National Survey of Spirometry Ownership and Usage in General Practice in Australia

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Abstract

Objectives: To determine availability of spirometry and the level of spirometry training in general practice throughout Australia.

Design: 5,976 general practices throughout Australia were sent a questionnaire requesting details of spirometer ownership, usage, and the level and source of spirometry training undertaken. To exclude response bias, a follow-up telephone survey was conducted of 160 practices that did not respond to the initial survey.

Setting and Participants: AGPAL registered general practices throughout Australia.

Results: 19.5% (1,125) of practices responded to the initial survey with 64.2% (722) of these owning a spirometer and 83.9% (134) in the follow up sample. Common reasons for not owning a spirometer were equipment cost (52.6%) and insufficient Medicare remuneration (32.0%). Most practices (61.0%) perform 1 - 5 tests/week. Practices commonly utilised spirometry to diagnose (89.5%) and manage (93.9%) asthma, assess breathlessness (83.4%), and to detect and manage other respiratory diseases such as COPD (77.7%). Spirometer accuracy was never checked using a syringe by 68.1% of practices and 50.3% do not test a healthy subject as part of their quality assurance programme. Spirometry training was received most commonly through courses run by general practice divisions (38.2%), RACGP (25.8%), and NAC (10.8%) with 47.1% using other sources. The duration of training courses was <2 hours in 40% of cases with 60% of respondents indicating probable attendance at further training.

Conclusion: Despite high spirometer ownership in general practice, the frequency of use is low. Low rates of verification of accuracy and performance suggest the need for reliable, stable spirometers to be available to GPs. Regular and more comprehensive training in spirometry is needed and would be welcomed by most GPs.

Keywords: spirometry, spirometer ownership, spirometry training, general practice

Introduction

Spirometry is a well established tool for detecting and quantifying airflow limitation and is an important component of national and international guidelines for the diagnosis and care of patients with asthma and COPD (1,2,3,4). These common diseases are largely diagnosed and managed within the primary care sector (5,6), though it is known that COPD in particular is widely under-diagnosed (7). The use of spirometry for screening in general practice, especially in people at risk of developing respiratory disease (eg smokers), almost doubles the number of patients identified with airflow limitation, especially those with milder disease (7,8). This may lead to early detection of airflow limitation, facilitating earlier diagnosis and intervention.

Routine spirometry measurement by general practitioners is now feasible with widespread availability of computerised portable spirometers (7). Despite this, there is evidence that it is grossly under utilised (9,10,11). Qualitative studies have identified some factors that influence spirometry use in general practice; lack of training, lack of time, low remuneration and lack of access to a well maintained spirometer (12). However, we are not aware of any published data on the level of spirometer ownership, usage and training in Australia general practice.

This study was conducted to determine the levels of spirometer ownership and usage in Australian general practice and the resources available for spirometry training. This information is very important in formulating strategies to build capacity to perform and interpret spirometry in general practice.

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Method

Quality in Practice Pty Ltd (QIP), a subsidiary of Australian General Practice Accreditation Limited (AGPAL), was contracted to conduct a survey to determine the level of spirometry use in general practice throughout Australia. A 22 item questionnaire covering spirometry ownership, use and training was developed in association with the Department of Health and Ageing and the National Asthma Reference Group. This was distributed in early 2004 to a total of 5,976 general practices. The questionnaire was initially distributed to 2,737 practices via email as an Excel™ spreadsheet for electronic return or as a PDF file that could be printed and posted or faxed back. However, of the initial 250 returned surveys only 30 were received via email. To avoid possible bias due to practices not having access to email, Excel™ (Microsoft) or PDF files, the questionnaire was faxed to all 5,976 practices, including the initial 2,737. An incentive of a chance to win a free registration to the QIP International Conference was offered.

In April 2004, a follow-up telephone survey was conducted on a random sample of 160 practices that did not respond to the survey to determine whether there was bias toward spirometer ownership in responses to the first survey.

All responses to the survey were entered into an Access™ (Microsoft) database for analysis.

Results

Of the 5,976 practices surveyed a total of 1,166 completed the questionnaire, representing a 19.5% response rate. Of these 1,166 responses, 1,125 (96.5%) were identified as AGPAL registered practices for which demographics were available. Therefore only responses from these 1,125 practices were analysed. One third of respondents (n=377, 33.5%) were from rural practices and 66.5% (n=748) urban (Table 1). This is approximately equivalent to the percentage of rural practices represented on the AGPAL database.

Of the 1,125 practices that responded to the survey, 722 (64.2%) owned a spirometer (Table 1). Spirometry ownership was highest in Queensland (83.3%) and Western Australia (76.3%). A greater proportion of rural practices owned a spirometer (n=278, 73.7%) than urban practices (n=444, 59.4%). The highest rate of ownership (85.3%) occurred in practices employing 6 – 10 full time equivalent practitioners and the lowest by solo practices (52.2%).

Of the 403 (35.8%) practices that responded that they did not own a spirometer, 219 (54.4%) had considered purchasing one. Multiple reasons were given for not owning a spirometer (Table 2) with high equipment cost and insufficient Medicare remuneration being the most common. Of the practices that do not own a spirometer, access to spirometry was stated to be mainly through specialist physicians and hospital services.

Of the 722 practices that own a spirometer, 643 (89.1%) provided specific details of the brand of spirometer. The most commonly owned brands were the Welch Allyn (17.7%), Micromedical (17.2%), Cosmed (14.9%), Fukuda (13.7%), Vitalograph (11.4%), and EasyOne (7.4%). Eighty three percent of spirometers produce a permanent record of the trace. Multiple responses regarding the reasons for performing spirometry were received

from practices that owned a spirometer and are summarised in Table 3. The assessment of breathlessness and the diagnosis and management of patients with asthma and COPD were the most common reasons given for performing spirometry.

Although all practices claimed to use their spirometer, the number of spirometry tests performed varied widely between practices with 29.2% performing more than 5 tests per week, 37.8% between 1-5 per week, 23.2% between 1-4 per month and 9.8% less than one per month.

Of the 722 practices that own a spirometer 67.5% (n=487) stated that they check spirometer accuracy periodically, 44.0% annually, 17.2% monthly, 4.9% weekly and 1.4% daily. However, only 22.2% (n=108) of these 487 practices use a 3 litre calibration syringe to check this. Forty percent of practices stated that they did assess overall spirometer performance by measuring spirometry on a healthy subject. Only 45.3% responded to the question asking how frequently they performed this check with 76.8% of those who responded stating that they did this monthly. The person performing these quality assurance checks was usually a nurse (24.4%) or general practitioners (23.0%) although the non-response rate to this question was high (53.9%).

All practices responded to the question asking who conducts the spirometry tests with 30.2% (n = 218) stating that more than one person. The test was performed by a nurse in 63.6% (n = 459), general practitioner in 57.8% (n = 417) and by another person (eg receptionist, asthma educator) in 8.9% (n = 64) of practices. Interpretation was usually by a general practitioner (98.8%, n = 713), only 5.5% (n = 40) by a nurse with a small proportion of practices (2.2%, n = 16) relying on the spirometer's interpretative software.

In terms of testing time, 19.8% (n = 143) of practices indicated that spirometry with reversibility testing took less than 10 minutes per patient to perform, 58.7% (n = 424)

between 10 and 20 minutes, and 19.9% (n = 144) more than 20 minutes. Almost all practices (98.6%, n = 712) reported taking precautions to minimise the risk of cross infection between patients during spirometry; the remainder (1.4%, n = 10) specifically stating that they used no precautions. More than one method of infection control was reported 15% practices. In-line barrier filters were used by 27% (n = 194), a new or disinfected mouthpiece by 84.5% (n = 610), and 1.1% (n = 8) use a mouthpiece with a one-valve or advise the patient not to inhale from the spirometer.

Training in the measurement and interpretation of spirometry had been received by all practices with a spirometer from a variety of sources (Table 4), with 22.3% stating more than one source. Resources used for self-directed learning included: spirometry CD, National Asthma Council website, spirometry textbook, seminars, spirometer operating manual, and journals. The duration of training reported varied; <2 hours (40.2%, n = 290), half day (23.7%, n = 171), 1 – 2 days (11.4%, n = 82), and 3 – 5 days (6.7%, n = 48).

Almost a third of respondents (32.3%, n = 233) indicated that they would definitely attend an accredited Continuing Professional Development (CPD) course, 30.5% (n = 220) stated that they probably would attend such a course and 21.1% (n = 152) that they may attend. Only 15.7% (n = 113) stated that they would not attend a CPD accredited course.

Follow-up Survey: Of the 160 practices randomly selected from those that did not respond to the original survey, 118 responded (73.8% response rate) to follow-up contact. The urban/rural mix and distribution across states was similar to the initial respondents. 83.9% (n=99) of the follow-up respondents owned a spirometer, which was significantly higher than the original respondents ($p<0.001$).

Discussion

This is the first study of spirometer ownership, usage and training in Australian general practice. We found that that 64.2% of general practices own a spirometer and almost 70% of these perform tests on a weekly basis for the diagnosis and management of respiratory diseases, particularly asthma and COPD. Only 10% of practices perform less than one test per month. Access to a spirometer in general practice has been reported in several recent overseas studies. A low level of spirometer ownership, 23% of practices, was reported in a New Zealand study (13), but much higher rates, similar to those reported in this study, were found in two UK studies where 82.4% (14) of practices and 59% of general practitioners (15) own a spirometer. Training varied widely, but 40% of practices received less than 2 hours on measurement and interpretation.

The study by Bolton et al (14) also found that 42% of users lacked confidence in the use of the spirometer and 66% lacked confidence in interpretation and this was an impediment to increasing the usage rate of spirometry in general practice. In the present study only 18% of practices who did not own a spirometer specifically stated that they did not own a spirometer due to lack of confidence in interpreting the spirometry results.

Spirometer guidelines recommend that the accuracy of a spirometer should be checked regularly using a certified 3-litre syringe (16). Our results indicate that although about two thirds of practices stated that they check spirometer accuracy, less than a quarter use a syringe to perform this check. This suggests confusion amongst many practitioners with respect to assessment of spirometer accuracy. Many believe that the measurement of spirometry on a healthy subject is sufficient to check spirometer accuracy, which is inconsistent with accepted guidelines (16). It is clear that accuracy checks, if done, are infrequent and that two thirds of practices have never calibrated or verified the accuracy of their spirometer using a 3 litre syringe. This suggests that even with a correctly

performed test, there is potential for inaccuracy leading to misdiagnosis and misclassification when grading the severity of airflow limitation. These data also suggest that training courses should place greater emphasis on the importance of and realistic mechanisms for achieving ongoing quality assurance. Spirometer accuracy and provision of feedback on the quality of each test has been recommended in a consensus statement from the National Lung Health Education Program (1). Although there is little direct evidence of cross-infection via lung function equipment there is evidence that patients can contaminate the equipment. We found that the vast majority of general practitioners who own a spirometer take some precautions to minimise the risk of cross-infection although these may not be adequate.

Medicare data on services for spirometry (item 11506) shows that a total of 251,000 claims were made in 2003, with 176,200 of these from general practice. Although additional non-billed spirometry tests would have been performed (e.g. complex lung function tests and services provided to non-private patients in public hospitals), and a portion of these will include multiple tests on the same patient, these data suggests that in general practice spirometry is under utilised. When crudely expressed as a percentage of the Australian population the rate of spirometry testing in general practice is 0.9%, which is far lower than the Australian asthma prevalence rate alone. An analysis by the Australian Centre for Asthma Monitoring (6) reported that the number of claims for spirometry between 1994 and 2002 fell steadily but increased slightly in 2003. The rate was about 100 general practice spirometry tests per 100,000 total Medicare claims and the total claims for lung function (general practice and laboratory-based) about 185 per 100,000 total Medicare claims. We identified insufficient Medicare remuneration as one of the key reasons for not performing the test in general practice. It may be that increased remuneration for spirometry and the provision of a rebate when the test is performed

without reversibility testing may help increase the uptake of spirometry. Although this would increase costs due to spirometry claims, there is evidence that proactive management of patients with COPD in general practice would offset the costs by reducing hospital admissions and number of days in hospital (17).

To obtain clinically useful spirometry results the operator must have specific knowledge and skills not only to correctly operate, maintain and calibrate the instrument but to motivate the patient to perform the correct breathing manoeuvre (1,20). A New Zealand study found that even brief training increased the amount of acceptable and reproducible spirometry when compared with reliance on the spirometer manual as 'training' (18). Similarly, a Dutch study (19) found that the quality of spirometry performed in general practice by trained practitioners and practice assistants was similar to laboratory-based tests when using a spirometer that displayed the flow volume loop in real time and after two 2.5 hour intense training sessions separated by one month. These two studies indicate the importance of spirometry training to improve quality and address the lack of confidence in use and interpretation found in previous studies (14). Our study suggest that spirometry training is also an issue in Australia, with 40% of general practitioners receiving less than two hours of training and 60% indicating interest in further training. It seems less likely that this is a major barrier to spirometry ownership as only 18% of practices without a spirometer identified lack of confidence in interpretation as a barrier.

The follow-up survey in which 84% of practices who did not respond to the initial survey own a spirometer indicates that the reported 64% ownership rate was unlikely to be biased toward practices that own a spirometer. Although the response rate to the survey was only 20%, we believe this reasonable for such a survey of general practices and provides useful data.

In conclusion, despite high spirometer ownership in general practice, the frequency of usage is low. Low rates of verification of accuracy and performance suggest the need for reliable, stable spirometers to be available to GPs. Regular and more comprehensive training in spirometry is needed and would be welcomed by most general practitioners.

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Table 1
Response rates to the survey and spirometer ownership by region**.**

	All Practices that Responded to Survey (n = 1125)				**Practices that own a Spirometer (n = 722)**		
	N	**Fraction of All Responders %**	**Urban %**	**Rural %**	**N**	**Fraction of National Ownership %**	**Fraction of State Ownership %**
Qld	229	20.4	64.2	35.8	192	17.1	83.8
WA	114	10.1	66.7	33.3	87	7.7	76.3
Tas	30	2.7	53.3	46.7	21	1.9	70.0
NSW	345	30.7	67.8	32.2	226	20.1	65.5
SA	129	11.5	65.1	34.9	76	6.8	58.9
Vic	256	22.8	68.4	31.6	107	9.51	41.8
NT	7	0.6	14.7	85.7	5	0.4	6.3
ACT	15	1.3	100.0	0	8	0.7	4.7
National Total	1125		66.5	33.5	722	64.2	-

Table 2

Reasons for not owning a spirometer (eligible practices = 403)

	n	**Percent of Practices**
High cost of spirometer	215	53.4
Insufficient Medicare Rebate	132	32.8
Insufficient time to perform the test	85	21.1
Did not employ a practice nurse	91	22.6
Lacked confidence in interpreting results	72	17.9
Spirometry is not useful	22	5.5
Other reasons	42	10.4

Table 3

Reasons given for performing spirometry by practices that owned a spirometer (eligible practices = 722)

Reason for Performing Spirometry	**Number of Responses**	**Percent of Practices**
Management of asthma patients	678	93.9
Diagnosing patients with asthma	646	89.5
Assessment of breathlessness / dyspnoea	602	83.4
Diagnosis and management of other respiratory diseases such as COPD	561	77.7
Screening current / ex-smokers	283	39.2
Other reasons:	194	26.9

Table 4

Training received in the use of the spirometer and interpreting the results (eligible practices = 722, multiple responses)

	n	**Percent of Practices**
Division of General Practice	276	38.2
Royal College of General Practitioners	186	25.8
National Asthma Council	78	10.8
MBBS, and during hospital residency	81	11.2
Equipment and/or pharmaceutical company	57	7.9
Hospital based courses	37	5.1
Asthma courses	30	4.2
Other	124	17.2

Survey Questionnaire

All information gathered in this survey will be de-identified, practice ID or name is asked for gauging practice demographic data only.

AGPAL PRACTICE ID NUMBER (if known) ……

PRACTICE NAME & ADDRESS ……..……...

Q1 **Does your practice own a spirometer?** **No** ☐ **Yes** ☐
If yes please go to Q4

Q2 **Have you considered buying a spirometer?** **No** ☐ **Yes** ☐
Please go to Q21

Q3 **For what reasons have you not brought a spirometer?**

(a) cost ☐
(b) Do not believe the information is useful ☐
(c) Not confident is interpreting results ☐
(d) Insufficient Medicare remuneration ☐
(e) Do not have practice nurse ☐
(f) No time to perform spirometry ☐
(g) Other (briefly explain) ……. ☐
…… **Please go to Q21**
……

Q4 **What is the make and model of your spirometer?** **Make**……
Model ……...

Q5 **Does your spirometer produce a permanently recorder trace?** **No** ☐ **Yes** ☐

Q6 **How often is spirometry performed in your practice?**

(a) More than 5 times per week ☐
(b) 1 to 5 times per week ☐
(c) 1 to 4 times per month ☐
(d) Less than once per month ☐

Q7 **Do you use spirometry for:**

(a) Diagnosing patients with asthma ☐
(b) Management of your asthma patients ☐
(c) Assessment of breathlessness/dyspnoea ☐
(d) Screening current/ex smokers ☐
(e) Diagnosis and management of other respiratory diseases such as COPD ☐
(f) Other (briefly explain) ☐
……
……
……

Q8 Who performs the spirometry testing in your practice?

(a) GP ☐
(b) Nurse ☐
(c) Other (briefly explain) ☐

……

……

Q9 How long does it take you or your staff to perform testing? (pre and post bronchodilator)

(a) Less than 10 minutes per patient ☐
(b) Between 10 & 20 minutes per patient ☐
(c) More than 20 minutes per patient ☐
(d) We only do pre-bronchodilator tests ☐

Q10 Who interprets the results?

(a) GP ☐
(b) Nurse ☐
(c) Other (briefly explain) ☐

……

……

Q11 What training have those persons had in the use of a spirometer and interpreting results?

(a) NAC ☐
(b) RACGP ☐
(c) Division ☐
(d) Other (briefly explain) ☐

……

……

Q12 How long was the training?

(a) Less than 2 hours ☐
(b) Half a day ☐
(c) 1-2 days ☐
(d) 3-5 days ☐

Q13 What other spirometer learning resources have you used? (briefly explain)

……

……

Q14 Would you attend a CPD accredited course on spirometry?

(a) Definitely ☐
(b) Probably ☐
(c) Maybe ☐
(d) Unlikely ☐
(e) Definitely not ☐

Q15 How often do you check the accuracy of your spirometer?

(a) Daily ☐
(b) Weekly ☐
(c) Monthly ☐
(d) Yearly ☐
(e) Never ☐

Q16 **Do you use a 3 litre calibration syringe to check the accuracy of your spirometer** **No** ☐ **Yes** ☐

Q17 **Do you measure spirometry on a healthy subject to check spirometry performance?** **No** ☐ **Yes** ☐
If no please go to Q20

Q18 **How often do you check spirometry performance?**
(a) Daily ☐
(b) Weekly ☐
(c) Monthly ☐

Q19 **Who performs this check?**
(a) GP ☐
(b) Nurse ☐
(c) Other (briefly explain) ☐
……
……..

Q20 **What precautions do you take to minimise the risk of cross infection between patients?**
(a) Barrier filters ☐
(b) New or disinfected mouthpiece ☐
(c) None ☐
(d) Other (briefly explain) ☐
……
……

Q21 **If your practice does not own a spirometer, what access do you have to spirometry services?**
(a) Mobile ☐
(b) Hospital ☐
(c) Local pathology service ☐
(d) Specialist physician ☐
(e) Other (briefly explain) ☐
……
……

Q22 **For those who are serviced by a mobile service, how often would you have access to that service?**
(a) Weekly ☐
(b) Monthly ☐
(c) Other (briefly explain) ☐
……
……