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ORIGINAL ARTICLE

The use of a poster to reduce expectations to receive antibiotics for a common cold

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Abstract

Many doctors prescribe antibiotics for a cold, to meet patient's expectations. As a result, patient's education about antibiotics and antibiotic resistance forms a major component of the WHO's Global Action Plan on Antimicrobial Resistance. However, it is not known whether simple educational material can change a person's attitudes about antibiotic therapy. We designed three posters about antibiotic treatment for "cold and flu". Hospital inpatients answered a baseline survey and then were asked to look at one of three randomly selected posters. The posters highlighted the futility of antibiotic treatment for colds (futility), the risk of adverse drug reactions from antibiotics (harm), and the issue of antimicrobial resistance (resistance). Participants then completed a follow-up survey. Participants' expectations to receive antibiotics for a "bad cold" reduced significantly after viewing a poster (82/299, 27% expected antibiotics in the baseline survey compared with 13% in the follow-up survey, $P < 0.01$). Continuing expectation to receive antibiotics after viewing one of the posters was associated with expectation to receive antibiotics in the baseline survey and the strong belief that colds were caused by bacteria. Participants who viewed the resistance poster were more likely to continue to expect antibiotics than participants who viewed the futility poster (OR 2.46, 95%CI 1.16–5.20, $P = 0.02$). Following discussion of the study, viewing a poster reduced participants' expectations to receive antibiotics for a hypothetical cold. Changing patients' expectations to receive antibiotics using simple educational material about antibiotic futility could lead to significant reductions in antibiotic prescription for viral upper respiratory tract infections.

Introduction

There is little debate that reducing inappropriate antibiotic consumption is essential to reduce the spread of antibiotic-resistant bacteria and prolong the utility of these valuable medicines. Antibiotic prescribing for common conditions in New Zealand, often deviates from guidelines [1, 2], and there has been a relentless annual increase in antibiotic dispensing [3]. As the overwhelming bulk of antibiotic dispensed in New Zealand is prescribed for patients in the community [4], reducing antibiotic prescriptions for viral upper respiratory infections (URTIs) should have a large impact on overall antibiotic consumption, and thus slow the spread of antibiotic-resistant bacteria, and reduce the harms caused by antibiotic use [5].

Almost all prescribers are aware that prescribing antibiotics for viral URTI provides no benefit, and most are also aware that such prescribing may cause adverse health effects; yet they continue to prescribe. The most common reason given for prescribing antibiotics for patients with an URTI is to meet patient's expectations to receive antibiotics for URTI [6–8]. This is a commonly held expectation—consistent with a study from Europe, a survey conducted in New Zealand indicated that 40% of adults expected to be prescribed antibiotics for a "bad cold or flu" [8, 9]. The potentially large benefits of reducing this common expectation through consumer education were recognised in the New Zealand Antimicrobial Resistance Plan—Priority action area 1 is to "Strengthen consumer awareness to improve

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understanding of antimicrobial resistance and the importance of using antibiotics appropriately" [10]. This action area echoes that of the World Health Organisation Global Action Plan [11].

There is little evidence that posters and other forms of passive education are able to change behaviours related to healthcare. Mass media campaigns in many countries have attempted to improve public knowledge about the futility of antibiotic treatment of viral infections, and the harms that may result from antibiotic treatment (e.g. https://www.pharmac.govt.nz/assets/wuoa-if-in-doubt-check-it-out-poster.pdf and http://www.who.int/campaigns/world-antibiotic-awareness-week/infographics/en/). These types of educational materials have been used as a small part of much more comprehensive successful campaigns to decrease antibiotic consumption in France and Belgium [12, 13]. However, an English antibiotic awareness campaign that only used posters sent to community pharmacies and general practice surgeries did not improve people's knowledge about antibiotics [14]. In this study, the participants might not have had the opportunity to view one of the posters.

We were not able to find evidence that viewing a poster or infographic could significantly change patients' expectations to receive antibiotics for URTI. Thus, we aimed to determine whether reading a simple poster about the disadvantages of antibiotic consumption significantly changed patients' expectations to receive antibiotics for a "bad cold or flu". We also aimed to determine whether reading posters about antibiotic resistance, or the futility of antibiotic treatment of URTI, or about the potential harms of antibiotic treatment had similar effects on patients' expectations [9, 15, 16].

Materials and methods

Ethical approval for this study (16/NTB/187) was provided by the Health and Disability Ethics Committee of the New Zealand Ministry of Health.

Participants and study design

Study participants were adult inpatients on general medical, surgical and orthopaedic wards at Auckland City Hospital. This hospital, in central Auckland (New Zealand's largest city), provides secondary care for a population of approximately 510,000 people. No specific inclusion or exclusion criteria were applied. All patients present at the time the study personnel visited each ward were invited to participate, except for patients who the ward staff deemed to be too unwell to participate.

Participants were asked to provide brief demographic information and then complete a baseline survey about antibiotics that included questions about their expected health behaviours if they had a hypothetical "bad cold". Participants were then shown one of three randomly selected posters that emphasised either the futility of antibiotic treatment of viral URTIs, or the risk of harm from antibiotic treatment, or the contribution of antibiotic consumption to the spread of antibiotic resistance. Each poster was of A3 size and handed to the participants to view. Participants were then invited to think about the information for 15–30 min. After this interval, the participants were asked to provide feedback about the poster and to complete a follow-up survey about antibiotics.

Poster design

With the assistance of a graphic designer, we designed three posters, which utilised the same font, layout and colour scheme. All three posters included two items of factual information: "Antibiotics will not help to fight the cold or flu because they are caused by viruses and not bacteria" and "New Zealand has high rates of antibiotic misuse compared to other developed countries". Furthermore, all posters concluded with the statement: "It doesn't make sense to take antibiotics for colds or other minor illness that get better on their own".

In addition, each of the three posters included two further pieces of information. The "futility" poster included information about treatment for URTI (the most effective treatment for flu and common colds is rest and drinking plenty of fluids) and about vaccinations (keeping up with vaccinations is an important way to stay healthy). The "harm" poster included information about the frequency of adverse drug reactions (1 in 3 people who take antibiotics get serious side effects such as nausea, rash, thrush, indigestion, diarrhoea) and about the relative harms of antibiotics (people who take antibiotics for colds are ten times more likely to end up in hospital due to a bad side effect than people who don't take antibiotics). The "resistance" poster included information about the development of antibiotic resistance (the more antibiotics are used, the more bacteria become resistant to those antibiotics) and about the possible future impact of antibiotic resistance (by 2050 deaths caused by antibiotic-resistant infections will be more common than deaths caused by cancer). All three posters are shown in Supplementary Figure 1.

Survey and measurements

The study surveys utilised items developed for a previous study [9], and utilised a 9-point Likert scale to gauge participants' agreement or disagreement with each item; participants were instructed that "5" represented a neutral response. The baseline and follow-up surveys included 11 items about antibiotics, and the baseline survey also included four items regarding recent antibiotic treatment and past experience of antibiotic-related adverse drug reaction. Participants were also asked 12 questions about their opinions of the posters, or about the topic of antibiotic resistance. Participants completed the surveys themselves using a Qualtrics (Provo, Utah) online survey via a tablet connected to the hospital's secure network.

The main outcome measure was participants' responses to the statement: "If I had a cold or flu I would expect antibiotics from my doctor". Based on data obtained previously [9], we estimated that a study of 95 participants would allow 90% power (alpha 0.05) to detect a reduction in the mean Likert scores of more than 1 between the baseline and follow-up surveys. We aimed to recruit 300 participants, to allow comparisons between the effects of the three posters on participants.

Analysis

To measure the effect of viewing the posters on the proportion of participants who expected to receive antibiotics for a cold, we used McNemar's test for paired data to compare the proportion of participants whose Likert scores were 6–9 between the baseline and follow-up surveys. Wilcoxon's signed rank test was used to compare the Likert scores between the baseline and follow-up surveys. Tableau (Seattle, USA) was used to graph the Likert responses to survey items, with the 9-point scale grouped into categories "strongly disagree" (score 1 or 2) to "strongly agree" (score 8 or 9).

Multivariate analysis was performed using ordinal logistic regression to determine the factors associated with participants' follow-up survey responses to the statement: "If I have a bad cold I expect antibiotics from my doctor". The model included the factors that were associated with an expectation to receive antibiotics in univariate ordinal logistic regression analyses that had a P value of < 0.1, refined to ensure that the model did not contain variables that were co-linear, and that the assumption of proportional odds was met. Ethnicity and the poster viewed were also included, despite P values ≥ 0.1, because they were factors of interest, and Likert scores were treated as categorical variables. All statistical analyses were performed using IBM SPSS Software 25 (IBM, New York).

Results

Three hundred participants were invited to participate in the study and completed the baseline survey; however, one participant was excluded because he was discharged from hospital before completing the follow-up survey. The number of participants who viewed each poster and their demographic details are shown in Table 1. The characteristics of the participants who viewed each poster were similar; although a higher proportion of people who viewed the harm poster reported a history of antibiotic-related adverse drug reaction during the baseline survey.

Participants' opinions about the posters

Almost all participants (289/299, 97%) reported that the posters were informative, 277/299 (93%) found the information to be interesting, 250/299 (84%) thought that the information was credible and 164/299 (55%) were keen to learn more about the topic. Many participants indicated that the information presented in the posters had the potential to change their behaviour (192/299, 64%) and that they were likely to discuss the information with friends and family (232/299, 78%).

The proportion of participants who reported the poster to be "scary" was higher for the harm poster (71/101, 70%) and the resistance poster (69/100, 69%) than for the futility poster (23/98, 23%) ($P < 0.01$). There were no other differences between the opinions of participants who viewed the three different posters.

The impact of viewing a poster on expectations to receive antibiotics

Figure 1 shows the number of participants overall who agreed and strongly agreed with each survey statement, in the baseline and follow-up surveys. In the baseline survey, 82/299 (27%) participants agreed with the statement that they would expect antibiotics if they "had a bad cold"; however, only 38/299 (13%) participants agreed with the same statement in the follow-up survey (McNemar's test, $P < 0.001$) (Table 2). All responses (mean values) to the statements in the follow-up surveys were significantly different from responses (mean values) to the baseline survey ($P < 0.01$)(Figure); and all of the changes were in keeping with the intention of the poster information. For example, the mean Likert score for the statement "colds are caused by bacteria" reduced from 4.9 in the baseline survey to 2.6 in the follow-up survey ($P < 0.001$).

Expectations to receive antibiotics

The final multivariate model was significantly more predictive of expectations to receive antibiotics than the intercept-only model (Chi squared, $P < 0.001$). This analysis showed that participants who had viewed the resistance poster were more likely to expect antibiotics (OR 2.46, 95% CI1.16–5.20, $P = 0.02$) than participants who viewed the futility poster (Table 3). Not surprisingly, it also showed that agreement (OR 3.32, 95%CI 1.20–9.23, $P = 0.02$) and strong agreement (OR 6.34, 95%CI 2.11–19.29, $P < 0.01$) with the statement "If I have a bad cold I expect antibiotics from my doctor" in the baseline survey were also predictive of agreement with the statement in the follow-up survey. Similarly, strong disagreement (OR 0.15, 95%CI 0.05–0.43) with the same baseline survey statement was associated with disagreement with the statement in the follow-up survey. The only other factor predictive of expectations to receive antibiotics was a strong agreement with the statement that "Colds are caused by bacteria" (OR 2.97, 95%CI 1.09–8.05, $P = 0.03$).

Table 1 Demographic features of study participants. IQR, interquartile range; NZE, New Zealand European

Poster viewed		Futility ($n = 98$)	Harm ($n = 101$)	Resistance ($n = 100$)	Total ($n = 299$)
Median age (IQR), years		60 (45–71)	56 (38–69)	55 (37–67)	57 (42–69)
Female (%)		46 (47%)	49 (49%)	60 (60%)	155 (52%)
Ethnicity	NZE	76 (78%)	78 (77%)	77 (77%)	231 (77%)
	Māori	9 (9%)	6 (6%)	6 (6%)	21 (7%)
	Pacific	6 (6%)	3 (3%)	7 (7%)	16 (5%)
	Asian	5 (5%)	11 (11%)	8 (8%)	24 (8%)
	Other	2 (2%)	3 (3%)	2 (2%)	7 (2%)
Highest education level	Primary	3 (3%)	2 (2%)	3 (4%)	8 (3%)
	Secondary	56 (57%)	52 (52%)	47 (47%)	155 (52%)
	Tertiary	33 (34%)	37 (37%)	34 (34%)	104 (35%)
	Trade	4 (4%)	9 (9%)	14 (14%)	27 (9%)
	Other	2 (2%)	1 (1%)	2 (2%)	5 (2%)
Used antibiotics in past 5 years		76 (78%)	85 (84%)	80 (80%)	241 (81%)
Past antibiotic ADR		32 (33%)	43 (43%)	36 (36%)	111 (37%)

Discussion

In this study, the overwhelming majority of participants reported that the simple educational material, presented in the form of a poster, was interesting and informative. Furthermore, reading the posters halved participants' expectations to receive antibiotics from 27 to 13%. Thus, this type of messaging could form the basis of interventions that aim to reduce patient expectations for antibiotics for viral URTI—to achieve substantial reductions in antibiotic prescribing for URTI or other conditions for which antibiotics provide little benefit.

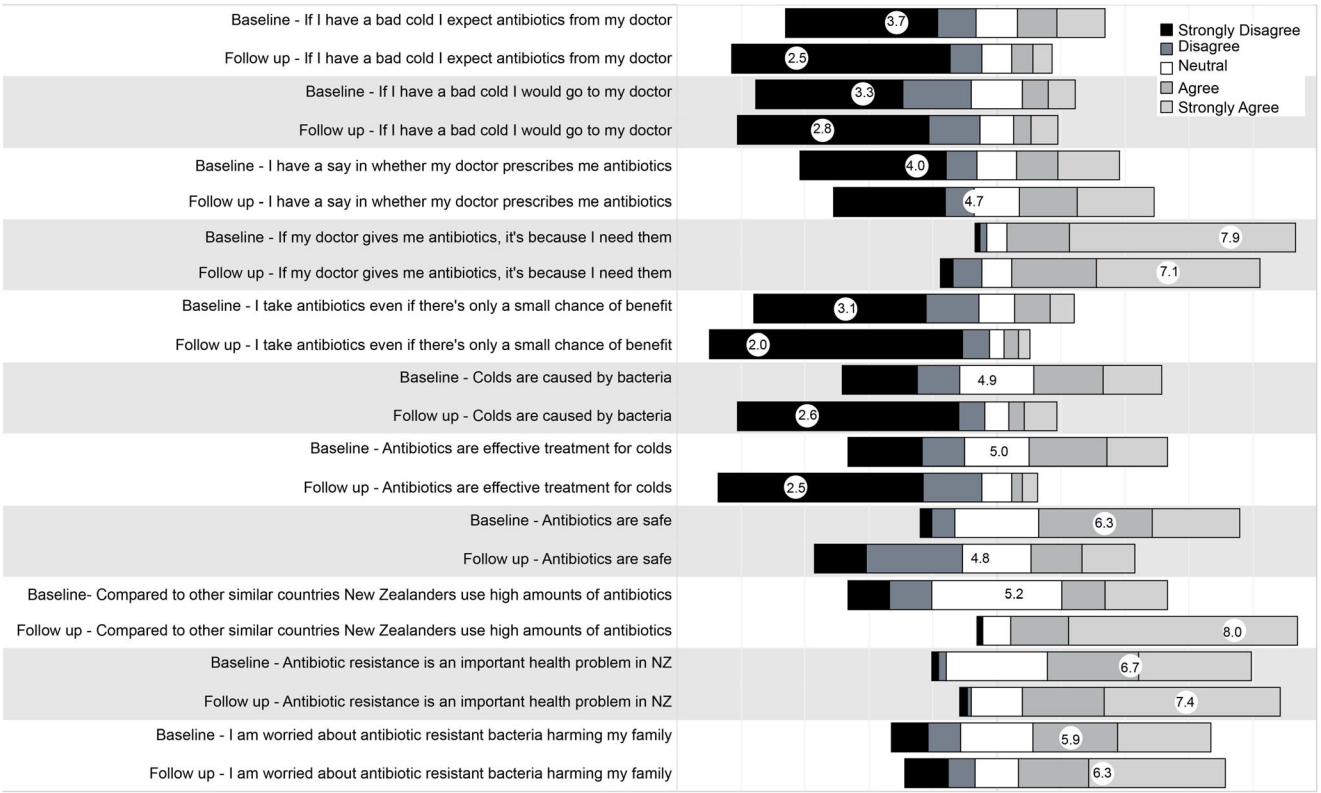

Fig. 1 Distribution of responses for each statement in the baseline and follow-up surveys. The number on each bar indicates the mean Likert score; all differences in Likert scores between the baseline and follow-up surveys were statistically significant (Wilcoxon's test, $P < 0.001$)

Table 2 The proportion of participants agreeing with survey items during the baseline and follow-up surveys, and the difference in mean Likert scores between the baseline and follow-up surveys. All differences in mean Likert scores were statistically significant ($P < 0.01$)

	Number in agreement prior to viewing poster (%)	Number in agreement after viewing poster (%)	Mean difference in Likert scores (95% CI)
If I have a bad cold I expect antibiotics from my doctor	82 (27%)	38 (13%)	− 1.25 (− 1.52, − 0.55)
If I have a bad cold I would go to my doctor	50 (17%)	41 (14%)	− 0.5 (− 0.73, − 0.28)
I have a say in whether my doctor prescribes me antibiotics	97 (32%)	126 (42%)	0.72 (0.41, 1.03)
If my doctor gives me antibiotics, it's because I need them	270 (90%)	232 (78%)	− 0.78 (− 1.02, − 0.55)
I take antibiotics even if there's only a small chance of benefit	55 (18%)	24 (8%)	− 1.1 (− 1.36, − 0.85)
Colds are caused by bacteria	120 (40%)	45 (15%)	− 2.28 (− 2.62, − 1.93)
Antibiotics are effective treatments for colds	130 (44%)	25 (8%)	− 2.53 (− 2.81, − 2.26)
Antibiotics are safe	188 (63%)	97 (32%)	− 1.53 (− 1.8, − 1.24)
Compared to other similar countries New Zealanders use high amounts of antibiotics	99 (33%)	268 (90%)	2.74 (2.44, 3.01)
Antibiotic resistance is an important health problem in NZ	191 (64%)	241 (81%)	0.71 (0.49, 0.93)
I am worried about antibiotic resistant bacteria harming my family	167 (56%)	193 (65%)	0.4 (0.07, 0.73)

Complex messages about future population harms caused by the development of antibiotic resistance do not provide additional benefit to reduce antibiotic expectation; the poster which focussed on antibiotic resistance was significantly less effective than the poster which focussed on the futility of antibiotic treatment. The messages about harms, whether they incorporate personal risk (harm) or population risk (resistance), were noticed by the participants—the information presented in the harm and resistance posters were significantly more likely to be seen as "scary". Clearly, scare tactics, such as providing information about antibiotic resistance, are to be avoided, as our results showed that they were not as beneficial as simple messaging about futility.

Patient expectations are often claimed to be the main driving factor for antibiotic prescription for viral URTI [6–8]. We found that the strongest predictor of continuing to expect antibiotics after viewing a poster was expectation to receive antibiotics in the baseline survey (odds ratio > 6 for those who strongly agreed). The participants also demonstrated fixed attitudes relating to illness. Although the posters did not suggest that going to the doctor with cold symptoms was unnecessary, agreement with the statement "if I have a bad cold I go to my doctor" changed very little after viewing a poster. These results indicate that changing these strongly held health-related beliefs requires additional resource. In keeping with this finding, participants who strongly agreed that "colds are caused by bacteria" in the baseline survey were also more likely to continue to expect antibiotics. However, correcting this knowledge gap was easily addressed with a poster—the greatest changes in responses to survey items after viewing a poster were in the belief that "colds are caused by bacteria" and that "antibiotics are effective treatments for colds".

While we delivered the information to study participants in the form of a poster, we do not underestimate the influence that the other study activities may have had on the results. The items in the study survey completed prior to viewing the poster, together with the explanation given by the investigator and the participant information sheet are also likely to have influenced participants' expectations. Thus, while mass media campaigns are likely to be able to improve the population's knowledge about antibiotic futility for viral URTI, we think that the success of any ensuing intervention is reliant upon a discussion with a person's regular healthcare professional that also focusses on their illness. We do not think that a poster placed in a waiting room will have much impact on prescribing.

In fact, there is limited evidence that posters are able to influence a person's healthcare beliefs. Waiting room posters formed only a very small part of the multi-faceted campaign that successfully reduced antibiotic prescribing for viral URTI in France [12]. Similarly, all of the studies that showed the benefits of posters to improve healthcare-related decision-making that we were able to find used posters in conjunction with other strategies to influence behaviour change. For example, a systematic review of 22 studies that promoted hand washing found that the interventions reduced episodes of diarrhoea by approximately one third [17]; however, all of the included studies that used posters also used other educational

Table 3 The adjusted odds ratios of expecting to receive antibiotics for a "bad cold" in the follow-up survey for selected participants' demographic factors and for baseline survey responses, determined by ordinal logistic regression. The baseline survey Likert responses were treated as categorical variables

Factor		Odds ratio	*P* value
Ethnicity	NZE/other	Reference	
	Maori	0.81 (0.28–2.33)	0.69
	Pacific	0.78 (0.20–3.11)	0.73
	Asian	0.86 (0.24–3.06)	0.82
Education level	Primary or secondary school	Reference	
	Trade certification	1.95 (0.72–5.26)	0.19
	Tertiary	0.69 (0.32–1.49)	0.35
Past antibiotic related adverse drug reaction		0.63 (0.32–1.22)	0.17
Poster viewed	Futility	Reference	
	Harm	1.34 (0.63–2.85)	0.45
	Resistance	2.46 (1.16–5.20)	0.02
If I have a bad cold I expect antibiotics from my doctor	Neutral	Reference	
	Strongly disagree	0.15 (0.05–0.43)	<0.01
	Disagree	0.94 (0.31–2.81)	0.91
	Agree	3.32 (1.20–9.23)	0.02
	Strongly agree	6.34 (2.11–19.29)	< 0.01
If I have a bad cold I would go to my GP	Neutral	Reference	
	Strongly disagree	0.56 (0.23–1.38)	0.21
	Disagree	1.27 (0.53–3.06)	0.59
	Agree	0.79 (0.24–2.61)	0.70
	Strongly agree	1.94 (0.59–6.31)	0.27
I have a say in whether my doctor prescribes me antibiotics	Neutral	Reference	
	Strongly disagree	1.78 (0.60–5.25)	0.30
	Disagree	1.00 (0.23–4.30)	1.00
	Agree	2.06 (0.58–7.33)	0.26
	Strongly agree	2.12 (0.66–6.80)	0.21
I take antibiotics even if there's only a small chance of benefit	Neutral	Reference	
	Strongly disagree	0.67 (0.24–1.83)	0.43
	Disagree	1.44 (0.48–4.30)	0.51
	Agree	1.17 (0.37–3.68)	0.80
	Strongly agree	1.65 (0.43–6.31)	0.46
Colds are caused by bacteria	Neutral	Reference	
	Strongly disagree	1.79 (0.50–6.37)	0.37
	Disagree	1.21 (0.35–4.15)	0.76
	Agree	1.43 (0.57–3.59)	0.45
	Strongly agree	2.97 (1.09–8.05)	0.03
Antibiotics are effective treatment for colds	Neutral	Reference	
	Strongly disagree	1.14 (0.34–3.82)	0.84
	Disagree	0.41 (0.11–1.59)	0.20
	Agree	0.45 (0.18–1.14)	0.09
	Strongly agree	0.52 (0.20–1.36)	0.18

elements including group training, songs and stories, amongst other activities.

Our study raises several questions requiring future study. Most importantly, the current study was performed on hospital inpatients, almost all of whom were admitted for reasons other than URTI—it will be important to study the impact of our messaging at the time patients present to their doctors with symptoms of a cold.

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Compliance with ethical standards

Ethical approval for this study (16/NTB/187) was provided by the Health and Disability Ethics Committee of the New Zealand Ministry of Health.

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