Monitoring of patients with COPD: A review of current guidelines’ recommendations

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Summary

Background: The goals for the management of COPD are to delay the process of disease progression and alleviate its manifestations. The follow-up of the patients’ physical and mental condition is part of best practice management when monitoring routines result in information that contributes to the achievement of management goals. However, the recommendations on monitoring procedures may differ between guidelines and may not be based on scientific evidence. The aim of this article is to review the current guideline recommendations on monitoring routines for COPD.

Methods: Clinical practice guidelines on the management of COPD were identified by a Medline search, Internet search and expanded by experts in the respiratory field. Guidelines on the management of COPD were analysed on recommended monitoring routines, recommended frequency of monitoring.

Results: Eighteen clinical practice guidelines on the management of COPD were analysed. The follow-up of lung function indices was the most frequently recommended monitoring routine.
monitoring routine. Moreover, monitoring of symptoms, exercise tolerance, comorbidity, and smoking habits were recommended regularly. In none of the guidelines, the recommended monitoring routines were evidence based. Only one guideline provides a different set of monitoring parameters for advanced COPD compared to mild and moderate COPD.

Conclusion: Some monitoring routines were recommended frequently, especially follow-up of lung function indices. However, evidence to support the guideline recommendations for the monitoring of patients with COPD is missing. The effect of monitoring on care process and outcomes should be assessed.

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Contents

Introduction .................................................. 2
Methods ................................................................ 2
Results ................................................................. 4
Clinical practice guidelines on the management of COPD ................................................. 4
Recommended monitoring routines ............................................................................. 5
Frequency of monitoring visits ................................................................................. 5
Evidence grading monitoring recommendations ....................................................... 5
Discussion ................................................................ 5
Conflict of interest ................................................................................................. 7
Acknowledgement ............................................................................................... 8
Appendix A Supplementary materials .................................................................... 8
References ............................................................................................................ 8

Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic condition that, by definition, is not amenable to cure. Therefore, the goals for the management of COPD are to delay disease progression and alleviate its manifestations. Periodic assessments that guide the management of a chronic or recurrent disease is usually called ‘monitoring’. The follow-up of the patients’ physical and mental condition is part of best practice when this results in the achievement of the management goals. Monitoring should therefore be based on markers of disease progression that truly predict outcome of disease and guide interventions to improve outcome. This would require a scientific evidence base of ‘monitored markers’. The latest revision of the global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease (GOLD-guideline) includes a paragraph on monitor of the disease. Moreover, over the past few years, several other clinical practice guidelines (CPGs) on the management of COPD have been published with directives on monitoring the status and prognosis of COPD. The reality is, however, that not all recommendations are evidence based and that most CPGs contain additional ‘opinion-based’ recommendations. We previously reflected on monitoring routines as currently recommended in clinical COPD guidelines, and how opinion-based recommendations may not necessarily result in clinical benefits or even cause an unnecessary physical or mental burden for patients, and an economic burden for the society at large. An overview of guideline recommendations regarding monitoring COPD patients is currently lacking. In this article, we review current COPD guidelines’ recommendations on monitoring routines, the recommended frequency of the monitoring visits, and the level of scientific evidence of the recommendations.

Methods

To identify CPGs on the management of COPD, a Medline search was carried out using the terms ‘COPD’ (exploded) and ‘guideline’. The treatment guideline links on the Pubmed site were searched on CPGs on the management of COPD (for instance, www.nelh.nhs.uk, and National Guideline Clearinghouse). Moreover, an Internet search engine (Google™) was used to search for additional CPGs. Finally, experts in the field of COPD disease management were asked to complete the list of guidelines. Only CPGs that addressed the integral management of COPD from diagnose on to treatment and (terminal) care were selected. CPGs for specific subgroups of patients or restricted to a specific aspect were not selected. The search was restricted to CPGs written in English or Dutch language that had been published or updated after the year 2000 and were still accurate at the time of our analysis. Table 1 shows the characteristics of the selected CPGs, including the title, the year of the latest update, and the organisation responsible for its development. More information on the CPGs (e.g. its clinical goal, definition of COPD, the professional groups included in development and target users) is described in an online data supplement (see online data supplement).

Monitoring of chronic disease was defined as the process of periodically assessing, observing, recording and/or
Table 1  Description of the characteristics of the selected clinical practice guidelines for chronic obstructive pulmonary disease.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Organisation</th>
<th>Year</th>
<th>Country/region</th>
<th>Title in English</th>
<th>Evidence grading (EG)</th>
<th>EG monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS/ERS</td>
<td>American Thoracic Society and European Respiratory Society</td>
<td>2004</td>
<td>Global</td>
<td>Standards for the diagnosis and treatment of patients with chronic obstructive pulmonary disease</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IPAG</td>
<td>International Primary care Airway Group</td>
<td>2004</td>
<td>Global</td>
<td>Chronic airway diseases; a guide for primary care physicians</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IPCRG</td>
<td>International Primary Care Respiratory Group</td>
<td>2006</td>
<td>Global</td>
<td>International Primary Care Respiratory Group (IPCRG) Guidelines: management of chronic obstructive pulmonary disease (COPD)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>EBM</td>
<td>Duodecim medical publications Ltd.</td>
<td>2004</td>
<td>Global</td>
<td>Evidence-based medicine guideline; chronic obstructive pulmonary disease</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>COPD-X</td>
<td>The Thorax Society for Australia and New Zealand and the Australian Lung Foundation</td>
<td>2007</td>
<td>Australia/New Zealand</td>
<td>Chronic obstructive pulmonary disease (COPD) Australian and New Zealand management guidelines and the COPD handbook (COPD-X)</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>CTS</td>
<td>Canadian Thoracic Society</td>
<td>2004</td>
<td>Canada</td>
<td>Canadian Thoracic Society recommendations for the management of chronic obstructive pulmonary disease</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>BCMA</td>
<td>British Columbia Medical Association</td>
<td>2007</td>
<td>Canada</td>
<td>Chronic obstructive pulmonary disease (COPD)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>India</td>
<td>WHO (India)</td>
<td>2003</td>
<td>India</td>
<td>Guidelines for management of chronic obstructive pulmonary disease (COPD) in India; a guide for physicians</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>CBO</td>
<td>Collaboration of many organisations including Dutch College of General Practitioners and Dutch Institute for Health Care (CBO)</td>
<td>2005</td>
<td>Netherlands</td>
<td>Guideline integrated care COPD</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>NHG</td>
<td>Dutch College of General Practitioners</td>
<td>2007</td>
<td>Netherlands</td>
<td>NHG-standard COPD</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>PA</td>
<td>Palestinian Ministry of Health</td>
<td>2003</td>
<td>Palestinian region</td>
<td>Palestinian guideline for diagnosis and</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
testing of certain aspects of a patient’s physical and mental condition. Consequently, all recommendations on periodic collection of data about the physical and/or mental condition of patients were listed as ‘monitoring routines’. General recommendations regarding monitoring of COPD patients were searched, like whether or not an hierarchic evidence grading system had been applied for the recommendations in the CPGs, if the monitoring recommendations were actually evidence graded, and whether or not there is a separate paragraph on monitoring included in the CPG. Moreover, the full text of each CPG was analysed to identify all aspects that should be monitored or be part of follow-up visits of patients by one of the authors (LB) and independently verified by a second author (TS). Next, the search function in the text processing program was used to crosscheck for terms like monitor*, follow-up and audit* (or Dutch equivalents when applicable) in the CPGs. All monitoring routines recommended by the CPGs are given in Table 2. The monitoring routines that were recommended by more than a third of the CPGs (n ≥ 7) are described in Table 3. Monitoring routines that were implied but not specifically recommended were graded with a +/- sign.

### Results

**Clinical practice guidelines on the management of COPD**

Nineteen CPGs on the management of COPD were identified that had been published or updated after the year 2000 and fulfilled the other inclusion criteria. One CPG was excluded because it only consisted of three written pages with no literature references. The remaining 18 CPGs were screened regarding the recommended monitoring routines. Characteristics of the CPGs are given in Table 1 and the online data supplement. One CPG did not give any recommendations regarding monitoring routines.
Guidelines’ recommendations on monitoring COPD

Six CPGs (33%) did not provide any information on the frequency of follow-up visits; three CPGs (17%) indicate that the frequency of monitoring visits should depend on the local health care system; and nine CPGs (50%) recommend that the number of visits should be tuned to the disease severity and progression of the individual patient. Eight CPGs provide suggestions for the frequency of monitoring visits that vary between monthly to yearly. Moreover, one CPG (CBO) recommended monitoring of lung function in a lower frequency than other monitoring routines, i.e. once every three years.

Evidence grading monitoring recommendations

Nine CPGs (50%) provided information regarding the level of evidence for management recommendations. Usually the evidence was graded from the highest level of evidence: A (evidence resulted from several well-designed randomised clinical trials) till the lowest level of evidence: D (expert opinion). Three CPGs—the CBO, IPCRG and NICE guidelines—used an evidence grading system for some of their specific monitoring recommendations. According to these guidelines, there was no scientific evidence for any of the monitoring recommendations (i.e. all monitoring recommendations were based on expert opinion).

Discussion

This review identified 19 CPGs on the management of COPD of which 18 were analysed on recommendations concerning disease monitoring in patients with COPD and the evidence behind these recommendations. The follow-up of lung function was the most frequently recommended monitoring routine. Symptoms, smoking habits, exercise tolerance, and comorbidity were also frequently recommended. However, none of the guidelines provided scientific evidence for their recommended monitoring routines. This implies that there is scant evidence that the defined ‘best practice’, is in the best interest of the patients with COPD. In appraising our findings, more emphasis should be placed on the nature of the information to be monitored. None of the guidelines we reviewed made the distinction between ‘direct’ monitoring of outcome of care—for example, symptom relief, or smoking cessation—and the monitoring that predicts the prognosis and of long-term outcome of care. As discussed elsewhere, measuring the direct outcome of care is usually self-evident, but monitoring the long-term course is based on markers of disease progression (pulmonary function; body mass index (BMI)) and in this evidence of its predictive value and therapeutic implications are essential. Some monitoring procedures like monitoring dyspnoea can serve several goals (i.e. facilitate COPD management decision making and provide information on disease progression). Below, we review the nature of the recommended monitoring procedures based on literature.

COPGs (67%) included a separate paragraph on monitoring disease or follow-up visits. Sixteen of the CPGs (89%) recommended monitoring of lung function (Table 2). When a definition of lung function monitoring was given in the guidelines, it was always the spirometric measurement of the (change in) FEV1 (forced expiratory volume in 1 second), sometimes combined with a recollection of information on the FEV1/FVC ratio. Monitoring of symptoms, exercise tolerance, comorbidity, exacerbations, inhaler technique, and smoking habits were recommended by at least half of the CPGs. There was large agreement on recommended monitoring routines between the NICE, CBO, GOLD, CKS, COPD-X, ABFP, and NHG guidelines. Additionally, the ATS/ERS standards for the diagnosis and management of patients with COPD recommend that the “intensity” of follow-up visits should be based on the patient’s disease status and course, though without providing specific recommendations. The NICE guideline is the only guideline that recommends a different set of monitoring routines for patients with mild or moderate COPD compared to patients with severe disease.
Smoking cessation is the only intervention that could reduce the lung function decline of patients with COPD. Smoking cessation also relieves symptoms and reduces mortality. Though difficult to achieve, there are opportunities to improve the success rate of smoking cessation. Therefore, monitoring of smoking status is important to identify smoking cessation opportunities, thereby improving disease status in short term (i.e. ‘direct’ monitoring) and delay disease progression.

Also, identifying symptoms is important to direct therapy. Symptoms are the patients’ subjective perception of disease manifestation and symptom relieve should have a prominent place in the management of COPD. Pharmacological therapy, smoking cessation, and pulmonary rehabilitation can reduce symptoms.

Moreover, various interventions can reduce the number of (hospitalised) exacerbations; use of inhaled corticosteroids, the use of a long acting bronchodilators, and self-management. Exacerbations impair quality of life and cause frequent hospital admissions and increased health care costs, especially in patients with more severe COPD. Early introduction of treatment for exacerbations resulted in faster recovery of the exacerbation. Therefore, the evaluation of the pattern of exacerbations as a part of periodic monitoring could lead to improved care.

Next, using medication in an appropriate way seems essential to have optimal benefits of treatment with minimal side effects of therapy (i.e. monitoring inhaler technique, effect and side effects of drug treatment). For example, most COPD medication is delivered by inhalers, which reduces systematic side effects, but about a quarter of patients with COPD make at least one essential mistake when using their inhaler device. Good inhaler technique has been related to symptom relieve, improve quality of life, reduce exacerbations, and improve exercise tolerance. Instructions and educational programs can improve the inhaler technique of patients with COPD.

<table>
<thead>
<tr>
<th>Monitoring parameters</th>
<th>NICE</th>
<th>CBO</th>
<th>IPCRG</th>
<th>GOLD</th>
<th>EBM</th>
<th>CKS</th>
<th>ICSI</th>
<th>CTS</th>
<th>COPD-X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung function</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Symptoms/dyspnoea</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+/−</td>
<td>+</td>
<td>+</td>
<td>+/−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Smoking habits</td>
<td>+/−</td>
<td>+</td>
<td>+/−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+/−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Exercise tolerance</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Comorbidity/complications</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Exacerbations</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Inhaler technique</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Side effects treatment</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Effect of drug treatment</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Nutritional condition</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Compliance with treatment</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
</tbody>
</table>

Scoring legend monitoring routines: +, monitoring routine recommended in CPG; +/−, item was mentioned in CPG, but unclear for reviewers if it was meant to be a monitoring procedure; −, monitoring routine not mentioned in CPG.
Moreover, patients with COPD frequently suffer from comorbid conditions and complications. Over 20% of COPD patients in a primary care population had undiagnosed congestive heart failure.45 Identifying comorbidity and complications could lead to (early) treatment and improved disease course or disease state by timely initiation of interventions that are not directly related to COPD (e.g., treatment of heart failure with diuretics, vasodilator therapy, and treatment with inotropic agents).

Finally, exercise capacity, often assessed by establishing the 6 min walking distance (6MWD), is influenced by lung capacity but also by extrapulmonary effects of COPD like diminished skeletal muscle strength.46 Research on the effectiveness of pulmonary rehabilitation has shown improvements on various outcomes, like the exercise capacity test, quality of life, prognosis, and incidence of comorbidity.47 Monitoring exercise tolerance could be useful to identify the patients that could benefit most from this intervention.

In addition to dyspnoea, lung function and exercise tolerance, the BMI may predict survival in patients with COPD (i.e. prognostic monitoring).48 Involuntary weight loss is associated with increased dyspnoea, impaired quality of life and less exercise tolerance in severe COPD.49,50 The effect of caloric supplementation on different outcomes like anthropometrical measures and exercise capacity in patients with stable COPD was found to be small and insignificant in a recent meta-analyses of published studies.51 So no clear statement can be made on the value of monitoring BMI in case of COPD.

What is more, the most frequently recommended monitoring routine—lung function (i.e. assess FEV₁ change)—has primarily an informative character, without therapeutic implication since no present therapy other than smoking cessation was found to modify the lung function decline in patients with COPD. However, spirometric testing remains essential to diagnose COPD and provides information on an important aspect of disease severity and progression.48 As the disease progresses, periodic reassessment of the severity of airflow obstruction enables the selection of stage-specific treatment recommendations, like the treatment with an inhaled steroid to prevent exacerbations, which is only recommended for patients with a FEV₁ below 50% of the predicted value.52 Moreover, a small improvement on lung function status was found when interventions were introduced, like the use of bronchodilators.31

Only two-thirds of the CPGs included a specific paragraph on monitoring COPD. The majority of CPGs that comprise recommendations on monitoring frequency recommend that the number of visits should be tuned to the severity and course of disease of each particular patient. In contrast to the number of monitoring visits, CPGs recommendations regarding monitoring routines did not differ between patients with different stages of disease severity, except in the NICE guideline.6 Several routines may not be applicable to the patients with mild or moderate COPD, like the monitoring of arterial oxygen saturation, whereas these patients make out the vast majority of the COPD patient population.53 Moreover, it is remarkable to see that the recommended frequency of performing does usually not differ between the recommended routines, despite the fact that there are important differences in the relevance of the acquired information, costs of the routines/measurements, and their burden for the patients. Although good follow-up is essential to achieve the optimal level of COPD patient care, the attention paid to monitoring in most CPGs is limited. To a certain extent this may be the result of the complete lack of well-designed studies on this topic, especially in contrast to other areas of COPD disease management like, for instance, pharmacotherapy. We suggest that studies on monitoring of COPD should focus on those routines that are not self-evident and result in considerable burden for the patient and/or society. For instance, evidence should be collected on the value of regular lung function monitoring and the effect of monitoring the exercise tolerance in patients with mild to moderate COPD. The effectiveness of these monitoring routines should be evaluated on clinical benefits for the patients like a reduction of symptoms, and improvement of quality of life.

Some methodological considerations warrant mentioning. This overview was limited to CPGs written in Dutch and English and consequently do not provides an overview of all guidelines developed worldwide. What is more, since CPGs are updated regularly and new scientific evidence becomes available continuously, the results in this article must be seen as a ‘freeze-frame’. Next, it was not always clear whether or not the procedure was a monitoring routine in the eyes of the authors of the CPGs. On the other hand, it might be that monitoring routines cannot be recognised as such, because of the formulation in the CPG. For example, all CPGs emphasised smoking cessation, with the recommendation to inquire after the patients smoking status. However, the subsequent periodic review of smoking status was not always recommended.

In this study, we focussed on the monitoring recommendations in the CPGs. Therefore, the quality of the whole CPGs was not assessed according to the AGREE procedure.54 The essential information on the CPGs, including the evidence grading system, was described in the online data supplement.

In conclusion, gathering information on some of the recommended monitoring parameters, like smoking status, symptoms, and inhaler technique may serve an obvious treatment purpose. At this time, insufficient information is available to assure that the collection of this data results in better management of patients with COPD. Therefore, it is not possible to formulate conclusive advices on the usefulness or benefits of guideline recommended monitoring routines for patients with COPD. An evidence-based approach on monitoring of patients with COPD seems essential in order to provide and maintain the best possible evidence based and efficient care. Moreover, evidence-based monitoring recommendations—not only the frequency but also the selected monitoring routines—should preferably be tuned to the disease severity level of the patient.

Conflict of interest

No conflict of interest for any of the authors.

Acknowledgement

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Appendix A. Supplementary materials

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.rmed.2007.12.014.

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Guidelines’ recommendations on monitoring COPD


