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Prevalence and Characteristics of Pictures in Cancer Screening Information: Content Analysis of UK Print Decision Support Materials

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ABSTRACT

This paper answers calls for further theoretical work into types of pictures used in health information. Pictures influence message reception, interpretation, and retention, making this an important area for research in health communication. A content analysis was used to produce a systematic and theory-orientated assessment of the use of pictures in cancer screening information materials ($N = 44$) produced for invitees to either cervical, breast or bowel screening in the United Kingdom. The main categories investigated in this study were function, content and style of the pictures. Pictures used in cancer screening information materials were twice as likely to be used to demonstrate what something looked like or depict a situation (display pictures) than to convey a specific cancer screening message (message pictures). The messages being conveyed were predominantly related to screening procedures (51%) or outcomes (38%) rather than screening experiences (6%) or decisions (9%). Pictures were rarely used to portray a narrative in the materials ($n = 12$). The paper brings conceptual clarity to the ways pictures can be, and have so far been used, to communicate cancer screening information. This study identifies that pictures conveying a cancer-related message, and pictures in the format of a narrative, should be used more often in print cancer screening communications.

Cancer is a leading cause of death by non-communicable disease in the United Kingdom (World Health Organization, 2018). Three centrally organized screening programmes (for breast, cervical and bowel cancer) have been established in the UK with the aim to increase the early detection of cancer, improve treatment outcomes and reduce mortality (Landy et al., 2016; Logan et al., 2012; Marmot et al., 2012). The primary mechanism for inviting eligible members of the general population to the screening is with posted letters (sent by mail) and these are accompanied by a leaflet providing additional information (Public Health England, 2018).

The UK National Screening Committee have asserted that personal informed choice, defined as making a decision "based on access to accessible, accurate, evidence-based information," should be supported throughout the cancer screening programmes (UK National Screening Committee, 2018, p. 2). The invitation letter and accompanying leaflet are the first opportunity to support informed choice for invitees. The UK screening information leaflets need to be able to support engagement with, understanding of, and consideration of, the cancer screening information, to support informed choice. Therefore, it is important to build a strong understanding of factors impacting the success of print materials in providing cancer screening information.

The role of pictures in health information

Pictures can improve the chances of a text being read, as well as improve comprehension and recall of health information compared to presenting text alone (Houts et al., 2006; Schubbe et al.,

2020). Therefore, the use of pictures in cancer screening information leaflets could support informed choice by increasing engagement with, and improving understanding of, written information. In line with this, many guidelines, toolkits and assessment tools for print health education materials assert that pictures should be used in patient and public health information (see, Table 1).

However, there is limited guidance on what types of pictures to use, and under which conditions, to best facilitate different desired communication outcomes – reflecting a lack of available or consistent research findings. Most research into picture use in a health information context has not distinguished between different types of pictures, their effectiveness to communicate different types of message or their use in different health contexts (Jensen, 2011). Lack of clarity between types of pictures, as well as heterogeneity across study samples and contexts, is likely the reason why reviews of pictures in health information materials have concluded mixed results and why studies have difficulty replicating the results in applied settings (for example, Houts et al., 2006; Schubbe et al., 2020). Jensen (2011) determines that a more systematic investigation into the visual elements of health information communication is needed. To be able to investigate how elements within a picture impact the way health messages are received and consequent behavior change, it is necessary to have precise and shared ways of categorizing and describing these elements. This will also improve the communication of recommendations made to designers and providers of health materials.

The use of pictures in health communications is supported by the cognitive theory of multimedia learning which proposes that visual images have an active role in the process of meaning

Table 1. Published guidelines and tools available for developing or evaluating print health information materials with items specific to using pictures.

Citation	Full title
Guideline	
NCI (2018)	Clear & Simple
Toolkits	
NHS (2003)	Toolkit for producing patient information
CDC (2009)[a,2]	Simply Put V3
NWT Literacy Council (2015)	A plain language audit toolkit
Assessment tools	
BALD, Baker (1997)	Baker Able Leaflet Design
BIDS, Bernier (1996)	Bernier Instructional Design Scale
CDC (2019)	Clear Communication Index
Moody and Rose (2004)[1]	ClearDOC index
CSAT, Guidry et al. (1998)	Cultural sensitivity assessment tool
EQIP, Moult et al. (2004)[2]	Ensuring Quality for Patients tool
Kaphingst et al. (2012)[1,2]	Health Literacy INDEX
HLE2, Rudd et al. (2019)	Health Literacy Environment Assessment tool V2
PEMAT-P, Shoemaker et al. (2014)[1,2]	Patient Education Materials Assessment Tool for Printable materials
SAM+CAM, Helitzer et al. (2009)	Suitability and Comprehensibility Assessment of Materials
TEMPtED, Clayton (2009)	Tool to Evaluate Materials Used in Patient Education

[a]CDC (2009) toolkit has the most extensive guidance on using pictures in print health information materials; [1] advise keeping leaflets clear of irrelevant content; [2] advise keeping pictures clear of irrelevant content; NCI – National Cancer Institute, NHS – National Health Service, CDC – Centers for Disease Control and Prevention, NWT – Northwest Territories.

making and that message comprehension is supported when textual information is accompanied by visuals that are consistent with the message (Mayer, 1999). Where the goal is to increase understanding to support informed decision making, it is important that the pictures in cancer screening materials are relevant to the leaflet messages and contribute to comprehension of those messages. The use of pictures also supports the approach of Social Cognitive Theory, in modeling behaviors through showing people carrying out actions (Bandura, 1998). Modeling plays a key role in getting people to adopt new behaviors and is particularly relevant for cancer screening information as it includes instructions for completing screening and invitees often report practical barriers as a reason for not taking part (Kotzur et al., 2020).

In response to calls for more systematic investigations of pictures in health information, King (2015) conducted a content analysis of pictures present in cancer information materials produced in the United States of America (US) from four key health and cancer organizations. King (2015) found visual images were used more often in materials targeted to minority populations and materials about cancer prevention and detection. Also, pictures most often depicted people and behaviors being modeled/demonstrated. King (2015) considers these variations in picture use in terms of relevant theories but concludes that more theory-based research into the use of visual information in cancer screening material is required.

Content and style are key qualities to analyze when attempting to describe the technical elements of a picture (Willats, 1997). Picture content refers to what is being depicted within the picture and style refers to the methods of expression used to produce the picture. Additionally, function is an important quality to capture as it describes something about how the picture will be received and interpreted by the viewer. Picture function refers to the quality of the information provided by the picture (i.e., what the picture is doing as part of the information material). The categories of content, style and function, were used in the current study to guide a systematic and theory-led investigation of the use of pictures in recent UK cancer screening information materials.

The current study is a partial replication of King's (2015) study, applied to screening information materials in the UK. The aim is to describe current practice in the UK and consider this in terms of current visual communication theory, something that has not been done before. A comparison between the US and UK context will be valuable as, although similar in many ways (in culture, economics, politics and industry; Henrich et al., 2010), they have very different approaches to health care provision; healthcare is a nation-wide universal public service in the UK but not in the US. In addition, replication of King's (2015) study provides an opportunity for testing and refinement of the original coding frame.

Aims

This study aims to extend the work of King (2015), on categorizing the use of pictures in print cancer screening information materials, in the UK context and to further develop empirically useful categories for describing pictures used in the cancer screening context.

The main objectives were as follows:

(a) Determine the extent to which pictures have been used in print cancer screening materials in the UK (Picture prevalence).
(b) Analyze the pictures by; content, style and function (Picture characteristics).
(c) Explore possible patterns in the way different picture characteristics have been used.

Method

Sample

Identifying and selecting the sample

The sample included any materials designed to be posted or handed to targeted readers, concerning any of the UK cancer screening programmes in operation at the time of the study (breast, bowel and cervical screening[1]) and, produced within

the ten years preceding the search date (i.e., 2009 or later). Only materials that had a version available in English were included. The sample did not include "Easy-read" materials designed specifically to be read with the support of another person. Where different versions of the same material were identified, the most recently published version was included in the sample.

Materials were identified through a hand search of the websites of seven UK cancer charities and public health organizations (National Health Service, nhs.uk; Macmillan, macmillan.org.uk; Cancer Research UK, cancerresearchuk. org; Bowel Cancer UK, bowelcanceruk.org.uk; Public Health England, gov.uk/government/organizations/public-health-england; NHS Wales, bowelscreening.wales.nhs.uk, Health & Social Care, cancerscreening.hscni.net). These seven organizations were selected as the main providers of advisory board approved and publicly trusted information about cancer or medical screening across the devolved nations (England, Wales, Scotland, Northern Ireland) in the UK. All materials were indicated on the websites as designed to be printed (e.g., described as leaflet/booklet or being in PDF print-ready format). The search was conducted during November 2019.

Final sample

There were 44 cases found during the search period that satisfied the inclusion criteria. Characteristics of the sample including cancer type, test types, provider, location, year produced and number of pages are reported in a data file accessible via Figshare (doi: 10.6084/m9.figshare.14483589).

Analysis

A basic content analysis (Drisko & Maschi, 2015) was used to give a systematic description of the prevalence and characteristics of pictures in the sample. Content analysis provides a systematic and replicable approach to summarizing the content of a sample of documents (Stemler, 2001).

Units of analysis: Pictures

All pictures in the materials were identified. The definition of picture was an image that visually resembles that which is being depicted, following Mitchell's (1986) definition, and the boundary of a picture was determined by the picture elements being self-contained, following Meynell's (2013) consideration of Willats (1997) description of a picture.

Coding manual development

A literature review was conducted to identify categories for usefully describing pictures in health information falling within the three picture elements; function, contents, and style. In addition, the primary researcher viewed, and made notes on, each picture as presented in its information material and in comparison to the other pictures. These notes were used to adapt, and add to, the categories identified from the literature to be suitable for the current study sample and to identify any additional categories where appropriate. A comparison between the categories used by King (2015) and the current study is provided in Table 2.

The coding manual was trialed and updated twice by LG and CH, for five pictures selected randomly from the sample. To test the validity of the coding manual, a new set of pictures was randomly selected and coded by the main researcher (LG) and an uninitiated coder (LF). Fifteen pictures were coded for contents and style, while 34 pictures were coded for function. Cohen's Kappa was used to test inter-rater reliability for the dichotomous codes. For the continuous codes, intra-class correlation estimates were calculated based on an absolute-agreement, 2-way mixed effects model. Most coding achieved good ($n = 7$) to moderate ($n = 11$) agreement (Altman, 1991). Twelve codes had too few occurrences across their variables for Kappa score to be calculated.[2]

Calculated variables

To determine the prevalence of picture use across the materials, the study recorded how often (frequency) pictures were used and how much surface space was dedicated to pictures

Table 2. Comparison of study characteristics between King (2015) and the current study.

	King (2015)	Current study
Sample		
Cases	Print cancer information material, United States (US). n = 147 (*25, related to cancer detection*)	Print cancer screening information materials, United Kingdom (UK). n = 44
Units	Images – Visual images and graphics, covering visual information, visual displays (graphs, charts and diagrams), pictures, computer renderings and technical medical imagery. n = 858	Pictures – A self-contained image that visually resembles the thing being depicted. n = 406 (*283, when logos excluded*)
Search strategy		
Retrieval	Requests made to organization.	Hand search of organization websites.
Dates	Between September 2010 and January 2011.	During November 2019.
Providers	Four US national health organizations:	Seven UK health organizations that provide public information on the national cancer screening programmes [a]:
	(1) American Cancer Society	
	(2) American Institute for Cancer Research	(1) National Health Service
	(3) Centers for Disease Control and Prevention	(2) Macmillan
	(4) National Cancer Institute	(3) Cancer Research UK
		(4) Bowel Cancer UK
		(5) Public Health England
		(6) NHS Wales
		(7) Health & Social Care Northern Ireland

(Continued)

	King (2015)	Current study
Inclusion criteria	Produced anytime.	Produced between 2009 and 2019.
	Available as single sheet unfolded (information sheet) or folded (pamphlet) or multiple sheets folded or bound (booklet).	Available as sheet unfolded (information sheet) or folded (leaflet) or multiple sheets folded or bound (booklet).
	Information was generally or specifically related to cancer.	Information was about at least one of the nationally available cancer screening programmes.
	Written in English.	Available in English.
Measurement		
Prevalence	Frequency: number of pages/panels with images out of total number of pages/panel.	Frequency: Quantity of pictures per case.
		Coverage: percentage case surface area covered by rectangular regions containing the picture.
	Saturation: the surface area covered by images (units combined) out of the total surface area of the pamphlet (case).	Mean document coverage.
		Mean coverage per picture.
Case characteristics		
Target population	Sex.	–
	Race/ethnicity.	
Cancer topic	Cancer site.	Cancer site.
	Cancer continuum.	Cancer screening test.
Unit characteristics		
Content	Focal phenomena: people, objects, data.	Main depiction: none, scenery, a subject, an action, speech.
People	(Where image content was primarily people) Sex.	Quantity.
	Race/ethnicity.	
Objects	(Where image content was primarily objects) Object type.	Object type.
Data displays	(Where image content was primarily objects) Display type.	–
Setting	-	Setting type.
Topic	-	Screening topic.
Message	-	(Where picture function was message) Screening message.
Point of view	-	Type of view.
Picture narrative	-	Presence.
Style	Composition: photographic, illustrated.	Production: Photograph, Digital illustration, Analogue illustration.
		Color or monochrome.
		Marks.
Word use	-	None or separate, Labeling, Sounds, Speech, Object, text.
Function	Information conveyed: demonstrative/modeling, explanatory/describing, statistical/numerical information, comparison/juxtaposition, other.	Picture function: Logos, Icons, Display, Message.

[a]At the time of data collection, NHS Scotland were using the information leaflets provided by Public Health England. NHS = National Health Service.

(coverage). Picture frequency was calculated across the entire sample (total number of pictures) and by case (number of pictures per print material). Picture coverage was calculated using the Nvivo 12 Pro region selection tool. The data were managed in SPSS v26.

$$\text{Mean Document coverage} = \frac{\sum \text{Coverage in each case}}{\text{number of cases}}$$

$$\text{Mean coverage per picture} = \frac{\sum \text{Coverage of each picture}}{\text{number of pictures}}$$

Coding categories

Picture function. The following four types of picture function were identified; Logos, Icons, Display pictures and Message pictures. Logos are pictures identifying a brand or organization. Icons are simple symbols that indicate the content of the text that follows. Display pictures are pictures that provide visual information without communicating a coherent message or functioning as a logo or icon (for example, to decorate the page, set the scene or show what something might look like). Message pictures are pictures used to communicate a coherent message (for example, explain how something works or a sequence of actions involved in completing a task). Logos and Icons are commonly used design terms while the terms

Display pictures and Message picture were developed for this analysis. See Supplementary material 1 for example picture extracts.

Picture content. The following categories of content were recorded for each picture; what the main depiction was (scenery, a subject, an action or speech, as well as, no depiction – which would be meaningless lines and shapes), the number of people, the types of objects (ranging from medical equipment to plants), the background setting (whether indoors, outdoors, medical, home, unclear or blank), what cancer screening topics were covered (ranging from anatomy to benefits of screening, as well as, no topic – indicating an entirely decorative picture), what cancer screening messages were included (ranging from procedural instruction to emotions experienced), the viewer's position within the picture's world (as part of it, as outside observer or having no presence) and whether the picture portrayed a narrative (a narrative being a sequence of connected events involving an actor and an action).

Picture style. The following methods of expression were recorded for each picture; how the picture had been produced (digitally, photographically, by hand or a mix), whether it was in color, what types of marks had been used (outline, fill, or a mix) and how words had been used (as labels, sounds, part of objects, parallel to the picture or within the picture).

Exploratory analyses

Pictures were coded based on the presence or absence of; (1) screening topic, (2) background scenery, (3) one or more objects and, (4) one or more people. This produces 16 permutations, and these permutations were explored to determine what the most frequent combinations of content were present for each picture based on their function.

Results

Overall picture prevalence

A total of 406 picture extracts were identified, within the 44 print cancer screening materials examined in this study. Each document had between two and 44 pictures, with the average being 9.23 (SD = 7.19) pictures. After excluding logos, there were 283 pictures and an average of 6.43 (SD = 7.30) pictures per document. Each picture covered a mean average of 1.10% (SD = 2.25) of a document's surface and each document had an average of 6.83% (SD = 5.67) surface area covered by pictures.

Picture function: Logos, icons, display and message pictures

The most common type of picture based on function were display pictures (n = 129/406), followed by logos (n = 123/406) and icons (n = 101/406). The least common type of picture were message pictures (n = 53/406). However, pictures of this type were the largest relative to document size (M = 2.15%,

SD = 4.21), followed by display pictures (M = 1.50%, SD = 1.85). Icons and logos covered an average of 0.16% (SD = 0.20) and 0.03% (SD = 0.06), respectively.

Picture content

This section reports the frequency of notable depictions present in pictures used in cancer screening information materials, looking at the pictures separately based on their function (logo, icon, display or message). Table 3 displays the findings for picture content.

The most common type of logo depicted no subject or action (n = 89/123) followed by having a subject as the main depiction (n = 34/123). No logos contained people, background settings or screening topics, and more often did not contain an object (n = 92/123). Logos did not position the viewer within the image world and were not narrative.

The most common types of icons contained only an object (n = 40/101) or shapes (n = 44/101), with no people, background setting or screening topic. Icons either had a subject as their main depiction (n = 60/101) or did not contain a depiction (n = 41/101). Sixteen icons (15.8%) portrayed a cancer screening topic, and these were all of the signs and symptoms of cancer. Icons did not position the viewer within the image and were not narrative.

The most common type of display picture portrayed at least one screening topic (such as, how to do the test) and included an object while having no people and no background setting

Table 3. Frequencies of contents in display and message pictures in print cancer screening materials.

	Display (n = 129)				Message (n = 53)			
	Frequency		Mean Coverage		Frequency		Mean Coverage	
	n	%	M%	SD	n	%	M%	SD
Main depiction								
None	0	0.0	.	.	10	18.9	1.58	0.62
Scenery	0	0.0	.	.	0	0.0	.	.
Subject	90	69.8	1.59	2.08	28	52.8	1.10	0.88
Speech	0	0.0	1.27	1.15	3	5.7	1.89	0.44
Action	39	30.2	.	.	12	22.6	5.17	8.38
People								
0	70	54.3	1.52	2.25	42	79.2	2.24	4.71
1	28	21.7	1.23	1.28	6	11.3	1.49	0.28
2	22	17.1	1.51	1.06	3	5.7	2.56	1.85
3 to 8	9	7.0	1.50	1.85	2	3.8	1.70	0.04
Objects								
parts of people	58	45.0	1.63	2.44	22	41.5	2.33	6.18
medical or scientific equipment	48	37.2	1.78	2.14	15	28.3	4.31	7.56
household items	33	25.6	1.19	1.18	15	28.3	4.36	7.53
signs	5	3.9	0.72	0.51	8	15.1	0.84	0.62
forests/trees/plants	2	1.6	1.27	0.64	0	0.0	.	.
food/drink [a]	1	0.8	0.41	-	0	0.0	.	.
sports or exercise equipment	0	0.0	.	.	0	0.0	.	.
medication/pills [b]	0	0.0	.	.	0	0.0	.	.
microscopic organisms/ molecules/cells	0	0.0	.	.	0	0.0	.	.
unhealthy products	0	0.0	.	.	0	0.0	.	.
Other [c]	2	1.6	1.00	0.01	3	5.7	10.30	17.51
Setting								
None	68	52.7	1.48	1.92	44	83.0	1.97	4.49
Indoors- unclear	10	7.8	2.06	1.67	3	5.7	1.20	0.30
Indoors- home	14	10.9	0.89	0.76	1	1.9	1.67	-
Indoors- doctors	16	12.4	1.18	0.85	3	5.7	2.54	1.70
Outdoors	9	7.3	1.29	0.96	0	0.0	.	.
Screening topics								
No screening topic	55	42.6	1.47	1.32	2	3.8	1.46	0.01

Table 3. (Continued).

	Display (n = 129)				Message (n = 53)			
	Frequency		Mean Coverage		Frequency		Mean Coverage	
	n	%	M%	SD	n	%	M%	SD
Anatomy	26	20.2	0.97	1.03	4	7.5	1.68	1.20
Signs of cancer	2	1.6	0.50	0.39	0	0.0	.	.
Cancer progression	0	0.0	.	.	4	7.5	1.66	1.20
Screening								
– being invited	3	2.3	1.25	0.90	1	1.9	2.39	-
– deciding to take part	2	1.6	1.01	0.60	6	11.3	1.67	0.36
– doing the test	50	38.8	1.86	2.56	17	32.1	4.00	7.15
– receiving result	0	0.0	.	.	1	1.9	1.43	-
– result possibilities	0	0.0	.	.	15	28.3	1.05	0.58
– benefits	0	0.0	.	.	14	26.4	1.48	0.87
– adverse outcomes	0	0.0	.	.	3	5.7	1.23	0.49
Treatment	0	0.0	.	.	2	3.8	0.55	0.30
Screening messages								
Procedure			– –		27	50.9	2.97	5.81
Outcomes			– –		20	37.7	1.37	0.79
Experiences			– –		3	5.7	2.49	1.73
Decisions			– –		5	9.4	1.81	0.36
Other			– –		4	7.5	1.17	0.33
Reader's Point of view								
Reader as part of situation	35	27.1	2.28	2.98	12	22.6	5.14	8.27
Reader as outside observer	45	34.9	1.30	1.10	11	20.8	1.60	0.73
Reader as having no presence	47	36.4	1.10	1.06	30	56.6	1.16	0.91
Picture narrative								
Yes	1	0.8	0.50	-	12	22.6	5.28	8.23
No	128	99.2	1.51	1.86	41	77.4	1.24	0.81

[a]excluding alcohol. [b] excluding illicit drugs. [c] For display pictures, other included feces. For message pictures, other included a building, a post box, feces, a sun and clouds.

(n = 43/129). The second most common type of display picture did not portray a screening topic but did include people, objects and background settings (n = 23/129).

The most common type of message picture did not portray a narrative, portrayed a screening topic, contained no setting, contained no people and either contained objects (n = 26/53) or did not (i.e., lines and shapes not forming an object; n = 10/53).

Picture style

Logos were either digital illustrations (n = 107/123) or digital illustration in combination with analogue illustration (n = 16/123). They were more often in color (n = 76/123) and most often created with only fill markings (n = 88/123), with 23 being outline only and 12 having both marking styles. All logos had a word or words in them, such as the organization's or campaign's name.

Icons were entirely digitally illustrated (n = 101/101) and more often in color (n = 76/101). Icons were created with an even range of marking styles (Outline only = 34; Fill only = 32; Outline and Fill = 35). Only 15 (14.9%) icons contained words, and all were used as labels.

Display pictures were most often photographs (n = 74/129), followed by digital illustrations (n = 44/129), produced in color (n = 114/129), created without outline markings (fill only = 94/129), and contained no words (n = 80/129). Where words were used, they were for labeling (n = 28), were part of objects (n = 21), or were part of text (n = 4). There were no words used to portray sound or speech. When text was included (n = 4) it was situated parallel to the pictorial images (Table 4).

Message pictures were most often digital illustrations (n = 35/53). Most message pictures were produced in color (n = 44/53). There were 31 (58.5%) message pictures created with blocks of color (only fill markings) and 21 (39.6%) created in combination with an outline (outline and fill markings). Only one (1.9%) message picture was a line drawing without solid sections of color. Most message pictures included words (n = 44/53), with many (n = 28) containing text. The only type of words not used were sound words. The text was integrated with the pictorial images in 16 of the cases and parallel in the other 12 (Table 4).

Discussion

Picture prevalence in cancer screening information

Most of the print materials produced for the purpose of communicating UK cancer screening information to invitees followed health communications guidelines by including visual information, with the materials containing an average of 6 pictures and 7% surface area dedicated to pictures (after discounting logos). Health communication guidelines stipulate using pictures wherever they may support or facilitate communicating a message within a document. The materials in our sample contain very similar messages, following guidelines on what information should be told to invitees of a screening programme (National Quality Forum, 2016, p. 9; Public Health England, 2009). Therefore, it could be expected that similar numbers of pictures are used across the sample. However, the number of pictures used, and the size of the surface area dedicated to pictures, varied greatly across the materials.

Table 4. Frequencies of style in display and message pictures in print cancer screening materials.

| | Display (n = 129) | | | | Message (n = 53) | | | |
| | Frequency | | Mean Coverage | | Frequency | | Mean Coverage | |
	n	%	M%	SD	n	%	M%	SD
Production								
Photograph	74	57.4	1.56	1.75	6	11.3	3.52	2.72
Digital illustration	44	34.1	1.06	1.04	35	66.0	2.18	5.01
Analogue illustration	7	5.4	1.44	0.50	2	3.8	1.37	0.01
Analogue & digital	1	0.8	0.94	-	2	3.8	0.22	0.01
Photograph & digital	3	2.3	6.78	6.11	8	15.1	1.71	1.19
Color								
Yes	114	88.4	1.56	1.95	44	83.0	2.33	4.58
No	15	11.6	1.02	0.63	9	17.0	1.31	1.27
Marks								
Outline	2	1.6	1.26	0.76	1	1.9	1.24	-
Fill	94	72.9	1.66	2.08	31	58.5	2.27	5.31
Outline & fill	33	25.6	1.05	0.95	21	39.6	2.02	1.95
Word use								
None or separate	80	62.0	1.45	1.36	9	17.0	1.40	1.71
Labeling	28	21.7	0.99	1.00	8	15.1	1.76	1.11
Sounds	0	0.0	.	.	0	0.0	.	.
Speech	0	0.0	.	.	5	9.4	2.32	1.27
Object	21	16.3	2.35	3.50	9	17.0	4.83	9.74
Text	4	3.1	3.84	5.65	28	52.8	2.77	5.66
Integrated	0	0.0	.	.	16	57.1	2.09	1.78
Parallel	4	100.0	3.84	5.65	12	43.0	3.69	8.52

King's (2015) study found a similar, but slightly greater, percentage of materials surface area to be covered by visual images in information materials about cancer detection in the US (11% vs 7%; Table 5), while both studies found the same average number of pictures per case (M = 6). The larger surface area taken up by pictures in the US sample may be accounted for by the inclusion of data graphs in the unit of analysis and would suggest data graphs require more space. The similarity in picture prevalence suggests that picture placement across cancer information leaflets is similar across the two contexts. This may potentially come down to principles of composition, where designers in both countries are aiming for the same ratio of pictures to text and white space. King's (2015) sample had more pictures with people in them (57% vs 39%) and more photographs (57% vs 50%), suggesting US cancer organizations are more reliant on pictures of people and on photographs than providers of information about cancer screening in the UK when developing information materials. Taken together, this perhaps reflects different tones used in healthcare messages between the US and the UK. The private healthcare system of the US means that most healthcare needs to "sell itself" to the public, leading to US healthcare information having a tone of product advertisements that rely on images of attractive, healthy and happy looking people. The national healthcare system of the UK positions health as a social responsibility (Brookes, 2021), leading to UK healthcare information having a tone of an instruction manual with educational diagrams and images of the tests, equipment and procedure.

Contributions to theory

Firstly, this analysis described picture characteristics across three categories; content, style, and function. These categories remained a stable way of grouping the different variables that were analyzed. Working to capture each of these categories gives a holistic assessment of individual pictures that integrates a description of the informational (content) and esthetic (style) qualities and the picture's relationship to the leaflet message (function).

This study determined four useful distinctions (logo, icon, display, message) to describe the different functions of pictures present in cancer screening materials. Firstly, the acknowledgment of logos and icons as pictures with unique functions is an important contribution to the analysis of pictures in print information material. These visual images can often be overlooked in health communication research (for example, King, 2015). However, their presence will contribute to a viewer's overall interpretation of an information leaflet (for example,

Table 5. Comparison of study findings between King (2015) and the current study.

	King (2015)	Current study
Picture prevalence	Average of 6 pictures per case.	Average of 9 pictures per case (6, when logos excluded)
	Pictures covered an average of 9.4% surface area of each case. (10.6% for cancer detection materials)	Pictures covered an average of 7.3% surface area of each case (6.8%, when logos excluded)
People	People were the predominant feature of 57% pictures (496 vs 228 object and 134 data).	People were in 38.7% (70 vs 112 no people) of display (45.7%) and message (20.8%) pictures.
Object	Food or drink were the most common type of object in pictures predominantly featuring object (31.2%), followed by parts of people (22.6%).	Parts of people were the most common type of object (44.0%) in display (45.0%) and message (41.5%) pictures, followed by medical or scientific equipment (34.6%).
Production	Photographic production was used for 56.8% (487 vs 371 illustrative).	Photographic production was used for 50% (91 vs 91 illustration) of display (59.7%) and message (26.4%) pictures.

Pieters & Wedel, 2018) as well as contribute to the visual complexity of the material. Visual complexity being both the objective feature and subjective perception of visual information related to the quantity, variety, arrangement and regularity of the visual elements (Berlyne, 1958; Pieters et al., 2010). Therefore, icons and logos are also worth recognizing and accounting for in descriptions of print health information.

Secondly, the classification of display pictures versus message pictures is a novel approach to describing types of pictures in health communication. A strength of the two categories is that they depart from the affect and cognitive dichotomy promoted by some recent health communication research (Bol et al., 2014; Cho et al., 2018) and bring the focus on the properties of the information being provided. The categories of affective and cognitive pictures are suitable as experimental conditions. However, during coding scheme development it was identified that when used to describe pictures in a naturalistic context, these categories create a false dichotomy, as a single picture can both facilitate learning and induce an emotional response, and such cognitive and emotional information is processed in an integrated way (VanRullen & Thorpe, 2001). Therefore, these two qualities should be kept separate when assessing picture use in health information.

Implications for research

In addition to describing pictures used in cancer screening print materials, this study also set out to provide empirically useful categories for describing such pictures.

The coding scheme and questionnaire developed in this study achieved high inter-coder reliability rates between the primary researcher and a second coder who had not been involved in the development of the coding scheme and had never formally analyzed pictures before. Therefore, the coding scheme was a valid and understandable way of describing the pictures, giving support for the use of the coding questionnaire[3] in future studies which could be used to replicate the research in different contexts (e.g., with other health leaflets or repeated in the future to measure changes) to build the field of visual health communication research.

The coding scheme developed in this study provides a scaffolding for the development of a standardized classification system for research into pictures in print health communication. This would support a more systematic investigation into pictures used in health information communication – a need highlighted previously (Jensen, 2011). The categories could be used as the starting point for deciding and describing which picture characteristic are being manipulated in a study, to be able to untangle the impact different manipulations have on different communication outcomes.

Implications for practice

A large proportion of the pictures did not connect directly with messages within the materials as they did not include a cancer screening topic. With visual images being the initial point from which viewers make a judgment about the leaflet (due to the picture superiority effect, Geise & Baden, 2015), it will be important for the pictures to indicate the type of information

being provided or the relevance to the viewer. Pictures that do not connect with the target audience and do not communicate the relevance of the information will discourage people from reading the materials. Accordingly, many existing print health information guidelines advise keeping leaflets and pictures clear of irrelevant content (see, Table 1). Current practice was found to be inconsistent with the advice to keep pictures entirely relevant to the leaflet message.

Topics that were particularly missing from the pictures were being invited, deciding to take part ($n = 8$), receiving result ($n = 1$), result possibilities ($n = 15$), screening benefits ($n = 14$) and potential adverse outcomes ($n = 3$). Future design work could focus on balancing the portions of pictures across these different screening topics. Shaffer and Zikmund-Fisher's (2013) taxonomy of screening narratives – identified while developing the coding scheme – was helpful in determining a broad range of screening topics capable of capturing the nuance of people's cancer screening experiences and decisions.

The pictures in the cancer screening materials analyzed in this study often did not portray an action and they seldom included people. Considering most of these pictures were about doing a screening test, more pictures should be showing an action being carried out as modeling behaviors is an important mechanism for learning and adopting new behavior (Bandura, 1998). Where the goal is to support informed choice, it is important that pictures of people modeling screening-related behaviors are used in cancer screening materials.

There were very few pictures that portrayed a narrative across the screening information materials. The success of comics (a media that uses spatially juxtaposed panels to portray a sequence of events or aspects; McCloud, 1994) in communicating health information (Noe & Levin, 2020) demonstrates the utility and suitability of using pictures that portray narratives for cancer screening communication efforts. Despite the low number of pictures used to portray a narrative across the cancer screening material analyzed, there were picture narrative examples for all the types of topics relevant to making and acting on a decision to screen (i.e., procedure, outcomes, experiences and decision dimensions). There were also picture narratives that included more than one type of topic, demonstrating the capacity and potential for picture narratives to communicate the entire range of cancer screening information within future leaflets. This content analysis identified that cancer screening information materials have underutilized picture narrative form.

A clear finding from this analysis is that cancer screening information materials include fewer, and have less surface area dedicated to, pictures that perform a message function compared to pictures that perform a display function, indicating that pictures are predominantly used to highlight or support the written messages rather than as a conduit of the messages themselves. In some situations, display pictures are the most suitable type of picture to use, as with anatomical drawing used to show what parts of the body look like. However, most messages within screening information materials go beyond showing what something looks like — from describing the process involved in doing the screening to the potential positive and negative outcomes of taking part. Therefore, cancer screening material designers should look to use a larger portion of pictures that convey coherent cancer screening messages.

Many of the display pictures were photographs of people. Such pictures do not need to be limited to a display function and future design work could focus on conveying relevant cancer screening messages through photographic pictures of people (for example, photos illustrated with symbols such as arrows and crosses or sequences of photos depicting speech, thought and behavioral enactment).

Limitations

On reflection, there are some picture characteristic categories that could be useful for cancer screening picture researchers that were not included in the coding scheme in this paper. Although we coded whether any action was depicted in the picture and what the screening topic the picture was portraying, we did not specifically code for instances where a picture was modeling cancer screening behavior. This specificity may be necessary for studies considering the interaction between different picture characteristics (such as ethnicity cues and behavior being modeled) on communication outcomes (such as raising awareness or changing behavior). Details were not kept about the ethnicities of the models or how recognizable the household objects would be in different cultures. Researchers ought to measure these factors if looking into diversity or image relevance in relation to the ethnicities of the target audience. King (2015) demonstrates a way of measuring this. Picture structure (such as positioning) was not coded for. Structure is a key message feature (Shen & Bigsby, 2012) alongside the contents and the style of a picture but was not within the scope of the current analysis.

This study did not evaluate the characteristics of the picture portraying a narrative present as there were so few in the sample. A future analysis of the contents of health communication pictures could include a qualitative description of the picture narratives used. The sample included only materials that were publicly available online. Any materials developed locally by individual clinics have not been included. Therefore, the findings reflect the standards of the centralized screening programmes.

Conclusions

This study provides a description of the types of pictures being used in current UK cancer screening information materials, and their prevalence. This has allowed for a reflection on current practices, with a consideration of where best practice guidelines are not being followed. This study has highlighted that the following types of pictures have been underused in recent cancer screening information materials produced in the UK: pictures that communicate a coherent message, picture that portray a narrative, pictures modeling a screening-specific behavior and pictures conveying experiences or decision dimensions involved in cancer screening participation.

The study offers researchers a theory-based context-appropriate coding scheme for describing the characteristics of a cancer screening information picture. This coding scheme could also be adapted to be used in other print health communication contexts and could be adopted in future studies to support a more systematic scientific investigation of pictures in health communication.

Notes

1. Prostate cancer screening was not in operation and a lung screening programme was being trialed but not yet available as a UK-wide screening programme.
2. A full description of the coding categories, the decisions behind them and their related interrater reliability can be accessed via Figshare (doi: 10.6084/m9.figshare.17282543).
3. The coding questionnaire can be accessed via Figshare (10.6084/m9.figshare.17283044).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data that support the findings of this study are openly available at http://doi.org/10.6084/m9.figshare.14483589.

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