

Refereed papers

Changing public attitudes to antibiotic prescribing: can the internet help?

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ABSTRACT

Introduction Antimicrobial resistance is a global problem with serious implications for modern medicine. Education of the public is essential for reducing patient pressure on GPs and subsequent inappropriate prescribing. Evaluation of educational interventions is necessary to assess their impact on public knowledge and attitudes. The aim of this study was to evaluate the effect of a health information website, part of the National electronic Library of Infection, on user knowledge and attitudes.

Method Questionnaires testing user knowledge and attitudes before and after using the website.

Results There were significant improvements in knowledge about the use of antibiotics and antibiotic resistance. Expectations that antibiotics should be prescribed were significantly reduced after using the website. Health professionals showed a significantly greater knowledge about antibiotics and were less likely to expect antibiotics to be prescribed for acute otitis media than non-health professionals before using the website. There was no significant difference between the knowledge of these groups after using the website, but non-health professionals continued to have higher expectations of antibiotics being prescribed than health professionals.

Conclusions Health information websites can play a significant role in influencing public knowledge and attitudes. Further research is needed to investigate how people learn from these interventions and to determine their long-term impact on public attitudes and subsequent behaviour.

Keywords: antibiotic resistance, antimicrobial resistance, attitude, health information website, internet, knowledge, public opinion

Introduction

Educating and informing the public is an essential component of any strategy for reducing the further development and spread of antimicrobial resistance. Research has shown that doctors believe patient expectations play a major role in inappropriate use of antibiotics.[1–3] A number of influential recent reports have emphasised the role of public education in reducing the pressure on general practitioners (GPs) to prescribe.[4,5] Recent investigations into the impact of community-wide campaigns and videotapes about antimicrobial resistance on prescribing patterns and

patient expectations have shown that they can reduce the expectation of antimicrobial prescribing.[6–9] In spite of the increasing interest in providing health information over the internet resulting in initiatives from Government organisations, for example NHS Direct Online, commercial enterprises such as Netdoctor and non-profit organisations like the Health On the Net Foundation, and whilst some research has attempted to discover how consumers search for and assess health information on the internet, little is known about the impact of this health information on attitudes and knowledge.[10–13] A recent review suggested that there was a paucity of evidence showing that consumer use of the internet for health information has any effect on health outcomes.[14] A study investigating which of five media (paper booklet, website, audio, audio plus website, website created using Flash) patients prefer for the delivery of information about cancer suggested that this group preferred the more interactive Flash format, although there was no significant difference in knowledge changes between formats. It should be noted that the study was small (nine participants in each group) and that the focus was on patient preferences rather than knowledge and attitude changes.[15] We could not find any studies which investigated if the internet could influence attitudes to antimicrobial prescribing. In this study we aimed to investigate the effect of a website about antimicrobial resistance on users by examining users' knowledge and attitudes before and after using the website.

Methods

Antimicrobial Resistance website

The pilot National electronic Library of Infection (NeLI) Antimicrobial Resistance website was the intervention used in this study.[16] The site comprises a selection of frequently asked questions about microbes, antimicrobials and antimicrobial resistance and provides the consumer with links to evidence-based resources on the internet if they require more depth. Funded by the Department of Health and built at the Institute of Health Sciences, City University, the site content draws from the evidence in the Sub-group on Antimicrobial Resistance (SMAC) report *The Path of Least Resistance* and other evidence-based publications.[4,5,17] The aim of the site is to inform the public of current evidence-based guidelines on antimicrobial prescribing and the issues surrounding those guidelines in an effort to reduce patient pressure on doctors and consequently reduce inappropriate prescribing.

Measuring changes in knowledge and attitudes

We conducted the study in the Science Museum, London in February 2003. The study was approved by the City University Senate Ethics Committee. As identical pre- and post-use questionnaires were successfully used in evaluating the impact of health information videos on knowledge and attitudes of the public, this method was adopted for this research.[8] An opportunistic sample of museum visitors was asked to complete a short electronic questionnaire before using the website. The subjects then browsed the website, and completed a post-use questionnaire. The study was conducted offline to ensure users were only using the Antimicrobial Resistance website and not following links out to the internet. The pre-use questionnaires contained seven true/false statements about antimicrobial resistance in general, and six statements about the use of antibiotics in acute otitis media (AOM) that the user was asked to rank agreement with on a Likert scale. The post-use questionnaire repeated the questions and also asked about the usability of the site. Discussion about the usability of the site is outside the scope of this paper, and has been reported elsewhere.[18] Demographic data about the users were collected.

The aims of the two identical sets of questions were:

- to test for changes in knowledge about antibiotics and AOM
- to investigate the relationship between perceived knowledge gain and actual gain
- to test for changes in attitudes to the information on the site and to antibiotic prescribing
- to investigate the difference in knowledge and attitudes between health professionals and non-health professionals.

Results

The study was conducted on seven days over a period of two weeks. The participants in the study were recruited opportunistically. A total of 227 completed the first part of the questionnaire prior to using the site and 177 of these completed both questionnaires and will be referred to as the study population from this point. The study population recruited closely matched the Science Museum visitor statistics in gender, age and highest level of education.[19] Although this is not strictly representative of the United Kingdom (UK) population as a whole, the aim of this study was to investigate the potential for internet resources in changing public knowledge and attitudes. Future

research will evaluate the impact of the website on real users once the site is online. A total of 51% of the study population were aged between 25 and 44, and 49% had an undergraduate degree or higher level qualification. The results for the true/false questions were tested for significance with the McNemar test and the results for the Likert scale questions were tested with the paired *t*-test. Where values were less than five, the Fisher's exact test was used. The results are discussed in relation to the four aims above.

1 Changes observed in knowledge about antibiotics and AOM

The exact changes in the proportion of users answering question 1 correctly are shown in Figure 1. Highly significant changes in answers given before and after using the site were observed in two of the true/false statements:

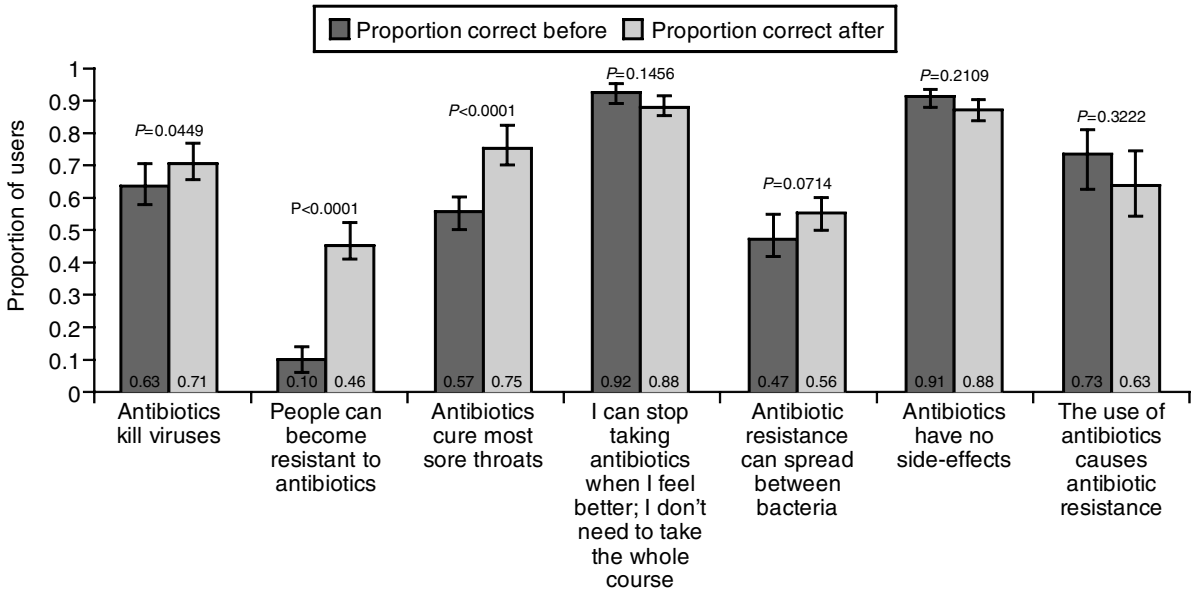
- 46% (81) of users were correct in stating that people cannot become resistant to antibiotics after using the site compared with 10% (17) of users before, an increase of 36% ($P<0.001$, $\chi^2 = 60.357$, 95% confidence interval (CI) of change: 27.47 to 44.53)
- there was also an increase in the number of users stating correctly that antibiotics do not cure most sore throats, from 57% (101) before using the site, increasing to 75% (133) after, an increase of 18% ($P<0.001$, $\chi^2 = 19.22$, 95% CI of change: 8.62 to 27.38).

Only 1.7% (3) of users got all the answers to question 1 correct before using the site compared with 10.7% (19) after using the site ($P=0.0003$).

2 Relationship between perceived knowledge gain and actual knowledge gain

We examined the relationship between individuals' belief that they had learned from using the site with the actual change in their scores for question 1. A total of 74% (81) of all users (110) strongly agreed or agreed with the statement 'I have learned something new after using this site'. Forty-three percent (47) of the users were correct in reporting that their knowledge improved, whilst 16% (18) thought they had increased their knowledge but had actually decreased their score, and 15% (16) thought they had improved their knowledge but had no change in score. This latter result may be explained by knowledge the user may have thought they gained from the site but that was not tested in the questions used.

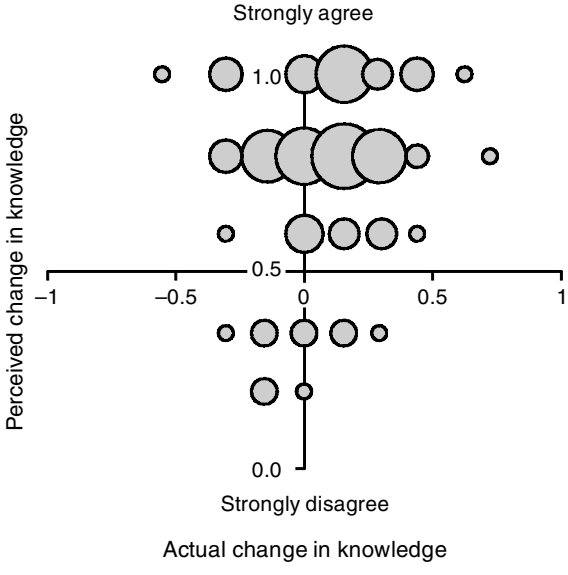
The actual change in knowledge represents the change in users' scores in the true/false questions. Users could have a positive or negative knowledge change depending on the number of questions answered correctly both before and after using the site. The perceived knowledge change represents the users' self-assigned ranking on a Likert scale of 1 (strongly disagree) to 5 (strongly agree) to the statement



The error bars show the 95% confidence intervals for the proportions

Figure 1 Changes in proportion of users correctly answering each statement of question 1 before and after using the website

'I have learned something new about antibiotic resistance after using this site'. Both scores are normalised to a scale of 0 to 1 for ease of comparison (see Figure 2).



The size of the bubbles represents the number of users at that point

Figure 2 Relationship between perceived knowledge change and actual change in scores for question 1

3 Changes observed in attitudes to antibiotic use in AOM

Attitudes to the information on the site

Four of the statements in question 2 were designed to test users' attitudes to the information on the site in the case of AOM. Users were asked to rank their agreement on a Likert scale of 1 (strongly disagree) to 5 (strongly agree). There were significant changes in the scores assigned by users for three of these statements following use of the site (see Table 1).

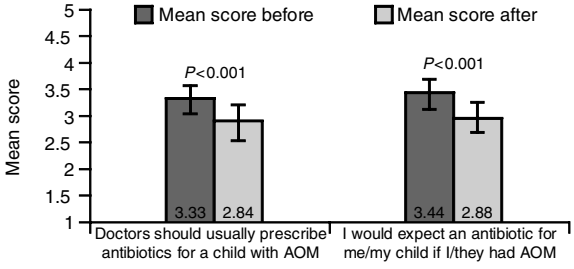
Attitudes to prescribing

There were two statements examining attitudes to prescribing antibiotics in AOM, and highly significant changes were observed in the scores assigned by users for both (see Figure 3):

- 51% (90) of users believed that 'Doctors should usually prescribe antibiotics for a child with AOM' before using the site, but after use this had decreased to 33% (58). The mean score decreased from 3.33 to 2.84, a change of –0.49 ($P<0.001$, 95% CI of difference in means: –0.72 to –0.26)
- a similar change was seen in the level of agreement with 'I would expect an antibiotic for me/my child if I/they had AOM'. A total of 59% (104) of users agreed or strongly agreed with this before using the site compared with 30% (53) after. The mean score decreased from 3.44 to 2.88, a change of –0.56 ($P<0.001$, 95% CI of difference in means: –0.78 to –0.33).

Table 1 Changes in mean scores, *P* values and confidence intervals for statements testing attitude to information on the site

	Strongly agree or agree before using site % (*n*)	Strongly agree or agree after using site % (*n*)	Change in mean score	*P* (paired *t*-test)	95% CIs for change in mean
Antibiotics are effective in AOM	64 (113)	38 (67)	–0.52	0.0003	–0.79 to –0.25
Ten-day courses are more effective than three-day courses of antibiotics in AOM	42 (74)	21 (38)	–0.70	0.000007	–0.99 to –0.42
Antibiotics help reduce the duration of pain in AOM	46 (82)	32 (57)	–0.23	0.09271	–0.49 to 0.03
You are more likely to have a complication from AOM if you do not have antibiotics	44 (78)	23 (41)	–0.49	0.00041	–0.76 to –0.23



The error bars show 95% confidence levels of the mean

Figure 3 Mean score of statements testing attitudes to prescribing antibiotics

Differences in knowledge and attitudes between health professionals and non-health professionals

Health professionals' and non-health professionals' knowledge

Twenty-seven participants reported that they were health professionals and completed both questionnaires. There were significant differences between the proportions of health professionals and non-health professionals answering correctly before using the site for four of the seven true/false statements (see Table 2). This is in contrast to no significant difference between these groups after use of the site.

Health professionals' and non-health professionals' attitudes

Non-health professionals consistently ranked a higher level of agreement with the attitude to prescribing statements in question 2 than health professionals (see Table 3), indicating that they would be more likely to expect antibiotics to be prescribed for AOM. These results were statistically significant both before and after using the site.

Discussion

This research provides evidence that health information websites have the potential to influence public opinion in important areas. In this study, following use of a website, users' knowledge increased and expectations of receiving an antimicrobial were reduced. Users generally felt they had learned from the site. There was a significant difference in the knowledge of health professionals compared to non-health professionals before using the site, and health professionals were less likely to expect antibiotics for AOM both before and after using the site. However, of concern was the number of health professionals misinformed about antimicrobial resistance, with only just over a quarter correctly stating that people cannot become resistant to antibiotics, before using the website.

This study has some limitations. Firstly, the study population was not representative of the general UK population, as previously discussed. Secondly, it was not possible to know if the changes in knowledge and attitudes observed were a result of active or passive learning: that is, did users set out specifically to find the correct answers within the site and then change their answers accordingly or by browsing the site did they just absorb the concept that antibiotics are not always appropriate treatment for every infection? Thirdly, we only evaluated the *immediate* impact of the site on knowledge and attitudes. It would be useful to do a follow-up study on real users a few months later to see if the changes were long-term and investigate any potential impact on health outcomes. On the other hand, the primary aim of this study was to inform the public about the existence of this resource and investigate the potential for internet resources to influence public opinion by determining if users gained short-term knowledge through use of the site. We would not expect users to be looking at the site without an information need to fulfil. We would also expect that they would be more likely to return to the site with a future query rather than remember everything on it the first time they view it.

The methodology used to test knowledge and attitudes, and relationships between the knowledge and attitude change of users, is discussed in greater detail in another paper.[20]

Conclusion

This study builds on existing research that provides evidence for the effectiveness of public education initiatives in improving public knowledge and attitudes towards antimicrobial prescribing.[6–9] A more recent paper highlights the still unmet needs of primary care patients for health-related information on the internet.[21] Evaluating the impact of current and future health information websites on patient knowledge and attitudes is clearly an important factor in meeting these needs.

This study provides a platform for further research into the effect of internet interventions on health

Table 2 Comparison of proportion of health professionals responding correctly to the true/false questions before and after using the website with proportion of non-health professionals

	Antibiotics kill viruses	People can become resistant to antibiotics	Antibiotics cure most sore throats	I can stop taking antibiotics when I feel better, I don't need to take the whole course	Antibiotic resistance can spread between bacteria	Antibiotics have no side-effects	The use of antibiotics causes antibiotic resistance
% (*n*) health correct before using site	81 (22)	26 (7)	78 (21)	93 (25)	70 (19)	96 (26)	81 (22)
% (*n*) non-health correct before using site	59 (89)	7 (10)	53 (80)	92 (138)	42 (63)	89 (134)	71 (106)
P (Fisher's exact test)	0.0314	0.006	0.0204	1	0.0109	0.4763	0.3504
% (*n*) health correct after using site	81 (22)	63 (17)	85 (23)	93 (25)	63 (17)	89 (24)	81 (22)
% (*n*) non-health correct after using site	69 (103)	43 (64)	73 (110)	87 (131)	54 (81)	87 (130)	65 (98)
P (Fisher's exact test)	0.2512	0.0605	0.2326	0.7456	0.41	1	0.1196

Table 3 Comparison of health professionals' attitudes to prescribing antibiotics for AOM with those of non-health professionals. The figures show the percentage (number) in each group who agreed or strongly agreed with the statement before and after using the site

Strongly agreed	Before	After
Doctors should prescribe antibiotics for a child with AOM		
Health % (n=30)	27 (8)	17 (5)
Non-health % (n=147)	35 (52)	29 (42)
P (Fisher's exact test)	0.0191	0.0183
I would expect an antibiotic for me/my child if I/they had AOM		
Health % (n=30)	27 (8)	13 (4)
Non-health % (n=147)	41 (60)	28 (41)
P (Fisher's exact test)	0.0046	0.0098

outcomes. We have shown that health information websites and digital libraries can change public knowledge and attitudes in the short term, and now larger studies are required to investigate the long-term impact of these and similar resources. As one GP participant in the study so aptly commented: 'I would recommend this to my patients instead of rushing in to see me as their GP!'

Understanding how people learn from internet interventions can ensure they are designed and promoted in a way that will reduce pressure on an already overburdened health system, rather than add to it, and ensure that up-to-date information is delivered to the public and health professionals instantly.

ACKNOWLEDGEMENTS

To the Department of Health for funding the project, to Sabiha Foster and the **live science** team for allowing and assisting us in undertaking the data collection in the Science Museum, London and to the Museum visitors who took part in the research.

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CONFLICTS OF INTEREST

None.

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Accepted December 2003