTRACT

Background: Health information often includes different categories of pictures. This study comprises: A) exploration of the perception of photos presented in a brochure on the prevention of osteoporosis and B) a systematic review on the effects of pictures in health information.
Methods: A) We conducted four focus groups. Participants with heterogeneous cultural and educational background were included. The interviews were subjected to qualitative content analysis. B) We searched PubMed, CENTRAL, PSYNDEX, PsycINFO, CINAHL, Campbell Collaboration and DIMDI. Randomized controlled trials (RCTs) on predefined cognitive and affective outcomes were included. Two reviewers independently extracted data and assessed the quality of evidence. Descriptive data synthesis was conducted.
Results: A) Within the focus groups comprising 37 participants, four generic categories were identified: comprehension, perception, congruence between photos and content, and alternatives. Identification with portrait photos and the connection between photos and text were important to participants. B) In total, 13 RCTs were included. Quality of evidence was moderate. Types of pictures and their intention varied between studies. Cartoons enhanced comprehension, satisfaction and readability. Photos did not improve cognitive or affective outcomes. Effects of anatomical pictures, pictographs, and drawings were ambiguous.
Conclusion: The overall effect of using pictures in health information remains unclear. The type of pictures and readers' characteristics may influence both perception and interpretation. Type, amount, and intention of the pictures should be considered carefully.

Abbreviations: EBHI, Evidence-based health information; GRADE, Grading of Recommendations Assessment, Development and Evaluation; RCT, Randomized controlled trial; SDM, Shared decision-making; UKMRC, United Kingdom Medical Research Council.

* Corresponding author. Julia Lühnen, Universität Hamburg, MIN Fakultät, Gesundheitswissenschaften, Martin-Luther-King Platz 6, 20146 Hamburg, Deutschland.
E-mail: Julia.Luehnen@uni-hamburg.de (J. Lühnen).

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ZUSAMMENFASSUNG

Hintergrund: Gesundheitsinformationen enthalten häufig unterschiedliche Arten von Bildern. Diese Arbeit umfasst: A) Fokusgruppeninterviews zur Wahrnehmung von Fotos aus einer Broschüre zum Thema Prävention von Osteoporose und B) eine systematische Übersichtsarbeit zu den Effekten von Bildern in Gesundheitsinformationen.
Methoden: A) In vier Fokusgruppen wurden Teilnehmerinnen und Teilnehmer mit unterschiedlichem kulturellen Hintergrund sowie Bildungsgrad eingeschlossen. Die Auswertung der Interviews erfolgte mittels qualitativer Inhaltsanalyse.
B) Literaturrecherchen wurden in den Datenbanken PubMed, CENTRAL, PSYNDEX, PsycINFO, CINAHL, Campell Collaboration und DIMDI durchgeführt. Randomisiert-kontrollierte Studien (RCTs) zu prädefinierten kognitiven und affektiven Endpunkten wurden eingeschlossen. Selektion, Datenextraktion und Bewertung der Qualität der Evidenz erfolgte unabhängig durch zwei Reviewer. Die Datensynthese erfolgte deskriptiv.
Ergebnisse: A) In den Fokusgruppen mit 37 Teilnehmerinnen und Teilnehmern wurden vier Hauptkategorien identifiziert: Verständnis, Interpretation der Fotos, Zusammenhang von Fotos und Inhalt, Alternativen. Die Identifikation mit Portraitfotos und die Verbindung zwischen Fotos und Text waren den Teilnehmerinnen und Teilnehmern wichtig.
B) Insgesamt wurden 13 RCTs eingeschlossen. Die Qualität der Evidenz war moderat. In den Studien variierten Art der Bilder und ihre Zielsetzung. Cartoons verbesserten das Verständnis, die Zufriedenheit und Lesbarkeit. Fotos verbesserten weder kognitive noch affektive Endpunkte. Die Effekte von anatomischen Bildern, Piktogrammen und Zeichnungen waren nicht eindeutig.
Schlussfolgerung: Insgesamt bleibt es unklar, welchen Effekt Bilder in Gesundheitsinformationen haben. Die Art der Bilder und die Charakteristika der Leserinnen und Leser können die Wahrnehmung und Interpretation beeinflussen. Art, Anzahl und Zielsetzung verwendeter Bilder sollte sorgfältig abgewogen werden.

Introduction

Evidence-based health information (EBHI), such as patient decision aids, can promote informed and shared decision-making (SDM) between patients and healthcare professionals by providing decision-relevant information in an understandable and unbiased manner [1,2]. EBHI addresses all health conditions and target groups with regard to prevention, screening, diagnosis, therapy and rehabilitation. Various formats are available, e.g. brochures, videos, or interactive websites. As a multifaceted intervention, EBHI itself comprises different elements [3] including numerical, graphical and linguistic representations of risk information and sometimes additional pictures or patient narratives. These elements may positively or negatively affect cognitive and affective outcomes, such as comprehension, understanding, credibility and attractiveness, and therefore may influence the decision-making process [4].

Developers of EBHI face the challenge of choosing both the elements and their format. Specific criteria for the development of EBHI have been described [4–8]. There is good evidence on how to present numerical information in order to improve cognitive outcomes [9,10]. EBHI often also contains pictures which are supposed to enhance attention, help readers to comprehend and recall information, and increase adherence to health instructions. People with low literacy skills appear to benefit [11], but evidence on how to utilize a certain picture remains heterogeneous [4].

Photos represent a special category of pictures. Health insurance companies in Germany usually provide photos in health information. Pictures comprise portraits of people or photographs of food and other everyday objects. In a preceding project, our working group developed and pilot-tested an EBHI on the prevention of osteoporosis commissioned by a statutory health insurance company [12]. The company's content style guide predefined an obligatory use of photos within its brochures. Consequently, photos had been placed on most pages of the brochure. In preparation of the pilot study, we conducted a literature search for systematic reviews and randomized controlled trials (RCTs) on effects of photos in EBHI which did not reveal any results. According to the framework of the *United Kingdom Medical Research Council* (UKMRC) on the development and evaluation of complex interventions, piloting of the EBHI with the target group is an important step, particularly in consideration of the paucity of evidence [3]. Thus, we used the pilot study to explore people's perceptions of the photos in this specific brochure.

In a subsequent project "Guideline for the Development of Evidence-based Health Information" [13,14], effects of photos in EBHI were addressed again as well as other categories of pictures. The *guideline evidence-based health information* [14] aims to improve the quality of health information by giving recommendations regarding contents, presentation of information and the development process of EBHI. The overall guideline development process has been published elsewhere [14].

This paper comprises two parts: A) focus group study on people's perceptions of photos in a brochure on the prevention of osteoporosis of a health insurance company and B) a systematic review of pictures provided in health information material within the scope of the guideline development project.

A) Piloting of photos in evidence-based health information - focus group study

Methods

In 2011, a focus group study was conducted to explore people's perceptions of photos used in the EBHI on osteoporosis [12]. The reporting follows the Standards for Reporting Qualitative Research [15] (Supplement 1).

Intervention

The EBHI comprises five chapters (Supplement 2; first version): definition, diagnosis, prevention, treatment of osteoporosis, and interviews with two experts of health sciences who provided the evidence, based on systematic literature searches and critical appraisal. The health insurance company adapted the information to the company's design which also included photos, mainly portraits of middle and older aged men and women. In addition, photos showed people doing sport, cooking, eating, or talking to

physicians. Some of the photos displayed food, such as cheese and kale, or everyday items, for example, books or glasses. All the photos were in color.

Recruitment and consent

Eligible participants were men and women from the age of 45 on without a diagnosis of osteoporosis. Cultural aspects might influence the understanding and interpretation of photos [11]. Hence, focus groups were supposed to represent people with different cultural and educational backgrounds. Participants were recruited from the northeast of Germany via announcements in different newspapers. People who responded to the announcements were contacted to check inclusion criteria. Since recruitment via newspapers is not appropriate to reach people with a migration background, we asked the association for intercultural communication, refugees and migration ("kargah") in Hannover, Germany, to contact eligible participants.

The brochure was sent out two weeks before the focus group interviews started. Participants were asked to read through the EBHI and to add comments.

At the beginning of each focus group interview, participants were informed about the aim of the interview and the interviewers' backgrounds. Written informed consent was obtained.

Data collection

In order to achieve data saturation we planned to conduct four initial focus groups, retaining the possibility for more interviews.

A questionnaire for the evaluation of the whole brochure was developed addressing clarity, design, completeness, and understanding of the brochures' main statements. One open-ended question focused on photos.

Initially, participants were asked to write down their perception of the photos on the questionnaire. Notes were collected at the end of the interview. Furthermore, participants were free to choose photos they wanted to discuss within the group. They were just instructed to refer to the photos while presenting their perceptions. In order to achieve in-depth understanding of participants' impressions and perceptions the interviewers enquired for more details.

All focus group interviews were conducted by two moderators (AS, SB) who were not involved in the development process of the EBHI. AS has extensive experience in moderating and analyzing focus group interviews. The interviews were audio-taped and field notes were taken. Participants' characteristics, such as gender, age, the country of origin, and graduation were asked at the end of the questionnaire.

Data analysis

Data analysis was based on the technique of qualitative content analysis comprising several steps [16]. First, extracts of the questionnaires and field notes were screened to generate headings and initial codes. After that, audio recordings of the discussion about participants' perceptions of the photos were transcribed verbatim. Transcripts were organized and analyzed using the software MAXQDA 2010. In addition, new categories were generated according to open coding by one of the interviewers. Another researcher, AG, who was involved neither in the development of the EBHI nor in the focus groups interviews, revised, discussed, and refined the coding. In the next step the categories were regrouped into hierarchical order by defining main categories and subcategories. Main categories illustrate similarities and interrelations. Subcategories show different characteristics.

Table 1
Baseline characteristics.

	N = 37
Women	26
Age, mean (SD)	50.6 (14.2)
Missing value	1
Migration background	12
Mother tongue: German	26
Graduation:	
None	3
Primary school	1
Junior High school	5
High school	14
Qualification for technical college	1
Qualification for university	12
Missing value	1

Values are numbers unless stated otherwise; SD = standard deviation.

Quotations presented within this paper were translated from German into English by two experts (AS and JF). Consensus was reached by discussion.

Results

Each focus group lasted approximately one and a half hours. Data saturation was achieved. The fourth focus group interview did not yield any new information on perception of photos. A total of 37 people took part in the focus group interviews. Twelve of them had a migration background. Countries of origin were Turkey, Georgia, Afghanistan, Syria, Ukraine, Poland, and Spain. Two of them were born in Germany; one participant did not answer the question. All participants had sufficient German language skills. The participants' characteristics are shown in Table 1.

Four generic interdependent categories were identified: *comprehension*, *perception of photos*, *congruence between photos and content*, and *alternatives*. Attributed subcategories, characteristics and corresponding examples are shown in Table 2. The quotes are labeled with *P number* for patients' memos and with *Transcript location number* for transcripts of the discussion. *Transcript Hannover* and *P1* to *P12* include solely people with migration background.

Some of the statements were so remarkable and catchy that we used them as in-vivo codes, such as *"typical brochure" (P14)*, *"I just say the keywords: a lot of nice photos. . . advertising brochure"* (Transcript Stralsund 1/2) and *"As if they are promoting a travel brochure or so, not a health insurance company"* (Transcript Stralsund 1/2).

These statements well reflect the overall perceptions and interpretations of participants of all focus group interviews.

Comprehension

Photos that were closely linked to statements from the text were considered to support understanding and comprehension. Pictures not referring to the text raised questions. For example, one photo showed an old man and a boy who caught a fish. A focus group participant asked:

> *"Fishing is supposed to prevent osteoporosis? Or should it encourage the back and forth (movement) or fish consumption?" (P34).*

Some photos showed food; for example one pictured kale. Not everyone was familiar with that kind of vegetable.

> *"What kind of vegetable is that?" (P34)*

Table 2
Generic categories, their subcategories, characteristics, and examples.

Generic category	Subcategory	Characteristics	Examples
Comprehension		Photo supports comprehension	"One sees how the measurement is done." (P2)
		Photo raises questions	"Fishing is supposed to prevent osteoporosis? Or should it encourage the back and forth (movement) or fish consumption?" (P34).
Perception of photos	Age	Negative	"Too many elderly people, it affects young people as well". (P29)
	Social status	Negative	"Not all classes are displayed. Rather the upper class I would say from the pictures, the rich upper class basically." (Transcript Hannover)
	Citizenship	Negative	"Only pictures of white Europeans can be seen. None of people with migration background" (P5)
	General	Positive	"All pictures break up the texts" (P37)
		Negative	"Everybody looks too happy; it looks like they are promoting a vacation or have just arrived from wonderland." (P17)
Congruence between photos and content	Congruence between photos and content	Congruence	". . . and actually I liked page 20/21 and the rendition the most. How can I prevent. There are associations straight away, at one glance: movement, nutrition and medical consultation, things like that. This was well done" (Transcript Stralsund 1/2)
		No congruence	"But what else was striking, on page 21the pictures and statements do not match. Which woman is smoking there?" (Transcript Stralsund 1/2)
	Congruence between photos and narratives	Congruence between number of narratives and photos	"These four pictures and two statements on page 7. They do not match at all. Same on page 33." (Transcript Stralsund 3)
Alternatives	Number of photos	Delete a photo	"On some pages, the number of pictures is unnecessary and doubled." (P6)
		Add a photo	"Maybe pictures of sports, specifically for prevention of osteoporosis." (P19)
	Size of photos	Reduce the image	"Chapter 2 page 22, pictures of the food shown should be downsized and other food named in the text should be included." (P29)
	Replace photos	Table instead of photo	"Page 22 - instead of pictures rather another table with food." (Transcript Stralsund 1/2)
		Another category of picture instead of photo	"Page 20 - pictograms instead of pictures." (P21)
		Swap photo	"31, careful, pitfall, I don't think the picture fits (maybe edge of the carpet)" (P28)
	Move photos		"Page 21- the picture with the glass of milk and the bread do not fit in on this page, rather page 22 instead." (P2)

P number = patients' memos; *Transcript location number* = transcripts of the discussion.

Perception of photos

There are four subcategories that are grouped together in the main category *perception of photos*: *general aspects*, *social status*, *citizenship*, and *age*.

Participants reported some positive but also negative perceptions regarding the photos. General positive statements referred to the increase of attractiveness of the brochure. Negative statements referred to the number and expressions of the portraits.

"For me, there are too many portraits." (Transcript Stralsund 3)
"Everybody looks too happy; it looks like they are promoting a vacation or have just arrived from wonderland." (P17)

Participants with a migration background missed photos showing people with an obvious migration background.

"*What is striking, there are no people with migration background, just white Europeans, no Asians, no Blacks. That's striking.*" *(Transcript Hannover)*
"Only pictures of white Europeans can be seen. None of the people with a migration background." (P5)

In addition, they interpreted the portraits as people with a higher socio-economic status. People shown on the photos were perceived as privately insured, although the EBHI was published by a statutory health insurance company.

"Not all classes are displayed. Rather the upper class I would say from the pictures, the rich upper class basically." (Transcript Hannover)
"On Thursday, where I got the brochure, when I saw that: privately insured, typical German." (Transcript Hannover)

Some participants tried to identify themselves with the persons depicted in the photos but had some problems because the brochure included mainly portraits of older people. The participants asked for photos of younger people, because in their opinion prevention of osteoporosis should already begin at younger age.

"When it comes to prevention, 54, 67, and 73 are not very suitable I have to say. Prevention should be - well, there should be at least one or two pictures where younger ones are shown. Actually, prevention starts at a younger age." (Transcript Stralsund 3)

Congruence between photos and content

This category has two subcategories, *congruence between photos and patient narratives* and *congruence between photos and informational text*.

The portraits were presented together with narratives of fictional characters. The narratives were underlined with a fictional first name and age. Most of the readers tried to assign the narratives to the photos.

"It is easier to identify with. Text and picture. You match it with the other one. I cannot tell right now if he actually said that. . ." (Transcript Stralsund 1/2)

In some cases, narratives and photos did not fit. One reason was the differing number of narratives and photos on single pages.

"These four pictures and two statements on page 7. They do not match at all. Same on page 33." (Transcript Stralsund 3)

Page 21 showed three photos, one woman drinking milk, another one with a sandwich, and a male patient with his physician.

Three narratives of two women and one man were attached. Numbers of narratives and photos fit, but content-related discrepancies were identified.

"But something else was striking, on page 21 the pictures and statements do not match. Which woman is smoking there?" (Transcript Stralsund 1/2)

In general, it seemed to be important that photos and textual information match up.

"In general I think that the pictures emphasize the written text and it shows what is said in the text. . .it indicates what is in the text and that is enough." (Transcript Stralsund 1/2)
". . . And actually I liked page 20/12 and the rendition the most. How can I prevent. There are associations straight away, at one glance: movement, nutrition and medical consultation, things like that. This was well done." (Transcript Stralsund 1/2)

Alternatives

The category *alternatives* can be considered as a result of the other three categories, including statements and demands regarding the number of photos, their size, and position.

"On some pages, the number of pictures is unnecessary and doubled." (P6)

Photos that were not directly linked to the content were perceived unnecessary. Some participants missed photos of specific issues that were discussed in the EBHI, for example:

"Maybe pictures of sports, specifically those for prevention of osteoporosis." (P19)

One participant proposed reducing the size of some photos in order to add additional photos of high-calcium food, which was listed in the text.

"Chapter 2 page 22, pictures of the food shown should be downsized and other food named in the text should be included." (P29)

With regard to *congruence between photos and informational text* participants suggested to move photos to a more appropriate position in the brochure. There was one photo of a dual energy X-ray absorptiometric assessment, a recommended measurement for bone-mineral density. It was shown in the section, *definition of osteoporosis*. Participants wished to move it to the *diagnosis* section.

Moreover, participants asked for more specific and suitable photos. In the section prevention of falls, the photo displayed toys as a form of trip hazard. Considering the content and the target group of the EBHI, it did not seem to be appropriate.

"31, careful, pitfall, I don't think the picture fits (maybe edge of the carpet)" (P28)

Some of the participants wished to replace some photos with tables or pictographs to receive more information, for example, pictographs of sports that may prevent osteoporosis instead of photos of people doing sport or an additional table including high-calcium food.

Based on the results of the interviews the brochure was revised (Supplement 3; revised version): the photos were adapted to the written information, one portrait of a health professional with a presumable migration background was added, and the number of photos was reduced from 33 to 23.

B) A systematic review of pictures provided in health information material within the scope of the guideline development project

Although there was no evidence on efficacy and effectiveness of photos in EBHI they were used in the brochure on the prevention of osteoporosis. Qualitative studies give insights for specific circumstances, but they do not allow causal interpretations of effects. However, our study revealed that readers had some issues with interpreting the photos and identifying themselves with portraits, which may limit the acceptability or understanding of such information. Therefore, in the development process of the *guideline evidence-based health information* efficacy of photos was focused again and extended to all categories of pictures [13,14].

Methods

We performed a systematic review on the effects of pictures in the context of health information. It was part of the development process of an evidence-based guideline for the development of EBHI [13,14], which was carried out according to GRADE (*Grading of Recommendations Assessment, Development and Evaluation*) [17]. The study protocol, the guideline, and the guideline report are available on the guideline's website [14]. The reporting of the systematic review follows the PRISMA statement [18] (Supplement 4).

Intervention, comparison and study design

The guideline development group defined and agreed on key questions for systematic literature searches. Key questions regarding pictures are shown in Box 1. Pictures in health information material are defined as drawings, cartoons, anatomical pictures, photos, and pictographs. We included RCTs that compared text only against text supported by pictures.

Box 1: Key questions regarding the use of pictures in addition to the text in EBHI [14]

- What effects do anatomical pictures used in health information have compared to text only?
- What effects do cartoons used in health information have compared to text only?
- What effects do photos used in health information have compared to text only?
- What effects do pictographs used in health information have compared to text only?
- What effects do drawings used in health information have compared to text only?

Outcome measures

Based on GRADE, relevant outcome measures were predefined and rated regarding their importance [19]. The cognitive outcome measures *risk perception*, *comprehension*, and *knowledge* were rated as critical, *understanding* and *readability* as important but not critical. *Comprehension, knowledge* and *risk perception* refer to the content of the information. *Understanding* and *readability* refer to the presentation of the given information and are more subjective. The affective outcome measures *credibility*, *trustworthiness*, *attractiveness*, and *acceptance* were classified as those of limited importance.

("Patient Education as Topic"[Mesh] OR "Patient Education Handout"[Publication Type] OR "Communications Media"[Mesh] OR "Teaching Materials"[Mesh] OR "Decision Support Techniques"[Mesh] OR "Decision Support Systems, Clinical"[Mesh] OR "Consumer Health Information"[Mesh] OR "health information" OR "patient information" OR "decision aid" OR "decision board" OR "information material" OR brochure OR leaflet OR pamphlet OR flyer OR presentation OR "web 2.0" OR "social media" OR "social network" OR website)

AND

(chart OR drawin* OR illustrat* OR "Medical Illustration"[Mesh] OR pict* OR photo OR photos OR photograph*)*

Fig. 1. Search terms.

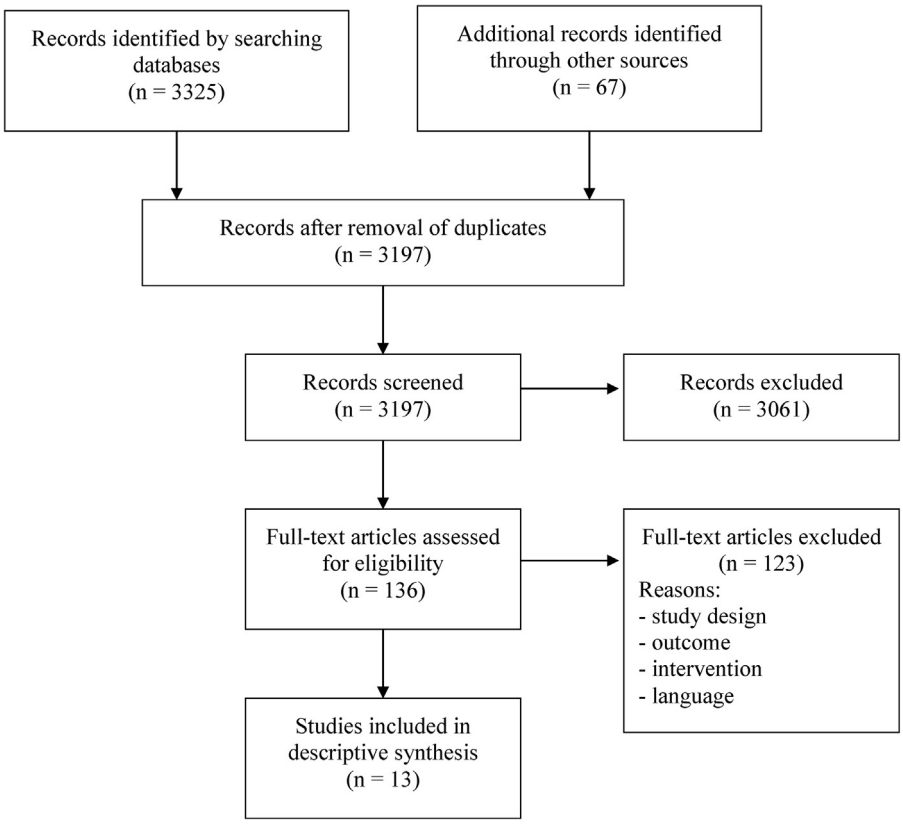

Fig. 2. Flow Diagram [18].

Searching strategy

We searched the databases PubMed, CENTRAL, PSYNDEX, PsycINFO, CINAHL, Campell Collaboration, and *DIMDI* up to April 2015. Monthly updates were conducted up to April 2017. The search terms are listed in Fig. 1. We included RCTs, systematic reviews, and meta-analyses. The publication language was restricted to English and German. In addition, reference lists of relevant reviews and also references identified by other literature searches within the guideline project were checked.

In a first step, title and abstracts were screened by two independent reviewers (SB and AS). In a second step, full-texts were screened for eligibility (SB and JL). Discrepancies were resolved by discussion and by a third reviewer (AS), if necessary.

Quality Assessment and Data Synthesis

The methodological quality of the included RCTs was assessed using the Cochrane risk of bias assessment instrument [20]. Objectives, setting, methods and results of the studies were summarized in study fact sheets. An evidence profile was drawn up according to GRADE [21]. The findings were summarized for each outcome and their quality of evidence was assessed. The quality assessment addressed study limitations (risk of bias), consistency, directness, and precision. The data syntheses were descriptive because of the complexity of the interventions. The quality assessments and data

Table 3
Characteristics of included studies.

Category	Author, Year (Country)	Intervention	Participants	Outcome Measures
ANATOMICAL PICTURES	Hollands, 2013 (UK)	Online information, full-body magnetic resonance imaging (MRI) scan images to visualize cardiovascular risk related to internal or external body fat	Healthy volunteers (n = 901), mean age 27 years	Credibility
	Bol, 2015 (Netherlands)	Online information, anatomical drawings to illustrate surgical procedures	Patients with colorectal cancer (n = 216), mean age 68 years	Knowledge Understanding Attractiveness / Acceptance
PHOTOS		Portraits of medical staff and patients in order to evoke emotions		
CARTOONS	Delp, 1996 (USA)	Cartoons to illustrate instructions for wound care	Patients of an emergency department with lacerations necessitating wound repair (n = 205), mean age 21 years	Comprehension Readability Attractiveness / Acceptance
PICTOGRAPHS	King, 2012 (USA)	Medication information leaflet for a fictitious medication, symbols to illustrate medication directives	Low health-literate population (n = 161), mean age 33,8 years	Knowledge
	Mansoor, 2003 (South Africa)	Medicine label and patient information leaflet, pictographs to illustrate medication directives	Persons with low literacy and with English as second language (n = 60), aged between 21-65 years	Comprehension Knowledge Readability Attractiveness / Acceptance
	Sahm, 2012 (Ireland)	Prescription instructions, graphic aid to visually depict dose and timing of the medication	Patients of an outpatient clinic (n = 94), over 18 years of age	Knowledge
	Thompsen, 2010 (Kanada & USA)	Pictorial-based information pamphlets about the medication methotrexate	Healthy volunteers (n = 100), aged between 18-65 years	Comprehension Knowledge Readability Attractiveness / Acceptance
	Yin, 2011 (USA)	Dosing instruction for infant acetaminophen, pictographic diagram of dose	Parents and their children at an urban public hospital pediatric clinic (n = 302), mean age approximately 31 years	Comprehension
DRAWINGS	Austin, 1994 (USA)	Drawings to illustrate discharge instructions	Patients with lacerations at a rural trauma center (n = 101), no information on age	Comprehension
	Brotherstone, 2006 (UK)	Visual illustrations to enhance understanding of the preventive aim of flexible sigmoidoscopy screening	Healthy volunteers (n = 65), aged between 60-64 years	Comprehension
	Henry, 2008 (Canada)	A handout outlining the risks of surgery, illustrations representing complications	Patients undergoing otologic surgery in a tertiary centre (n = 51), mean age 42 years	Knowledge
	Kools, 2006 (Netherlands)	Instructions for using asthma devices (inhaler chamber and peak flow meter), drawings to visualize the actions	Healthy volunteers (n = 99), aged between 20-60 years	Comprehension Readability
	Liu, 2009 (USA)	Six short health-related texts, explanatory illustrations	Students (n = 30), mean age 22 years and older adults (n = 26), mean age 72 years	Comprehension Readability

extraction for each included study were performed by two reviewers (JL, SB).

Results

Database searches up to April 2015 identified 3,325 references. A total of 136 full-texts were reviewed; 13 studies met the inclusion criteria and were included (Fig. 2). Up to April 2017, no further eligible studies were identified.

Study characteristics

We clustered the included studies by categorizing the pictures: *anatomical pictures*, *cartoons*, *photos*, *pictographs*, and *drawings*. For the categorization, we considered the types of pictures (e.g. drawings or photos) and their purpose (e.g. to explain anatomical structures, visualize instructions or evoke emotions). All types of pictures were used to illustrate written information; the control groups received written information only. The study characteristics are shown in Table 3.

Risk of bias and quality of evidence

Three studies showed a high risk of bias regarding blinding of participants [22–24]. In six trials, it was unclear whether or not the participants knew about the allocated intervention [25–30]. The processes of generating allocation sequences and concealing allocation were not sufficiently described in most of the studies [22–25,27–32]. In addition, baseline outcome measurements were not adequately assessed or reported [22–34]. Fig. 3 displays the risk of bias of the included studies. The majority of the studies used no standardized or validated instruments. Studies showed no serious inconsistency, indirectness or imprecision. Overall, the quality of evidence was rated as moderate.

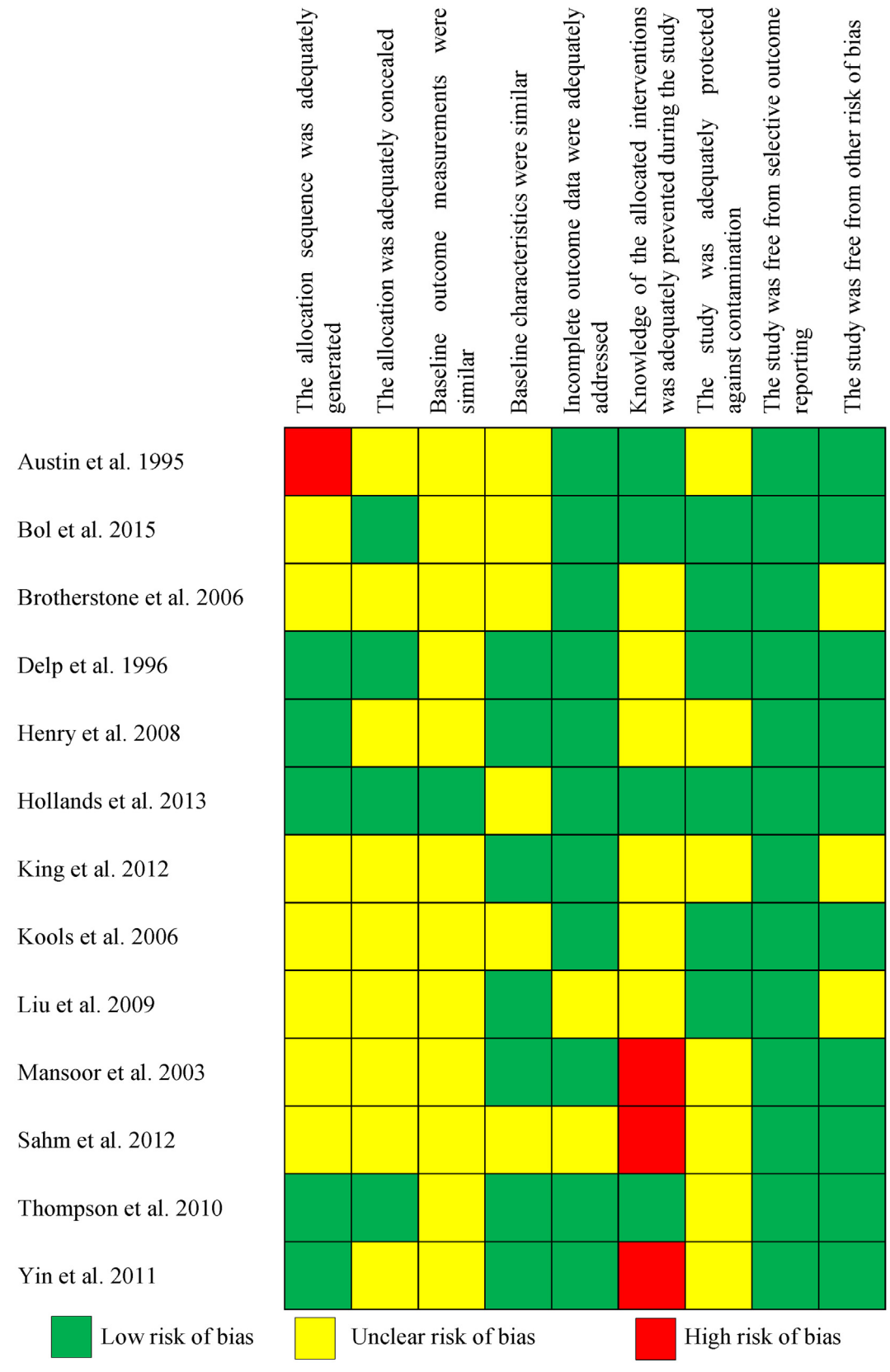

Fig. 3. Summary of study limitations: review authors' ratings of the risk of bias [20].

Table 4
Effects of pictures included in health information material compared to written information alone.

Outcomes	Results
ANATOMICAL PICTURES	
Knowledge (1 RCT, n = 143)	**No significant effect for anatomical pictures and text compared to text-only** [31]: 9.61 (5.40) vs. 8.93 (5.50), p ≥ 0.05 *Knowledge was assessed by 11 free-recall questions. The score ranges from 0 to 22 with higher scores indicating more information was recalled; mean (standard deviation (SD).*
Understanding (1 RCT, n = 143)	**No significant effect for anatomical pictures and text compared to text-only** [31]: 5.86 (0.98) vs. 5.55 (1.25), p ≥ 0.05 *Understanding was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating more satisfaction with understanding; mean (SD).*
Attractiveness (1 RCT, n = 142)	**Effect for anatomical pictures and text compared to text-only** [31]: 5.00 (1.15) vs. 4.16 (1.44), p < 0.001 *Attractiveness was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating more satisfaction with attractiveness; mean (SD).*
Credibility (1 RCT, n = 901)	**Small effect for anatomical pictures and text compared to text-only** [33]: 4.48 (1.58) vs. 4.25 (1.67), p = 0.033 *Credibility was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating higher credibility; mean (SD).*
PHOTOS	
Knowledge (1 RCT, n = 143)	**No significant effect for photos and text compared to text-only** [31]: 9.55 (4.66) vs. 8.93 (5.50), p ≥ 0.05 *Knowledge was assessed by 11 free-recall questions. The score ranges from 0 to 22 with higher scores indicating more information was recalled; mean (standard deviation (SD).*
Understanding (1 RCT, n = 143)	**No significant effect for photos and text compared to text-only** [31]: 5.66 (1.32) vs. 5.55 (1.25), p ≥ 0.05 *Understanding was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating more satisfaction with comprehensibility; mean (SD).*
Attractiveness / Acceptance (1 RCT, n = 143)	**No significant effect for photos and text compared to text-only** [31]: 4.65 (1.19) vs. 4.16 (1.44), p ≥ 0.05 *Attractiveness was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating more satisfaction with attractiveness; mean (SD).*
CARTOONS	
Comprehension (1 RCT, n = 205)	**Effect for cartoon and text compared to text-only** [26]: 0-1 questions: 3% vs. 33%, 2-3 questions: 51% vs. 61%, 4 questions: 46% vs. 6%; p < 0.001 *Comprehension was assessed by 4 open questions. Answers were rated as correct / incorrect. Given is the percentage of participants with n correctly answered questions.*
Readability (1 RCT, n = 205)	**Effect for cartoon and text compared to text-only** [26]: Very easy: 98% vs. 64%, somewhat easy: 2% vs. 31%, not easy: 0% vs. 5%; p < 0.001 *Readability was rated as very easy, somewhat easy or not easy. Given is the percentage of participants for each rating.*
Attractiveness / Acceptance (1 RCT, n = 205)	**Effect for cartoon and text compared to text-only** [26]: Very satisfied: 97% vs. 66%, somewhat satisfied: 3% vs. 32%, not satisfied: 0% vs. 2%; p < 0.001 *Attractiveness / acceptance were assessed by 1 question. Satisfaction with the instruction was rated as very satisfied, somewhat satisfied or not satisfied. Given is the percentage of participants for each rating.*
PICTOGRAPHS	
Comprehension (3 RCTs, n = 459)	**Effect for pictographs and text compared to text-only** [22,24]: 73% vs. 53%, p = 0.005 [22] *Comprehension was assessed by 11 questions, each broken down into 2 parts (1. location information in the leaflet quickly and easily; 2. recall of the information in own words). Given is the percentage of participants with a high level of comprehension (>80% correct answers).* 43.9% vs. 59.0%, p = 0.01 [24] *Comprehension was assessed* by observing the accuracy of medication (doses) taken. *Given is the percentage of participants who made a dosing error (>20% deviation of recommended dose).* **No significant effect for pictographs and text compared to text-only** [34]: 7.98 (1.21) vs. 7.96 (1.37), p = 0.93 *Comprehension was assessed by 10 multiple choice questions. The score ranges from 0 to 10 with higher scores indicating better comprehension; mean (SD).*
Knowledge (4 RCTs, n = 362)	**Effect for pictographs and text compared to text-only** [22]: Question 2: 93.3% vs. 46.7%, p = 0.000; question 4: 73.3% vs. 3.3%, p = 0.000 *Knowledge was assessed by 6 open questions. Answers were rated as correct / incorrect. Given is the percentage of participants with correct answers in question 2 and 4. Questions 1, 3, 5 and 6 were answered correctly by most of the participants in both groups.* **No significant effect for pictographs and text compared to text-only** [23,28,34]: Free-recall 'must know': 3.67 (1.47) vs. 3.81 (1.71), p = 0.66; free-recall 'must call': 1.63 (1.46) vs. 1.50 (1.17), p = 0.61; MC 'must know': 7.79 (1.88) vs. 8.01 (2.02), p = 0.57; MC 'must call': 2.54 (1.21) vs. 2.58 (1.38), p = 0.86 [34] *Knowledge was assessed by 25 free-recall questions to facts about medication (16 items 'must know') and to reasons for calling the rheumatologist (9 items 'must call') and by 20 multiple choice (MC) questions (12 items 'must know' and 8 items 'must call'). Scores range from 0 to max. 1 point for each correctly answered question (16, 9, 12 and 8 respectively); mean (SD).* >79% in all groups, no statistical test for comparison of interest[23] *Knowledge was assessed by 2 open questions. Given is the percentage of participants who correctly answered both questions.* 6.65 (1.40) vs. 6.54 (1.40), no statistical test for comparison of interest [28] *Knowledge was assessed by 2 open questions. The score ranges from 0 to 8 with higher scores indicating better knowledge; mean (SD).*

Table 4 (*Continued*)

Outcomes	Results
PICTOGRAPHS	
Readability (2 RCTs, n = 160)	**Effect for pictographs and text compared to text-only** [22]: Pictographs and text: 98.3%, text only: 1.7%, no statistical test *Participants were shown both leaflets (with and without pictographs) and were asked to rate which version is easier to read. Given is percentage of participants.* **No significant effect for pictographs and text compared to text-only** [34]: 4.6 (0.7) vs. 4.7 (0.5), p = 0.52 *Readability was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating better readability; mean (SD).*
Attractiveness / Acceptance (2 RCTs, n = 160)	**Effect for pictographs and text compared to text-only** [22,34]: Pictographs and text: 98.3%, text only: 1.7%, no statistical test [22] *Participants were shown both leaflets (with and without pictographs) and were asked to rate which version they prefer. Given is percentage of participants.* 4.1 (1.0) vs. 3.5 (1.1), p = 0.004 [34] *Attractiveness was rated on a 7-point Likert scale (1 item). The score ranges from 1 to 7 with higher scores indicating higher attractiveness; mean (SD).*
DRAWINGS	
Comprehension (4 RCTs, n = 321)	**Effect for drawings and text compared to text-only** [25,32]: 84% vs. 57%, p = 0.027 [25] *Comprehension was assessed by 8 free-recall questions. Answers were coded and rated as showing good or poor understanding. Given is the percentage of participants with good understanding.* 65% vs. 43%, p = 0.033 [32] *Comprehension was assessed by 5 open questions. The score ranges from 0 to 10 with higher scores indicating more correct answers. Given is the percentage of participants with 5 or more correct answers.* **No definite effect for drawings and text compared to text-only** [29]: Intervention 1 (recall): 6.04 (1.71) vs. 4.81 (2.06), significant difference; intervention 2 (recall): 13.04 (4.59) vs. 12.29 (3.29), no significant difference; Intervention 1 (performance): 7.71 (0.86) vs. 6.31 (0.86), significant difference; intervention 2 (performance): 6.79 (1.64) vs. 6.67 (1.01), no significant difference *Comprehension was assessed by recall and performance of two instructions (intervention 1: Inhaler chamber, intervention 2: Peak flow meter). The number of correctly recalled propositions was rated. The score ranges from 0 to 11 (intervention 1) and to 26 (intervention 2) respectively; mean (SD). The number of instructional steps performed correctly right away was counted with 8 steps in both instructions; mean (SD).* **No significant effect for drawings and text compared to text-only** [30]: Younger adults: 14.40 (1.99) vs. 15.07 (1.44), older adults: 15.77 (1.92) vs. 15.77 (1.24); no statistical test for comparison of interest *Comprehension was assessed by 36 yes / no questions. The score ranges from 0 to 18 with higher scores indicating better comprehension; mean (SD).*
Knowledge (1 RCTs, n = 51)	**No significant effect for drawings and text compared to text-only** [27]: 45% vs. 42%, p = 0.84 *Knowledge was assessed by a free-recall question. Rated was the number of risks the participant could recall. Given is the recall rate in percent.*
Readability (2 RCTs, n = 155)	**No significant effect for drawings and text compared to text-only** [29,30]: Intervention 1: 48.29 (18.95) vs. 59.85 (37.90), intervention 2: 57.92 (20.70) vs. 66.36 (32.85); no significant differences [29] Younger adults: 24.86 (6.34) vs. 24.24 (5.07), older adults: 30.96 (4.05) vs. 27.69 (7.71); no statistical test for comparison of interest [30] *Readability was assessed as reading time in seconds; mean (SD).*

Findings

Descriptive data syntheses of each category are shown in Table 4.

Text with anatomical pictures was rated to be more attractive [31] and credible [33] compared to text only. However, adding anatomical drawings did not result in higher levels of knowledge or understanding [31]. The study showed no improvement of affective and cognitive outcomes when photos were added to written information [31].

The positive effect of cartoons was shown in one study [26]. Participants in the intervention group had higher levels of comprehension, were more satisfied with the information and rated it as very easy to read.

The effects of pictographs on the cognitive outcome measures were ambiguous. Two of three studies showed that pictographs increase comprehension [22,24]. Knowledge was assessed in four studies, three of them showed no differences between the groups [23,28,34], one an increased level of knowledge in the intervention group [22]. The leaflets with pictographs were perceived as more attractive than text-only leaflets [22,34].

Two studies showed better comprehension when drawings were used [25,32], two other studies did not. Effects on further cognitive outcomes were not found and none of the predefined affective outcomes was assessed.

Based on the results of this systematic review the guideline development group discussed and agreed on the recommendations regarding the use of pictures in addition to the text within EBHI. Results are displayed in Box 2.

Discussion and Conclusion

Discussion

The results of the focus group interviews suggest that photos may convey important messages and may influence comprehension of EBHI. For example, missing connections between photos and written information were irritating for some participants. Participants with migration background could not identify themselves with the portrait photos. The results were partly considered in the revised brochure. In the end, one portrait photo showed a person with migration background. The number of photos was reduced.

Box 2: Guideline recommendations regarding the use of pictures in addition to the text in EBHI [14]

	Recommendation	Quality of evidence
⇔	"Anatomical pictures may be used in addition to the text."	moderate quality
⇔	"Cartoons may be used in addition to the text."	moderate quality
	No recommendation could be given for the use of photos.	moderate quality
⇔	"Pictographs may be used in addition to the text."	moderate quality
⇔	"Drawings may be used in addition to the text."	moderate quality

In the systematic review, we included 13 studies to assess the effects of pictures regarding cognitive and affective outcomes in the context of health information. The interventions were heterogeneous with respect to the type of pictures and to their intention. Overall, no definite effect of pictures in health information could be assessed. Positive effects were only shown for some types of pictures in specific circumstances. For example, a cartoon visualizing instructions for wound care enhanced comprehension, readability, and satisfaction [26]. Generalizability is questionable. Harmful effects were not reported in the included studies.

Only one RCT that evaluated photos in health information material met the inclusion criteria [31]. No effect on cognitive or affective outcomes was found [31].

The non-systematic review by Houts et al. [11] also assessed the effects of pictures on health communication. The review comprises studies comparing pictures and text vs. text-only in the context of health education material and verbal instructions. In addition, the authors included studies comparing different types of pictures and studies assessing the effect of pictures in the context of education, psychology, and marketing. They concluded that the relationship of text, messages, and pictures is complex. Pictures may increase attention and improve recall and comprehension of health information if they are closely linked to the text or show associations between ideas [11]. These results are in line with the findings of our focus group interviews. They also support our observations that cultural features have an impact on the perception of pictures.

Houts et al. suggested that the emotional response to pictures might affect adherence to health instructions [11]. EBHI are not intended to persuade the reader or to increase a target behavior. The guideline development group defined persuasiveness as an adverse outcome [14] but there were no studies that could be included in the review.

The anticipated benefit of pictures in health information for elderly persons or persons with low literacy skills, or non-native speakers was not clearly shown in the studies included in our systematic review [22,27,28,30,31,34]. Nevertheless, pictures are used with the intention of enhancing comprehension, especially in these groups [35–37]. Different formats were developed and individually pilot tested [35–37]. Usability was high [35] and the formats were rated as helpful [36] and comprehensible [37]. Different sets of pictographs are used to illustrate instructions [36,38–40]. For example, Zeng-Treitler et al. developed and evaluated a system that automatically converts text to sets of pictographs that enhance recall [38,39]. Pictographs also may enhance the comprehension of medication instructions [40]. A general improvement in comprehension by pictures could not be verified in our systematic review.

This paper has a number of strengths demonstrating the complexity of using pictures in EBHI.

The interviews focused on peoples' perception of photos. First, individual perceptions about the photos were assessed separately using a questionnaire. Subsequently, participants talked about their impressions and interpretations within the groups. These interactions enabled a deeper discussion on single photos. Data saturation was achieved. The focus group participants were socially and culturally heterogeneous.

The systematic review comprises a comprehensive literature search and critical appraisal of national and international RCTs on the efficacy and effectiveness of pictures in EBHI. GRADE was applied [17].

There are some limitations. The assessment of information on photos was one part of the feasibility study. Thus, there was only limited time to explore people's perceptions of the photos. Some of the focus group participants were younger than 45 years and therefore did not meet the inclusion criteria. The reason was a misunderstanding during external recruitment of participants with migration background by *kargha*. However, this was not considered as a limitation. The transcripts were not returned to participants for comments or corrections and the two researchers did not independently analyze the data. Participants did not provide feedback on our findings. Due to the company's content style guide, revision of the brochure was limited. The revised brochure was not tested again, because of restricted funding time.

The methodological approach of the systematic review has been described in the study protocol for the guideline development process [14]. The systematic review has not been registered. The effect of photos was evaluated in various research fields, such as education, psychology, and marketing [11]. Standards for evaluation and reporting may differ between these research fields. Nevertheless, RCTs are considered as the gold standard for the evaluation of benefits and harms of interventions. Our search strategy included databases in the fields of education, psychology, medicine, and nursing. Studies on the effectiveness of pictures in advertisements were not included. Such trials would possibly provide additional relevant information. The restriction of the inclusion to English and German papers may have limited the total sample size and may have led to publication bias.

Conclusion

Pictures seem to be an important element in healthcare information. For the providers of EBHI it is important to know which type of pictures in what context are most appropriate to improve understanding and informed decision-making. However, the overall effect of pictures in health information material remains unclear. The *guideline evidence-based health information* [14] could not even give weak recommendations for their use.

Further studies should take the diversity of pictures and the variability of their application into account. In particular, RCTs are needed including affective and adverse outcomes, such as acceptability and persuasiveness.

In practice, providers of EBHI have to take the diversity of their target groups into account. The cultural, social and educational background may influence the needs, preferences, and perceptions of EBHI [11]. Therefore, the target group should be involved in the development process [5,14]. A test for feasibility of EBHI should be common practice [3,5,14] and the assessment of comprehension and perception of the included pictures should be part of it.

Declarations

***Ethics approval and consent to participate*:** We conducted several focus group studies to explore readability and understanding of health information material. Until recently, the ethics committee of the Hamburg State Chamber of Physicians held the opinion that these studies do not require approvals, because they contained no scientific research on humans. Furthermore, the University of Hamburg does not provide a separate ethics committee. For that reason, we established an internal audit at our department. The study protocol as well as the informed consent and data protection declaration was independently reviewed by two experts in the field of evidence-based medicine and evidence-based patient information and who were not involved in the project. The applied criteria for the internal review of study protocols were based on the criteria of the Hamburg State Chamber of Physicians' ethics committee and the data protection authority of the University of Hamburg.

In our study, no medical interventions were involved. The impact of the focus group interviews on participants was considered to be minor. Written informed consent was obtained.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

None declared.

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Authors' contributions

This study manuscript was carried out in collaboration between all authors. The systematic review was performed by SB, JL and AS. Title and abstracts were screened by SB and AS. Full-text screening for eligibility, the quality assessments and data extraction were performed by JL, SB. Discrepancies were resolved by AS, if necessary. The focus group interviews were conducted by SB and AS. SB performed the qualitative content analysis. All authors have read and approved the final version of the manuscript.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.zefq.2018.08.002.

References

[1] Stacey D, Legare F, Col NF, Bennett CL, Barry MJ, Eden KB, et al. Decision aids for people facing health treatment or screening decisions. Cochrane Database Syst Rev 2014:CD001431.
[2] Lenz M, Buhse S, Kasper J, Kupfer R, Richter T, Mühlhauser I. Decision aids for patients. Dtsch Arztebl Int 2012;109:401–8.
[3] Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 2008;337:a1655.
[4] Bunge M, Mühlhauser I, Steckelberg A. What constitutes evidence-based patient information? Overview of discussed criteria. Patient Educ Couns 2010;78:316–28.
[5] Arbeitsgruppe GPGI. Gute Praxis Gesundheitsinformation [Good practice guidelines for health information]. Z Evid Fortbild Qual Gesundhwes 2016;110-111:85–92.
[6] Australian Goverment, National Health and Medical Research Council. General guidelines for medical practitioners on providing information to patients. 2004. https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e57_guidelines_gps_information_to_patients_150722.pdf (accessed 21 July 2017).
[7] National Health Service. Brand guidelines. Patient information introduction. 2010. http://www.nhsidentity.nhs.uk/tools-and-resources/patient-information (accessed 2 June 2016).
[8] Elwyn G, O'Connor A, Stacey D, Volk R, Edwards A, Coulter A, et al. Developing a quality criteria framework for patient decision aids: online international Delphi consensus process. BMJ 2006;333:417.
[9] Berry DC, Knapp P, Raynor T. Expressing medicine side effects: assessing the effectiveness of absolute risk, relative risk, and number needed to harm, and the provision of baseline risk information. Patient Educ Couns 2006;63(1–2):89–96.
[10] Woloshin S, Schwartz LM. Communicating data about the benefits and harms of treatment: a randomized trial. Ann Intern Med 2011;155(2):87–96.
[11] Houts PS, Doak CC, Doak LG, Loscalzo MJ. The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. Patient Educ Couns 2006;61:173–90.
[12] Barmer GEK. Osteoporose verstehen – Knochenbrüchen vorbeugen. Informationen für bessere Entscheidungen [Understand osteoporosis – prevent bone fractures. Information to make better decisions]. 2011. https://www.gesundheit.uni-hamburg.de/pdfs/osteoporose-web-finale-version-200911.pdf (accessed 13 Dec 2017).
[13] Lühnen J, Albrecht M, Hanssen K, Hildebrandt J, Steckelberg A. Leitlinie evidenzbasierteGesundheitsinformation: Einblick in dieMethodik der Entwicklung und Implementierung [Guideline for the Development of Evidence-based Patient Information: insights into the methods and implementation of evidence-based health information]. Z Evid Fortbild Qual Gesundhwes 2015;109:159–65.
[14] Lühnen J., Albrecht M., Mühlhauser I., Steckelberg A. Leitlinie evidenzbasierte Gesundheitsinformation [Guideline evidence-based health information]. Hamburg 2017. http://www.leitlinie-gesundheitsinformation.de (accessed 21 July 2017).
[15] O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med 2014;89:1245–51.
[16] Elo S, Kyngas H. The qualitative content analysis process. J Adv Nurs 2008;62:107–15.
[17] The Grading of Recommendations Assessment Development and Evaluation (GRADE) Working Group. GRADE guidelines - best practices using the GRADE framework. 2014. https://gradepro.org/guidelines-development#develop-publics (accessed 21 July 2017).
[18] Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 2009;6:e1000097.
[19] Guyatt GH, Oxman AD, Kunz R, Atkins D, Brozek J, Vist G, et al. GRADE guidelines: 2. Framing the question and deciding on important outcomes. J Clin Epidemiol 2011;64:395–400.
[20] Cochrane Effective Practice and Organisation of Care (EPOC) Group. Suggested risk of bias criteria for EPOC reviews. EPOC Resources for review authors. 2015. http://epoc.cochrane.org/epoc-specific-resources-review-authors (accessed 29 Nov 2016).
[21] Guyatt G, Oxman AD, Akl EA, Kunz R, Vist G, Brozek J, et al. GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. J Clin Epidemiol 2011;64:383–94.
[22] Mansoor LE, Dowse R. Effect of pictograms on readability of patient information materials. Ann Pharmacother 2003;37:1003–9.
[23] Sahm LJ, Wolf MS, Curtis LM, Behan R, Brennan M, Gallwey H, et al. What's in a label? An exploratory study of patient-centered drug instructions. Eur J Clin Pharmacol 2012;68:777–82.
[24] Yin HS, Mendelsohn AL, Fierman A, Schaick L, Bazan IS, Dreyer BP. Use of a pictographic diagram to decrease parent dosing errors with infant acetaminophen: a health literacy perspective. Acad Pediatr 2011;11:50–7.
[25] Brotherstone H, Miles A, Robb KA, Atkin W, Wardle J. The impact of illustrations on public understanding of the aim of cancer screening. Patient Educ Couns 2006;63:328–35.

[26] Delp C, Jones J. Communicating information to patients: the use of cartoon illustrations to improve comprehension of instructions. Acad Emerg Med 1996;3:264–70.
[27] Henry E, Brown T, Bartlett C, Massoud E, Bance M. Informed consent in otologic surgery: prospective randomized study comparing risk recall with an illustrated handout and a nonillustrated handout. J Otolaryngol Head Neck Surg 2008;37:273–8.
[28] King SR, McCaffrey DJ, Bentley JP, Bouldin A, Hallam J, Wilkin NE. The influence of symbols on the short-term recall of pharmacy-generated prescription medication information in a low health literate sample. J Health Commun 2012;17(Suppl 3):280–93.
[29] Kools M, van de Wiel MW, Ruiter RA, Kok G. Pictures and text in instructions for medical devices: effects on recall and actual performance. Patient Educ Couns 2006;64:104–11.
[30] Liu CJ, Kemper S, McDowd J. The use of illustration to improve older adults' comprehension of health-related information: Is it helpful? Patient Educ Couns 2009;76:283–8.
[31] Bol N, Smets EM, Eddes EH, de Haes JC, Loos EF, van Weert JC. Illustrations enhance older colorectal cancer patients' website satisfaction and recall of online cancer information. Eur J Cancer Care (Engl) 2015;24:213–23.
[32] Austin PE, Matlack R, Dunn KA, Kesler C, Brown CK. Discharge instructions: do illustrations help our patients understand them? Ann Emerg Med 1995;25:317–20.
[33] Hollands GJ, Marteau TM. The impact of using visual images of the body within a personalized health risk assessment: an experimental study. Br J Health Psychol 2013;18:263–78.
[34] Thompson AE, Goldszmidt MA, Schwartz AJ, Bashook PG. A randomized trial of pictorial versus prose-based medication information pamphlets. Patient Educ Couns 2010;78:389–93.
[35] Durand MA, Alam S, Grande SW, Elwyn G. 'Much clearer with pictures': using community-based participatory research to design and test a Picture Option Grid for underserved patients with breast cancer. BMJ Open 2016;6:e010008.
[36] Choi J, Jacelon CS, Kalmakis KA. Web-based, pictograph-formatted discharge instructions for low-literacy older adult after hip-replacement surgery: findings of end-user evaluation of the website. Rehabil Nurs 2016, http://dx.doi.org/10.1002/rnj.274.
[37] Koops van't Jagt R, de Winter AF, Reijneveld SA, Hoeks JC, Jansen CJ. Development of a communication intervention for older adults with limited health literacy: photo stories to support doctor-patient communication. J Health Commun 2016;21:69–82.
[38] Zeng-Treitler Q, Perri S, Nakamura C, Kuang J, Hill B, Bui DD, et al. Evaluation of a pictograph enhancement system for patient instruction: a recall study. J Am Med Inform Assoc 2014;21:1026–31.
[39] Hill B, Perri-Moore S, Kuang J, Bray BE, Ngo L, Doig A, et al. Automated pictographic illustration of discharge instructions with Glyph: impact on patient recall and satisfaction. J Am Med Inform Assoc 2016;23:1136–42.
[40] Chan HK, Hassali MA, Lim CJ, Saleem F, Tan WL. Using pictograms to assist caregivers in liquid medication administration: a systematic review. J Clin Pharm Ther 2015;40:266–72.