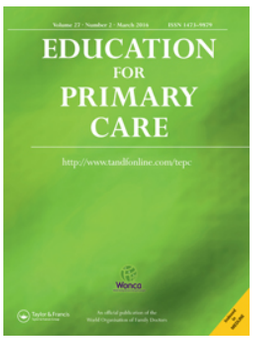

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RESEARCH

Reducing general practice trainees' antibiotic prescribing for respiratory tract infections: an evaluation of a combined face-to-face workshop and online educational intervention

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ABSTRACT

Over-prescription of antibiotics for non-pneumonia respiratory tract infections (RTIs) is a major concern in general practice. Australian general practice registrars (trainees) have inappropriately high rates of prescription of antibiotics for RTIs. The 'apprenticeship' educational model and the trainee–trainer relationship are drivers of this inappropriate prescribing. We aimed to reduce registrars' non-pneumonia RTI antibiotic prescribing via an educational intervention (a 90-min face-to-face workshop supported by online modules), complemented by delivery of the same intervention, separately, to their trainers. We conducted a pre- and post-intervention comparison of the registrars' intention to prescribe antibiotics for common RTIs using McNemar's test. We similarly tested changes in supervisors' intended prescribing. Prescribing intentions were elicited by responses to six written clinical vignettes (upper respiratory tract infection, otitis media, sore throat and three acute bronchitis vignettes). We found that, for registrars, there were statistically significant reductions in antibiotic prescribing for the sore throat (24.0% absolute reduction), otitis media (17.5% absolute reduction) and two of the three acute bronchitis (12.0% and 18.0% absolute reduction) vignettes. There were significant reductions in supervisors' antibiotic prescribing intentions for the same four vignettes. We conclude that our intervention produced a significant change in registrars' intention to prescribe antibiotics for non-pneumonia RTIs.

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KEYWORDS
Antibacterial agents; family practice; respiratory tract infections; bronchitis; physician prescribing patterns; education; medical; graduate

What is already known in this area

- Over-prescription of antibiotics and subsequent antibacterial resistance are major threats to health worldwide.
- Most antibiotic prescription occurs in general practice, with respiratory tract infections the most common reason for prescription.
- General practice trainees demonstrate inappropriate levels of antibiotic prescribing for common respiratory tract infections.
- The 'apprenticeship' model of training and the trainee–trainer relationship are identified as drivers of inappropriate prescribing.

What this work adds

- An educational intervention consisting of a 90-min face-to-face workshop supported by online modules and delivered to trainees (and, separately, to their trainers) resulted in significant reductions in trainees' intended antibiotic prescribing for respiratory tract infections (when assessed via written vignettes).

Suggestions for future work or research

- The efficacy of the intervention in reducing trainees' actual (as opposed to intended) prescribing should be assessed in a controlled trial.

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Introduction

Overuse of antibiotics is a concern worldwide [1,2] due to its impact on bacterial resistance at both community [3] and individual patient [4] levels and on antibiotic-related adverse effects. Most antibiotic prescribing is performed in general practice (family practice).[3] Hence, general practice prescribing is a key element in addressing antibiotic harms including bacterial resistance and consequent antibiotic failure.[5]

Much of the overuse of antibiotics is for the treatment of respiratory tract infections (RTIs).[3] For RTIs commonly seen in general practice, there is evidence of modest (otitis media,[6] sore throat),[7] very little (acute bronchitis) [8] or no (URTI) [9] efficacy of antibiotics. This evidence for limited or no efficacy is reflected in evidence-based guidelines internationally, including authoritative Australian guidelines.[10] These recommend against prescription of antibiotics for acute bronchitis or URTI and advise that routine use of antibiotics for acute otitis media, pharyngitis and tonsillitis should be avoided.[10] Despite this, antibiotic prescribing rates for these conditions in Australia [11] are inappropriately high.[12] Though Australian rates of antibiotic prescription have previously been found to be unremarkable compared to other developed countries,[13] more recent data suggest Australian antibiotic consumption increased markedly over the period 2000–2010.[14]

Given that GPs' antibiotic prescribing practices, once established, tend to remain consistent.[15,16] GPs in training are an important group with which to attempt to influence antibiotic prescribing. In this study, we evaluated changes in knowledge and attitudes to prescribing antibiotics for acute non-pneumonia RTIs of GP registrars (vocational trainees) following an intervention comprising an educational workshop presentation and access to two online educational modules. This evaluation of knowledge and attitudes was designed to complement an evaluation, still in progress, of registrars' changes in behaviour (actual prescribing) following the intervention. While registrars are the focus of the evaluation, their supervisors (trainers) also received the intervention as a professional development activity (separately to the registrars – see below for rationale).

Methods

We performed a questionnaire-based evaluation of a pragmatic intervention, using a pre- and post-test design without a control group.

Study population and recruitment

The study population was GP registrars in two of Australia's 17 Regional Training Providers (RTPs) and supervisors in one of the RTPs. Registrars were in Terms 1 and 2 of their three mandatory general practice-based training terms. Each term lasts six months (full-time equivalent). These GP terms are undertaken after at least two years full-time equivalent spent in hospital training.

Inclusion criteria required Term 1 and 2 registrars eligible to attend a workshop conducted as part of their vocational training programme. Registrar participants were also participants in the Registrars Clinical Encounters in Training (ReCEnT) project.[17] Registrar demographic data from the broader project were available for our analyses. Supervisor inclusion criterion was attendance at a parallel training workshop.

Intervention

The separate interventions for registrars and supervisors were both comprised of (i) a 90-min face-to-face educational session conducted during separate daylong educational workshops and (ii) two online educational modules specified as pre-reading for the educational sessions. The content of the modules was identical for registrars and supervisors. For supervisors, the workshop sessions included (as well as the material in the registrar sessions) guidance on teaching registrars about rational antibiotic prescribing. The location and group size of the workshop sessions were dictated by logistic and geographic factors.

The modules

These were two of the three INternet Training for Reducing AntibiOtic use (INTRO) electronic modules (developed within the European Union funded GRACE study) [18] adapted for the Australian context. The first module covers the epidemiology of RTIs in primary care, Australian and international antibiotic use and antimicrobial resistance, and the evidence base of current clinical guidelines (with a focus on Therapeutics Guidelines: Australia (Antibiotics), 2013 version).[10] The second module focuses on communication skills for GP management of acute bronchitis.

Workshop sessions

The interactive 90-min workshop sessions covered the epidemiology and implications of antimicrobial resistance and the current consensus guidelines for non-pneumonia RTIs in Australia.[10] It also included discussion of how to best implement the guidelines in daily practice (including appropriate communication skills and, for the registrar workshop, a role-play). There was an emphasis on URTIs and acute bronchitis as exemplars of infections, for which antibiotics are seldom indicated. Sore throat, acute otitis media and acute sinusitis were also covered.

The workshop content was constructed by the GP research team: GP vocational training educators, academic GPs and an infectious diseases physician/researcher. The process was informed by the current literature in the area and our recent work in registrar antibiotic prescribing – the prevalence and associations of antibiotic prescribing for non-pneumonia RTIs [19] and the qualitative experiences of registrars in managing URTI and acute bronchitis.[20]

We proposed three underlying principles as guiding management. Firstly, the default therapeutic decision in managing non-pneumonia RTIs is *not* to prescribe antibiotics. Deviation from this principle in any particular case requires careful consideration of the rationale for prescribing in that individual patient's clinical circumstance. The second principle was that attempts to treat non-pneumonia RTIs on the basis of presumed viral or bacterial aetiology are problematic and do not reflect current understanding of the complex interplay of bacterial and viral pathogens.[21,22] Rather, RTIs should be diagnosed and treated syndromically – which reflects the empirical evidence for treatment in the area.[6–9] The third principle was that the clinical science of consultations for non-pneumonia RTIs in general practice may be straightforward but managing patient perceptions and expectations may be complex and require advanced communication skills with close attention to a patient-centred approach. That is, the sophistication of consultation techniques employed will reflect the biopsychosocial complexity of the consultation rather than the biological complexity of the clinical scenario.

The workshops were delivered either by GP medical educators (one RTP) or a GP medical educator with an infectious diseases specialist (the other RTP), depending on local logistics.

The rationale for supplementing the registrar educational sessions with sessions for their supervisors was that our previous research [19,20] has suggested that the prescribing patterns (role modelling) of supervisors and the 'apprenticeship' model of the registrar–supervisor relationship are drivers of non-rational antibiotic prescribing.

Questionnaires

Registrars from both RTPs and supervisors from one RTP were invited via email and mail communication to complete pre- and post-intervention questionnaires as part of workshop evaluations. They could consent for these data to be used for research purposes.

Questionnaires elicited demographic data and whether the online modules had been accessed. They also elicited management responses to eight general practice scenarios of presentations of acute infectious disease: three cases of acute bronchitis (with different demographic and symptom combinations – vignettes 2, 3 and 5) and one each of URTI (vignette 1), sore throat (vignette 4) and acute otitis media (vignette 6). See Table 2 for summaries of clinical information within the vignettes. The sore throat and otitis media vignettes were constructed to reflect clinical situations in which the Australian eTG guidelines would recommend against antibiotic prescription. There were also cases of cellulitis and urinary tract infection to provide vignettes for which antibiotics are guideline-recommended. Respondents could choose one of several antibiotic management options or 'symptomatic treatment'. Scenarios or vignettes have been found to be a valid tool for measuring the quality of clinical practice [23–25] and have been used in previous studies of appropriateness of clinicians' antibiotic prescription for RTIs.[26,27]

The pre-workshop questionnaires were distributed four weeks prior to the workshops and the post-workshop questionnaires 12 weeks of post-workshop.

Statistical analysis

Primary outcome

We calculated proportions of registrars' management responses (antibiotic or 'symptomatic' treatment) for each of the six RTI vignettes, both pre- and post-workshop. For our primary analysis, we then tested change in responses on each of the six vignettes (antibiotic or 'symptomatic' treatment) using McNemar's test. Analysis included all registrars, whether or not they had attended the workshop or accessed the modules, as this best approximates the reality of delivering education in vocational education programmes.

Secondary outcome

The focus of the intervention was on registrars (and the supervisor aspect of the intervention was to reinforce and facilitate the registrar intervention). We also calculated pre- and post-workshop changes in supervisors' responses to the vignettes as a secondary outcome.

For all analyses, statistical significance was set at $p < 0.05$.

Results

Of 90 Term 1 and 2 registrars in the two RTPs, 80 (89%) registrars completed pre-workshop questionnaires, 67 (74%) attended the workshop and 76 completed both pre- and post-workshop questionnaires (though one registrar did not provide consent for research use of the data). Thus, the effective response rate for the completed study was 75/90 (83%). Of those who completed both questionnaires, 58 (77%) attended the workshop and 53 (71%) accessed the online modules. The flow chart of registrar recruitment and participation is shown in Figure 1.

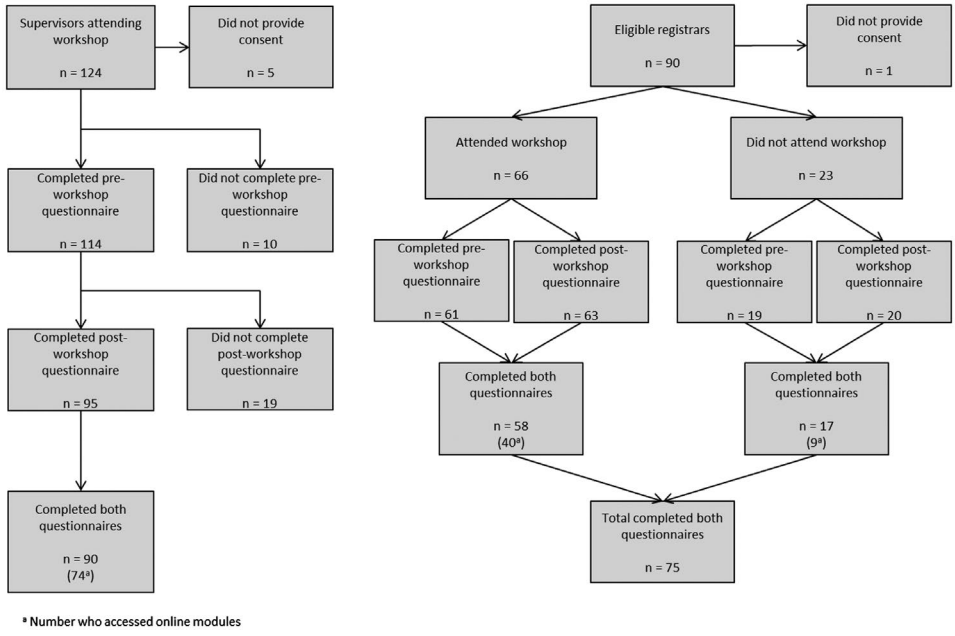

Figure 1. Flow chart of supervisor and registrar participation.

The demographics of registrars who completed both pre- and post-workshop questionnaires (see Table 1) were similar to those who completed only one of the two questionnaires.

The demographics of participating supervisors are presented in Table 1. The flow chart of supervisor recruitment and participation is shown in Figure 1.

The pre- and post-workshop responses of both registrars and supervisors to the six RTI vignettes are shown in Table 2. The registrars' baseline pre-workshop 'antibiotic prescription rates' were 1.3% for the URTI vignette, 89.3% for sore throat, 74.3% for acute otitis and 14.7, 8.0 and 45.8% for the three acute bronchitis vignettes. The supervisors' 'antibiotic prescription rates' were 0% for the URTI vignette, 79.6% for sore throat, 69.3% for acute otitis and 11.2, 13.6 and 51.1% for the three acute bronchitis vignettes.

For registrars, there were statistically significant reductions in antibiotic prescribing for the sore throat vignette (24.0% absolute reduction), the otitis media vignette (17.5% absolute reduction) and two of the three acute bronchitis vignettes (12.0 and 18.0% absolute reduction). There were significant reductions in supervisors' antibiotic prescribing intentions for the same four vignettes.

Discussion

Main findings and comparison with previous literature

Baseline (pre-intervention) prescribing intentions

The proportion of registrars intending to prescribe is considerably less than the documented prevalence of prescribing in Australian GP registrars [20] for URTI (1.3% vs. 21.6%) and acute bronchitis (14.7, 8.0 and 45.8%, in the three vignettes, versus 73.1%). Supervisors' reports of anticipated antibiotic management for these vignettes, too, were appreciably less than in studies of actual Australian GP prescribing.[11]

Supervisors' anticipated antibiotic prescribing for the vignettes was broadly similar to those of registrars, with no appreciable propensity to more liberal prescribing for either group. This contrasts with a recent Swedish study which found that trainees prescribe less antibiotics for acute bronchitis than GPs, especially older GPs.[28] It may well be that our supervisors are a population of more evidence-based practitioners than an unselected GP population.

A notable finding of baseline intended antibiotic prescribing in our study is the marked difference in responses to the three acute bronchitis vignettes (8.0–45.8% and 11.2–51.1% for registrars and supervisors, respectively). This is despite there being no clear evidence of clinically meaningful benefit from antibiotics in subgroups of patients with acute bronchitis.[29] Clinical features contributing to increased prescribing across the three vignettes may have been discoloured sputum and fever. Discoloured sputum [30,31] and fever [30,32] have previously been associated with GP prescription of antibiotics for acute bronchitis, despite a lack of evidence for efficacy in these patient subgroups.[29,31]

Reductions in prescribing post-intervention

We found significant decreases in registrars' anticipated antibiotic prescribing for four of the six RTI vignettes.

Table 1. Demographics of registrar and supervisor participants completing both questionnaires, and comparison with non-completing registrars and supervisors.

		Registrars			Supervisors		
		Registrars completing both pre- and post-questionnaires	Registrars completing only one questionnaire		Supervisors completing both pre- and post-questionnaires	Supervisors completing pre-questionnaire only	
Variable	Class	*n* = 75 *n*(%)	*n* = 14 *n*(%)	*p*	*n* = 90 *n*(%)	*n* = 19 *n*(%)	*p*
Gender	Female	57 (76.0)	9 (64.29)	0.51[a]	31 (34.44)	8 (42.11)	0.53
Age	Mean (SD)	33.10 (6.23)	31.40 (4.01)	0.53[b]	52.42 (9.70)	52.26 (10.51)	0.98[b]
Australian-trained	Yes	53 (70.67)	13 (92.86)	0.10[a]	75 (84.27)	15 (78.95)	0.52[a]
Regional training provider	RTP 1 (vs. 2)	44 (58.67)	11 (78.57)	0.16	90 (100)	19 (100)	–
Full time[c]	Full time	55 (76.39)	9 (64.29)	0.34[a]	62 (69.66)	12 (63.16)	0.58
Practice size[d]	Large	45 (67.16)	7 (50.00)	0.22	38 (43.68)	11 (61.11)	0.18
Term	Term 1 (vs. 2)	18 (24.00)	6 (42.86)	0.19[a]	–	–	–
Years worked in general practice	Mean (SD)	–	–	–	22.85 (10.18)	24.05 (11.31)	0.77[b]
Rurality	Major city	31 (41.33)	9 (64.29)	0.20[a]	59 (65.56)	14 (73.68)	0.49
	Inner regional	24 (32.00)	4 (28.57)		31 (34.44)	5 (26.32)	
	Outer regional/ Remote/Very remote	20 (26.67)	1 (7.14)		0 (0)	0 (0)	
SEIFA[e] index	Mean (SD)	984.16 (36.89)	985.29 (26.67)	0.75[b]	989.34 (49.70)	989.68 (38.90)	0.81[b]

Notes: Numbers and percentages may not match '*n*' due to missing data.
[a]Fisher's exact probability.
[b]Wilcoxon rank-sum probability.
[c]Full-time status is defined as 8 sessions or more per week.
[d]Practices defined as large if 6 or more GPs were working in the practice.
[e]Socio-economic Index for Area, Index of Relative Socio-economic Disadvantage.

Table 2. Prescription of antibiotics (versus symptomatic treatment) in response to six respiratory tract infection vignettes.

Vignette*	Registrars[a]			Supervisors[b]		
	Prescribed antibiotics pre-questionnaire *n*(%)	Prescribed antibiotics post-questionnaire *n*(%)	McNemar's chi-square *p*-value	Prescribed antibiotics pre-questionnaire *n*(%)	Prescribed antibiotics post-questionnaire *n*(%)	McNemar's chi-square *p*-value
1. 18-month-old boy with a 4-day history of clear runny nose and being somewhat off his food. He attends day care. On examination he appears well. Temperature 37.6 °C. Throat and tympanic membranes are normal to examination	1 (1.33)	0	0.32	0	0	–
2. 66-year-old man with a four-day history of clear rhinorrhoea and cough with green-yellow sputum. Past history of hypertension. Afebrile. Chest clear	11 (14.67)	2 (2.67)	0.003	10 (11.24)	1 (1.12)	0.007
3. 6-year-old girl with a 4-day history of clear rhinorrhoea, sore throat, sore ears and dry cough, Off school for 3 days. Temperature 38.0 °C. Throat is mildly red, no lymphadenopathy. Chest and tympanic membranes normal to examination	6 (8.00)	3 (4.00)	0.18	12 (13.64)	6 (6.82)	0.13
4. 17-year-old boy with a 4-day history of sore throat, feeling hot, and anorexia. No cough. Off school for 3 days. Temperature is 37.6 °C. Throat moderately red with moderate tonsillar exudate. No lymphadenopathy	67 (89.33)	49 (65.33)	<0.001	70 (79.55)	53 (60.23)	<0.001
5. 24-year-old man with a 4-day history of myalgias, green-yellow rhinorrhoea and a cough with green-yellow sputum. Off work for 4 days. Temperature 38.1 °C. Throat and chest are normal to examination	33 (45.83)	20 (27.78)	0.009	45 (51.14)	23 (26.14)	<0.001
6. 4-year-old boy with a four-day history of clear runny nose and pulling at his right ear. Has felt hot to his mother. Normally attends day care. He appears well. Temperature 37.4 °C. Throat and chest normal to examination. Right tympanic membrane bulging and red	55 (74.32)	42 (56.76)	0.007	61 (69.32)	47 (53.41)	0.004

*principal clinical elements from questionnaire items.
[a]$n = 75$.
[b]$n = 90$.

The two vignettes for which there was not significant change both elicited such low pre-intervention antibiotic prescription responses that detectable change was unlikely.

The effect sizes of reductions in anticipated antibiotic prescribing are generally greater than those previously achieved in actual prescribing with educational meeting interventions for RTI antibiotic prescribing.[33,34]

Strengths and limitations

A Cochrane 2005 review concluded that simple interventions such as guideline publication and distribution, didactic educational meetings and audit interventions are unlikely to lead to a reduction in the incidence of antibiotic-resistant bacteria causing community-acquired infection. Higher complexity interventions (including interactive workshops) appear to be more effective in changing antibiotic-prescribing behaviours.[33] A strength of our study is that we constructed such an intervention and tested it in a 'real world' situation of GP trainees' routine educational programmes (and conducted the equivalent of an 'intention-to-educate' analysis of all registrars – including those who did not receive all or any elements of the intervention – to reflect real-world educational logistics). We also administered our post-intervention questionnaire 12 weeks of post-intervention, demonstrating a persistence of effect beyond the immediate post-intervention period.

A limitation of the study is that our outcome factor was expressed intention to prescribe rather than actual prescribing. Though use of vignettes has been found to be a valid means of measuring the quality of clinical practice,[23–25] it may be argued that knowledge alone is not enough to ensure evidence-based management of RTIs. Patient expectations (and pressure), supervisor expectations and role modelling, time-efficiency, limited tolerance of diagnostic uncertainty, fear of poor clinical outcomes for the patient and logistical issues have all been identified as mitigating against registrars' evidence-based antibiotic prescribing for RTIs.[20] The low baseline (pre-intervention) expressed intention to prescribe compared to previous studies of actual prescribing probably reflects these factors (as well as, possibly, social desirability bias on our questionnaire).

The lack of a control group is also a limitation of the study.

Implications for practice and further research

Despite the above caveats, this study demonstrates an ability of a complex educational intervention, delivered as part of a usual education programme and with face-to-face contact of only 90 min, to change registrars' intended prescribing behaviours in RTIs.

Further research must evaluate changes in actual prescribing, as opposed to expressed intent to prescribe and employ a control group. Data collection of our participant registrars' actual prescribing compared to that of control RTPs is continuing and will address this issue.

A further consideration is that the Cochrane review of this area concluded that multifaceted interventions combining medical practitioner, patient and public education were the most successful in reducing antibiotic prescribing for inappropriate indications.[33] We have only addressed the medical practitioner component of this triad in our study. Further research could include our medical practitioner-focused educational intervention in a broader intervention.

Conclusions

Our complex intervention, consisting online educational materials and an interactive workshop, produced significant change in intention to prescribe antibiotics for non-pneumonia RTIs. The intervention, including the underlying principles of 'default non-prescription', syndromal management, and matching the sophistication of consultation techniques to the biopsychosocial complexity of the consultation, requires further evaluation. It is, however, a promising approach to bridging an important evidence–practice gap.

Ethical approval

Ethics approval for the registrar study was from the Human Research Ethics Committee of the University of Newcastle (Approval number: H-2009-0323). The Committee deemed the supervisor evaluation a quality assurance activity.

Disclosure statement

No potential conflict of interest was reported by the authors.

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