

# Online Patient Resources to Support Shared Decision Making For Fundoplication Surgery: A Review Article

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## Abstract

**Introduction:** The royal college of Surgeons' Supported Decision-Making guidance details how patients should access information necessary to make clinical decisions alongside their medical team. As patients become more reliant on information found via the internet, it is important to ensure that there are suitable, validated and appropriate resources. This study aims to assess the quality of online patient information related to anti reflux (Fundoplication) surgery and we believe this review is first of its kind with regards to surgery for gastroesophageal reflux disease.

**Methods:** A comprehensive, targeted search was made of online healthcare information relating to Fundoplication surgery. Search terms 'fundoplication' and 'anti-reflux surgery' were entered into three main search engines using a pre-defined search strategy. Websites were assessed according to their readability (Klesch-Kincaid Reading Ease Score), quality and content (International Patient Decision Aids Standards (IPDAS) and DISCERN scores) as well as the presence of accreditation. The PRISM and AMSTAR guidelines have been followed in this article.

**Results:** Overall, 74 sources from three search engines were found. Duplicates were removed and pre-defined eligibility criteria applied, giving 40 sources for analysis. The mean readability score of literature was higher than the recommended score for patient education materials, while the IPDAS and DISCERN scores were low. Areas of weakness were in describing non-treatment option and lack additional source of sport and information. There were only 22.5% of the websites that are accredited by the HANcode and the rest with no form of accreditation. However, no statistical significance was found on the overall quality of websites between the accredited and non accredited websites

**Conclusion:** Patient information available online for fundoplication is difficult to read, is of poor quality and is lacking in clear sources. In order to allow for shared decision-making, there is a need for high quality resources made available for patients.

**Keywords:** Reflux disease, Anti-reflux surgery, Online health resources shared decision making

## Introduction

Gastroesophageal reflux disease (GERD) by the Montreal definition is a condition of troublesome symptoms and complications that result from the reflux of stomach contents into the oesophagus [1]. It is a common upper gastrointestinal diagnosis with a prevalence as high as 8.8-25.9% in Europe as opposed to 2.5-7.8% in the East. Affecting a wide range of ages with 30-39 years age group being more common [2]. It can present with a large variety of symptoms with varying degrees of severity. This condition often requires daily medication which in turn can have a significant negative impact on patient's quality of life [3].

The symptoms can be long term and debilitating causing severe lifestyle restrictions. Normal modalities of investigation are through esophago gastro duodenoscopy (EGD), Ph and manometry [4]. Treatment option involves life style modifications, medical management, endo-luminal and surgical management [5]. The surgical management is often offered in case other two option fail or for severe cases with notable complication. The NICE guidelines recommend considering laparoscopic fundoplication for people with confirmed diagnosis of acid reflux and adequate symptom control with acid suppression therapy, but who do not wish to continue with this therapy long term or in those that are responding to a PPI, but who cannot tolerate acid suppression therapy [6].

The gold standard for surgical management is laparoscopic Fundoplication in severe cases of GERD with a 95% satisfaction rate amongst patients [7]. Anti reflux surgery is considered a lifestyle

changing rather than a lifesaving operation. Although a relatively safe surgery it is still a major operation for patients who have to consider the risks and benefits applicable to their individual circumstances. Hence, it is important that patients consider all the risks, benefits and alternatives carefully with the aid of comprehensive, shared consent.

The current guidance from the Royal College of Surgeons England specifies consent as a shared and supported decision making process [8]. In the limited period of time a patient spends with surgical doctor it is not possible to have all question answered.

Hence it is quite natural for people looking for further information to help them make a decision towards the surgery by searching the internet at their own time.

The purpose of this review is to assess the available material regarding fundoplication online for its content and quality in view of aiding the process of shared decision making.

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## Methods

A comprehensive, targeted search was made of online healthcare information relating to Fundoplication surgery using search terms 'fundoplication' and 'anti-reflux surgery'. Three main search engines were used with pre-defined search strategy. Websites were assessed according to their readability (Klesch-Kincaid Reading Ease Score), quality and content (International Patient Decision Aids Standards (IPDAS) and DISCERN scores) as well as the presence of accreditation. The work has been carried out and reported in line with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and AMSTAR (Assessing the methodological quality of systematic reviews) Guidelines.

## Search Strategy

Searches were performed on three search engines: Google ([www.google.co.uk](http://www.google.co.uk), California, USA), Yahoo ([uk.yahoo.com](http://uk.yahoo.com), California, USA), and Bing ([www.bing.com](http://www.bing.com), Washington, USA). NHS Evidence, NHS Choices, the UK Clinical Trials Gateway (Be Part of Research) and the Decision Aid Library Inventory (DALI).

All searches use the search terms 'anti-reflux surgery' or 'fundoplication' as would be expected by a patient carrying out the search. Websites on the first two pages of each search across the three search engines were assessed for inclusion. The authors restricted the search option to the first two pages of each search engine to capture the most 'visible' data. Many patients may read more widely and thus identify resources beyond those considered in this study. Previous studies have shown, however, that 92% online users do not search beyond the first page when using a search engine [9]. Results were limited to those in English language. Private browsing was enabled in order to avoid any personalization based on researchers' own search history.

## Data Extraction

Data was collected independently by two authors (RK and AM). Conflicts were resolved by consensus or a third senior author. Data were extracted onto a Microsoft Excel 2019 (Microsoft, Washington, USA) spreadsheet.

## Inclusion and Exclusion Criteria

Data were screened for duplicates and these removed. Full-text analysis was carried out against the following pre-defined inclusion criteria:

- Content relating to fundoplication surgery
- Aimed at patients and not medical professionals (simple English)
- Content in English language

Sources were excluded if they did not meet inclusion criteria or meet the following pre-defined exclusion criteria: adverts for private institutions, academic resources (e.g. journals and academic journals), websites requiring subscription, patient forums, video resources (e.g. YouTube), and advert links.

## Data Analysis

The websites incorporated in this systematic review were analysed using the Flesch-Kincaid reading ease score, DISCERN score, HONcode certification, the information standard certification and the IPDAS score.

## Flesch-Kincaid Reading Ease Score

A valuable and widely used computer calculation index developed by Rudolf Flesch and J Peter Kincaid that indicates what level of education someone will need to read and understand with ease texts on a website [10]. Reading ease is represented as a range of number between 0 to 100 based on a mathematical formula. Typical factors used for readability scoring include:

- Average sentence length
- Syllable count
- Percentage of multi-syllable words
- Average word length
- Familiarity of words
- Complexity of sentences

The obtained score basically implies that the higher the range the easier the text is to read. The following is used as a guide:

- Scores 90 – 100 considered easily understandable by an average education of fifth standard or grade student or 11 years old
- Scores 60 – 70 considered easily understandable by an average education of eighth and ninth standard or grade student or 14 to 15 years old
- Scores 0 – 30 considered easily understandable by college graduate

A readability score of 90 – 100 would ensure that 85% population is able to read the content of the website. For the purpose of the review we have used the online tool <http://www.prepostseo.com/readability-checker> to calculate the score for each website.

## DISCERN Score

This is a reliable tool which assesses the quality of information written up specifically on health-related topics for patients. The information is pertaining to a disease and related matters like symptoms, diagnosis and treatment for patients. It utilizes a Likert 5 points scale based on 16 questions rated accordingly on the point system. On the scale 5 implying complete satisfaction of quality criteria, 1 being none of the criteria satisfied and 2-4 being partial satisfaction. The two authors involved in this review scored each website for consensus. A DISCERN manual was used to verify the scoring. The 16<sup>th</sup> question is implicated to an overall score on the same Likert scale [11]. All sites were scored by two authors (AM and RK) with a third senior author for validation.

## HONcode Certification

HON refers to a service of the health on Net code of conduct. It focuses only on contents pertaining to human health published online. Their aims to define a set of rules that will hold websites to adhere to a basic ethical standard in the information presented online and ensure the readers know the source and purpose of published online information [12].

## The information standard certification

This is a certificate provided by the NHS England. This certificate supports publications of high-quality healthcare related information. It is compiled of 6 principles each supported by quality statement based on best practice. Details of the principles and the quality statement

can be found online (<https://www.england.nhs.uk/tis/about/the-info-standard/>).

### IPDAS score

It represents an internationally accepted Patient Decision Aids Standard scoring system. It aims at the quality and effectiveness of aids available to patients for decision making. It identifies health related information interns of its quality, qualifying criteria and certification. It comprises of a 12 item checklist against with websites are scored. All the websites described in this review have been scored against this check list [13,14]. All sites were scored by two authors (AM and RK) with a third senior author for validation.

### Results

Initial search from three search engines yielded 74 sources (Figure 1). After applying the inclusion and exclusion criteria this number was narrowed down to 40 sources for analyses (Table 1). This accounts for only 54% of the online information meeting the defined criteria for laparoscopic Fundoplication in this review.

The Readability score was computed by using the Flesch-Kincaid tool for the 40 websites that were short listed. The descriptive statistic for these scores was obtained using the SPSS software. Results show that the average readability material available scored 52.2+/-13.2 standard deviation corrected to one decimal place. The median score

notes is 51.2, which implies that most of the available information online regarding Laparoscopic Fundoplication is suitable for ages 15.

On applying the DISCERNS scoring system for the same 40 websites, an average for each of the 16 questions was computed. Most of the websites partially satisfied the quality criteria. In the case of 3 questions regarding that of shared decision making, information on consequences on no treatment given and details of additional sources of support and information very few websites satisfied the criteria with an average score of less than 2. The statistical descriptive figures noted a mean of 2.9+/-0.8 standard deviation. The minimum score was 1.3 and the maximum was 4.5. The median score was 2.8 (Figure 2).

Similar results were noted on applying the IPDAS scoring system. A mean of 5.5+/-2.4 as the standard deviation was noted. Only 2 websites achieved a higher score of 10. The ideal score recommended by IPDAS is 12. One website scored 0, meaning it did not score on any criteria put down by the IPDAS scoring system. The area were most websites failed to score was in describing the experience of the consequences of options, update of policy provided and funding sources. The median score was 6 implying most websites only satisfy 50% of the recommended criteria by IPDAS.

Overall the combined results of the selected 40 websites show reasonable readability for age group 15 years and above but low quality of the written information for laparoscopic Fundoplication

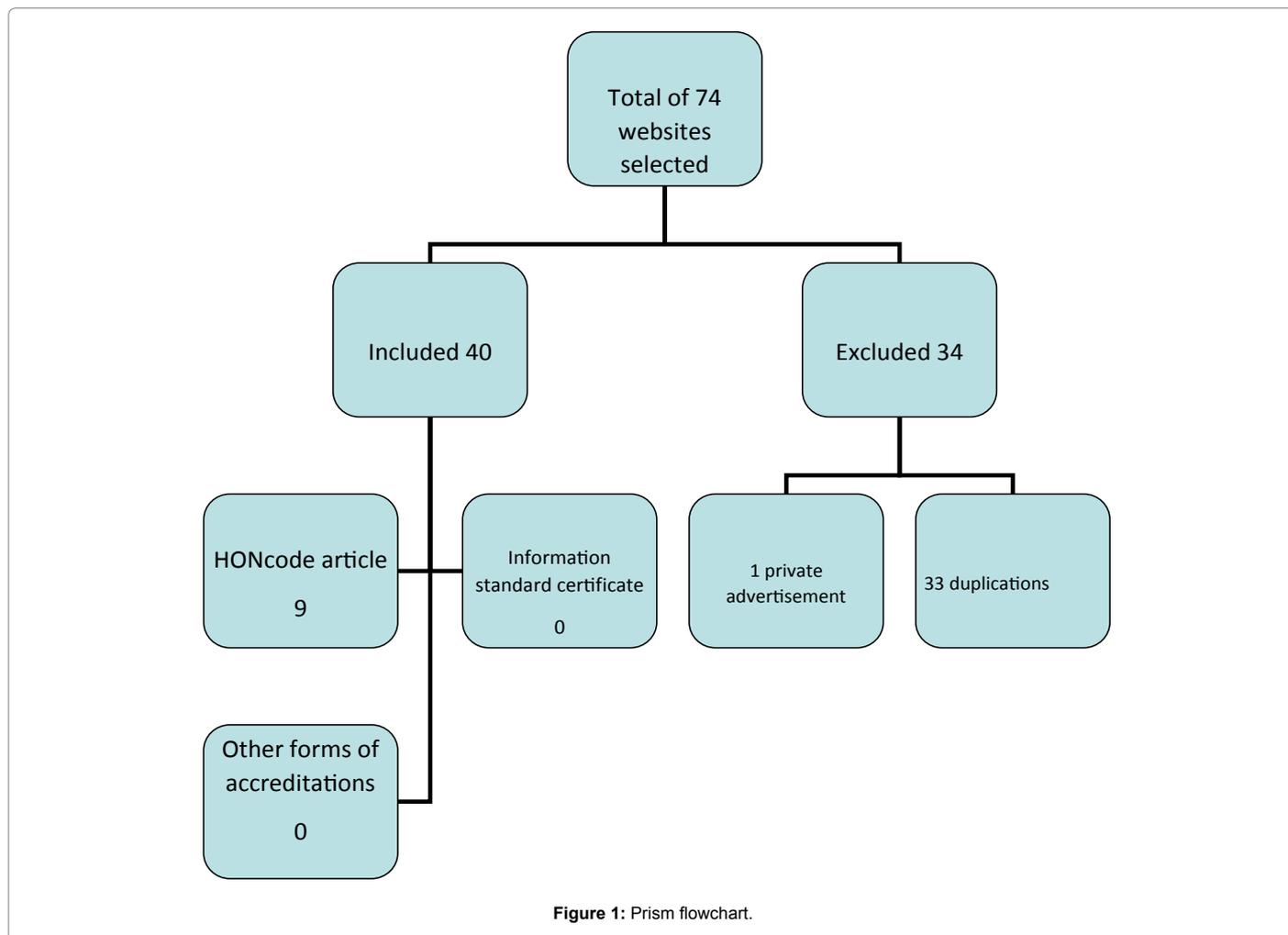


Figure 1: Prism flowchart.

#	Source and HONCoed	Author	Country of origin	Described treatment (medical / surgical / both)
<b>Bing - fundoplication</b>				
1		<a href="https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication">https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication</a>		
		Bupa	UK	Both
2		<a href="https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#2">https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#2</a>		
		WebMD	USA	Surgical
3		<a href="https://www.medicinenet.com/fundoplication/article.htm">https://www.medicinenet.com/fundoplication/article.htm</a>		
		Medicine Net	USA	Surgical
4		<a href="https://healthjade.net/fundoplication/">https://healthjade.net/fundoplication/</a>		
	None	Health Jade	USA	Both
5		<a href="https://www.nbt.nhs.uk/our-services/a-z-services/upper-gastro-intestinal-surgery/laparoscopic-fundoplication">https://www.nbt.nhs.uk/our-services/a-z-services/upper-gastro-intestinal-surgery/laparoscopic-fundoplication</a>		
	None	North Bristol NHS Trust	UK	Surgical
6		<a href="http://reflux.surgery/fundoplication/">http://reflux.surgery/fundoplication/</a>		
	None	Reflux Surgery	UK	Surgical
7		<a href="https://www.healthline.com/health/gerd/fundoplication">https://www.healthline.com/health/gerd/fundoplication</a>		
		HealthLine	USA	Surgical
8		<a href="https://www.bmihealthcare.co.uk/treatments/gastroenterology/nissen-fundoplication-laparoscopic#gdpr-out">https://www.bmihealthcare.co.uk/treatments/gastroenterology/nissen-fundoplication-laparoscopic#gdpr-out</a>		
	None	BMI Healthcare	UK	Surgical
9		<a href="https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/">https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/</a>		
	None	Hull University Teaching Hospitals	UK	Surgical
10		<a href="https://www.drmalladi.com/reflux-surgery/nissen-fundoplication/">https://www.drmalladi.com/reflux-surgery/nissen-fundoplication/</a>		
	None	Dr Malladi	USA	Surgical
<b>Bing - anti-reflux surgery</b>				
11		<a href="https://medlineplus.gov/ency/article/002925.htm">https://medlineplus.gov/ency/article/002925.htm</a>		
		Medline Plus	USA	Surgical
12		<a href="https://www.bmihealthcare.co.uk/treatments/general-surgery/gastroesophageal-reflux-surgery--anti-reflux-surgery">https://www.bmihealthcare.co.uk/treatments/general-surgery/gastroesophageal-reflux-surgery--anti-reflux-surgery</a>		
	None	BMI Healthcare	UK	Surgical
13		<a href="https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf">https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf</a>		
	None	Royal United Hospital Bath NHS Trust	UK	Both
14		<a href="https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery">https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery</a>		
	None	Ramsay Health Care (Springfield Hospital)	UK	Both
15		<a href="https://www.birmingham-upper-gastrointestinal-surgery.co.uk/surgical-procedures/anti-reflux-surgery/">https://www.birmingham-upper-gastrointestinal-surgery.co.uk/surgical-procedures/anti-reflux-surgery/</a>		
	None	Ewen Griffiths	UK	Both
16		<a href="https://www.circlehealth.co.uk/treatments/anti-reflux-surgery">https://www.circlehealth.co.uk/treatments/anti-reflux-surgery</a>		
	None	Circle Health	UK	Surgical
17		<a href="http://www.refluxsurgery.co.uk/reflux-disease-gord/#treatment">http://www.refluxsurgery.co.uk/reflux-disease-gord/#treatment</a>		
	None	Mr Andrew Jenkinson	UK	Both
18		<a href="https://www.ramsayhealth.co.uk/treatments/anti-reflux-surgery">https://www.ramsayhealth.co.uk/treatments/anti-reflux-surgery</a>		
	None	Ramsay Health Care	UK	Surgical
19		<a href="https://www.ashteadhospital.co.uk/treatments/anti-reflux-surgery">https://www.ashteadhospital.co.uk/treatments/anti-reflux-surgery</a>		
	None	Ashstead Hospital	UK	Surgical
20		<a href="http://www.refluxsurgery.co.uk/reflux-surgery/">http://www.refluxsurgery.co.uk/reflux-surgery/</a>		
	None	Mr Andrew Jenkinson	UK	Both
21		<a href="https://my.clevelandclinic.org/health/treatments/4354-laparoscopic-antireflux-surgery">https://my.clevelandclinic.org/health/treatments/4354-laparoscopic-antireflux-surgery</a>		
		Cleveland Clinic	USA	Both
<b>Yahoo - anti-reflux surgery</b>				
22		<a href="https://www.sages.org/publications/patient-information/patient-information-for-laparoscopic-anti-reflux-gerd-surgery-from-sages/">https://www.sages.org/publications/patient-information/patient-information-for-laparoscopic-anti-reflux-gerd-surgery-from-sages/</a>		
	None	SAGES	USA	Both
23		<a href="https://www.southwestreflux.co.uk/reflux-disease/keyhole-anti-reflux-surgery/">https://www.southwestreflux.co.uk/reflux-disease/keyhole-anti-reflux-surgery/</a>		
	None	South West Reflux	UK	Surgical
24		<a href="https://thesurgerygroup.com/services/anti-reflux-surgery/">https://thesurgerygroup.com/services/anti-reflux-surgery/</a>		
	None	The Surgery Group	USA	Surgical

Yahoo - fundoplication				
25		https://www.ouh.nhs.uk/patient-guide/leaflets/files/100629laparoscopicnissen.pdf		
	None	Oxford Radcliffe Hospitals	UK	Surgical
26		https://badgut.org/information-centre/a-z-digestive-topics/fundoplication/		
	None	Canadian Society of Intestinal Research	Canada	Surgical
27		https://www.nth.nhs.uk/content/uploads/2016/08/Surg543-Laparoscopic-Nissen-Fundoplication-14.06.16-RB.pdf		
	None	North Tees and Hartlepool NHS Foundation Trust	UK	Surgical
Google - anti-reflux surgery				
28		https://www.ruh.nhs.uk/patients/services/upper_gi/non_cancer/reflux.asp?menu_id=11		
	None	Royal Unid Hospital Bath NHS Trust	UK	Both
29		https://www.nuffieldhealth.com/treatments/laparoscopic-anti-reflux-surgery		
	None	Nuffield Health	UK	Both
30		https://www.aboutgerd.org/surgery/surgical-treatments.html		
	None	International Foundation for Gastrointestinal Disorders	USA	Both
31		https://www.aboutgerd.org/surgery/gerd-and-hiatal-hernia-surgery.html		
	None	International Foundation for Gastrointestinal Disorders	USA	Both
32		https://www.healthline.com/health/gerd/surgery		
		Healthline	USA	Both
33		https://www.uwhealth.org/health/topic/surgicaldetail/fundoplication-surgery-for-gastroesophageal-reflux-disease-gerd/hw95701.html		
	None	University of Wisconsin Health	USA	Both
Google - fundoplication				
34		https://www.uofmhealth.org/health-library/hw95701		
	None	University of Michigan Health	USA	Both
35		https://www.gosh.nhs.uk/conditions-and-treatments/procedures-and-treatments/fundoplication-0		
	None	GOSH	UK	Both
36		https://www.uclh.nhs.uk/PandV/PIL/Patient%20information%20leaflets/Laparoscopic%20Fundoplication.pdf		
	None	University College London Hospitals	UK	Both
37		https://www.mayoclinic.org/diseases-conditions/gerd/multimedia/gerd-surgery/img-20006950		
		Mayo Clinic	USA	Surgical
38		https://www.mcw.edu/departments/surgery/divisions/general-surgery/patient-care/gerd-and-gastrointestinal-surgery-program/gastroesophageal-reflux-disease-gerd/laparoscopic-nissen-fundoplication-gerd-surgery		
	None	Medical College of Wisconsin	USA	Surgical
39		https://www.ramsayhealth.co.uk/treatments/nissen-fundoplication		
	None	Ramsay Health care	UK	Both
40		https://my.clevelandclinic.org/health/treatments/4200-fundoplication-procedure-for-children		
		Cleveland Clinic	USA	Surgical

Table 1: List of selected websites.

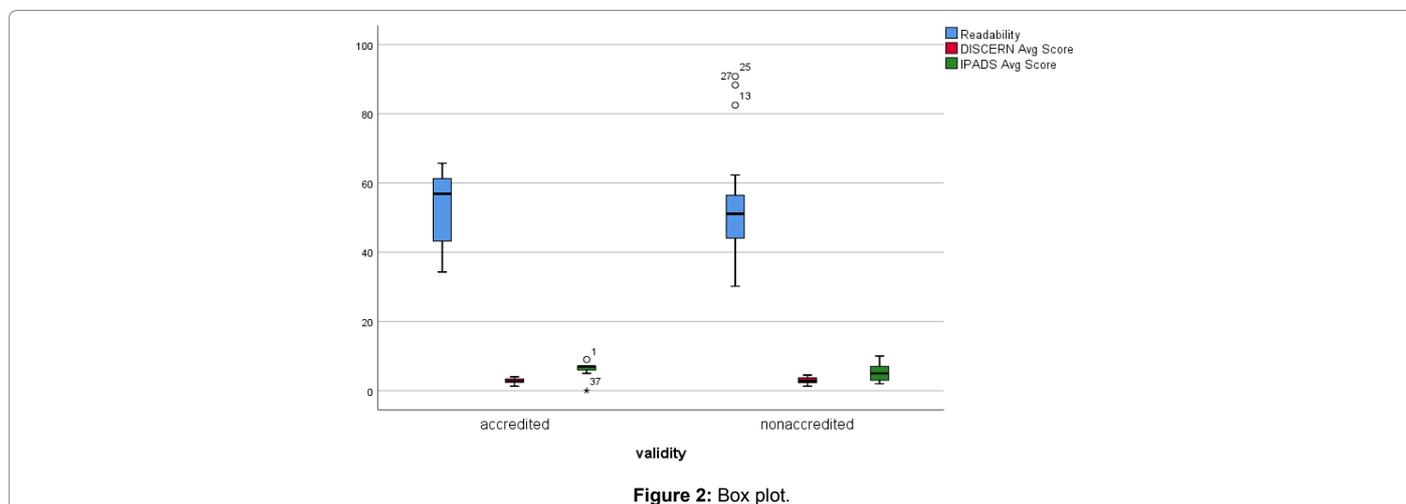


Figure 2: Box plot.

and poor availability of aids to help patients make decisions regarding laparoscopic Fundoplication (Table 2).

It was noted that only 9 of the 40 websites had the HONcode certification, while none of them had the Information Standard Certification. There were no other forms of accreditation identified on any of the websites. On comparing the accredited with the non accredited websites using an independent sample T-test no statistical difference was noted with the readability, DISCERN or IPDAS score (Table 3).

## Discussion

It has been noted that around 75% of UK users search for information online related to illness, their presentation and treatment options [15,16]. Hence the resources available online can aid in decision making as well as influence the final decision [17]. There has been one study done involving health decisions in North east of England with respect to internet resources highlighting the complexity of online health information sourcing and their relevance with shared decision-making [18].

	Accreditation status	Readability (Flesch-Kincaid)	DISCERN Score	IPADS Score
1		61.3	4.0	9
2		65.7	2.4	6
3		43.2	2.7	6
4	none	41.1	3.3	7
5	none	35.1	1.3	2
6	none	44.7	2.4	3
7		61.5	3.4	7
8	none	62.3	3.6	6
9	none	61.2	2.7	4
10	none	52.2	1.9	4
11		56.9	3.1	7
12	none	56.2	2.2	5
13	none	82.5	4.3	8
14	none	56.4	2.3	3
15	none	50.1	2.5	3
16	none	51.8	1.8	2
17	none	47.4	2.8	6
18	none	51.3	2.3	3
19	none	48.9	2.3	3
20	none	45.4	2.8	6
21		34.3	2.0	7
22	none	43.4	2.9	6
23	none	40.6	2.2	3
24	none	30.2	2.0	4
25	none	90.8	3.9	9
26	none	46.3	2.4	4
27	none	88.3	3.3	8
28	none	55.6	4.0	5
29	none	58.5	3.0	4
30	none	40.4	4.2	10
31	none	53.2	3.8	7
32		57.2	3.5	7
33	none	46.6	4.3	8
34	none	56.5	4.3	8
35	none	56.5	3.0	6
36	none	37.5	4.5	10
37		46.9	1.3	0
38	none	40.9	2.2	4
39	none	51.1	2.9	3
40		38.4	2.4	5

Table 2: Comprehensive scores and accreditation status

Group Statistics						
	validity	N	Mean	Std. Deviation	Std. Error Mean	T-test p-value
Readability	accredited	9	51.711	11.2718	3.7573	0.9
	nonaccredited	31	52.355	13.9286	2.5017	
DISCERN Avg Score	accredited	9	2.756	0.8353	0.2784	0.559
	nonaccredited	31	2.948	0.871	0.1564	
IPADS Avg Score	accredited	9	6	2.5	0.833	0.435
	nonaccredited	31	5.29	2.341	0.42	

**Table 3:** Independent sample t test comparing accredited vs non accredited websites in terms of overall readability and quality.

This study looks the available online information for patient related to laparoscopic fundoplication. This was done by a simulated patient search. The aim is to assess the readability, quality of written information and accreditation in order to see if they are suitable to aid in decision making. These assessments were carried out using validated internationally accepted tools with defined criteria to ascertain high quality and standard of information. We believe this to be the first such kind review of patient literature pertaining to laparoscopic anti-reflux surgery (fundoplication).

This review has found that the readability is high as it is suited to ages 15 years and above. The recommended readability for patient healthcare information is 80 – 100 on the Flesch-Kincaid scoring system as per Cotunga et al [19]. In this review no sources achieved this recommended score. The mean readability score noted in this review was 52.2 as assessed by the Flesch – Kincaid tool. This score implies the readability is high to be understood and appreciated by all in our patient demographics. Similar findings were noted with information regarding other health topics where the readability was found to be high with a mean of 48.8+/-15.6. The median DISCERN score was 1.5±1.18 standard deviation (range 1–5). No sources met minimum decision-making standards (median IPDAS score 5/12±2.01 standard deviations, range 1–8) [20]. Unfortunately if the available information is not readable by the patient cohort there is bound to be lack of insight and understanding. It can also lead to misinterpretation of written information leading to wrong decisions being made. Therefore, it is very important to focus on ease of readability with designs of online patient resources. This will also positively impact on the quality.

On further evaluation for information standards only 9 of the 40 selected websites had the HONcode certification which accounts for 22.5%. This was obtained but downloading the HONcode toolbar onto the web browser which enable you to see if the website you are browsing is HONcode certified making it an easily accessible internet tool. Unfortunately, the information standard certificate was not displayed on any of these websites. Similar results were also noted in other published reviews related to sleeve gastrectomy, coloproctology procedures and anxiety treatment [21-23]. On comparing the accredited websites with the non accredited websites for the parameters of readability, DISCERN score and IPDAS score they showed no statistically significant difference. A simple independent sample T Test was performed to demonstrate this with P values of 0.90, 0.55 and 0.43 respectively (Table 4).

On analyzing the results obtained from the DISCERN score the overall quality of publications only partially satisfied the criteria. The main area of concern was those related to questions on-does it provide details of additional sources of support and information? Does it describe what would happen if no treatment is used? And does it provide support for shared decision-making? The criteria that most websites satisfied were relevance of the topic and how each treatment works. Having all the information including the consequences of not

opting for the described treatment and providing alternative treatment options is a vital part of shared decision making. It then becomes very important to focus on these poorly addresses matters as per our review to improve the quality of online information.

Similarly, with the IPDAS score the areas of concern in the quality criteria were failure of most websites to describe the experience of the consequence of options. There were more areas of concern in the certification criteria with a highest of 42.5% of the websites attaining the selected requirements. The update of policy provided and paucity of information on the funding sources being the least satisfied areas with only 10% of the websites satisfying these criteria.

Some recommendations to improve on the quality on online information available to patients would be to strictly adhere to the well establishes quality control tool and certification being made mandatory. Another approach would be for the web designers to incorporate the information available by patient groups and clinicians to improve on the readability and quality of information.

A notable limitation of this review is that we only focused on the first two pages of the web search. This is based on studies that show 92% of online users limit their search to the first visible page [24]. This limitation fails to account for patients who would carry out more extensive online search beyond what has been considered in this review article. In our search we have eliminated the influence of the search history; however this may not be the case in the patient population.

We have not looked into the information available in the form of subscription websites, forums and videos which patient will also have access to. Subscription websites were thought to be less accessible to the general public and the assessment of video quality was out of the scope of our scoring parameters. The role of these mediums in patient education is not fully understood and is a limitation of our study. Further research will be required to ascertain the quality, role and importance of information available in video and other digital media. It is also important to consider and further research the impact of social media. Another limitation is author bias on which the scoring is dependent on. We have tried to mitigate this by multiple authors scoring.

After having gained substantial information from the results of this review and taking into consideration the limitations it can be said that that information available online related to laparoscopic fundoplication is substandard in relation to readability and quality. Thus it becomes important for better interaction between health professionals, patients and web designers to produce online health information of higher standards. There perhaps should be a role for focus groups and wider public consultation and testing for patient related online information.

## Conclusion

From this review articles extensive report on information available

		Source	
Bing - fundoplication	1	<a href="https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication">https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication</a>	
	2	<a href="https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#2">https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#2</a>	
	3	<a href="https://www.medicinenet.com/fundoplication/article.htm">https://www.medicinenet.com/fundoplication/article.htm</a>	
	4	<a href="https://healthjade.net/fundoplication/">https://healthjade.net/fundoplication/</a>	
	5	<a href="https://www.nbt.nhs.uk/our-services/a-z-services/upper-gastro-intestinal-surgery/laparoscopic-fundoplication">https://www.nbt.nhs.uk/our-services/a-z-services/upper-gastro-intestinal-surgery/laparoscopic-fundoplication</a>	
	6	<a href="http://reflux.surgery/fundoplication/">http://reflux.surgery/fundoplication/</a>	
	7	<a href="https://www.healthline.com/health/gerd/fundoplication">https://www.healthline.com/health/gerd/fundoplication</a>	
	8	<a href="https://www.bmihealthcare.co.uk/treatments/gastroenterology/nissen-fundoplication-laparoscopic#gdp-out">https://www.bmihealthcare.co.uk/treatments/gastroenterology/nissen-fundoplication-laparoscopic#gdp-out</a>	
	9	<a href="https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/">https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/</a>	
	10	<a href="https://www.drmalladi.com/reflux-surgery/nissen-fundoplication/">https://www.drmalladi.com/reflux-surgery/nissen-fundoplication/</a>	
Bing - anti-reflux surgery	11	<a href="https://medlineplus.gov/ency/article/002925.htm">https://medlineplus.gov/ency/article/002925.htm</a>	
	12	<a href="https://www.bmihealthcare.co.uk/treatments/general-surgery/gastroesophageal-reflux-surgery--anti-reflux-surgery">https://www.bmihealthcare.co.uk/treatments/general-surgery/gastroesophageal-reflux-surgery--anti-reflux-surgery</a>	
	13	<a href="https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf">https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf</a>	
	14	<a href="https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery">https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery</a>	
	15	<a href="https://www.birmingham-upper-gastrointestinal-surgery.co.uk/surgical-procedures/anti-reflux-surgery/">https://www.birmingham-upper-gastrointestinal-surgery.co.uk/surgical-procedures/anti-reflux-surgery/</a>	
	16	<a href="https://www.circlehealth.co.uk/treatments/anti-reflux-surgery">https://www.circlehealth.co.uk/treatments/anti-reflux-surgery</a>	
	17	<a href="http://www.refluxsurgery.co.uk/reflux-disease-gord/#treatment">http://www.refluxsurgery.co.uk/reflux-disease-gord/#treatment</a>	
	18	<a href="https://www.ramsayhealth.co.uk/treatments/anti-reflux-surgery">https://www.ramsayhealth.co.uk/treatments/anti-reflux-surgery</a>	
	19	<a href="https://www.ashteadhospital.co.uk/treatments/anti-reflux-surgery">https://www.ashteadhospital.co.uk/treatments/anti-reflux-surgery</a>	
	20	<a href="http://www.refluxsurgery.co.uk/reflux-surgery/">http://www.refluxsurgery.co.uk/reflux-surgery/</a>	
	21	<a href="https://my.clevelandclinic.org/health/treatments/4354-laparoscopic-antireflux-surgery">https://my.clevelandclinic.org/health/treatments/4354-laparoscopic-antireflux-surgery</a>	
Yahoo - anti-reflux surgery	22	<a href="https://medlineplus.gov/ency/article/002925.htm">https://medlineplus.gov/ency/article/002925.htm</a>	Duplicate
	23	<a href="https://www.bmihealthcare.co.uk/treatments/general-surgery/gastroesophageal-reflux-surgery--anti-reflux-surgery">https://www.bmihealthcare.co.uk/treatments/general-surgery/gastroesophageal-reflux-surgery--anti-reflux-surgery</a>	Duplicate
	24	<a href="https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf">https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf</a>	Duplicate
	25	<a href="http://www.refluxsurgery.co.uk/">http://www.refluxsurgery.co.uk/</a>	Advert
	26	<a href="https://www.circlehealth.co.uk/treatments/anti-reflux-surgery">https://www.circlehealth.co.uk/treatments/anti-reflux-surgery</a>	Duplicate
	27	<a href="https://www.ramsayhealth.co.uk/treatments/anti-reflux-surgery">https://www.ramsayhealth.co.uk/treatments/anti-reflux-surgery</a>	Duplicate
	28	<a href="https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery">https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery</a>	Duplicate
	29	<a href="http://www.refluxsurgery.co.uk/reflux-surgery/">http://www.refluxsurgery.co.uk/reflux-surgery/</a>	Duplicate
	30	<a href="https://www.sages.org/publications/patient-information/patient-information-for-laparoscopic-anti-reflux-gerd-surgery-from-sages/">https://www.sages.org/publications/patient-information/patient-information-for-laparoscopic-anti-reflux-gerd-surgery-from-sages/</a>	
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	32	<a href="https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery">https://www.springfieldhospital.co.uk/treatments/anti-reflux-surgery</a>	Duplicate
	33	<a href="https://www.birmingham-upper-gastrointestinal-surgery.co.uk/surgical-procedures/anti-reflux-surgery/">https://www.birmingham-upper-gastrointestinal-surgery.co.uk/surgical-procedures/anti-reflux-surgery/</a>	Duplicate
	34	<a href="https://www.circlehealth.co.uk/treatments/anti-reflux-surgery/?h=b">https://www.circlehealth.co.uk/treatments/anti-reflux-surgery/?h=b</a>	Duplicate
	35	<a href="https://www.southwestreflux.co.uk/reflux-disease/keyhole-anti-reflux-surgery/">https://www.southwestreflux.co.uk/reflux-disease/keyhole-anti-reflux-surgery/</a>	
	36	<a href="http://www.refluxsurgery.co.uk/reflux-surgery/">www.refluxsurgery.co.uk/reflux-surgery/</a>	Duplicate
	37	<a href="https://thesurgerygroup.com/services/anti-reflux-surgery/">https://thesurgerygroup.com/services/anti-reflux-surgery/</a>	
	Yahoo - fundoplication	38	<a href="https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication">https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication</a>
39		<a href="https://www.healthline.com/health/gerd/fundoplication">https://www.healthline.com/health/gerd/fundoplication</a>	Duplicate
40		<a href="https://www.medicinenet.com/fundoplication/article.htm">https://www.medicinenet.com/fundoplication/article.htm</a>	Duplicate
41		<a href="https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#1">https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#1</a>	Duplicate
42		<a href="https://healthjade.net/fundoplication/">https://healthjade.net/fundoplication/</a>	Duplicate
43		<a href="https://www.nbt.nhs.uk/our-services/a-z-services/upper-gastro-intestinal-surgery/laparoscopic-fundoplication">https://www.nbt.nhs.uk/our-services/a-z-services/upper-gastro-intestinal-surgery/laparoscopic-fundoplication</a>	Duplicate
44		<a href="https://www.ouh.nhs.uk/patient-guide/leaflets/files/100629laparoscopicnissen.pdf">https://www.ouh.nhs.uk/patient-guide/leaflets/files/100629laparoscopicnissen.pdf</a>	
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46		<a href="http://reflux.surgery/fundoplication/">http://reflux.surgery/fundoplication/</a>	Duplicate
47		<a href="https://www.nth.nhs.uk/content/uploads/2016/08/Surg543-Laparoscopic-Nissen-Fundoplication-14.06.16-RB.pdf">https://www.nth.nhs.uk/content/uploads/2016/08/Surg543-Laparoscopic-Nissen-Fundoplication-14.06.16-RB.pdf</a>	
Google - anti-reflux surgery	48	<a href="https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf">https://www.ruh.nhs.uk/patients/services/upper_gi/documents/Laparoscopic_Antireflux_Surgery1.pdf</a>	Duplicate
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	54	<a href="https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery">https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery</a>	Duplicate
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	57	<a href="https://www.aboutgerd.org/surgery/gerd-and-hiatal-hernia-surgery.html">https://www.aboutgerd.org/surgery/gerd-and-hiatal-hernia-surgery.html</a>	
	58	<a href="https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/">https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/</a>	Duplicate
	59	<a href="https://www.healthline.com/health/gerd/surgery">https://www.healthline.com/health/gerd/surgery</a>	
	60	<a href="https://www.uwhealth.org/health/topic/surgicaldetail/fundoplication-surgery-for-gastroesophageal-reflux-disease-gerd/hw95701.html">https://www.uwhealth.org/health/topic/surgicaldetail/fundoplication-surgery-for-gastroesophageal-reflux-disease-gerd/hw95701.html</a>	

Google - fundoplication	61	<a href="https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication">https://www.bupa.co.uk/health-information/digestive-gut-health/fundoplication</a>	Duplicate
	62	<a href="https://www.healthline.com/health/gerd/fundoplication">https://www.healthline.com/health/gerd/fundoplication</a>	Duplicate
	63	<a href="https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/">https://www.hey.nhs.uk/patient-leaflet/laparoscopic-nissens-fundoplication-hiatus-hernia-repair/</a>	Duplicate
	64	<a href="https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#1">https://www.webmd.com/heartburn-gerd/guide/heartburn-surgery#1</a>	Duplicate
	65	<a href="https://www.uofmhealth.org/health-library/hw95701">https://www.uofmhealth.org/health-library/hw95701</a>	
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	68	<a href="https://www.ouh.nhs.uk/patient-guide/leaflets/files/100629laparoscopicnissen.pdf">https://www.ouh.nhs.uk/patient-guide/leaflets/files/100629laparoscopicnissen.pdf</a>	Duplicate
	69	<a href="https://www.ucl.nhs.uk/PandV/PIL/Patient%20information%20leaflets/Laparoscopic%20Fundoplication.pdf">https://www.ucl.nhs.uk/PandV/PIL/Patient%20information%20leaflets/Laparoscopic%20Fundoplication.pdf</a>	
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	73	<a href="https://www.ramsayhealth.co.uk/treatments/nissen-fundoplication">https://www.ramsayhealth.co.uk/treatments/nissen-fundoplication</a>	
	74	<a href="https://my.clevelandclinic.org/health/treatments/4200-fundoplication-procedure-for-children">https://my.clevelandclinic.org/health/treatments/4200-fundoplication-procedure-for-children</a>	

All extracted Data are made available in the following Table with the associated DOI of <https://www.webfx.com/tools/read-able/check.php?tab=Test+By+Url&uri=https%3A%2F%2Fwww.webmd.com%2Fheartburn-gerd%2Fguide%2Fheartburn-surgery%231>

Table 4: Data statement.

online for laparoscopic anti-reflux (fundoplication) surgery, one can conclude that the quality is of lower than recommended standards and the readability is much higher than that recommended for patients.

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