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ORIGINAL ARTICLE

Effect of educational outreach on general practice prescribing of antibiotics and antidepressants: A two-year randomised controlled trial

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Abstract

Objective. Prescribing of broad spectrum antibiotics and antidepressants in general practice often does not accord with guidelines. The aim was to determine the effectiveness of educational outreach in improving the prescribing of selected antibiotics and antidepressants, and whether the effect is sustained for two years. *Design.* Single blind randomized trial. *Setting.* Twenty-eight general practices in Leicestershire, England. *Intervention.* Educational outreach visits were undertaken, tailored to barriers to change, 14 practices receiving visits for reducing selected antibiotics and 14 for improving antidepressant prescribing. *Main outcome measures.* Number of items prescribed per 1000 registered patients for amoxicillin with clavulanic acid (co-amoxiclav) and quinolone antibiotics, and average daily quantities per 1000 patients for lofepramine and fluoxetine antidepressants, measured at the practice level for six-month periods over two years. *Results.* There was no effect on the prescribing of co-amoxiclav, quinolones, or fluoxetine, but prescribing of lofepramine increased in accordance with the guidelines. The increase persisted throughout two years of follow-up. *Conclusion.* A simple, group-level educational outreach intervention, designed to take account of identified barriers to change, can have a modest but sustained effect on prescribing levels. However, outreach is not always effective. The context in which change in prescribing practice is being sought, the views of prescribers concerning the value of the drug, or other unrecognised barriers to change may influence the effectiveness of outreach.

Key Words: *Continuing, education, family practice, medical, physician's practice patterns*

Educational outreach is a strategy in which a trained person meets with providers in their setting to give information with the intention of changing the provider's practice [1]. It can lead to modest improvements in care processes and can be delivered to individual providers or groups, but the value of the method in routine practice depends on the duration of its effect [1–4].

Antimicrobial resistance is a significant problem [5]. Current national guidance in England, consistent with guidance at the time of our study (2002–2004), advises the prescription of an antibiotic only when it is likely to have clinical benefit and the avoidance of broad-spectrum antibiotics such as amoxicillin with clavulanic acid (co-amoxiclav) or quinolones since they increase the risk of resistant infections [6].

Educational outreach can be effective in improving prescribing practice, but the specific methods of outreach and the duration of the effect are uncertain.

- An outreach intervention, tailored to address barriers to change, was effective in improving antidepressant prescribing, the effect persisting for two years.
- There was no improvement, however, in the prescribing of broad-spectrum antibiotics.
- For some drugs, or in some contexts, barriers to improved prescribing may be either more difficult to identify or more difficult to overcome

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Current English guidelines on the management of depression recommend selective serotonin reuptake inhibitors (SSRI) because they are less likely to be discontinued and are as effective as tricyclics [7]. At the time of our study, local guidelines recommended lofepramine (a tricyclic antidepressant) as first choice [8].

Tailoring interventions to address identified barriers may improve effectiveness [9]. Barriers may exist at the level of the individual health professional, the team, or the organization [10,11], but evidence on which interventions are effective in addressing specific barriers is limited [9]. Educational interventions to improve antibiotic prescribing appear promising [3,12,13]. Barriers to appropriate antibiotic prescribing include concern about complications and maintenance of the doctor–patient relationship [14], and organizational context [15,16]. Lack of confidence in counselling patients about the side-effects of antidepressants can be a barrier to prescribing therapeutic doses [17]. Few studies address the question of whether the effects of outreach visits persist, follow-up being short in most trials [2,13,18]. In this two-year follow-up study, we investigated the impact of a tailored educational outreach intervention aimed at reducing the prescribing of broad-spectrum antibiotics, and increasing the prescribing of lofepramine and fluoxetine.

Material and methods

The study took place in Leicestershire, central England. All local general practices (n = 151) were invited to participate by post in February 2002. Twenty-eight practices agreed; all completed the study (Figure 1).

We conducted a randomized controlled trial with randomization, intervention, and analysis at the level of the practice. Practices were randomized to two groups using a table of random numbers. To account for variability in initial levels of prescribing of broad-spectrum antibiotics, randomization was stratified to ensure each study group included similar numbers of practices with prescribing of quinolones and co-amoxiclav above and below the median of the 28 included practices at baseline. One group of practices received an intervention for antidepressant prescribing and served as controls for antibiotic prescribing, and the other group received an intervention for antibiotic prescribing and served as controls for antidepressant prescribing [19].

The intervention was an educational outreach visit based on the principles of academic detailing [20]. Two educational packages were developed that included summaries of current evidence on the appropriate prescribing of either antidepressants or antibiotics. Prior to outreach visits, the outreach visitor (A E-P) received training in academic detailing and undertook semi-structured interviews of four volunteer non-study general practitioners to identify barriers to the appropriate prescribing of antidepressants and broad-spectrum antibiotics. The findings of the interviews were used to tailor the intervention to the barriers, including the content of the educational packages and the discussions during the outreach visits. The intervention was then piloted with two other non-study general practitioners.

The practices were visited between May and November 2002. The visits lasted 20 to 40 minutes, and were attended by all doctors with prescribing responsibilities at the practice. Practices were blind to the fact that they were also serving as controls for the non-intervention drugs. The intervention was carried out at group level with interactive discussion of the supporting evidence for appropriate prescribing, perceived barriers to change, and best methods to overcome them. Practices were presented with their baseline prescribing data in comparison with the range of prescribing for all local practices. The prescribing information was itemised per class of antibiotic or antidepressant, and a copy was given to each doctor. Doctors were also given an antidepressant-prescribing flow chart or guidelines for the management of common infections in primary care, according to study group. Before leaving the practice, agreement was sought from the doctors that they would modify their prescribing as advised. The outreach visitor made structured notes after each visit on the doctors' reactions and whether they agreed to implement the prescribing recommendations. A second visit to each of the practices was carried out six months later to provide feedback on prescribing patterns and clarify outstanding issues.

The prescribing data were retrieved from a nationally available database [21] that provides information to health service managers and practices, itemized as follows: prescription rates per 1000 patients registered with the practice for co-amoxiclav and quinolones; prescription rates per 1000 registered patients for all antibiotics; average daily quantities (ADQs) per 1000 patients for lofepramine and fluoxetine; and ADQs for all tricyclics and all SSRIs. The ADQ is a measure of prescribing volume based on prescribing behaviour in England and represents the assumed average maintenance dose per day for a drug used for its main indication in adults [22]. The ADQ per patient is 140 mgm for lofepramine and 20 mgm for fluoxetine. The prescribing data did not identify which patients in the participating practices had received prescriptions and did not differentiate between prescriptions for new courses of treatment or for continuing treatment.

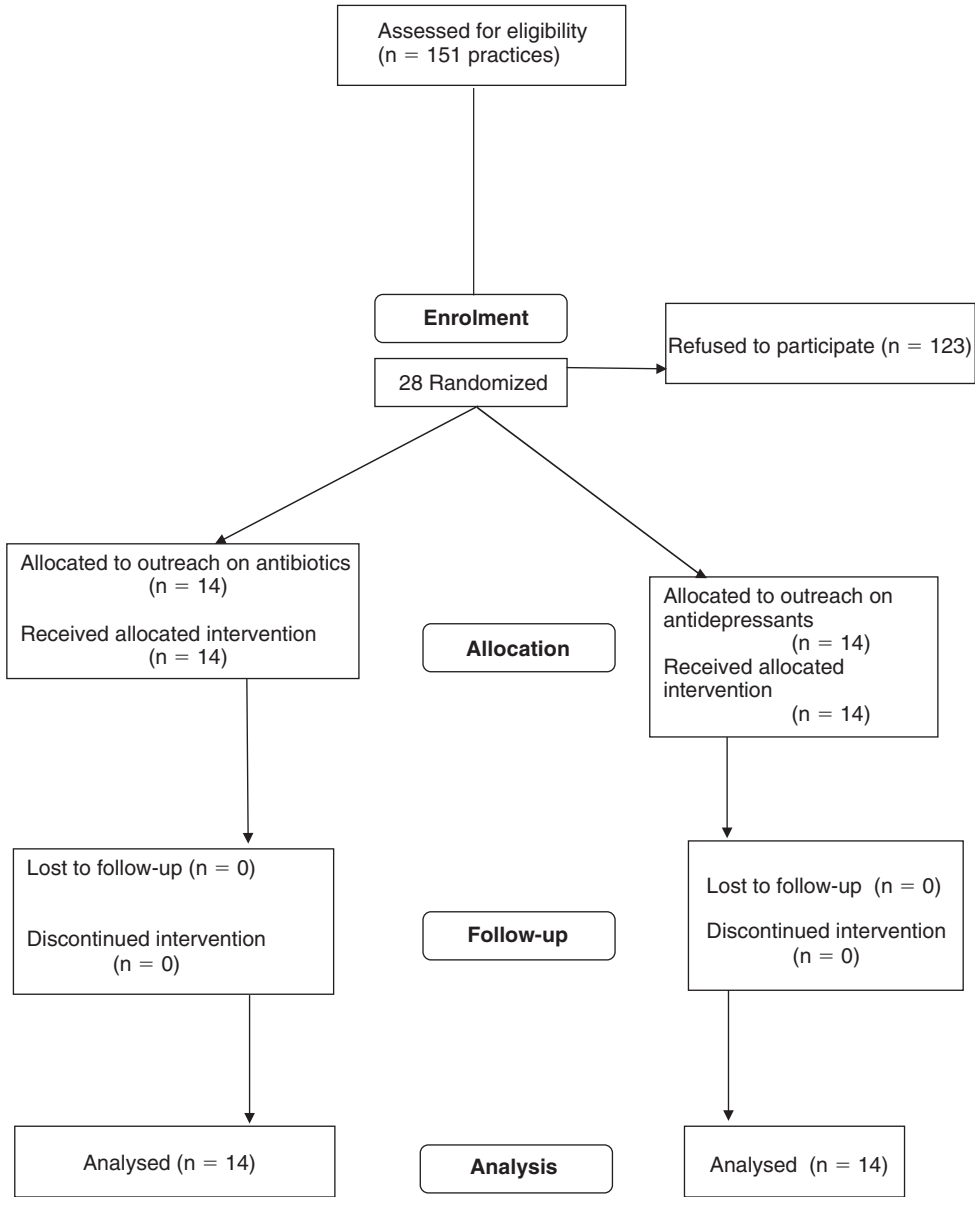

Figure 1. Study flowchart.

Information was obtained on number of doctors in each practice, socioeconomic deprivation among practice patient populations using a standard index [23], and patient list size by age group and gender. The study outcomes were number of items prescribed for each six-month study period per 1000 patients by practice for co-amoxiclav and quinolone antibiotics, and the number for each six-month study period of average daily quantities (ADQs) per 1000 registered patients by practice for lofepramine and fluoxetine antidepressants at six, 12, 18, and 24 months after the first outreach visit.

Randomization, delivery of the intervention and analysis were all done at the practice level. The prescribing data used in the study described prescribing at practice and not patient level. Consequently, the study was not a cluster randomized design [19]. The sample size was sufficient to detect a difference of 1.8 items per 1000 patients for antibiotic prescribing and 20 ADQs per 1000 patients for antidepressants, with 5% significance and 80% power. Descriptive statistics were used to determine whether the two groups of practices had similar characteristics.

Two consecutive six-month periods were used to establish baseline prescribing levels before the interventions to account for possible seasonal variations in prescribing. Since there were no differences in prescribing rates between these two periods we have used the mean of the two periods to indicate baseline prescribing. To analyse the rate- and count-based

data we used Poisson regression [24] and tested for goodness-of-fit in terms of over-dispersion using the deviance based Chi-square test. For all study variables, the Chi-square p values were highly significant suggesting over-dispersion. Consequently we used Negative Binomial regression models [24] to assess the effect of the intervention, having adjusted for the baseline effect. These analyses were done separately for every six-month period. The appropriate diagnostic criteria were used, including the likelihood ratio test to assess the fits. The overall effect of the interventions was also examined combining outcome measurements over all review periods and baseline measurements, using a generalized mixed-effects model based on Negative Binomial distributions. To assess the effect of the intervention on the targeted antibiotics as a percentage of all antibiotics prescribed, and the targeted antidepressants as a percentage of all antidepressants prescribed, we used robust linear regression techniques, adjusting for baseline, to account for the problem of heteroscedasticity and non-normality. All statistical analyses were conducted using STATA 8 software.

Results

Practice characteristics are given in Table I. Three practices in the antibiotic group were accredited to train residents (trainees), and two in the antidepressant group. Practices in the antidepressant intervention group were smaller, although patient socioeconomic status was similar. The interviews indicated that barriers to appropriate antibiotic prescribing included failure of a narrow-spectrum antibiotic to be effective, doctor and patient attitude towards risk, lack of information on the sensitivity of bacteria in the community, and concern by the doctor to treat a patient with comorbid conditions effectively. Barriers to appropriate antidepressant prescribing included habit, the prescribing policy of the local psychiatrists, and cost. Most doctors welcomed the guidance and did not challenge the evidence, but some saw the intervention as criticism of their prescribing. At the end of the first outreach visits, six practices in the antidepressant group and seven in the antibiotic group gave a firm commitment to change their prescribing.

Negative binomial regression analysis for each six-month period did not identify any consistent changes in antibiotic or antidepressant prescribing (detailed results not shown). The mixed-effects negative binomial regression model with identity link to detect impact over the 24-month period of follow-up on absolute levels of prescribing indicated an effect on lofepramine prescribing (rate ratio 2.85, $p<0.001$, Table II). There was no effect on co-amoxiclav, quinolone, or fluoxetine prescribing. Table III presents regression models adjusted for baseline prescribing of the target antibiotics combined as a percentage of all antibiotic prescriptions, and target antidepressants as a percentage of all antidepressants. The proportion of target antibiotics prescribed was not significantly lower at any review point, but the proportion of target antidepressants prescribed was higher in the intervention group in the last three review periods up to 24 months.

Discussion

Principal findings

There was a small change in the desired direction in the proportion of antidepressants prescribed according to guidelines that lasted for 24 months,

Table I. Baseline characteristics of study practices by intervention group (items per patient – numbers of prescriptions in six-month period per 1000 registered patients; ADQ per 1000 patients – average daily quantities [the assumed average maintenance dose per day] in six-month period per 1000 patients).

	Antibiotic intervention group (n=14) Mean (95% CI)	Antidepressant intervention group (n=14) Mean (95% CI)	p
Number of GPs per practice	3.3 (2.2, 4.5)	2.2 (1.4, 2.9)	0.08
Patients per practice			
Females 0–18 years	930 (279, 1124)	424 (279, 580)	0.06
Females 19–65 years	2261 (857, 3198)	1156 (670, 1799)	0.15
Females 66 + years	693 (296, 899)	266 (164, 367)	0.06
Males 0–18 years	974 (317, 1159)	469 (308, 604)	0.06
Males 19–65 years	2088 (978, 3275)	1119 (670, 1768)	0.33
Males 66 + years	449 (219, 671)	194 (136, 282)	0.06
ID2004 Deprivation Score	20.6 (14.3, 26.8)	23.3 (16.2, 30.3)	0.46
Co-amoxiclav items per 1000 patients	10.9 (6.6, 15.2)	8.0 (4.4, 11.6)	0.31
Quinolone items per 1000 patients	11.4 (5.1, 17.8)	8.0 (5.2, 10.7)	0.38
Lofepramine ADQs per 1000 patients	256.4 (195.9, 316.8)	252.7 (109.4, 396.1)	0.36
Fluoxetine ADQs per 1000 patients	1832.7 (1278.4, 2387)	1629.1 (1227.3, 2030.9)	0.89

Table II. Effect of intervention combining data on all review periods using generalized mixed-effect model based on negative binomial regression distributions, with adjustment for baseline. Antibiotic prescribing – items per 1000 patients, antidepressant prescribing – average daily quantities.

Drug	RR[a]	95% CI of RR	p
Co-amoxiclav	0.89	0.52, 1.50	0.65
Quinolones	0.98	0.63, 1.53	0.92
Lofepramine	2.85	1.92, 4.34	<0.001
Fluoxetine	1.06	0.75, 1.52	0.74

Note: [a]Rate ratio.

although no change for antibiotics. A simple, group-level educational outreach intervention, designed to take account of identified barriers to change, appears to have a small sustained effect on prescribing levels, but the effect is not consistent across different groups of drugs. The degree of effectiveness is likely to depend on the context, including the prevailing barriers to change, the clinical topic concerned, and the particular change being sought.

Strengths and weaknesses of the study

The study was a randomised trial with a carefully planned and delivered intervention and two years of follow-up, but there are a number of limitations. Only 28 practices were included, and only a limited proportion of practices in the locality agreed to participate, raising concern about the external validity of the findings. It is possible, for example, that the barriers to changing prescribing would be different in other practices. The prescribing data did not differentiate between new and continuing prescriptions, a factor that may have reduced the ability to detect a rapid effect of the intervention on antidepressant prescribing. Nevertheless, the study provides further evidence about the role of tailored outreach to influence clinical practice.

Implications

It is not clear why the outreach intervention influenced the prescribing of antidepressants but not of antibiotics. The context in which the participating practices were making prescribing decisions may have played a part in facilitating changes in antidepressant prescribing but not antibiotic prescribing; in other settings and circumstances, context may play a different or even contrary role. Despite the clear statements about effectiveness contained in the guidelines, doctors' continued perceptions of clinical effectiveness, and desire for prompt benefit [25], may have played a part in explaining the impact of the outreach intervention. Doctors in the study had expressed concern about reduced clinical effectiveness if they did not use broad-spectrum antibiotics. However, doctors did not express doubts about the effectiveness of the recommended antidepressants. In a review of trials of interventions to improve antibiotic prescribing, educational outreach was found to have mixed results, although multi-faceted educational interventions applied after addressing barriers to change were more likely to be successful than other approaches [3]. Our findings are consistent with this conclusion, and also with the finding that educational outreach has relatively small effects on prescribing [2]. Our study shows that these effects can be relatively long lasting.

Table III. Percentage of co-amoxiclav and quinolones prescribed as a proportion of total antibiotic (number of items per 1000 patients), and lofepramine and fluoxetine as a proportion of total antidepressant prescribing (ADQs per 1000 patients).

	Antibiotic group Mean (CI)	Antidepressant group Mean (CI)	p-values
Co-amoxiclav and quinolones as percentage of total antibiotic prescribing			
Average baseline	6.9 (4.6, 9.0)	5.8 (3.1, 8.3)	
Review 1	4.6 (3.3, 5.9)	6.2 (3.7, 8.8)	0.40
Review 2	5.7 (4.2, 7.2)	6.2 (3.7, 8.7)	0.43
Review 3	5.4 (4.30, 6.4)	6.8 (4.0, 9.5)	0.97
Review 4	5.8 (4.3, 7.3)	6.4 (3.8, 9.0)	0.98
Lofepramine and fluoxetine as percentage of total antidepressant prescribing			
Average baseline	20.9 (16.8, 25.1)	26.7 (22.6, 30.9)	
Review 1	21.4 (17.3, 25.4)	27.7 (22.2, 33.2)	0.07
Review 2	21.3 (17.3, 25.3)	29.5 (24.0, 351)	0.01
Review 3	20.7 (16.6, 24.8)	29.4 (24.3, 34.5)	0.01
Review 4	20.8 (16.5, 25.2)	28.6 (23.0, 34.2)	0.01

Notes: Regression analysis adjusting for baseline. Review periods 1 to 4 were consecutive six-month periods, total follow up 24 months.

The interviews undertaken to identify barriers to inform the design of the intervention indicated that prescribing of antibiotics was influenced by contextual factors such as lack of information on drug resistance or concern to treat patients with comorbidity effectively [14,26], and the doctor's and patient's perception of risk. In contrast, antidepressant prescribing appeared to be influenced more commonly by habit rather than concern about effectiveness. It is possible that placing greater emphasis on the safety of avoiding broad-spectrum antibiotics would have given general practitioners the confidence to apply the guidelines.

Although half the practices expressed agreement with the recommendations on antibiotic prescribing, they did not change their prescribing habits. The method of educational outreach includes seeking agreement from the participating doctors to change their practice as recommended, but our study suggests this is not a sufficient guide as to whether the barriers have been overcome [20]. We used a relatively simple method of exploring the barriers to recommended prescribing, but the methods generally used to identify barriers and to tailor interventions to overcome them are not yet well developed [9]. Research is required to develop and evaluate alternative approaches to barriers analysis, and to check with participants whether barriers have been addressed before discontinuing interventions and moving on to collect performance data.

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