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Feasibility and efficacy of COPD case finding by practice nurses

Background
Chronic obstructive pulmonary disease (COPD) is a leading cause of disability, hospital admission and premature mortality, but is often undiagnosed. This study assessed the effectiveness, feasibility and acceptability of COPD case finding by practice nurses performing spirometry on patients identified as being at risk of developing COPD.

Methods
Practice nurses were trained in spirometry. From four general practices, 1010 patients were identified who were aged 40–80 years and current or ex-smokers. Four hundred were randomised to receive a written invitation to attend a case finding appointment with the practice nurse, including spirometry.

Results
Seventy-nine patients attended, 16 (20.3% of attendees) had COPD diagnosed on spirometry; practice nurses correctly identified 10 of the 16, but also incorrectly identified a further six patients as having COPD. One patient in the usual care group was diagnosed with COPD, but this was not confirmed on spirometry.

Discussion
This study confirmed that COPD is underdiagnosed, with 20% of those at risk and attending for screening having COPD. The search strategy successfully identified patients at risk. Further training in spirometry would be required for practice nurses to increase the accuracy of the diagnoses. The opportunity cost would require consideration. The acceptability to patients is also an issue, this may be related to the recruitment method or the intervention. This study also does not answer whether earlier diagnosis in these patients leads to any change in outcomes.

Chronic obstructive pulmonary disease (COPD) is a leading cause of disability, hospital admission and premature mortality.[1] Nationwide, the costs of COPD are estimated to be $820–900 million annually.[2] Its prevalence is estimated to be 3.5% of the Australian population, however the true prevalence is likely to be greater as COPD is often undiagnosed.[3] It is estimated that 15–20% of smokers will develop clinically significant COPD,[4,5] although more recent research suggests that this may be as much as 50%.[6]

Earlier diagnosis allows the initiation of evidence based treatment including smoking cessation, immunisation, optimisation of medication and pulmonary rehabilitation.[7] Interventions may be less effective when COPD is diagnosed at a more advanced stage.[8,9] Even mild to moderate COPD is associated with impaired health status, which represents an additional argument in favour of early detection[10] given the availability of evidence based treatment.

Spirometry is essential to the accurate diagnosis and assessment of severity of COPD.[7,8] Despite high rates of spirometer ownership in Australian general practice, the frequency of use is low.[11] Barriers include lack of time, training and practice support, and difficulties in interpreting results which contributes to inaccurate diagnosis.[12] It is feasible to delegate the performance of spirometry to other health professionals including nurses.[13–15]

General practice is well placed to diagnose, provide early intervention and longer term management of COPD.[16,17] The role of practice nurses (PNs) in Australian general practice is evolving.[18] More nurses are entering general practice, and nurses' work is being funded in increasingly complex ways through Medicare.[19] On average, 57.5% of practices employ a PN, and the number of PNs has increased by 59% between 2005–2007.[20]

Methods

Four general practices in southwest Sydney (New South Wales) took part in this case finding project. Practices were eligible to participate if they had computerised medical records, a spirometer and employed

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a PN. Spirometers were serviced and calibrated before patient recruitment.

Workshops were held for the PNs and general practitioners taking part in the project. Workshops covered the project aims, methodology and COPD diagnosis and management. Two hours were devoted to the performance and interpretation of spirometry.

Practice nurses undertook a search of computerised medical records to identify patients 40–80 years of age who were current or ex-smokers. These were assumed to be the patients at high risk of having COPD, given that population based surveys demonstrate a rising prevalence with age after 40 years, and a correlation with exposure to cigarette smoke.[21,22] A random sample of approximately 1000 patients who met the criteria defined above was selected. This list was reviewed to exclude subjects with cognitive impairment, those who did not speak English, and those who were no longer active patients (less than two visits in the preceding year). Subjects with an established diagnosis of COPD were also excluded. This allowed calculation of the baseline prevalence of COPD diagnosis within these practices.

Eligible subjects were randomised to receive either an invitation to attend a case finding appointment with the practice nurse, or usual care. Invitations were mailed and two reminder letters were sent at fortnightly intervals to nonresponders.

Patients attending the case finding appointment with the PN completed a questionnaire (age, educational and occupational history, country of birth, and smoking history). Spirometry was performed in accordance with international guidelines.[8] A sample of the study spirometry results (25%) was reviewed by a member of the study team. These were regarded as technically adequate for interpretation.

The PNs were instructed to interpret the results of spirometry according to an algorithm derived from these guidelines (FEV_1/FVC after bronchodilator <70% = obstruction) and made a diagnosis of COPD on the basis of this interpretation of spirometry alone. At conclusion of the study, the validity of the PNs' interpretation of spirometry was assessed with reference to a final spirometric diagnosis by one of the investigators, who applied the same criterion for COPD diagnosis.

Practice nurses advised patients diagnosed with COPD to attend their GP for further assessment and management. A brief smoking cessation intervention was undertaken with all patients, including an offer of referral for current smokers, and reinforcement of the behaviour of nonsmokers. Each case finding appointment took approximately 20 minutes.

At the end of the study period, clinical records of patients not invited to attend a case finding appointment were searched to determine the number of new diagnoses of COPD in this 'usual care' group.

Participating GPs and PNs were interviewed and completed a questionnaire seeking their perception of the feasibility and efficacy of the intervention.

Ethics approval for this study was obtained from the Human Ethics and Research Committee of the University of New South Wales.

Analysis

Data were managed using SPSS 14 for Windows. Risk factors for COPD in the subjects who underwent spirometry were examined using generalised estimating equations with a logistic link and an exchangeable correlation matrix to adjust for within practice clustering of subjects.

The main themes emerging from semistructured interviews with PNs and GPs were extracted and analysed.

Results

Among 1010 randomly selected current or ex-smokers aged 40–80 years, 116 (11.5%) had a prior diagnosis of COPD (*Figure 1*, range 8.7–17.6% among the four practices). Of the 400 eligible subjects randomised to the intervention group, 79 (19.75%) responded to the invitation to attend a case finding appointment. The characteristics of subjects attending are shown in *Table 1*.

Of these 79 patients, 16 (20.3%) met spirometric criteria for COPD (FEV_1/FVC ratio <70%) on final review by the project officer. The Global Initiative for Chronic Obstructive Lung Disease guidelines (GOLD)[8] were applied to determine the severity of COPD in these patients. Five patients had Stage 1 COPD, (FEV_1/FVC <70%, with FEV_1 >80% of predicted), nine patients (11.4%) had Stage 2 COPD (FEV_1/FVC <70% with FEV_1 of 50–80% of predicted) and two (2.5%) had Stage 3 COPD (FEV_1/FVC <70% and FEV_1 of 30–50% of predicted). There were no subjects with severe obstruction (FEV_1 <30% predicted). An additional 13 subjects (16.5%) were identified with FVC <80% predicted, indicating possible restriction.

Among those who attended for the case finding appointment, subjects with spirometry results consistent with COPD were significantly more likely to be older, male, Australian born and current smokers (univariate analysis adjusted for clustering).

It was not possible to fit a multivariable model, adjusting for within practice clustering. However, in a simple multivariable logistic regression model, not adjusted for clustering, a stepwise selection

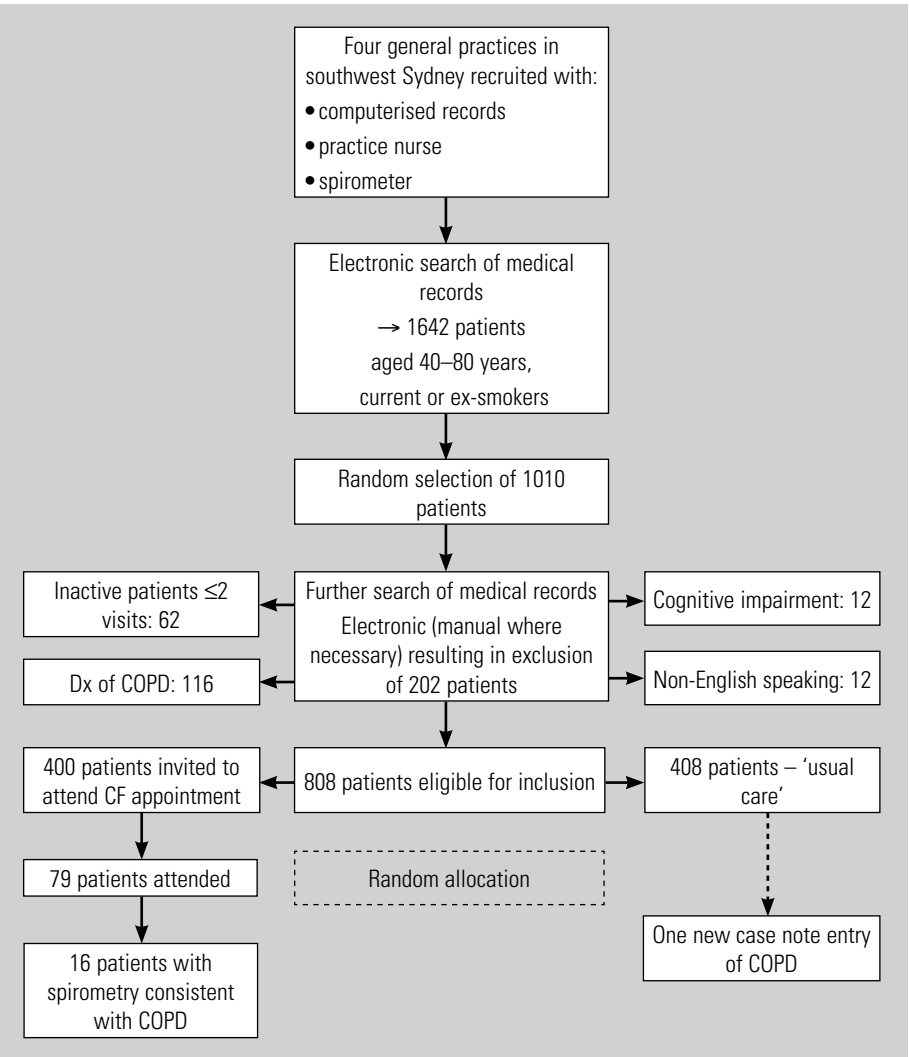
procedure identified older age and current smoking status as independent predictors of COPD.

Among the 16 subjects who met spirometric criteria for COPD, PNs correctly identified 10 as having COPD. However, they incorrectly labelled a further six patients with nonobstructive spirometry results as having COPD. Hence, case finding for COPD by the PNs in these four practices had a sensitivity of 0.63 and a specificity of 0.9 for a confirmed spirometric diagnosis. The positive predictive value of a PN diagnosis of COPD is 62.5%, and the negative predictive value is 90.5% in this study population.

During the course of this study there was one new diagnosis of COPD in the control group. However, we did not have the opportunity to assess the validity of this diagnosis by spirometric criteria.

Interview and questionnaire results indicated a high degree of acceptance and enthusiasm by GPs and PNs for the intervention, and for the role of PNs in case finding of COPD. A number of participants indicated a desire and/or plans to incorporate the intervention in the organisation and day-to-day work of the practice.

Figure 1. Project design and stages



Discussion

The study confirmed that COPD is often undiagnosed, with 20% of those patients at risk who attended a case finding appointment yielding spirometry results consistent with COPD. This is similar to findings of other studies in the primary care setting with rates of new diagnosis between 7.4–29.5%.[13,15,23–28]

The search strategy was successful in identifying patients at risk of COPD. Of the 400 patients from four practices who were invited to attend screening, 79 attended a case finding appointment. This indicates that some patients find invitations to attend case finding appointments with PNs acceptable, although the response rate was lower than we had hoped. Response rates to mailed invitations to attend COPD case finding appointments in other studies vary between 16%[13] and 81%.[29] The Royal Australian College of General Practitioners *Putting prevention into practice: guidelines for the implementation of prevention in the general practice setting* (the 'green book')[30] suggests a number of ways in which practices can systemise preventive or screening tasks, and the reliance in this study on mailed invitations was in retrospect a weakness. Practice nurse interviews at the end of the study yielded a number of suggestions about how recruitment in a 'real life setting' could be improved, using flagging of records, phone invitations and reminders, the use of a recall and reminder system, incorporation into health checks and waiting room prompts.

Reasons for this low response rate may include lack of perceived relevance of the intervention for the nonresponders, difficulties in understanding or responding to the mailed invitation, difficulties in attending an appointment, or a low level of motivation to contemplate smoking cessation. We were unable to explore the reasons for this low response rate in this study.

Practice nurses are able to perform spirometry and interpret the results. However, there were a significant number of false positive and false negative diagnoses. The rate of false positive and false negative diagnoses based on their interpretation of spirometry results may be reduced by longer and more intensive training.[31] Six hours of training may be required for operators to report confidence in spirometer use,[32] and the 2 hours of training in this project was clearly inadequate to equip PNs with the confidence and skills to accurately interpret spirometry. Regular review of results and feedback may also help improve and maintain the quality of spirometric diagnosis. The need for further training was also supported by the results of questionnaires and semistructured

interviews administered to PNs at the end of the case finding phase. Other studies have pointed to a relatively high rate of misdiagnosis of COPD, sometimes involving lack of use of spirometry, and at other times due to misinterpretation of the results.[32,33]

It is possible that the inclusion of patients up to the age of 80 years and the application of a spirometric criterion of FEV_1/FVC of <70% postbronchodilator may have led to some overdiagnosis of COPD, given that FEV_1, and FEV_1/FVC do change with age. There is an ongoing and complex debate about the extent to which spirometric criteria for the diagnosis of COPD should be modified with age, with some studies suggesting lower ratios should be accepted as nonobstructive after 70 years of age.[34] Others argue that even if within the lower limit of normal for age, FEV_1/FVC <70% does predict increased later diagnoses of, and hospital admissions for, COPD.[35]

Only one patient in the group not invited to attend screening acquired a new diagnosis of COPD during the study period (based on case note review) compared with 16 patients with spirometry consistent with COPD in the intervention group. Although these are different endpoints, inviting at risk patients to case finding appointments does lead to an increase in the number of new diagnoses. Based on the results of this study, a PN would need to screen five patients at risk of COPD to make one new diagnosis of COPD, assuming that the accuracy of interpretation could be improved by further training.

Limitations of study

The small number of practices and patients involved limits the generalisability of the findings. The practices were all urban, which may limit the applicability to rural and regional contexts. The practices, due to the recruitment criteria and interest in research focused on a respiratory condition, may not be representative. The sample size was too small to test the independent effects of risk factors for COPD among those who attended for screening, although as expected, age and current smoking status appeared to be most significant. A larger study with a range of practice types and locations would address these limitations.

It was not possible to explore any differences between the characteristics of responders and nonresponders. A range of strategies to improve the response rate were suggested by PNs and GPs at the conclusion of the study, which will be incorporated and investigated in any future similar study.

The endpoints in the control and intervention groups are different. In the intervention group new diagnoses of COPD have been made on the basis of interpretation of spirometry. In the control group, the rate of new diagnosis is derived from medical record review of GP diagnoses.

The acceptability of the intervention to patients was not explored. As a proxy, the response rate to the invitation would raise the possibility that there is an issue with interest and/or acceptability to patients. Further investigation of this may inform strategies to increase the response rate. The acceptability of this use of PN time – the 'opportunity cost' – was not quantified.

Table 1. Characteristics of intervention group subjects with and without COPD*

	COPD N=16	No COPD N=63	Odds ratio† (95% CI)
Age (years)**	70.1	60.5	2.59 (1.42–4.69)
Pack years smoking **	25.4	22.6	1.10 (0.91–1.32)
Gender (male)#	12 (75%)	33 (52%)	2.66 (1.20–5.89)
Birthplace (Australian born)#	15 (94%)	37 (59%)	10.7 (1.25–92.2)
Current smoker#	8 (50%)	18 (29%)	2.47 (1.34–4.54)

* All statistics are adjusted for within practice clustering
** Mean is shown, together with odds ratio for a 10 year difference
# Number and proportion (%) are shown, together with odds ratio
† Univariate statistics are shown

This study did not test whether earlier clinical diagnosis of COPD by the PN led to engagement of the patient with earlier treatment, or improved patient outcomes such as smoking cessation rates and further research to explore this question is needed.

Practice nurses and practices were paid a small honorarium to participate. In the absence of such an additional payment, the viability of this use of PN time is uncertain, and questions about the sustainability remain unanswered.

Conclusion

This study supports consideration of an expansion of the PN role to include case finding of COPD in patients at risk. Practice nurses are able to perform spirometry but more training is required to improve skills in interpreting the results of spirometry. Any further similar interventions should incorporate a range of additional methods of inviting at risk patients to attend: reliance on mailed invitations in this study produced a disappointing response rate. The acceptability to patients also needs further consideration.

General practitioners and PN participants were enthusiastic about the feasibility and efficacy of case finding by PNs, and were positive about incorporating this role into the work of the practice, but the sustainability of this particular intervention given the pressing demands on PNs and GPs remains uncertain.

This may point the way to a greater role for PNs in case finding and diagnosis of other diseases where earlier diagnosis may improve patient outcomes, however a disappointing participation rate by patients, and demonstrated lack of accuracy in interpretation of spirometry raise questions about the generalisability of this approach in its current form.

This study and its results do highlight many of the current issues and difficulties in screening for COPD.

Conflict of interest: none declared.

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