

# Information gain in patients using a multimedia website with tailored information on anaesthesia

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## Editor's key points

- The usefulness of a multimedia website in enhancing patient information before anaesthesia was studied.
- Information gained using the website was compared with traditional clinical explanations, a brochure, or both.
- Patients who used the website were better informed than those who used other methods.
- The use of websites has potential for quality improvement by enhancing patient information and experience.

**Background.** The preoperative visit is an appropriate time to educate the patient on anaesthesia. The aim of this study was to determine if a website, as an information source for anaesthesia before the visit to the preoperative assessment clinic (PAC), increases patients' knowledge on anaesthesia.

**Methods.** A multimedia website was developed containing specific information about anaesthesia relevant to the patient. A questionnaire was developed to measure knowledge gain. Patients were divided into three groups: (i) those who read the existing brochure; (ii) those who looked at the new website; and (iii) a cluster of non-brochure and non-website users: those who did not read the brochure or website but had completed the questionnaire. An anaesthesiologist also informed all three groups during the preoperative visit at the PAC.

**Results.** Patients visiting the website had a higher educational level than others. A significant increase in knowledge was observed after using the website information compared with the other two groups ( $P < 0.001$ ). The group with higher education levels had higher knowledge gains, and the website independently contributed to the knowledge gain.

**Conclusions.** A patient-tailored multimedia website is an effective way to support the information provided by the anaesthesiologist in order to inform patients about their upcoming anaesthetic procedure. The use of such a website gives a significant increase in knowledge compared with only spoken information, or spoken information combined with a brochure.

**Keywords:** computers; education

Accepted for publication: 22 October 2010

In the Netherlands, most patients visit the preoperative assessment clinic (PAC) to be assessed by an anaesthesiologist. This preoperative visit is an appropriate time to educate the patient on anaesthesia, perioperative care, and pain treatments; this is in order to reduce anxiety, to develop care plans, and to obtain informed consent for anaesthesia.

It is a legal requirement that all elective patients give valid or informed consent for medical examination or exploration and treatment. Consent should be given voluntarily, and the patient has to be competent to decide on the procedure. Therefore, patients need a clear appreciation and understanding of the facts before they can truly give consent: the procedure, possible alternatives, and potential risks and benefits should be explained.

Previous studies show that the use of a video will increase patients' knowledge about the forthcoming anaesthesia.<sup>1 2</sup>

Patient information on the Internet, specifically information on anaesthesiology, is variable and often inaccurate.<sup>3–5</sup> Hering and colleagues<sup>6</sup> tested the impact of a hospital-built website as an information source on perioperative patient education, anxiety, and satisfaction and showed that hospital-built websites might reinforce the knowledge of patients on anaesthesia. An increase in information gain has a high correlation with patient satisfaction.<sup>7 8</sup>

In a previous study, we found that patient experiences with the PAC could improve substantially by informing patients better.<sup>8</sup> Therefore, the department of anaesthesiology of the Academic Medical Centre (AMC) in the Netherlands developed a multimedia website with tailored information on a patient's upcoming anaesthetic procedure. The aim of the present study was to determine whether the use of the website as an information source for anaesthesia, to

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support the information provided by the anaesthesiologist, increases patients' knowledge compared with only spoken information, or spoken information combined with a brochure.

## Methods

### Background website

Before the new website was introduced, patients visiting the PAC of the AMC got a brochure with information on anaesthesia in addition to the information supplied by the anaesthesiologist. In cooperation with the Audio Visual Centre of the University of Amsterdam, we developed a multimedia website containing information about anaesthesia (<http://www.amc.nl/?pid=4999>). The website was designed as an interactive site to allow patients to get specific information on the anaesthetic procedure relevant to their upcoming surgery, for example, aspects of regional anaesthesia were presented only if relevant for the respective operation. However, if the patient liked, he could easily access additional information on anaesthesia and perioperative care.

The first page of the website gives general information and determines the patient's profile. The profile is dependent on three variables, namely the part of the body to be operated on, the type of admission (day-case surgery or hospital admission), and the type of anaesthesia. These variables are given as lists of options in drop-down menus. On the basis of the profile, a selection of pages is shown containing only tailored information related to the chosen profile of the patient. The selection of pages appears as a logically ordered list of topics; the patient can choose from this list or can navigate through the pages in the given order, using arrow buttons. Every page then gives concise information. Next to information about the anaesthesia, there is information about the PAC, day-case surgery, or hospital admittance, and if applicable the intensive care unit.

Videos (e.g. of the intake at the PAC and various anaesthesiological procedures) and animations (e.g. of the performance of regional and general anaesthesia) were used to further enhance knowledge transfer.

Next to the information related to the profile, the patient had access to all other information available given in menu items appearing at the top of the page throughout the website. So a patient undergoing knee surgery under local anaesthesia could also look at the information about general anaesthesia or spinal anaesthesia.

There is specific information for pregnant women, diabetic patients, and patients undergoing cardiac surgery. In addition, there is information about anxiety related to anaesthesia, smoking and anaesthesia, and anaesthesia personnel. Readspeak enables the Internet page to be read out loud by a computer voice; the videos and animations are supported by voiceover speech. Currently, the website is only available in Dutch.

### The patient survey

The PAC at the AMC, a tertiary care centre, assesses 13 000 patients annually. All patients who visited the PAC aged 18 yr or older were included, irrespective of previous anaesthetic, surgery, or type of admission (day surgery or inpatients). To prevent bias, the staff of the department of anaesthesiology was not informed about the specifics of the study.

Patients were divided into different groups; the first group of patients received the existing brochure with information on anaesthesia, used by the hospital for years. They got the brochure in the hospital from their referring outpatient department, before their visit to the PAC. They were informed about the study by posters at the PAC. This group visited the PAC during a 3 week period in March 2008. The second group received a letter at home 1 week before their PAC visit, informing them about the new website, which they could access at home before their visit to the PAC. This group visited the PAC during a 3 week period in November 2008. The timeframe between these groups was necessary to implement the newly built website and to make anaesthesiologists and nurses familiar with the website.

All patients were asked to carefully read the information presented to them before their visit to the PAC. Within 2 days after their visit to the PAC, patients received a questionnaire together with a covering letter and a freepost return envelope. Patients who did not return the questionnaire within 6 days received a follow-up phone call. If, after 13 days, there still was no response, another questionnaire was sent to the patient, including a covering letter and freepost return envelope.

### Developing the questionnaire

The Departments of Anaesthesiology and Medical Psychology developed a Dutch questionnaire. Patients were asked whether they used the information source supplied. There were five report style questions relating to the information source: (1) What did you think of the amount of information in the brochure/website? (2) How clear was the information in the brochure/website? (3) Could you find all the information you wanted in the brochure/website? (4) Did the information in the brochure/website influence your choice of anaesthesia? (5) Was the brochure/website user-friendly?

The questionnaire included seven multiple-choice questions adapted from Snyder-Ramos and colleagues<sup>1</sup> to test patients' knowledge on anaesthesia in order to measure differences in information gain (see Supplementary material Appendix). The information needed to answer the questions could be found in both the brochure and the website. The questions were: (1) What is true about the PAC? (2) What is an anaesthesiologist? (3) What does 'fasting' before an operation mean? (4) Where do the anaesthesiologist and nurse anaesthetist stay during the operation? (5) What is true about the duration of the anaesthesia? (6) What do you know about (severe) pain after surgery? (7) Where do you stay straight after the operation? There was one question

on anxiety: Did reading the brochure/website and the visit to the PAC influence your anxiety about the anaesthesia? Finally, there were some background questions to determine the respondents' gender, age, and educational level.

**Statistical analysis**

The scores were entered into a Microsoft Office Access database. SPSS 16.0 for Windows was used for statistical analysis. Frequencies, cross-tables,  $\chi^2$  tests, and t-tests were used to describe and compare three groups of patients: (i) those who had received the brochure and had read it; (ii) those who had looked at the website; and (iii) a cluster of non-brochure and non-website users: those who did not read the brochure or website but had completed the questionnaire and had no additional information than the information provided by the anaesthesiologist during the visit to the PAC. Differences between these groups in knowledge gain and anxiety reduction were determined by conducting a 3 x 3 analysis of variance with patient group as one factor and education level (low, intermediate, and high) as a control factor.

**Results**

The questionnaire was sent to a total of 893 patients; 416 patients received the brochure and 477 patients were informed about the website. There was no significant difference between the two groups with respect to gender or age. The response rate was significantly higher in the brochure group (67%) compared with the website group (54%). In both groups, non-respondents were on average younger than respondents, with no difference with respect to gender (Table 1).

Not all respondents made use of the information supplied: 189 (68%) patients had actually read the brochure and 144 (56%) patients had actually visited the website. The users of the brochure were significantly older [mean 56 (range 19–92) yr] than the non-users [mean 46 (19–92) yr]. With a mean of 54 yr, there was no significant difference with respect to age between the users (range 18–79) and the non-users (range 18–88) of the website (Table 1).

There were seven knowledge questions. Table 2 shows the number of patients (%) in each group who answered the questions to test patients' knowledge on anaesthesia

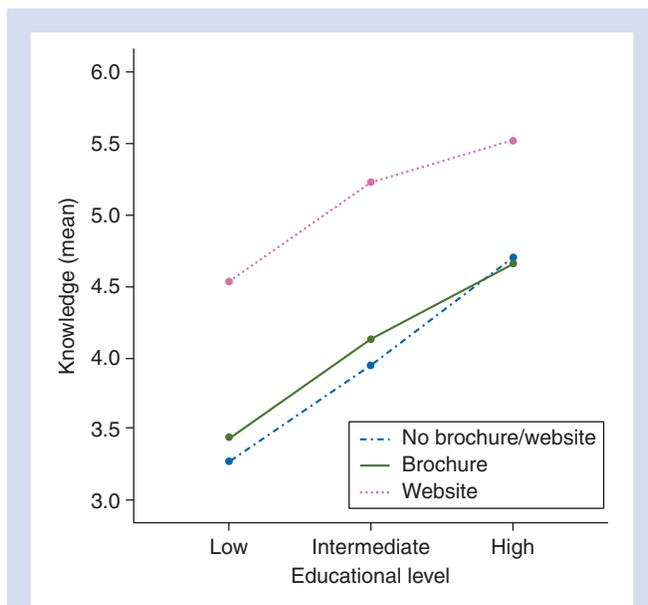
Downloaded from [bjia.oxfordjournals.org](http://bjia.oxfordjournals.org) at Universiteit van Amsterdam on February 21, 2011

**Table 1** Patients' characteristics

	Brochure (n=416)			Website (n=477)		
	Non-respondents (n=136)	Respondents (n=280)		Non-respondents (n=220)	Respondents (n=257)	
		Users (n=189)	Non-users (n=91)		Users (n=144)	Non-users (n=113)
Age (yr) mean (range)	45 (19–96)	56 (19–92)	46 (19–92)	47 (19–87)	54 (18–79)	54 (18–88)
Gender [n (%)]						
Male	58 (43)	86 (46)	42 (46)	99 (45)	63 (44)	44 (39)
Female	78 (57)	103 (54)	49 (54)	121 (55)	81 (56)	69 (61)
Educational level [n (%)]						
Low		48 (25)	18 (20)		17 (12)	38 (34)
Intermediate		79 (42)	33 (36)		48 (33)	39 (35)
High		56 (30)	39 (43)		73 (51)	31 (27)
Missing		6 (3)	1 (1)		6 (4)	5 (4)

**Table 2** Questions to test patients' knowledge on anaesthesia in order to measure differences in information gain. The number of patients (%) in each group who answered the question correctly. PAC, preoperative assessment clinic

	No brochure/website (n=204)	Brochure (n=189)	Website (n=144)	P-value
Were you informed enough after visiting the PAC and reading the brochure/website?	147 (72%)	154 (82%)	118 (82%)	<0.05
Knowledge				
What is true about the PAC?	94 (46%)	86 (46%)	99 (69%)	<0.001
What is an anaesthesiologist?	106 (52%)	96 (51%)	94 (65%)	<0.05
What does 'fasting' mean before an operation?	117 (57%)	121 (64%)	115 (80%)	<0.001
Where do the anaesthesiologist and nurse anaesthetist stay during the operation?	139 (68%)	138 (73%)	134 (93%)	<0.001
What is true about the duration of anaesthesia?	63 (31%)	57 (30%)	68 (47%)	<0.01
What do you know about (severe) pain after surgery?	125 (61%)	115 (61%)	117 (81%)	<0.001
Where do you stay straight after the operation?	175 (86%)	159 (84%)	137 (95%)	<0.01



**Fig 1** Information on anaesthesia (as assessed by Knowledge Score) relative to the level of education in the patients who used website, brochure, or neither.

correctly. If a question was answered correctly, a patient received one point; if a question was answered incorrectly, a patient received no points. The mean score of the seven questions was calculated. The mean score was 4.0 for the patients who did not receive any additional information, 4.1 for the patients who read the brochure, and 5.3 for the patients who visited the website. There was no significant difference between the first two groups regarding knowledge. Patients who visited the website were significantly better informed than those who had read the brochure or those who did not get any additional information ( $P < 0.001$ ).

Of the patients who read the brochure and those who visited the website, 82% felt they were informed enough after visiting the PAC and reading the brochure/website. Of the patients who did not get any additional information, 72% felt they were informed enough after visiting the PAC (Table 2).

Patients' educational level was divided into three categories: low, intermediate, and high.

The first category comprises no education or only primary education. The second category comprises secondary education. The last category comprises college and university. The patients who visited the website were significantly more highly educated than those who read the brochure or who did not get any additional information ( $P < 0.001$ ). There was no significant difference in educational level between the latter two groups (Table 1).

The two-way analysis of variance showed main effects of both, patient group and educational level. Figure 1 shows a graphical display of the group means: the significant differences between patient groups are caused by higher knowledge gains in the website group than in the other groups. The figure also shows higher knowledge gains for patients

**Table 3** Questions related to the information source (brochure or website). \* $P < 0.05$

Questions and answers	Brochure, n (%)	Website, n (%)
What did you think of the amount of information in the brochure/website?*		
Too much	10 (5)	5 (4)
Precisely right	172 (92)	122 (85)
Too little	5 (3)	16 (11)
How clear was the information in the brochure/website?		
Very clear	24 (13)	31 (22)
Clear	156 (84)	106 (74)
Not (very) clear	6 (3)	6 (4)
Could you find all the information you wanted in the brochure/website?		
Yes, definitely	131 (70)	92 (65%)
Yes, to some extent	52 (28)	45 (32%)
No	3 (2)	5 (4)
Did the information in the brochure/website influence your choice of anaesthesia?*		
Yes	29 (16)	12 (8)
No/hardly	125 (67)	92 (64)
No, but there were no alternatives	32 (17)	39 (27)
Was the brochure/website user-friendly?		
Yes, definitely	141 (76)	113 (81)
To some extent	43 (23)	27 (19)
No	1 (1)	

with higher education levels. However, by controlling for education level, the analysis shows that the website itself also contributed to the information gain. There was no significant interaction effect, indicating that the differences between patient groups were equal across all education levels.

There was no significant difference in anxiety reduction between the three groups.

Patients were generally positive about both information sources: 95% of the patients thought that the amount of information in the brochure was precisely right; this was 85% for the website. The information in the brochure was clear/very clear for 97% of the patients; the information on the website was clear/very clear for 96% of the patients. Seventy per cent of the patients found that the brochure supplied all the information they wanted, vs 65% for the website. Seventy-six per cent of the patients thought that the brochure was user-friendly, vs 81% for the website. In the majority of cases, the information source did not influence the choice of anaesthesia (Table 3).

## Discussion

In this study, we compared the differences in knowledge gain on anaesthesia in three groups: (i) those who had received the brochure with information on anaesthesia and had read it; (ii) those who had looked at the patient tailored, multimedia website with information on anaesthesia; and (iii) a

cluster of non-brochure and non-website users: those who did not read the brochure or website but had completed the questionnaire. The main results show that patients who visited the website had a higher educational level and showed a significant increase in knowledge compared with the other two groups. Both educational level of the patients and the website itself contributed to this significant increase in knowledge. Although the patients who visited the website showed the highest increase in knowledge, this information source was used significantly less than the brochure. There was no significant difference in anxiety between the groups.

Medical information provided by healthcare practitioners is poorly remembered by patients, 40–80% of the information is forgotten immediately.<sup>9</sup> Written or visual material to support spoken information helps to improve patients' memory for medical information.<sup>9</sup> Previous studies show that the use of video contributes to patient knowledge.<sup>1 2 7 10</sup> Combining text, animation, and video on a website to increase patient knowledge on the upcoming anaesthetic procedure has not been studied before. Patients are increasingly using the Internet for health information. Research on patient experience with interactive, multimedia (web-based) information such as our website shows that this source of information is widely accepted.<sup>11–13</sup> Other studies have suggested supplying hospital-built websites to educate and inform patients.<sup>14 15</sup> Patient-tailored information using relevant modules, which can be viewed separately, are more effective in educating patients than general information sites.<sup>11 13</sup> Not all patients want the same amount of information and a modular website can facilitate individual needs. Patients like to be able to go over specific information again at a later time, which is convenient with a modular website.<sup>13</sup> Our study shows that supporting the information provided by the anaesthesiologist by a multimedia website with patient-tailored information increased patient knowledge significantly.

The utility and acceptability for both the website and brochure are good; both being user-friendly with clear information. We found that although the patients who visited the website showed the highest increase in knowledge, this information source was used significantly less than the brochure. According to Statistics Netherlands [CBS StatLinei (<http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=71098ned&D1=33-40&D2=0&D3=I&HDR=G1&STB=T,G2&VW=T>)], 93% of the households in the Netherlands have access to the Internet. The use of the website might increase by sending patients an e-mail with a direct link to the website instead of a letter, making access to the website more user-friendly. Having computers available for viewing the website at the PAC might also increase the use of the website; this enables patients who have to wait or who do not have easy access to the Internet at home to look at the website before the appointment with the anaesthesiologist.

Although objectively the website contained more information, 11% of the patients who used the website thought it contained too little information; this was significantly less for patients who read the brochure (3%). This outcome suggests that patients have higher expectations for a

website than a brochure. However, we do not have a group that has seen both information materials to allow a direct comparison of information completeness and user-friendliness.

To reach elderly patients, physicians should direct elderly patients towards credible health information websites, as we did in our study.<sup>16</sup> We found no significant difference with respect to age between the patients who visited the website and those who did not visit the website. This suggests that there is no age bias regarding the use of the website.

Currently, the website is only available in Dutch, and it is aimed to inform adult patients about anaesthesia procedures. Translating the website into different languages will most likely help to better inform more patients; especially in a tertiary medical centre with a large population of non-Dutch-speaking patients. A special site for paediatric patients is also advisable.<sup>17</sup>

In the present study, it was possible for patients who had to undergo surgery within days after the PAC visit, to fill out and return the questionnaire after surgery took place. If patients fill in the questionnaire after their operation, it could influence the outcome.<sup>7 10</sup> However, the majority of patients were seen at the PAC well before their operation and the questionnaire was received well on time.

It was possible for patients to refer to the website/brochure while they completed the questionnaire at home, although the text clearly stated that this should not be done. As this was possible for both groups, we do not believe this to have a substantial effect on our conclusions.

The significantly lower use of the website compared with the brochure might be explained by the study setup. The brochure was given to the patients in the hospital, whereas the website had to be looked up by patients themselves at home, after receiving a letter with the link for the website.

It is still unclear whether knowledge gain reduces anxiety.<sup>2 10 18</sup> We found no significant difference in anxiety reduction between the three groups. However, the questionnaire only contained one question regarding anxiety. A more elaborate questionnaire is needed to determine whether knowledge gain by website information reduces anxiety.

To conclude, a patient-tailored multimedia website combining text, animation, and video is an effective way to support the information provided by the anaesthesiologist in order to inform patients about their upcoming anaesthetic procedure. The use of such a website gives a significant increase in knowledge compared with only spoken information, or spoken information combined with a brochure.

## Supplementary material

Supplementary material is available at *British Journal of Anaesthesia* online.

## Conflict of interest

None declared.

## Funding

The study was supported by a grant from *Agis Zorgverzekeringen*, The Netherlands.

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