Promoting better use of the PSA test in general practice: randomized controlled trial of educational strategies based on outreach visits and mailout

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**Background.** Prostate-specific antigen (PSA) testing for prostate cancer is controversial. Demand for PSA testing is likely to rise in the UK, Australia and other western countries. Primary care needs to develop appropriate strategies to respond to this demand.

**Objectives.** Our aim was to compare the effectiveness of educational outreach visits (EOVs) and mailout strategies targeting PSA testing in Australian primary care.

**Methods.** A randomized controlled trial was conducted in general practices in southern Adelaide. The main outcome measures at baseline, 6 months and 12 months post-intervention were PSA testing rates and GP knowledge in key areas relating to prostate cancer and PSA testing.

**Results.** The interventions were able to demonstrate a change in clinical practice. In the 6 months post-intervention, median PSA testing rate in the EOV group was significantly lower than in the postal group, which in turn was significantly lower than the control group (P < 0.001). Statistically significant differences were not, however, maintained in the 6–12 month post-intervention period. The EOV group, at 6 months follow-up, had a significantly greater proportion of ‘correct’ responses than the control group to questions about prostate cancer treatment effectiveness (P = 0.004) and endorsement of PSA screening by professional bodies (P = 0.041).

**Conclusions.** Primary care has a central role in PSA testing for prostate cancer. Clinical practice in this area is receptive to evidence-based interventions.

**Keywords.** Primary care, prostate-specific antigen, PSA test, randomized controlled trial.

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**Introduction**

Cancer of the prostate is a leading cause of male cancer-related mortality in western countries such as the UK and Australia, and its incidence is rising in the UK and internationally. PSA testing offers the prospect of early detection and treatment of the disease, but has not been shown conclusively to lead to observable improvements in mortality from prostate cancer. Trials currently are underway in North America and Europe to examine this question, but results will not be available for some years.

Testing of asymptomatic men for prostate cancer is not widespread in the UK, although recent NHS guidance promotes a policy of ‘informed consent’ in response to requests for PSA tests, replacing an active policy of discouragement; this may lead to increased awareness and activity. Rates of PSA testing are higher in Australia, and it occurs largely in the context of primary care. Available evidence suggests that most of this testing is for ‘screening’ purposes, and this is at odds with existing evidence and recommendations, prompting calls to develop strategies for changing this area of clinical behaviour. Effecting such change is a complex
and difficult task, although multifaceted strategies which include mechanisms such as educational outreach visits (EOVs) to tailor interventions to particular contexts show the most promise.\textsuperscript{12} Such strategies are resource-intensive, so it is important to assess their potential against less expensive approaches such as mailout of evidence-based materials.

We report a randomized study in GP practices in central and southern Adelaide, South Australia. GPs in intervention groups received evidence-based information materials, delivered either by an educational outreach programme or by mail. The aim of the trial was to assess the relative effectiveness of these two modes of delivery, and to compare each with a control group reflecting current practice. Outcomes measured were PSA testing rates and GP knowledge in key areas relating to prostate cancer and PSA testing.

Methods

GPs in Adelaide’s southern suburbs were identified from lists provided by the Southern Division of General Practice, and a recent telephone directory-derived census. GPs were invited to participate in a ‘study about PSA testing for prostate cancer’ in the first half of 1999 by mail, with a follow-up telephone call. Royal Australian College of General Practitioners (RACGP) postgraduate education credits were offered to participating GPs. We identified 527 GPs from our sampling procedure, of whom we assumed approximately a quarter would respond to an invitation to participate in a study linked to RACGP postgraduate education credits (based on similar studies amongst southern Adelaide GPs).

Our sample size calculation assumed a one-way analysis of variance with $\alpha = 0.05$, 80% power, a common standard deviation of 2.0, and a mean PSA testing rate per 100 male consultations at 6 months of 3.0, 2.0 and 1.0 in the control, postal and EOV groups, respectively. For our study, we considered changes in existing PSA testing rates of 15% in 70+ age groups and 10% in all ages combined were ‘clinically significant’. Sample size calculation also incorporated patient age-specific PSA test-ordering rates, and an adjustment for any within-practice clustering of responses, given that allocation was at the level of the practice (in order to minimize any contamination of results).

GPs were randomized by practice; we assumed that the intraclass correlation coefficient (ICC) between our GP practices would be very low, based on evidence from intervention trials in primary care which quote ICCs in the range of 0.000005–0.0002.\textsuperscript{13} There was no reason in this study to believe that belonging to a given practice would affect the PSA testing rates of an individual GP. Further, the number of practices involved (82) was high compared with the numbers of GPs (145). A \textit{post hoc} analysis of baseline PSA testing rates provided an ICC of 0.00067, justifying these assumptions. Allowing for drop-outs and the small effect of clustering, 40 GPs per group were recruited to the study.

Randomization was undertaken with a random number generator based in the Department of General Practice, Flinders University. This provided a computer-generated randomization list of those GPs willing to participate in the study, and a study researcher was responsible for seeing GP practices allocated the next available number. The code was only revealed to the investigators once recruitment, data collection and analyses were complete. The nature of the study and its interventions meant that participants and educational outreach visitors could not be blinded to group assignment. Those supplying PSA test-ordering information and data entry personnel were, however, blinded.

The two intervention groups received identical educational materials and feedback which were delivered either by an educational outreach programme or by mailout. The outreach visitor used in this study was an experienced clinical pharmacist who underwent an intensive 2-week period of training in social marketing techniques.\textsuperscript{14} The EOVs followed the model of academic detailing proposed by Avorn and Soumerai,\textsuperscript{15} and targeted individual GPs. The training included piloted visits and strategies for providing information amongst a small group of GPs associated with the trial management. The educational materials comprised:

1. printed summaries of evidence on PSA testing based on systematic reviews from national health technology assessment groups in Australia and the UK;\textsuperscript{3,4}
2. patient education materials which had been trialled and used in a general practice setting;\textsuperscript{16} and
3. epidemiological information on prostate cancer in Australia.\textsuperscript{1}

Feedback comprised individualized PSA test-ordering rates. There were two EOVs, 4–6 weeks apart, and posted materials were split between two mailouts 5 weeks apart.

Test-ordering rates (PSA tests per 100 male consultations) were obtained for individual GPs in three 6-month periods; the 6 months prior to the intervention, months 0–6 post-intervention and months 6–12 post-intervention. Data on the ordering of tests were obtained from both the federal government Health Insurance Commission’s pathology data collection systems and the state pathology service, which together cover almost all PSA testing carried out in general practice in South Australia.

A questionnaire was used to examine knowledge in relation to PSA testing for prostate cancer. It was based thematically on the educational materials and was modelled on a similar instrument used previously to
examine GPs’ knowledge, attitudes and practices in relation to colorectal cancer screening.\textsuperscript{17} It was administered at baseline and at 6 months post-intervention.

The rate of PSA testing by GPs was found to be significantly skewed to the right, so average measures have been presented as medians and the data analyzed using non-parametric tests. Comparison of PSA testing rates between trial groups was undertaken by Kruskall–Wallis test. Where this proved to be statistically significant, two approaches were undertaken: (i) where a trend was suspected, a Cuzick test for trend was applied;\textsuperscript{18} and (ii) Mann–Whitney \textit{U}-tests\textsuperscript{19} were undertaken for pairwise analyses, with allowance made for multiple testing by treating a \textit{P}-value of \( \leq 0.025 \) as statistically significant.

**Results**

Of the 527 GPs approached in this study, 145 (27\%) agreed to participate. Allocation to groups, baseline characteristics and follow-up completion rates are shown in Table 1; all 145 GPs completed 6 month post-intervention questionnaires (without which RACGP credits would not have been granted), two withheld permission to access information about their PSA test-ordering rates in the 0–6 month post-intervention period (seven for the 6–12 month period).

The groups were similar with respect to age, years since graduation and hours worked per week. There was a higher proportion of female GPs in the outreach visit group (chi-squared = 8.98, 2 df, \( P = 0.011 \)).

**PSA testing rates**

Pre- and post-intervention PSA testing rates in the three randomized groups are summarized in Table 2. There were no significant differences in this rate at baseline (Kruskall–Wallis test, \( P = 0.577 \)), hence rates at 6 and 12 months post-intervention were compared directly without adjusting for baseline results.

**0–6 months post-intervention period**

All patient age groups combined. Median GP PSA testing rate per 100 consultations rose in both the control and postal group and decreased in the EOV group. The three groups differed significantly in their testing rates in the 0–6 month post-intervention period (Kruskall–Wallis test: \( P = 0.018 \)). A Cuzick test of trend demonstrated significant differences between the three groups (\( P < 0.001 \)); the median rate in the EOV group was significantly lower than in the postal group, which in turn was significantly lower than the control group.

70–79 age group. There was a statistically significant difference in testing rate between the three groups (Kruskall–Wallis test: \( P = 0.015 \)). The outreach group had a statistically significant lower PSA testing rate than the control group (Mann–Whitney \textit{U}-test: \( P = 0.009 \)).

80+ age group. Again, there was a statistically significant difference in testing rate between the three groups (Kruskall–Wallis test: \( P = 0.012 \)). There was a statistically significant reduction in PSA testing in the outreach group relative to both the postal group (Mann–Whitney \textit{U}-test: \( P = 0.016 \)) and the control group (Mann–Whitney \textit{U}-test: \( P = 0.017 \)).

Men in other age bands. No statistically significant differences were observed in testing rates for men in the age bands shown in Table 2.

**6–12 months post-intervention period**

At this later follow-up period, PSA testing rates did not differ significantly between groups, either for all age groups combined or for any individual age group. However, in the 80+ age group, the difference between groups approached statistical significance (Mann–Whitney \textit{U}-test: \( P = 0.058 \)), with the outreach group having the lowest rate.

**Knowledge in key areas**

**Evidence of effectiveness of treatments for localized prostate cancer.** Responses to the following statement: “There is convincing evidence that available treatments for localized prostate cancer can lead to prolonged survival” are shown in Figure 1; a widely disseminated

### Table 1  \textit{GP numbers and characteristics at baseline and follow-up}

<table>
<thead>
<tr>
<th>Group</th>
<th>( n ) (baseline)</th>
<th>Completed 6 month post-intervention questionnaire</th>
<th>Available for 0–6 months post-intervention PSA testing analysis</th>
<th>Available for 6–12 months post-intervention PSA testing analysis</th>
<th>Mean age</th>
<th>( n ) (%) female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information from outreach visit</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>44</td>
<td>47.4</td>
<td>17 (37%)</td>
</tr>
<tr>
<td>Information by mail</td>
<td>47</td>
<td>47</td>
<td>45</td>
<td>45</td>
<td>48.1</td>
<td>5 (11%)</td>
</tr>
<tr>
<td>Control</td>
<td>52</td>
<td>52</td>
<td>52</td>
<td>49</td>
<td>48.7</td>
<td>12 (23%)</td>
</tr>
</tbody>
</table>
TABLE 2  Median GP PSA test-ordering rates per 100 consultations by age group of patients tested

<table>
<thead>
<tr>
<th>Age of men tested</th>
<th>Information from EOV</th>
<th>Information by mail</th>
<th>Control</th>
<th>All groups combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 0–6 months</td>
<td>6–12 months</td>
<td>Baseline 0–6 months</td>
<td>6–12 months</td>
</tr>
<tr>
<td>All age groups</td>
<td>1.60 1.32 1.59</td>
<td>1.85 1.97 2.10</td>
<td>1.73 2.20 1.89</td>
<td>1.67 1.78 1.82</td>
</tr>
<tr>
<td>&lt;40</td>
<td>0.00 0.00 0.00</td>
<td>0.00 0.00 0.00</td>
<td>0.00 0.00 0.00</td>
<td>0.00 0.00 0.00</td>
</tr>
<tr>
<td>40–49</td>
<td>0.00 0.00 0.16</td>
<td>0.95 0.69 1.08</td>
<td>0.87 1.19 0.95</td>
<td>0.83 0.70 0.70</td>
</tr>
<tr>
<td>50–59</td>
<td>2.81 2.70 2.48</td>
<td>4.32 3.45 2.81</td>
<td>3.38 3.81 4.00</td>
<td>3.50 3.55 3.04</td>
</tr>
<tr>
<td>60–69</td>
<td>3.54 3.27 3.67</td>
<td>3.92 3.90 4.17</td>
<td>4.04 4.18 3.02</td>
<td>3.70 4.00 3.62</td>
</tr>
<tr>
<td>70–79</td>
<td>2.94 2.36 2.81</td>
<td>3.66 3.12 4.32</td>
<td>3.20 3.72 3.77</td>
<td>3.12 3.13 3.48</td>
</tr>
<tr>
<td>80+</td>
<td>1.14 0.00 0.00</td>
<td>1.54 1.81 2.70</td>
<td>2.01 2.07 1.57</td>
<td>1.64 1.34 1.62</td>
</tr>
</tbody>
</table>

Rates shown are tests per 100 consultations within the defined age group.
review of PSA testing in Australia had concluded there was no such evidence.

The proportion of respondents providing a ‘correct’ response was greater at 6 months than at baseline in all three groups, but the greatest improvement was seen in the EOV group. After adjusting for baseline response, a logistic regression analysis found that at 6 months, the EOV group had a significantly greater proportion of ‘correct’ responses than the control group ($P = 0.004$). The postal group did not differ significantly from the control group ($P = 0.345$).

**Endorsement of PSA testing by professional bodies.** Responses to the following question: “Has widespread screening for prostate cancer in asymptomatic men been supported by recent National Health and Medical Research Council systematic reviews and guidelines in Australia?” are shown in Figure 2 (the ‘correct’ answer was ‘no’). After adjusting for baseline response, a logistic regression analysis found that at 6 months, the EOV group ($P = 0.041$) had a statistically significant improvement in the percentage with a correct answer.

**Discussion**

It is likely that demand for PSA testing will rise in the UK over the next few years, following trends in the USA and Australia. Our study demonstrates that GPs can be influenced by interventions targeting PSA testing, and EOVs show particular promise.

**Applicability and other methodological issues**

While the results of the study were not significantly affected by withdrawal of participants, they are based on GPs who agreed to participate in a study linked to postgraduate education credits (145 out of a possible 527). In examining the generalizability of findings from our study, we were unable to find any differences between our group of GPs and the wider population of South Australian GPs, in terms of age, gender, years since graduation and qualifications. Caution should, nevertheless, be exercised in applying these results to GPs in different contexts, particularly those who are not engaged in continuing education activities. Our randomization process led to a higher proportion of female GPs in the EOV group than in the other study arms, and while there is no evidence of gender differences in response to EOVs, we were not able to investigate this formally.

While clinical practice in UK and Australian primary care is very similar, structural differences in systems of payment for GPs may influence the applicability of this study’s findings in the UK; Australia’s fee-for-service, more competitive system possibly facilitates higher levels of PSA testing in response to consumer demand. There are also likely to be differences in the ways Australian and UK GPs respond to guidance about PSA testing.

We were unable to differentiate between PSA testing for ‘screening’ purposes, and testing in the presence of symptoms and for surveillance purposes. Thus our findings may underestimate the actual effect of our interventions on PSA testing rates. The study used a single outreach visitor—a trained clinical pharmacist. Further research should examine the use of more than one detailer, perhaps from different professional
backgrounds. Importantly, the material presented in our interventions did not carry an explicit message to reduce PSA testing; rather, it presented material based on systematic reviews of evidence, highlighting that there is no conclusive evidence either in favour of or against PSA testing for prostate cancer.

There was a drop-off in the influence on PSA testing over time, suggesting that interventions targeting these behaviours would need to be delivered periodically; the National Prescribing Service in Australia provides a model of periodic EOVs which could, in theory, be adapted to cover other areas such as pathology testing. Indeed, our study has prompted a national field study, led by the National Cancer Control Initiative, to “develop strategies for improving the use of the prostate-specific antigen test in the Australian community”.

The study did not include a formal economic analysis, although unregulated PSA testing for prostate cancer has the potential to generate very substantial costs for the health service from investigations and treatments, and it is likely that costs of educational interventions targeting health professional will be small by comparison. There is evidence that EOVs can be cost-effective in influencing prescribing, although there are limited numbers of formal economic appraisals. While provision of written educational materials by mail typically has low success rates, it is less resource-intensive than EOVs. Our study suggests, however, that strategies based on mailing out of materials are less effective than EOV in bringing about change in clinical practice in this area, and insufficient in themselves to influence necessary knowledge and activity domains. Further research is needed to test the cost-effectiveness of EOV-based interventions, particularly outside the context of prescribing.

Cancer detection in general practice: influencing clinical behaviour

While use of EOVs is established in the area of prescribing, there is growing interest in the usefulness of this strategy in modifying other areas of professional behaviour, and there is some evidence which suggests that such an approach is helpful specifically in improving early cancer detection activities. Evidence suggests that ‘informed consent’ has an important role in promoting better decision making about PSA testing, and provision of suitable information can moderate demand for testing. However, interventions targeting primary care personnel should also be considered. In Australia, GPs indicate there is pressure from a number of sources to provide PSA testing to men, including medico-legal factors and high levels of patient anxiety. In this context, withholding PSA testing poses greater challenges for GPs than providing it. It is important that evidence plays a greater role in decision making about PSA testing; the incongruence between evidence, recommendations and actual screening activity poses important dilemmas for general practice.

The content and structure of the outreach visit is important. Our intervention included feedback on test-ordering rates; a recent systematic review concluded that audit and feedback can be effective in improving the performance of health care providers, although the effects are generally small to moderate. Further, informal feedback from our sample of GPs suggests that the provision of patient education materials in the context of an EOV was a most helpful device, particularly if the visitor could provide guidance on how information might best be presented to patients.

Influence of patient group characteristics

Our study’s interventions demonstrate a more pronounced effect in very old age groups; there is a stronger consensus in Australia that PSA testing in older age groups should be actively discouraged, and this was reflected in the design of the interventions. Our interventions focused on testing in asymptomatic men, but PSA testing in men presenting with lower urinary tract symptoms is also controversial; in Australia, NHMRC guidelines do not advocate routine testing in the presence of symptoms, while new NHS guidance indicates that men who have symptoms of prostatic disease should be offered the PSA test but only with informed consent.

Conclusion

Use of the PSA test for detecting prostate cancer in primary care is controversial. There are high rates of testing in Australian primary care, and demand for the test is likely to rise in the UK, where a policy of education and informed consent is currently being promoted. Our study demonstrates that it is possible to influence GPs’ practice and knowledge in relation to prostate cancer and PSA testing, although repeated interventions would probably be needed to make such changes sustainable. The intervention which showed most promise in bringing about these changes was based on the use of EOVs.

Primary care has an important role in addressing the significant burden of prostate cancer. Until evidence from randomized controlled trials of the effectiveness of PSA testing in reducing mortality from prostate cancer becomes available, it is important that both primary care personnel and patients are adequately informed about the risks and potential benefits of PSA testing.

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