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Stroke Education Materials on the World Wide Web: An Evaluation of Their Quality and Suitability

Erin Griffin, Kryss McKenna, and Linda Worrall

Web-based information is a valuable resource for people affected by stroke, however its accuracy and quality have been questioned. In this study, 30 stroke education websites were reviewed using accountability, readability, and reliability measures. Fifteen consumers and 11 health professionals evaluated six sites in terms of their design, content, and ease of use. The websites mostly met accountability criteria, but their reliability scores were low and their readability was high. Consumers' opinions were consistently higher than health professionals', but scores indicated their preferences for particular websites, especially in terms of design. The importance of considering consumers' preferences when designing and recommending websites is highlighted. **Key words:** cerebral vascular accident, client education, Internet, stroke, World Wide Web

Web-based stroke education resources are potentially enormously beneficial for people with stroke, particularly those living in the community, because of their ease of access. The degree to which stroke education websites conform to established guidelines is unknown. The quality and readability of the information available on these websites are also yet to be analyzed.¹ No previous research has examined whether people who have had a stroke, or their carers or family, access the Internet. Although stroke clients' opinions of written health information have been examined,² their opinion of web-based materials and whether they would use this source of information is unknown.

Web-Based Health Information

It is estimated that over 70,000 health-related websites exist.³ Internet access at home and in public facilities such as libraries⁴ provides unprecedented opportunity for consumers seeking health information.⁵ The Internet has enormous potential for educating people who have experienced stroke and their carers and family. A study examining knowledge and perception of stroke revealed that both clients and carers wanted more information about the causes of stroke, treatment methods, and risk of recurrence.² The provision of information about stroke is an important role of health professionals,⁶ and the Internet

has been identified as a key service delivery resource.⁷ Numerous factors such as anxiety, physical discomfort, limited privacy, and time constraints impede a client's ability to learn in a health care setting.⁸ The Internet provides the opportunity for consumers to access information at a time when they are ready to learn.⁹

Problems with Web-Based Information

Information on the Internet can be incomplete, misleading, and inaccurate.¹⁰ Consumers seeking health information on the Internet can be especially vulnerable to information inaccuracies because they lack skills to evaluate the information.¹¹ The absence of restrictions on publication of material on the Internet has led to a proliferation of information that may or may not be bene-

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ficial.¹⁰ Much of this information is designed to promote financial benefit or political views.¹² Unlike printed material, information published on the Internet is not subject to standards designed to judge the quality of content or to discern evidence from opinion.¹²

Evaluation of Websites

Various guidelines for the evaluation of web-based health materials have been published, but there is not one widely accepted approach in place.¹³ Kim et al.⁵ reviewed 29 published rating tools and identified several key criteria for the evaluation of websites (see **Table 1**). Self-policing approaches, such as that established by Health on the Net (HON), enable websites to exhibit the HON code if they conform with a set of principles similar to those identified by Kim and colleagues.⁵ Industry groups have also been formulating guidelines in an attempt to promote self-regulation.¹⁰ A study conducted by Griffiths and Christensen examined the quality of web-based information on the treatment of depression.¹² This study used the accountability criteria established by Silberg and colleagues (disclosure of authorship, ownership, and currency of information)¹⁰ and showed that many websites failed to conform to these standards. It also identified that although these factors are important in the evaluation of websites, they are no guarantee of website quality.¹⁰

Evidence-Based Information

Current client education materials, not just those available on the World Wide Web, can omit relevant data, fail to give a balanced view of the effectiveness of different treatments, and ignore uncertainties.¹⁴ Evaluation of website material needs to go beyond mere accountability to assess the content of the website. The determination of whether the information provided in a website equates with current evidence-based practice involves comparison with accepted guidelines.¹⁵ In a study that evaluated the reliability of health information advice for the management of fever in children, only a few websites were found to provide complete and accurate information regarding

this condition.¹

Readability of Web-Based Information

For health education material to be effective, it needs to be accurate and comprehensible to the consumer. Graber et al.¹⁶ randomly selected 50 samples of client education material from the World Wide Web and analyzed their readability. An average reading level of 10th grade 2 months was found. Previous studies have shown that this reading level is not comprehensible to the majority of clients; their recommendation is a reading level of 6th to 7th grade as appropriate.¹⁷⁻¹⁹ Readability levels are particularly pertinent when examining stroke education sites. Stroke can affect people of all ages, but the majority of people affected by stroke are older, and poorer literacy skills have been linked to older age.²⁰ Neurological deficits that result from stroke, such as aphasia and hemianopia, can also have an impact on an individual's ability to read.

Aims of the Study

No previous research has examined whether people who have had a stroke and their carers and families access web-based stroke education resources. Health care professionals play an important role in recommending high quality websites to consumers.²¹ A critical evaluation of the reliability and comprehensibility of information contained on websites is required to do this effectively. The opinions of stroke clients have not been examined to determine how effective they find these resources to be and whether they would use the information to manage their condition.

The aims of this study were to:

1. Analyze the accountability, reliability, and readability of stroke websites.
2. Examine the perceptions of people who have experienced stroke, carers, and health care professionals about web-based stroke education materials. This will encompass the following steps: determine the current use of stroke websites by people who have had a stroke and their carers; determine if differences exist between the perceptions of this group and

those of health professionals about the design and aesthetics, ease of use, and content of sites; and ascertain the opinions of stroke health professionals about the accuracy of the content of these websites

Method

Participants

Two convenient groups of participants were recruited. Ethical clearance was obtained from a university ethics committee, and approval to contact potential participants was obtained from a community support group. All participants provided informed consent before participating in the study.

The consumer group, comprising 11 people who had experienced a stroke and 4 primary informal carers, was sourced through community- and university-based support groups. They were eligible to participate if they had experienced a stroke or were the primary carer of a person who had experienced a stroke; lived in the community; and could read and speak English sufficiently to give informed consent and read information on a website. Participants were ineligible to participate if they lived in a residential facility such as a nursing home or hostel; did not read or speak English well enough to give informed consent or read information on a website; had an obvious dementia or cognitive impairment that would impair their participation in the study; or had a visual acuity or perceptual impairment that would impair their participation in the assessments.

The health professional group, comprising 11 health professionals who had experience in the area of stroke rehabilitation, was recruited through the researchers' professional networks.

Selection of websites

A search of stroke education websites was conducted using the Internet Explorer browser from March to June 2002 using the search engines MetaCrawler (www.go2net.com/search.html) and Google (<http://www.google.com/>). MetaCrawler integrates results from several search engines including Alta Vista, Direct Hit, LookSmart, and

About. Google uses a page rank system to return the most popular sites according to the number of links. The search term *stroke* was used.

The search using Metacrawler yielded 60 sites, and the search using Google yielded 3,200,000 sites, of which the first 200 were selected. Of the 260 sites, those that contained information designed to educate laypeople and those that met accessibility criteria (i.e., required no fee for access and were stable for the duration of the selection process) were identified. A random sample of 30 of the 90 websites (selected by choosing every third website) was subject to the following evaluation:

1. Site characteristics were identified, including purpose, ownership, and country of origin.
2. The websites were analyzed according to their compliance with the accountability criteria identified by Kim et al.⁵ These authors reviewed the published criteria for evaluating health-related websites. A journal and Internet search was conducted and 29 published rating tools were identified, from which cited criteria were extracted. Fourteen criteria that could be measured objectively were organized into eight categories (see **Table 1**). These were used to rate the selected websites.
3. The readability level of text contained in the websites was calculated using the Flesch Readability Test and the Flesch-Kincaid Index. The Flesch score ranges from 0 (*most difficult to read*) to 100 (*easiest to read*), and the Flesch-Kincaid Index converts the reading score to a grade level estimate indicated in years and months. Website content was copied by systematically following all links within the site that contained material relevant to laypeople. Text was downloaded in MS Word 97 and the hypertext markup language (HTML) codes were deleted to eliminate the effect of these codes on readability evaluation. The readability level of text was calculated by activating the Flesch Readability Test and the Flesch-Kincaid Index in the readability statistics option located in the Tools menu under Spelling and Grammar in MS Word.
4. The reliability of the information provided by the websites was analyzed by comparing it

Table 1. Accountability criteria for evaluating websites as identified by Kim et al.⁵

Objective criteria: rated by researcher	
Disclosure of authors, sponsors, and developers	1. Purpose identified
	2. Nature of organization identified
	3. Sources of support identified
	4. Authorship identified
Currency of information	5. Site updated/maintained
	6. Site updated after June 2001
Authority of source	7. Credible/trustworthy
Accessibility/availability	8. No difficulty with access
	9. Stable for duration of study
Links	10. Links present
	11. Links of acceptable quality
Attribution and documentation	12. Origin of information identified/referenced
Contact address or feedback mechanism	13. Contact address or feedback mechanism provided
User support	14. Support available
Subjective criteria: rated by participants	
Design and aesthetics	1. Layout
	2. Presentation
	3. Graphics
	4. Appeal
	5. Variety of media
Ease of use	6. Usability
	7. Navigability
	8. Functionality
Content of site	9. Usefulness of information
	10. Ease of understanding
	11. Range of information
	12. Sufficient information for needs of user ^a
	13. Accuracy of information ^b
	14. Objectivity of information ^b

^aConsumers only. ^bHealth professionals only.

with sections 9, 10, and 11 of the *National Clinical Guidelines for Stroke*, published by the Royal College of Physicians²² (www.rcplondon.ac.uk/pubs/books/stroke). These guidelines provide a comprehensive review of current evidence-based practice that can be used to judge the reliability of the content of web-based stroke sites. Much of the information contained in the guidelines focuses on acute treatment and management, therefore only sections 9 (rehabilitation interventions), 10 (transfer back to the community), and 11 (long-term client management) were selected to be used to analyze the websites, as they covered areas more suited to the community-based sample involved in the study. A checklist was developed from the individual recommen-

dations contained in each of the three sections. The checklist items are summarized in **Table 2**. The information contained in each selected website was compared with the guidelines to determine whether the main concept of each recommendation was included (e.g., recommendation: "all patients should be assessed for pain on a regular basis"; main concept: pain may occur and should be assessed).

Following this evaluation, 6 of the 30 websites were chosen as being representative of the range of readability and reliability levels according to the above measures. Specifically, two websites were selected from each of the categories of high, medium, and low readability. One of these had a high reliability score and the other had a low reliability score.

Table 2. Evidence-based guidelines²² used to evaluate the content of selected websites

Rehabilitation interventions	Example statement
Psychological impairment <ul style="list-style-type: none"> • Mood disturbance (8 items) • Cognitive impairment (2 items) 	<ul style="list-style-type: none"> • Patients should be screened for depression and anxiety in the first month of stroke. • Patients with persistent visual neglect or visual field deficits should be offered specific retraining strategies.
Communication (6 items)	<ul style="list-style-type: none"> • Patients with specific communication difficulties should be assessed by a speech and language therapist.
Motor impairment (10 items)	<ul style="list-style-type: none"> • An experienced physiotherapist should coordinate therapy to improve motor performance.
Sensory impairment and pain (8 items)	<ul style="list-style-type: none"> • All patients should be assessed for pain on a regular basis.
Drugs reducing impairment (1 item)	<ul style="list-style-type: none"> • With the exception of analgesia, no drugs for reducing impairment should be prescribed routinely.
Functional rehabilitation interventions (20 items)	<ul style="list-style-type: none"> • A contact number should be provided for future advice or help with prescribed equipment.
Transfer back to the community	Example statement
Discharge planning (4 items)	<ul style="list-style-type: none"> • Carers should receive necessary equipment and training to ensure safe positioning and transfer of patients at home.
Long-term patient management	Example statement
Further rehabilitation after discharge (1 item)	<ul style="list-style-type: none"> • Patients with disability after 6 months should be assessed for additional rehabilitation.
Postdischarge social function (4 items)	<ul style="list-style-type: none"> • Patients who drove before their stroke need accurate up-to-date advice on their responsibilities.
Secondary prevention (13 items)	<ul style="list-style-type: none"> • Patients not on anticoagulation should take aspirin daily.

Instruments

Consumers

Interview questionnaire. An interview questionnaire, comprising 15 questions, was developed for this study to gather demographic and clinical information and details of computer experience and usage. The latter included frequency of computer and Internet use (every day, once a week, once a month, less than once a month), location of access (home, local library, or other), and confidence when using a computer. Consumers were asked whether they had accessed information about stroke using the Internet, and if they felt this would be a valuable resource. They were asked about stroke topics they would like more information on from a list commonly discussed in websites (what is a stroke, effects of a stroke, causes, prevention, treatment, rehabilitation, community living, experiences of others with stroke).

Rapid Assessment of Adult Literacy in Medicine. Consumers' reading ability was assessed using the Rapid Assessment of Adult Literacy in Medicine (REALM),²³ which is a reading recognition test that measures a person's ability to pronounce aloud 66 common medical words and lay terms for body parts and illness.²¹ Raw scores are con-

verted to grade range estimates: 3rd grade and below, 4th to 6th grade, 7th to 8th grade, 9th grade and above.

Website questionnaire. The accountability criteria identified by Kim et al.⁵ that could not be measured objectively by the researchers were included in the questionnaire. Using a visual analogue scale of 1 to 10 (*1 = poor* and *10 = excellent*), participants provided a score for each of the six selected websites according to 12 criteria (see **Table 1**). These criteria were grouped into three categories: design and aesthetics, ease of use, and content of site.

Health professionals

Health professional participants completed a self-administered questionnaire that was mailed to them with instructions. They were asked whether they had previously used the Internet to access client education resources for stroke and whether they felt this would be a valuable resource for people who had experienced stroke and their carers and families. They also completed the website questionnaire as above. Questions regarding the information contained in the site were modified to focus on health professionals' use of websites with clients. The final question (was the information

sufficient for your needs) was replaced with two questions regarding health professionals' perceptions of the accuracy and objectivity of the websites.

Procedure

One of the researchers (E.G.) met the consumers, either in their own homes, using a laptop if they did not own a computer, or in a room with a computer at the university campus. Consumers were asked to review each of the six websites for approximately 15 minutes. Health professionals were sent details of the six websites and were asked to review them in a set order, with a suggested time limit of 15 minutes per website. The order of presentation was randomized to avoid ordering effects.

Data were analyzed descriptively using the Statistical Package for the Social Sciences (SPSS, Version 11; SPSS, Chicago, IL). Some consumers were unable to rate all items in the website questionnaire due to fatigue. Independent sample *t* tests were used to compare the mean website scores for consumers and health professionals.

Results

Initial selection of 30 websites (see Table 3)

The initial selection of 30 websites included 22 sites from the United States, 2 sites from the United Kingdom, 1 European-based site, and 1 site each from Ireland and Australia. Eleven sites were created by commercial organizations, 10 by professional organizations (e.g., government, university, or hospital), and 6 by nonprofit organizations. Three sites did not identify either ownership or county of origin.

The content and presentation of the initial selection of 30 websites were analyzed according to the following measures.

*Accountability criteria identified by Kim et al.*⁵ Websites were rated according to 14 criteria devised from the eight objectively measured categories stated by Kim et al.⁵ Website scores ranged from 3 to 13 for these criteria, with a mean score of 9.3 ($SD = 2.0$). The most common

criteria met included stability for the duration of the study (all websites), no difficulty with access (29 websites), identification of purpose (27 sites), presence of links (27 sites), and provision of a contact address (27 sites). The most common criteria not met by sites included referencing of information (6 sites), provision of user support (7 sites), and an update during the previous 12 months (8 sites).

Flesch-Kincaid Reading Grade. Analysis of the content of the websites revealed grade level scores according to the Flesch-Kincaid Index that ranged from 7.3 to 12, with a mean score of 10.1 ($SD = 1.6$).

*Comparison of content with the National Clinical Guidelines for Stroke.*²² The content of each website relating to client education was compared with 77 items from the *National Clinical Guidelines for Stroke*. Scores ranged from 0 to 13, averaging 3.8 ($SD = 3.9$). The most common corresponding items were from the section describing secondary prevention, specifically the item stating "all patients should be given appropriate advice on lifestyle factors (such as not smoking, regular exercise, diet, achieving a satisfactory weight, reducing the use of added salt)."

The results of the aforementioned three tests were compiled and a sample was selected that represented the range of readability and reliability of website information according to the above measures. Websites were ranked in ascending order according to Flesch-Kincaid reading grade and were divided into three categories: high (mean reading grade 11.9), medium (mean reading grade 10.6), and low (mean reading grade 8.6) readability scores. The websites with the highest and lowest reliability ratings (according to the *National Clinical Guidelines for Stroke*²²) from each of these three categories were chosen. These six sites were then used as a representative sample for analysis by the participant groups (see Table 4).

Participants

Consumers. Consumers were aged from 26 to 69 years ($M = 55.9$, $SD = 10.8$). Seven were female and 8 were male. All participants in this group had previously used a computer and had access to a

Table 3. Objective evaluation of 30 randomly selected websites

Website name	Flesch-Kincaid reading grade	Reliability score	Accountability score	
Websites with a high reading grade (mean 11.9)				
European Stroke Initiative ^a	http://www.eusi-stroke.com/index.shtml	12.0	3	9
Stanford University Stroke Centre	http://www.stanford.edu/group/neurology/stroke/	12.0	0	11
The Stroke Association ^b	http://www.stroke.org.uk/factsindex.htm	12.0	2	8
Stroke	http://www.reutershealth.com/wellconnected/doc45.html	11.6	7	10
InteliHealth	http://www.intelihealth.com/IH/ihIH/WSIHW000/8772/8772.html	12.0	11	13
Neurology Channel	http://brainattacks.net/	12.0	4	12
Scientific American Explorations: A Strike Against Stroke	http://www.sciam.com/explorations/043096explorations.html	12.0	0	6
Websites with a medium reading grade (mean 10.6)				
American Speech-Language-Hearing Association	http://www.asha.org/speech/disabilities/Stroke.cfm	10.9	3	8
National Stroke Association	http://www.stroke.org/	11.7	7	8
Heart Center Online: for patients	http://www.heartcenteronline.com/	11.4	1	8
National Association for Alternative Medicine	http://naam-stroke.lle.org/	10.4	1	8
Family CaregiverAlliance Clearinghouse Factsheets: Stroke	http://www.caregiver.org/factsheets/stroke.html	11.7	1	11
University of Washington: Harborview Medical Center	http://depts.washington.edu/uwstroke/	8.5	1	9
Drkoop.com	http://drkoop.com/dyncon/toc.asp?id=1160	11.2	1	9
Northern Ireland Multidisciplinary Association for Stroke Teams ^c	http://www.stroke.cwc.net/	10.2	13	8
American Stroke Association	http://www.strokeassociation.org/	9.4	6	10
BBC Health: The Stroke Guide ^b	http://www.bbc.co.uk/health/stroke/	11.0	5	11
Stroke Survivors ^d	http://www.stroke-survivors.co.uk/	10.4	0	7
Websites with a low reading grade (mean 8.6)				
Stroke Association of Victoria ^e	http://home.vicnet.net.au/~stroke/	8.8	0	10
Yale New Haven Health Library	http://www.yalenehwhavenhealth.org/HealthTopics/HealthTopics.asp?URL=Stroke	9.5	5	13
Stroke Survivors ^d	http://www.stroke-survivors.com/	9.3	1	9
Methodist Health Care System: Stroke	http://www.methodisthealth.com/stroke/	9.3	1	9
Lifeclicnic	http://www.lifeclicnic.com/focus/stroke/diagnosis/asp	8.8	9	9
The Internet Stroke Center	http://www.strokecenter.org/	8.9	12	9
Stroke-TIA.org	http://www.stroke-tia.org/	8.4	9	11
Stroke Support ^d	http://strokesupport.com/info/stroke/default.asp	8.6	0	3
The Oregon Stroke Center	http://www.oregonstrokecenter.org/pat_index.php?main=pat_main.php	8.6	1	10
The Stroke Network	http://www.strokenetwork.org/	7.3	2	11
Welcome to SAFE - Stroke Awareness for Everyone	http://www.strokesafe.org/	7.9	6	10
The National Women's Health Information Center	http://www.4woman.gov/faq/Easyread/stroke-etr.htm/	7.6	2	9

^aEuropean-based website. ^bUnited Kingdom-based site. ^cIrish-based site. ^dSite origin not identified. ^eAustralian-based site.

computer at the time of the study. Twelve reported that they felt confident using the computer, and 12 had used the Internet prior to this study. Of the 12 who had Internet experience, 7 had used the Internet to access stroke information. Overall, 12 consumers felt that stroke information on the

Internet would be a valuable resource, and 9 identified specific topics relating to stroke that they would like to access more information on via the Internet. The most frequently identified topics included information on the experiences of others (10), community living (9), and rehabilitation (8).

Table 4. Websites evaluated by participants

Website number	Website name	Flesch-Kincaid reading grade	Reliability score	Accountability score
1	Stroke Support http://www.strokesupport.com/info/stroke/default.asp	8.6	0	3
2	The Internet Stroke Centre http://www.strokecenter.org	8.9	12	9
3	Stroke Survivors Website http://www.stroke-survivors.co.uk	10.4	0	7
4	Northern Ireland Multidisciplinary Association for Stroke Teams http://www.stroke.cwc.net	10.2	13	8
5	Aetna Intellihealth http://www.intelihealth.com/IH/ihtIH/WSIHW000/8772/8772.html	12	11	13
6	Stanford University Stroke Center http://www.stanford.edu/group/neurology/stroke	12	0	11

Five consumers experienced aphasia as a result of their stroke, however, only one of these was unable to complete the REALM as a result. According to the REALM, 11 consumers had a reading ability of grade 9 or above and 3 had a reading ability of grade 7 to 8 level.

Health professionals. The health care professional group included two occupational therapists, two physiotherapists, two doctors, two speech pathologists, two nurses, and one social worker. Although all felt that client education resources on the Internet would be a valuable resource for people who had experienced stroke and their carers and families, only four had previously accessed the Internet for clients with stroke.

Participant analysis of six websites. Consumers and health professionals rated the six selected websites according to criteria identified by Kim et al.⁵ (see **Table 1**). **Tables 5, 6, and 7** show the mean scores, ranges, and standard deviations for each of the criteria in the categories of design and aesthetics, ease of use, and content of site. Although consumers consistently scored websites more favorably than health professionals, there was agreement between groups on the best and worst websites. Website 2 received the best score by both groups across all categories, and it had one of the highest reliability scores and one of the lowest readability ratings on objective measures. Websites 1 and 4 were consistently rated the worst, despite website 1 having the lowest reading grade and website 4 recording the highest score for information reliability.

When compared with the Flesch-Kincaid reading grade for each website, both consumers and health professionals scored the websites with the lowest reading grade scores as the easiest to read (2, 1, 3, and 1, 3, 2, respectively), and the websites with the highest reading grade scores as the most difficult to read (5, 6, 4, and 6, 4, 5, respectively).

The three websites with the highest reliability ratings according to comparison with the *National Clinical Guidelines for Stroke*²² were scored first, second, and fourth highest by health professionals, while the websites with the lowest reliability ratings were scored third, fifth, and sixth highest by health professionals for measures of accuracy and objectivity.

Discussion

The random sample of 30 websites contained a large proportion of sites from the United States (22 of 30 sites), consistent with a review by Baird who suggested that the majority of stroke websites are North American in origin.²⁴ This may present a problem for non-American consumers for whom terminology and information regarding local supports and services may not be appropriate.

Selected websites were initially analyzed according to objective measures to determine their accountability and the readability and reliability of the information they contained. Scores ranging from 3 to 13 ($M = 9.3$, $SD = 2.0$) were recorded for website accountability according to criteria identi-

Table 5. Comparison of website ratings by consumers and health professionals on design and aesthetics criteria (best possible score of 50)

Website number ^a	Consumers			Health professionals			<i>t</i>	<i>p</i>
	<i>M</i>	Range	<i>SD</i>	<i>M</i>	Range	<i>SD</i>		
1	26.7	13-37	6.9	20.4	13-33	6.3	2.4	.026*
2	37.8	25-50	8.1	33.7	4-45	12.4	1.0	.348
3	29.8	20-37	5.1	22.2	13-37	7.1	2.9	.009*
4	36.2	17-49	12.9	26.0	10-39	10.2	2.1	.046*
5	28.5	14-41	6.8	25.3	9-37	7.8	1.1	.301
6	35.4	5-50	12.6	32.0	13-45	9.9	0.7	.467

Note: For specific criteria, refer to **Table 1** (subjective criteria).

^aFor name of website, refer to **Table 3**.

*Indicates significant values.

Table 6. Comparison of website ratings by consumers and health professionals on ease of use criteria (best possible score of 30)

Website number ^a	Consumers			Health professionals			<i>t</i>	<i>p</i>
	<i>M</i>	Range	<i>SD</i>	<i>M</i>	Range	<i>SD</i>		
1	25.3	18-30	3.9	19.9	9-29	6.7	2.4	.026*
2	26.5	20-30	3.6	23.3	16-27	4.0	2.0	.054
3	25.5	21-30	2.9	22.5	15-30	4.4	1.9	.073
4	20.3	5-30	9.7	15.1	3-26	7.6	1.4	.168
5	22.8	7-30	6.3	18.1	3-27	7.6	1.6	.124
6	24.0	3-30	7.8	20.4	3-30	6.9	1.2	.236

Note: For specific criteria, refer to **Table 1** (subjective criteria).

^aFor name of website, refer to **Table 3**.

*Indicates significant values.

Table 7. Comparison of website ratings by consumers and health professionals on content criteria (best possible score of 30)^a

Website number ^b	Consumers			Health professionals			<i>t</i>	<i>p</i>
	<i>M</i>	Range	<i>SD</i>	<i>M</i>	Range	<i>SD</i>		
1	21.9	12-30	5.6	18.8	13-26	4.2	1.5	.135
2	24.8	15-30	4.7	22.3	17-26	3.1	1.5	.156
3	23.0	17-30	3.4	17.2	13-24	3.7	3.9	.001*
4	22.4	7-30	8.1	16.7	6-25	6.2	1.9	.071
5	22.9	7-30	6.1	20.3	9-30	6.4	1.0	.309
6	22.3	3-30	8.5	19.4	8-23	4.3	1.1	.301

Note: For specific criteria, refer to **Table 1** (subjective criteria).

^aCommon criteria scored by both participant groups. ^bFor name of website, refer to **Table 3**.

*Indicates significant values.

fied by Kim et al.,⁵ indicating the varying levels of compliance with these well-recognized standards.²⁵ Similar to other findings,²⁶ the criteria with which there was least compliance were those that are essential to ensure a degree of reliability of website information (i.e., referencing and regular updates). A study by Coulter et al.¹⁴ also identified that very few client education materials (including Internet-based materials) contained information regarding the primary sources on which they were based and that only one third of materials contained a publication date.

Comparison with the *National Clinical Guidelines for Stroke*²² demonstrated minimal inclusion of the recommendations, with between 0 and 13 items contained in the websites. With a mean score of 3.8 (5% of items), the websites contained little or no information regarding best practice in the areas of rehabilitation, transfer back to the community, or long-term management. Although this does not necessarily reflect that the information contained in the sites is incorrect, it indicates that they have failed to include balanced best evidence with regard to topics that are frequently identified as important.^{27,28} This reflects the suggestion of Coulter et al.¹⁴ that few client education materials meet the recommended standards of accuracy.²⁹ If education materials are to support consumers' involvement in the clinical process, they must contain relevant, research-based data,¹⁴ and present information consistent with current evidence-based practice.²⁹

Websites that provided a larger proportion of specific evidence-based information were more likely to be rated by health professionals as containing more accurate and objective information overall. Health professionals need to be critical consumers of web information in order to recommend high quality sites to clients. The results of this study indicate their ability to do this.

Despite the relatively high ratings recorded for website accountability ($M = 9.3$, out of a best possible score of 14), reliability ratings according to the *National Clinical Guidelines for Stroke*²² were consistently low ($M = 3.8$, out of best possible score of 77). Although the accountability criteria listed by Kim et al.⁵ are important factors to consider when assessing a website, they do not accu-

rately reflect the quality of the information contained in the website. Other studies investigating a variety of health topics on the Internet have documented similar findings indicating that features of website credibility and accountability do not necessarily correlate with the accuracy of information contained in the website.^{12,30} This can make it difficult for consumers (particularly those with limited health knowledge) to judge the quality of the material contained in websites.

The mean readability level of website information was found to be 10th grade 1 month (range, 7.3 to 12). This is equivalent to the mean readability level identified in a review of 50 client education materials on the Internet.¹⁶ If education materials are to be read and understood, they must be written at a level appropriate to the target audience. A reading level of 6th to 7th grade has been recommended by several sources as an optimal reading level for client education material.¹⁷⁻¹⁹ Congruent with claims in the literature,³¹ all websites reviewed exceeded this recommended reading level, potentially making it difficult for consumers to understand their content.

The reading levels of consumers were found to be higher than averages reported in the literature. Almost 80% had a REALM score of 9th grade or above, with the remainder scoring at a grade 7 to 8 level. This may indicate a possible bias in this participant group, as the mean REALM score for the general population is reported as 6th to 7th grade.¹⁷⁻¹⁹ Despite the high overall reading levels of consumers, they still found the websites with lower reading grades easier to understand and those with higher reading grades more difficult to understand.

Consumers included a sample of 11 people who had experienced stroke and 4 primary informal caregivers who were asked to provide information regarding their use of Internet-based stroke education resources. All consumers had previously used a computer, and 12 had previously accessed the Internet. Of this 12, over half had accessed stroke information and could identify specific topics about which they would like more information. Other studies have found that a large proportion of people who had experienced stroke wanted more information, especial-

ly regarding community services and the recovery process.¹⁶ This is consistent with the topics most frequently identified by consumers in this study, including rehabilitation and community living. Several studies have shown that people who had experienced stroke and their families were not satisfied with the amount of information received in hospital and that this group of people is poorly informed about stroke.^{2,27} Most wanted more information on their condition and treatment than was provided.^{14,32} The Internet provides an accessible means for people to do so, which is reflected in over half of participants in this study with Internet experience who used this resource to access further information about their condition.

Consumers and health professionals rated six websites on design and aesthetics, ease of use, and content criteria. The mean scores recorded by consumers for these categories indicated that, overall, they were most satisfied with the ease of use of the websites followed by their content and were least satisfied with website design and aesthetics. This may be attributed to participants' confidence and experience with this medium, resulting in higher ease of use ratings and more critical ratings for design and aesthetics due to their knowledge of what this medium can offer.

Consumers consistently recorded higher scores for all common criteria (1–11) than health professionals. This disparity may be due to the increased familiarity of health professionals with the Internet medium in the area of health and the differing needs and preferences of these two populations. According to Coulter et al.,¹⁴ health professionals tend to be more critical of education materials than their clients. This highlights the importance of involving consumers when developing and recommending these materials to ensure that their needs are met.

Website 2 scored favorably on reliability and readability ratings according to the initial objective measures and was rated highest by participants in both groups in all categories. Website 6 was rated favorably by participants despite it recording the worst readability and reliability ratings. Website 1 was the easiest to read but received the lowest mean rating by consumers.

This may reflect the high reading ability of consumers in this study, causing them to be more comfortable with websites of a higher reading level. Website 4 received the lowest mean rating from health professionals, despite receiving the highest objective reliability measure of all six websites. This appears to reinforce that idea that there may be a variety of factors (such as design features and personal experience) that influence a person's opinion of websites.

The number of participants in the study ($N = 26$) precluded the use of inferential statistics. The high reading ability and level of computer use of consumers and the method of their recruitment (voluntary participation from members of stroke groups) may make this sample unrepresentative of people who have experienced stroke and their carers. The participant questionnaire was developed for the purposes of this study and has not been subjected to measures of reliability or validity. Participants had limited time to review each website (approximately 10 to 15 min each), which was insufficient to view the entirety of content in the larger sites in detail.

Conclusion

This study showed the variability that exists in the reliability, accountability, and readability of Internet stroke education materials, which has implications for their use by consumers. Consumers appeared to be critical of this medium and were able to identify factors that contribute positively and negatively to their perceptions of websites. Although the opinions of consumers and health professionals were similar, differences were present; this emphasizes the importance for website developers and health professionals to be conscious of the needs of consumers when creating and recommending websites. Website information should be consistent with current evidence and should be presented in a way that is easily read and understood by consumers. Consumers should be involved in the process of website design to ensure that an optimal product is developed for their needs. Further study is needed to determine exactly what website characteristics best meet the needs of this consumer group.

REFERENCES

1. Impicciatore P, Pandolfini C, Casella N, Bonati M. Reliability of health information for the public on the world wide web: systematic survey of advice on managing fever in children at home. *BMJ*. 1997;314:1875-1884.
2. Wellwood I, Dennis MS, Warlow CP. Perceptions and knowledge of stroke among surviving patients with stroke and their carers. *Age Ageing*. 1994;23:293-298.
3. Benigeri M, Pluye P. Shortcomings of health information on the Internet. *Health Promot Int*. 2003;18:381-386.
4. Computer-based consumer health information. *The Consumer Health Information Source Bulletin*. 2000;6:70-81.
5. Kim P, Eng TR, Deering MJ, Maxfield A. Published criteria for evaluating web sites: review. *BMJ*. 1999;318:647-649.
6. Forster A, Smith J, Young J, Knapp P, House A, Wright J. Information provision for stroke patients and their caregivers (Cochrane Review). *The Cochrane Library*. 2001(1).
7. Kuster JM. Internet resources for stroke and aphasia. *Top Stroke Rehabil*. 2000;7(2):21-31.
8. O'Mahony PG, Rodgers H, Thomson RG, Dobson R, James OFW. Satisfaction with information and advice received by stroke patients. *Clin Rehabil*. 1997;11:68-72.
9. Lewis D. The Internet as a resource for healthcare information. *JAMA*. 1998;283(13):1677.
10. Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the Internet. *JAMA*. 1997;277:1244-1246.
11. Cline RJW, Haynes KM. Consumer health information on the Internet: the state of the art. *Health Educ Res*. 2001;16:671-692.
12. Griffiths KM, Christensen H. Quality of web based information on treatment of depression: cross-sectional survey. *BMJ*. 2000;321:1511-1515.
13. Seidman JJ, Steinwachs D, Rubin HR. Design and testing of a tool for evaluating the quality of diabetes consumer-information websites. *J Med Internet Res*. 2003;5:e30.
14. Coulter A, Entwistle V, Gilbert D. Sharing decisions with patients: Is the information good enough? *BMJ*. 1999;318:318-322.
15. Wyatt JC. Commentary: measuring quality and impact of the world wide web. *BMJ*. 1997;314:1879-1883.
16. Graber MA, Roller CM, Kaeble B. Readability levels of patient education material on the World Wide Web. *J Fam Pract*. 1999;48(1):58-63.
17. Davis TC, Mayeaux EJ, Fredrickson D, Bocchini JA, Jackson RH, Murphy PW. Reading ability of parents compared with reading levels of pediatric patient education materials. *Pediatrics*. 1994;93(3):460-468.
18. Estrada CA, Hryniewicz MM, Barnes Higgs V, Collins C, Byrd JC. Anticoagulant patient information material is written at high readability levels. *Stroke*. 2000;31:2966-2970.
19. Clement WA, Wilson S, Bingham BJ. A guide to creating your own patient-oriented website. *J R Soc Med*. 2002;95:64-67.
20. Australian Bureau of Statistics. *Aspects of Literacy: Assessed Skill Levels*. Canberra: Australian Bureau of Statistics; 1996.
21. Sullivan-Fowler M. Consumer health web sites. *Consumer Health Information Source Bull*. 2000;6:94-113.
22. The Intercollegiate Working Party for Stroke. National Clinical Guidelines for Stroke. Royal College of Physicians. Available at: <http://www.rcplondon.ac.uk/pubs/books/stroke/>. Accessed August 14, 2001.
23. Murphy PW, Davis TC, Long SW, Jackson RH, Decker BC. Rapid Estimate of Adult Literacy in Medicine (REALM): a quick reading test for patients. *J Reading*. 1993;37(2):124-130.
24. Baird TA. Surfing for stroke: websites on stroke for patients and professionals. *J Neurol Neurosurg Psychiatry*. 2001;70(4):i2.
25. Eysenbach G. Consumer health informatics. *BMJ*. 2000;320:1713-1716.
26. Doupi P, Van Der Lei J. Rx medication information for the public and the WWW: quality issues. *Med Inform*. 1999;24:171-179.
27. Hanger HC, Mulley GP. Questions people ask about stroke. *Stroke*. 1993;24:536-538.
28. van Veenedaal H, Grinspun DR, Adriaanse HP. Educational needs of stroke survivors and their family members, as perceived by themselves and by health professionals. *Patient Educ Counseling*. 1996;28:265-276.
29. Coulter A. Evidence based patient information is important, so there needs to be a national strategy to ensure it. *BMJ*. 1998;317(7153):225-227.
30. Kunst H, Groot D, Latthe PM, Latthe M, Khan KS. Accuracy of information on apparently credible websites: survey of five common health topics. *BMJ*. 2002;324:581-582.
31. Eysenbach G, Jadad AR. Evidence-based patient choice and consumer health informatics in the Internet age. *J Med Internet Res*. 2001;3:e19.
32. O'Mahony PG, Rodgers H, Thomson RG, Dobson R, James OFW. Satisfaction with information and advice received by stroke patients. *Clin Rehabil*. 1997;11:68-72.