Outcomes Evaluation of a Skill-Based Workshop Targeting the Use of Spirometry in Chronic Obstructive Pulmonary Disease

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Abstract

Background: This report presents the evaluation of a skill-based continuing education workshop on knowledge and use of spirometry in diagnosing and managing chronic obstructive pulmonary disease (COPD) by family physicians (FP).

Methods: A time series design included a pre-workshop discussion group and questionnaire, a post-workshop questionnaire, and a 3-month post-workshop interview and questionnaire. Qualitative tools included open-ended probes. Questionnaires included quantitative (5-point agreement rating) and qualitative (open-ended) items. Qualitative data were analyzed using content analysis; quantitative data using Friedman 2-way ANOVA by rank with Bonferroni correction. Twenty-nine FPs out of 129 participants from 5 workshop sites participated.

Results: Diagnosis: Following the workshop, participants indicated increased knowledge and confidence in their skill using spirometry in diagnosing COPD and increased utilization of spirometry in practice. Quantitative results showed increased confidence in using spirometry to diagnose COPD ($\bar{X}_{pre-workshop} = 2.31$, $\bar{X}_{post-workshop} = 3.46$, $P \leq .04$), with $\bar{X}_{3 months post-workshop} = 3.23$ ($P \leq .29$). Seventy-five percent of respondents reported increased skill and intent to use spirometry ($\bar{X}_{pre-workshop} = 2.92$, $\bar{X}_{post-workshop} = 4.62$, $P \leq .00$), with mean for long-term use $\bar{X}_{3 months post-workshop} = 4.15$ ($P \leq .23$). Interpretation: Little change in skill in interpreting spirometry results was reported qualitatively, and initial significant changes were not maintained at 3 months ($\bar{X}_{pre-workshop} = 2.33$, $\bar{X}_{3 months post-workshop} = 3.08$, $P \leq .66$). Monitoring: Substantive increases were reported in knowledge of spirometry in monitoring COPD ($\bar{X}_{pre-workshop} = 2.33$, $\bar{X}_{3 months post-workshop} = 3.50$, $P \leq .01$) and use or intent to use spirometry in practice ($\bar{X}_{pre-workshop} = 3.00$, $\bar{X}_{post-workshop} = 4.77$, $P \leq .01$). At 3 months, little change was identified in clinical management of COPD ($\bar{X}_{pre-workshop} = 3.54$, $\bar{X}_{3 months post-workshop} = 3.54$, $P \leq 1.00$).

Conclusions: This evaluation demonstrates the effectiveness of a skill-based continuing education workshop in increasing incorporation of spirometry in diagnosing COPD, less in monitoring and management, highlighting the importance of tailoring workshops to targeted clinical gaps.

Introduction

Chronic obstructive pulmonary disease (COPD) affected 12.1 million Americans in 2008 [1], with a further 24 million reporting symptoms suggestive of the disease [2]. It accounted for 120,970 deaths in 2006, representing 5.1% of deaths in the United States and making it the fourth leading cause of death [3]. The economic cost of this illness projected for the year 2010 was estimated at $49.9 billion, including $29.5 billion in direct healthcare expenditures, $8.0 billion in indirect morbidity costs, and $12.4 billion in indirect mortality costs [4]. It is projected that it will become the fifth highest disease in disability-adjusted life years (an indicator of disease burden) worldwide by 2020 [5].

Effective therapeutic regimens have been developed to treat COPD, and guidelines provide direction in the screening (case finding), diagnosis, treatment, and management of COPD [6-8]. The importance of early detection and aggressive treatment is critical [9-12], yet COPD continues to be under-diagnosed and under-treated [13,14] causing continued suffering and rising cost. Physicians rely almost exclusively on patients’ reports despite the ineffectiveness of this strategy [15], resulting in failure to identify early symptoms of mild COPD [16]. Spirometry provides a sensitive, objective means to assess respiratory status, yet primary care physicians (PCPs) are not sufficiently familiar with this method [17-19] and therefore do not use it adequately [20,21]. Family physicians (FPs) and other PCPs play a crucial role in the early detection, diagnosis, and management of COPD [22], yet evidence suggests that physicians do not adhere to guidelines recommending spirometry [23-26].
In order to address this gap in the use of spirometry in screening, diagnosing, and managing COPD, a continuing education initiative was developed by the New Jersey Academy of Family Physicians (NJAFP). The initiative was based on the outcomes of a needs assessment carried out by the NJAFP with FPs who had attended a previous program on COPD in 2006. This needs assessment identified key knowledge and skill gaps, including the use of spirometry in diagnosis and management of COPD, interpretation of spirometry results, and being reimbursed for spirometry. A major underlying cause was FPs not knowing about newer, smaller, more affordable spirometers and lacking skill in using them in practice. In response to these identified gaps in the use of spirometry in identifying and monitoring COPD, NJAFP developed a continuing educational initiative. The initiative consisted of (1) a printed summary of current research and recommendations for clinical care; (2) a hands-on, case-based, 1.5- to 3-hour workshop including practice with spirometers, a video-taped patient case scenario in which the test was demonstrated, and information about conducting and interpreting spirometry testing; and (3) an interactive, case-based, web-based program extending the workshop case through follow-up over time and adding a second case to provide an opportunity for further learning and validation. The live workshop was offered by 20 constituent state chapters of the American Academy of Family Physicians (AAFP). An evaluation study of the workshop component of the initiative was conducted to determine if the educational and performance objectives were met and to what extent. Furthermore, findings will inform future educational iterations in this area. Based on Moore and colleagues’ levels of evaluation [27], the following were examined:

- Level 1: Participation
- Level 2: Participants’ satisfaction
- Level 3: Change in participants’ declarative (3A) and procedural (3B) knowledge and attitude related to spirometry
- Level 4: Change in participants’ skill and intent to change practice in carrying out and interpreting spirometry testing
- Level 5: Participants’ practice change (by self-report) related to the use of spirometry

This article reports on the mixed-method evaluation of the hands-on, skill-based educational workshop component of the overall educational initiative.

**METHODS**

**Evaluation Design**

A mixed-methods approach was used, including both qualitative (discussion groups, semi-structured interviews) and quantitative (questionnaire) data collection techniques to enhance rigor and trustworthiness of findings [28,29]. A triangulated research design combined multiple data collection methods (qualitative, quantitative) to examine the same phenomena from different perspectives [30,31], strengthening the trustworthiness and validity of the evidence [29-31]. Five chapters of the AAFP participated in the evaluation. Data collection was carried out between June 2008 and May 2009.

A time series design (Table 1) evaluated impact on knowledge, skill, and attitude, as well as intent and self-reported behavior change [32-34]. Participants were tested prior to the workshop, immediately following the workshop, and 3 months following the workshop. The backgrounds of the 3 researchers (KC, SH, SM) included extensive experience in qualitative research.

**Tool Development and Design**

Qualitative discussion and interview guides were developed based on best practice in diagnosing and treating COPD and practice challenges in the use of spirometry in COPD [35]. Guides were semi-structured, consisting of open-ended probes such as “How confident are you in your ability to interpret the results of spirometry testing?” A complementary questionnaire was designed that included statements describing knowledge, skill, confidence, current practice, and intent to change practice related to the use of spirometry in practice. Agreement statements such as “I use spirometry in screening and diagnosing patients with respiratory symptoms” were rated using a 5-point rating scale where 1 indicated “Completely Disagree” and 5 “Completely Agree.” The questionnaire also included multiple choice questions assessing knowledge, case reflection, and clinical decision mapping in which

<table>
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<tr>
<th>Table 1. Evaluation Design [27]*</th>
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<tr>
<td><strong>Objective</strong></td>
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<td><strong>Prior to the Workshop</strong></td>
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<td><strong>Immediately Following the Workshop</strong></td>
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<td><strong>3 Months Following the Workshop</strong></td>
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<tr>
<td>To assess use of spirometry in the care of patients with COPD: knowledge, skill, and clinical practice behaviors</td>
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<td><strong>Data Collection: Mixed Methods</strong></td>
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<td>Discussion groups (5) and questionnaires</td>
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<td><strong>Timeline</strong></td>
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*COPD indicates chronic obstructive pulmonary disease.
participants were prompted by probes to describe their decisions and key challenges in providing care.

**Participants**

Workshop participants were given the option of participating in the evaluation either through an opt-in option when registering (e.g., a checkbox on the registration form) or by telephone invitation. The evaluation study was explained by AXDEV Group (Brossard, Quebec, Canada), and those who opted in were invited to enroll. Ethical approval (Institutional Review Board [IRB] Services, Boca Raton, Florida, USA) was obtained to ensure the protection of human subjects with respect to their anonymity and confidentiality. Participants received financial compensation for their time as approved by IRB review.

As seen in Table 2, the majority of participants were in practice 6 to 30 years (87%). Seventy-two percent saw 11 to 50 patients with COPD per month. Seventy-one percent practiced in private clinics, and 48% practiced in rural settings. The high proportion of rural participants reflects 1 group that was based in a rural setting (South Dakota). Fifty-nine percent (17/29) participated in the 3-month follow-up evaluation (Table 2).

**Data Collection**

**Phase I: Discussion Group**

Discussion groups (half-day) were conducted the day before the workshop, including the questionnaire.

**Phase II: Immediate Post-Workshop**

Participants completed the questionnaire again. Items evaluating Level 2 workshop satisfaction were included.

**Phase III: 3-Month Follow-Up**

Participant interviews (1-hour) were conducted approximately 3 months after the workshop. Participants completed the questionnaire a third time.

Both discussion groups and interviews were audio-recorded.

**Analysis**

Coding of qualitative data began with open coding [36], reviewing data in detail based on the conceptual framework and program learning objectives. Coding categories were then grouped into related themes and subthemes, for example: Knowledge (Knowledge of spirometry in screening and diagnosis of COPD); Skill (Skill in carrying out spirometry); and Attitude (Prioritization of COPD).

Themes were validated among 3 coders through review of selected data excerpts and discussion of coding. Discrepancies were resolved through discussions until concordance was achieved. Concordance was achieved in all cases through discussion,
review of coding categories and themes, and review of study objectives. Selective coding was then conducted [36], whereby data were systematically coded with respect to core concepts identified in the literature review and analysis of interview data.

Quantitative data were analyzed using descriptive (mean, standard deviation) and non-parametric methods (Friedman 2-way ANOVA by rank with Bonferroni correction) (PASW Statistics 18.0, 2009, SPSS Inc., Chicago, Illinois, USA) [37]. Probes provided self-assessment of skill, knowledge, attitude, and intended and self-reported practice in the use of spirometry. Results of qualitative and quantitative analyses were triangulated [28,29].

The findings related to changes in skill, knowledge, attitude, intent to use spirometry, and practice change are reported in this article.

RESULTS
Satisfaction scores ranged from $X = 4.00$ to 4.43 (Table 3). Scores related to workshop deployment and organization, design and facilitation, relevance, workshop materials, knowledge of speakers, and opportunities to interact ranged from $X = 4.36$ to 4.43. Scores related to clarity of information, speakers’ ability to generate interest, and the demonstrations of spirometry by live and on video were $X = 4.00$ to 4.07.

Use of Spirometry in Screening and Diagnosis of COPD
Prior to the workshop, participants reported relying predominantly on patients’ histories and reports of symptoms to assess and diagnose COPD. Twelve participants (41%) did not use spirometry at all in diagnosis. They characterized their current practice as being based on knowledge and practices that they acquired in medical school. Spirometry was not emphasized in their training, and therefore they lacked confidence in skill in completing and interpreting the test.

They characterized spirometry as intimidating and questioned their skills in carrying it out correctly, finding it easier and faster to prescribe antibiotics and refer to a pulmonologist.

*Trying to find someone who knows how to use it... Then get results and go 'Oh God!'

They further reported that they did not prioritize COPD or its objective assessment using spirometry. Rather, they addressed what the patient presented in the office visit and gave greater importance to other tests such as electrocardiograms (EKGs), with which they had more experience and comfort.

*We treat the patient, not the test. They will not die if it [spirometry] is not done today.

Another factor was the time taken to carry out the test. [You're] on a treadmill. Anything that breaks your rhythm.

Following the workshop, participants reported increased knowledge of indications for screening for COPD, as described by this FP:

*I didn't know there were so many indications... A lot more other patients you can use it on... Patients that cough, the smokers, somebody who gets short of breath easily with exertion.*

In responding to the questionnaire, 75% of participants reported increased skill and intent to use spirometry. Table 4, Item 1 shows significant increases from pre-workshop to post-workshop data collection in participants’ plan to use spirometry. An increase in mean scores from pre-workshop to 3-month follow-up was seen as well, though this was not significant. Qualitative data suggest that this quantitative change was attributed to increased knowledge gained in the workshop, as stated by this FP:

*Information in the workshop was new. You don't need a nose-plugging device, ... have to be seated... I spoke to the doctor [facilitator] after... I thought I'd heard wrong.*

Not all participants, however, achieved their personal goals in attending the workshop, with 1 FP stating that (s)he is still not diagnosing early enough:

*Not doing well enough at it [catching the disease early]... Too many other things.*

Confidence level in the use of spirometry to assess symptoms was initially low ($X = 2.31$, Table 4, Item 2), increasing to a moderate level ($X = 3.46$) immediately following the workshop. A similar pattern was seen in confidence in using spirometry to stage COPD (Table 4, Item 3), with the mean increasing from a low level ($X = 2.25$) to moderate ($X = 3.50$) post-workshop and a moderate level ($X = 3.42$) 3 months following the workshop ($P < .03$). Pairwise comparisons were not significant, however. Intent to improve use of spirometry in differential diagnosis (Table 4, Item 4).

<table>
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<tr>
<th>Table 3. Level 2 Evaluation: Reaction, Satisfaction*</th>
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<tr>
<td><strong>Average Score</strong></td>
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<tr>
<td>Relevance of program content to family medicine clinical practice</td>
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<tr>
<td>Clarity and complexity of information</td>
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<td>Clarity, relevance, and usefulness of slides, reading material, and handouts</td>
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<tr>
<td>Contribution of demonstration of spirometry to skill</td>
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<td>Appropriateness of video of spirometry to practice</td>
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<td>Skill of speaker in generating interest</td>
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<tr>
<td>Knowledge level of speaker about COPD and spirometry</td>
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<tr>
<td>Opportunities to ask questions and interact with speaker and other participants</td>
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</table>

*COPD indicates chronic obstructive pulmonary disease. Agreement statements were rated using a 5-point scale where 1 indicated “Completely Disagree” and 5 indicated “Completely Agree” n = 29.*
decreased significantly from pre-workshop (\( \bar{X} = 4.85 \)) to 3 months following the workshop (\( \bar{X} = 3.85 \)). In qualitative data collection, participants described this ongoing lack of confidence, as reported by this FP who described having greater confidence and familiarity with EKGs compared with those who described having greater confidence:

[FP] not as comfortable as with EKGs . . . We see EKGs every day and spirometry almost never.

**Skill in Interpretation of Spirometry Results**

Prior to the workshop, participants described spirometry as a complex and unfamiliar procedure that participants had little skill and little confidence in interpreting. As stated by these FPs:

We all have spirometry . . . What do we do with what we get? Can we use it? Do we need to redo it?

We have a basic one, that’s already too much in the numbers it gives.

Following the workshop, in qualitative interviews, participants expressed increased confidence in their skill in interpreting spirometry, as stated by this FP participant: [My confidence is] a lot better than it was previously. I need to apply it now.

Other participants reported that the workshop provided only brief instruction in interpretation, and that this was insufficient to alter their practice:

Some of us would have liked to know better how to interpret . . . Main drawback:

This lack of change in interpretation skill was reflected in quantitative questionnaire responses as well. When presented with the statement “I am confident in my ability to interpret spirometry results” and asked to rate their level of agreement with the statement, the pre-workshop average was \( \bar{X} = 2.33 \) (standard deviation [SD] = 1.07, \( n = 28 \)); the average immediately following the workshop was \( \bar{X} = 3.42 \) (SD = 0.10, \( n = 12 \)); and the average 3 months post-workshop was \( \bar{X} = 3.08 \) (SD = 0.08, \( n = 12 \)). Significant differences were found across the 3 time periods (Friedman \( \chi^2 = 6.00, P \leq .05 \)), but not between the scores pre-workshop and 3 months following the workshop (Bonferroni corrected Friedman \( \chi^2 = -1.23, P \leq .66 \)). Further, prior to the workshop, 77.8% (21/27) responded correctly to a multiple choice question asking for correct interpretation of spirometry results, and 76.9% (10/13) responded correctly 3 months following the workshop.

**Use of Spirometry in Treatment and Management of COPD**

Prior to the workshop, spirometry was seen primarily as a diagnostic tool, less as a tool in monitoring status for management purposes. As with diagnosis, participants self-reported relying on symptoms. In fact, if patients’ symptoms and spirometry were contradictory, participants described making treatment decisions based on symptoms and not spirometry results, not having the confidence in the test to supersede the more familiar patient presentation.

Nor would spirometry results lead them to change treatment in the absence of changes in symptoms, as stated by this FP who described not thinking about spirometry and being uncertain about its role in providing care for asymptomatic patients:

If patient asymptomatic: [Do] not think about it [spirometry]. Maybe I should, I don’t know.

Following the workshop, in questionnaire responses, significant increases were seen in self-reported knowledge of the use of spirometry in monitoring COPD. Table 5, Item 1 reflects significant increases in knowledge of spirometry in monitoring from pre-workshop to both post-workshop and 3-month follow-up scores. In qualitative interviews, participants reported being previously unaware that spirometry had a role in COPD management and described lacking sufficient confidence in their skill.

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### Table 4. Ratings of Confidence and Use or Intent to Use Spirometry in Assessment and Diagnosis of COPD*

<table>
<thead>
<tr>
<th>Level of Agreement with Statements, Average Score [SD]†</th>
<th>Friedman ( \chi^2 )</th>
<th>( P )</th>
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<tbody>
<tr>
<td><strong>Pre-workshop</strong> (( n = 13 ))</td>
<td><strong>Post-workshop</strong> (( n = 13 ))</td>
<td><strong>3 months follow-up</strong> (( n = 13 ))</td>
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<tr>
<td>1. Plan to or are using spirometry in screening and diagnosing patients with respiratory symptoms</td>
<td>2.92 [1.38]‡</td>
<td>4.62 [0.51]‡</td>
</tr>
<tr>
<td>2. Confidence in using spirometry to assess symptoms of COPD</td>
<td>2.31 [0.95]§</td>
<td>3.46 [0.87]§</td>
</tr>
<tr>
<td>3. Confidence in using spirometry to stage COPD</td>
<td>2.25 [0.97]</td>
<td>3.50 [0.91]</td>
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*COPD indicates chronic obstructive pulmonary disease. Friedman 2-way ANOVA by rank with Bonferroni correction was carried out.
†Agreement statements were rated using a 5-point scale where 1 indicated “Completely Disagree” and 5 indicated “Completely Agree.”
‡Multiple comparisons with Bonferroni correction: \( \chi^2 = -3.24, P \leq .00 \).
§Multiple comparisons with Bonferroni correction: \( \chi^2 = 2.45, P \leq .04 \).
to adopt an unfamiliar practice behavior, as described by this FP:

*I'm not sure about that... Would I look at the numbers? ... I don't think I'd be confident about that [spirometry]... More in diagnosis than in treatment.*

In an interview, this FP provides an explanation for this reluctance to use spirometry, stating that (s)he is more influenced by the patient in the office:

*I'm still hanging on it [symptoms]... Because what I have in front of me [is the patient].*

Participants’ intent to improve their ability to use spirometry in managing treatment was initially high in questionnaire responses, and remained high immediately following the workshop and 3 months later, showing no significant changes (Table 5, Item 2). When presented with the statement “I do not use spirometry in monitoring and managing my patients with COPD” in questionnaires (Table 5, Item 3), participants’ scores showed little long-term change, with initial significant increase immediately following the workshop being followed by significant decrease at 3 months. Participants’ self-reported practice behavior in qualitative interview responses continued to reflect reliance on patient report as the basis for treatment decisions, as characterized by this FP participant:

*If numbers are mild but quality of life is moderate, then treat to moderate.*

As in diagnosis, lack of prioritization of spirometry over other tests was seen:

*If I have to choose between a stress test and spirometry, I’d choose the stress test.*

Other participants reported change in attitude toward spirometry in monitoring:

*I’m requesting it more, which I wasn’t doing prior.*

**DISCUSSION**

Evaluation of workshop impact showed increased knowledge and confidence in FPs’ skill and clinical use of spirometry in diagnosing COPD. Slight increases in knowledge of the role of spirometry in managing COPD were reported; however, participants acknowledged ongoing lack of knowledge and skill in using spirometry to monitor COPD status and in interpreting spirometry in making treatment decisions, preferring to rely on symptoms with which they are more comfortable.

A 1999 review of guideline adherence identified knowledge and skill in implementing guidelines as major barriers [24]. The evaluation of this program suggests that the workshop increased both knowledge and confidence with skill in using spirometry in diagnosing COPD. Participants initially reported lack of familiarity with spirometry as a barrier in practice, contrasting it with greater levels of knowledge and confidence in their skill in carrying out and interpreting EKGs. Following the workshop, increased knowledge and confidence in skill with spirometry were revealed in both qualitative and quantitative findings (Moore et al Levels 3 and 4 [27]). Post-workshop evaluation findings suggest that this hands-on workshop resulted in qualitative self-reports of increased confidence and intent to use of spirometry in diagnosis of COPD (Moore et al Level 4 [27]). These qualitative findings were substantiated by significant increases seen in quantitative questionnaire responses. The Healthcare Effectiveness Data and Information Set (HEDIS) measures over this time period showed little

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<th>Table 5. Ratings of Spirometry in Monitoring and Managing Patients with COPD*</th>
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<tr>
<td><strong>Level of Agreement with Statements, Average Score (SD)</strong></td>
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<tr>
<td><strong>Pre-workshop</strong> (n = 13)</td>
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<tr>
<td>Knowledge of use of spirometry in monitoring patient</td>
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<tr>
<td>Intent to improve use of spirometry in managing treatment</td>
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<tr>
<td>Plan to or are using spirometry in monitoring and managing patients with respiratory symptoms</td>
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| Self-reported planned or actual use of the following to determine treatment (checkboxes, all that apply) | n (%), n = 13 | **Friedman χ²** | **P** |

*COPD indicates chronic obstructive pulmonary disease; FEV₁, forced expiratory volume in 1 second. Friedman 2-way ANOVA by rank with Bonferroni correction was carried out.
†Agreement statements were rated using a 5-point scale where 1 indicated “Completely Disagree” and 5 indicated “Completely Agree.”
‡Multiple comparisons with Bonferroni comparisons: χ² = 2.65, P ≤ .02.
§Multiple comparisons with Bonferroni comparisons: χ² = 3.14, P ≤ .01.
¶Multiple comparisons with Bonferroni comparisons: χ² = 3.16, P ≤ .01.
†Multiple comparisons with Bonferroni comparisons: χ² = –2.45, P ≤ .04.
change [38]. Increases seen in the intent and use of spirometry—in both qualitative discussion groups and interviews and validated in quantitative questionnaires—suggest that a hands-on experiential workshop such as this may support practice improvement in using spirometry to diagnose respiratory symptoms. This change did not extend to using spirometry for differential diagnosis in distinguishing between respiratory illnesses. The emphasis on patient reports of symptoms in differential diagnosis reported by FPs prior to the workshop remained after the workshop, and the intent to improve use of spirometry in differential diagnosis actually decreased.

The same positive impact was not seen in skill in interpreting spirometry results nor in use of spirometry in monitoring patients or making treatment decisions. Initial findings suggested little self-reported knowledge or use of spirometry in monitoring COPD in both discussion group responses and questionnaire ratings, but greater intent to improve its use in management. At 3 months, knowledge of spirometry in monitoring had increased, as described in interviews and self-reported in questionnaires. Self-reported use in practice did not increase; in fact questionnaire responses showed significant increase immediately following the workshop, which then dropped 3 months later, also significantly, resulting in no net increase at 3 months. Intent to increase use in practice remained high, however. Qualitative findings suggested lack of confidence based on an ongoing lack of knowledge and skill in using spirometry findings to determine treatment decisions. This was attributed to little formative and experiential familiarity with spirometry across the COPD care continuum.

This program evaluation suggests the effectiveness of a targeted, skill-based workshop in addressing a skill-based practice gap. It also delineates shortfalls in this approach, providing direction in the design of programs targeting positive behavioral practice change. Participants had limited knowledge and skill in using spirometry to diagnose COPD, but lacked the knowledge, skill, and confidence to implement the practice. This workshop provided hands-on practice, addressing these performance gaps effectively. Participants had less knowledge and confidence in their skills in interpreting spirometry, a discomfort that was not addressed, therefore little impact was seen. This difference highlights the importance of targeting specific identified gaps and designing performance improvement (PI) initiatives adapted to the nature of the gap being addressed.

**Study Limitations**

Workshop participants who enrolled in the evaluation were self-selected, opening the possibility that they were different in some way from those workshop participants who chose not to contribute. This evaluation study was based on self-report by participants, which is vulnerable to subjective interpretations and perceptions of individuals. The small number of participants in the 3-month follow-up phase of the study limits the power of statistical testing to detect significance and the extent to which conclusions regarding long-term impact can be drawn.

**CONCLUSION**

A skill-based, case-based workshop targeting use of spirometry in diagnosis and management of COPD was evaluated. The workshop was found to be effective in improving practice in the use of spirometry in diagnosis of COPD, but less so in its interpretation and use in monitoring and management. This may reflect the different levels of hands-on experience provided in skill in carrying out spirometry testing versus its interpretation.

**ACKNOWLEDGMENTS**

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**REFERENCES**


