

RESEARCH ARTICLE

Communication of Pulmonary Function Test Results: A Survey of Patient's Preferences

Debbie Zagami¹, Jessica Hockenhull¹, Alanna Bodger¹, Krishna Bajee Sriram^{1,2*}

1 Department of Respiratory Medicine, Gold Coast University Hospital, 1 Hospital Boulevard, Southport, Queensland, Australia, **2** School of Medicine, Parklands Drive, Griffith University, Southport, Queensland Australia

* bajee.krishna@gmail.com



Abstract

Introduction

Physician-patient communication in patients suffering from common chronic respiratory disease should encompass discussion about pulmonary function test (PFT) results, diagnosis, disease education, smoking cessation and optimising inhaler technique. Previous studies have identified that patients with chronic respiratory disease/s often express dissatisfaction about physician communication. Currently there is a paucity of data regarding patient awareness of their PFT results (among those who have undergone PFTs previously) or patient preferences about PFT result communication.

Methods

We undertook a three-month prospective study on outpatients referred to two Pulmonary Function Laboratories. If subjects had undergone PFTs previously, the awareness of their previous test results was evaluated. All subjects were asked about their preferences for PFT result communication. Subjects were determined to have chronic respiratory disease based on their past medical history.

Results

300 subjects (50% male) with a median age (\pm SD) of 65 (\pm 14) years participated in the study. 99% of the study participants stated that they were at least moderately interested in knowing their PFT results. 72% (217/300) of the subjects had undergone at least one PFT in the past, 48% of whom stated they had not been made aware of their results. Fewer subjects with chronic respiratory disease preferred that only a doctor discuss their PFT results with them (28% vs. 41%, $p = 0.021$).

Conclusion

Our study demonstrates that while almost all subjects want to be informed of their PFT results, this does not occur in a large number of patients. Many subjects are agreeable for their PFT results to be communicated to them by clinicians other than doctors. Further

OPEN ACCESS

Citation: Zagami D, Hockenhull J, Bodger A, Sriram KB (2015) Communication of Pulmonary Function Test Results: A Survey of Patient's Preferences. PLoS ONE 10(5): e0126617. doi:10.1371/journal.pone.0126617

Academic Editor: Ashutosh Nath Aggarwal, Postgraduate Institute of Medical Education and Research, INDIA

Received: January 29, 2015

Accepted: April 5, 2015

Published: May 7, 2015

Copyright: © 2015 Zagami et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: All relevant data are within the paper.

Funding: The authors received no specific funding for this work.

Competing Interests: The authors (Debbie Zagami, Jessica Hockenhull, Alanna Bodger) have no conflicts of interest. Dr Krishna B Sriram: received honorarium as speaker fees: 2012: Novartis (AUD \$1000) and 2014: Novartis (AUD \$850). The authors have declared that this does not alter the authors'

adherence to all PLOS ONE policies on sharing data and materials.

research is required to develop an efficient method of conveying PFT results that will improve patient satisfaction and health outcomes.

Introduction

Chronic respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD) and interstitial lung diseases, are associated with considerable morbidity and mortality in both developed and developing nations worldwide [1]. The diagnosis of chronic respiratory diseases typically consists of a comprehensive assessment of patients' symptoms, pulmonary function tests (PFTs), radiological imaging, health and functional status and quality of life evaluations [2–4]. Once the diagnosis of chronic respiratory disease is established, adequate patient education is very important in achieving improvements in important health outcomes [5, 6]. The ideal physician-patient communication in patients with the common respiratory diseases will most likely be multi-faceted consisting of (but not restricted to) communicating diagnosis, test results, disease education and management plan/s. It is now well recognised that effective physician-patient communication can positively influence a patient's adherence to treatment [7].

Communicating PFT results to patients with chronic respiratory diseases is an integral component of a successful patient education and self-management strategy. Research demonstrates that one of the unmet needs for patients and caregivers is better physician-patient communication relating to interpretation of diagnostic test results [8–14]. One small study assessed physician-patient communication in COPD outpatient visits and found that spirometry test results were only discussed in 69% of instances [14]. This is concerning since improved patient awareness of their own PFT results may assist them in relating the objective measurements to their symptoms and connect with their diagnosis and treatment plan. Furthermore, some studies have reported that communicating spirometry results to smokers resulted in increased smoking cessation rates [15–20].

Indeed, it has been our experience the physician communication of PFT results to patients is often an overlooked aspect of chronic respiratory disease management. To the best of our knowledge, patient awareness of their PFT results or their preferences for the communication of PFT results has not been specifically evaluated previously. This is surprising since PFTs are being performed in increasing numbers and in the majority of instances PFTs are being performed in patients with chronic respiratory disease to follow disease progression or response to treatment [21].

The aims of this study were to document patient awareness of previous PFT results, their interest and their preference for the communication of PFT results. It is hoped the results of our study would provide us with much needed information that can be used to develop a protocol for the appropriate and adequate communication of PFT results to patients.

Methods

Subjects

Consecutive adult (age ≥ 18 years old) outpatients who were booked to undergo PFTs (spirometry, bronchodilator reversibility assessment, diffusion capacity measurement, lung volume measurement and fractional exhaled nitric oxide testing) were considered for the survey. The study was undertaken in the Pulmonary Function Laboratories of the Gold Coast Hospital and Health Service (GCHHS) between May and August 2014. The GCHHS comprises two regional hospitals, the Gold Coast University Hospital (570-bed) and Robina Hospital (300-bed) both

of which operate pulmonary function Laboratories. The laboratories provide PFT services to only GCHHS outpatients and in-patients. After completion of their PFTs, subjects were invited to participate in the study. All participating subjects provided written informed consent. Review of the medical records was used to determine if a subject suffered from a chronic respiratory disease (COPD, Asthma, Bronchiectasis, Interstitial lung disease). The study was approved by the GCHHS Human Research Ethics Committee (HREC 13/QGC/188).

Questionnaire

Basic demographic information (including age, smoking status and sex) and educational attainment was collected from consenting subjects. Subjects were given the questionnaire by one of three respiratory scientists (DZ, JH, AB). The questionnaire was designed to evaluate subjects' understanding and awareness of their underlying pulmonary disease (if any), self-perception of the severity of their underlying lung disease, awareness of previous PFT results (if applicable); recall of whether the previous PFTs were explained to patient; interest in knowing the results of their current PFT results; patient preference only a doctor should discuss PFT results with them; difficulty in performing PFTs and willingness to perform PFTs again. Responses were tailored to a multiple-choice format to aid completion.

The PFT report was reviewed to collate the following information: reason for referral to PFT laboratory; physician diagnosis (i.e. was the patient known to have a chronic respiratory disease); specialisation of the requesting physician (i.e. pulmonary specialist versus non-pulmonary specialist); physician report of the patients PFT results (pattern and severity of abnormality).

Statistical Analysis

All statistical analyses were performed using the statistical software Statistical Package for the Social Sciences (SPSS, Version 20, SPSS Inc., Chicago, USA). Descriptive statistics were summarised for demographic and social factors and reported as means and standard deviations. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess normality of the data. Normally distributed data was analysed for differences between individual groups using the Student's *t*-test, nonparametric data was analysed for differences between groups using the Mann-Whitney U test and *p*-values less than 0.05 were considered significant.

Results

Among the initial set of 348 eligible subjects, 21 declined to participate in the study, 11 had difficulty comprehending the questionnaire, 16 patients could not complete the questionnaire as they had to leave early for another medical appointment. The data for the remaining 300 subjects was used for the study (Table 1). 40% of subjects had attained at least a tertiary education. 56% of the study participants stated they were former smokers and 19% stated that they were current smokers. Spirometry testing was performed in 299 (99%) subjects, lung volume measurement in 239 (80%) subjects and diffusion capacity in 263 (88%) subjects.

Among the study subjects, the interest to know the results of the PFTs was almost universal (299/300). 217 subjects stated that they had performed spirometry and/or other PFTs in the past. Among these, 48% stated that previous PFT results had not been discussed with them. Of those who stated that their PFT results has been discussed with them, there was a strong correlation between the subjects' self-perception of the severity of their lung disease and the physician's assessment of the PFT results (Pearson correlation coefficient of 0.495, $p < 0.001$). However, among subjects who stated that their PFT results had not been discussed with them, there was no correlation between their self-perception of the severity of their lung disease and

Table 1. Characteristics of Respondents.

| Characteristics | Subjects with Known Chronic Respiratory Disease (N = 131) | Subjects without Known Chronic Respiratory Disease (N = 169) | p-value |
|---|---|---|--------------|
| Sex | | | |
| Male | 66 (50.4%) | 85 (49.7%) | 1.000 |
| Female | 65 (49.6%) | 85 (50.3%) | |
| Age, years | | | |
| Mean (SD) | 63 (15) | 63 (14) | 0.627 |
| Range | 18–89 | 21–89 | |
| Highest level of schooling | | | |
| Primary | 28 (21.4%) | 36 (21.3%) | 0.698 |
| Secondary | 48 (36.6%) | 68 (40.2%) | |
| Tertiary | 55 (42%) | 65 (38.5%) | |
| Smoking status | | | |
| Never smoked | 30 (22.9%) | 46 (27.2%) | 0.959 |
| Former smokers | 79 (60.3%) | 88 (52.1%) | |
| Current smokers | 22 (16.8%) | 35 (20.7%) | |
| Clinician requesting current PFT | | | |
| Respiratory physicians | 99 (75.6%) | 103 (61%) | 0.009 |
| Other hospital clinicians | 32 (24.4%) | 66 (39%) | |
| PFTs requested | | | |
| Spirometry | 130 (99%) | 169 (100%) | 1.000 |
| Bronchodilator reversibility assessment | 45 (34%) | 47 (28%) | 0.256 |
| Lung volumes | 104 (79%) | 135 (80%) | 1.000 |
| Diffusion capacity | 109 (83%) | 154 (91%) | 0.051 |
| Major reasons for PFT referral | | | |
| | Known respiratory disease-COPD: 58 (44%) | Assess lung function in Connective Tissue Disease (CTD): 1 (0.6%) | N/A |
| | Known respiratory disease-Asthma: 18 (13.7%) | Assess lung function in other organ disease: 1 (0.6%) | |
| | Known respiratory disease-Bronchiectasis: 19 (14.5%) | Investigation of specific disease-Asthma: 17 (10.1%) | |
| | Known respiratory disease-Interstitial Lung Disease (ILD): 27 (20.6%) | Investigation of specific disease-COPD: 23 (13.6%) | |
| | Known respiratory disease-Other: 5 (3.8%) | Investigation of specific disease-ILD: 16 (9.5%) | |
| | Pre-operative assessment—Lung Cancer: 2 (1.5%) | Investigation of specific symptoms-dyspnoea 44 (26%) | |
| | Pre-operative assessment-Other: 2 (1.5%) | Investigation of specific symptom-cough: 6 (3.6%) | |
| | | Possible induced lung disease-Occupational: 4 (2.4%) | |
| | | Pre-operative assessment—Lung Cancer: 25 (14.8%) | |
| | | Pre-operative assessment-Other: 32 (18.9%) | |

doi:10.1371/journal.pone.0126617.t001

the physicians’s assessment of the PFT results (Pearson correlation coefficient of 0.169, $p = 0.21$).

One hundred and thirty one subjects had been previously diagnosed with chronic respiratory disease and the remaining 169 subjects had no known chronic respiratory disease. There was no sex difference among the respondents. Respiratory physicians were the requesting

clinicians more often in subjects with chronic respiratory disease compared to subjects without known chronic respiratory disease (74.8% vs. 26.6%, $p < 0.001$). The most common reason for referral for PFT among subjects with chronic respiratory disease was COPD (44%), while among subjects without known chronic respiratory disease, it was for pre-operative evaluation for non-lung cancer related procedures (18.9%). Not surprisingly, subjects with known chronic respiratory disease were more likely to report that they suffered from a lung disease (74.8% vs. 26.6%, $p < 0.001$) subjects without chronic respiratory disease were more likely to be unaware of the severity of their lung disease (85% vs. 53%, $p < 0.001$).

Subjects with chronic respiratory disease had undergone PFTs previously more often than subjects without known chronic respiratory disease (84% vs. 63%, $p < 0.001$) (Table 2). Fewer subjects with chronic respiratory disease wanted a doctor to discuss their PFT results with them compared to subjects without chronic respiratory disease (28.2% vs. 41.4%, $p = 0.021$). While subjects with chronic respiratory disease reported that they found it difficult to perform PFTs compared to subjects without chronic respiratory disease (26.7% vs. 13.6%, $p = 0.005$), almost all subjects were willing to undergo repeat PFTs in the future if required (99.2% vs. 98.8%, $p = 1.000$).

Discussion

In patients with chronic respiratory diseases, such as COPD, asthma and interstitial lung disease, physician-patient communication may need to encompass PFT results, smoking cessation, medications, lifestyle changes and if appropriate advanced care planning as well [2–4]. However, it has been recognised that patients are often dissatisfied with physician communication surrounding chronic respiratory disease diagnosis and management plans [14, 22]. One area of communication that has been highlighted that could readily be improved is physician patient communication of PFT results [14]. In the wider context of diagnostic tests, it is recognised that in some instances only one-third of patients are informed about abnormal test results and the majority of patients with normal results are not informed about their results [11]. On the contrary more than 90% of patients express a desire to be informed of both normal and abnormal results [23]. The lack of communication of test results can result in patient harm and has been found to contribute to about 45% of malpractice claims [24]. While the importance of patient communication about test results is well recognised in the literature, it is also noted that the issue of communicating test results is complex. Not surprisingly, there are no formal guidelines directing or assisting clinicians in the most appropriate method of communicating test results.

For patients with chronic respiratory disease, being aware of their PFT results may influence their health behaviour such as smoking cessation. Cigarette smoking is by far the most important risk factor for COPD, and smoking cessation is the single most effective way to reduce the risk of developing COPD and to affect the clinical outcome in all stages of the disease [3]. Discussing abnormal test results with smokers has been suggested to be a “teachable moment” that may increase motivation to quit smoking, albeit the evidence to support such an approach is weak [16, 25–27]. In our study, 52% of subjects stated that they had not been informed about their PFT results. Furthermore 57 (19%) subjects stated that they were current smokers. While it is still unresolved in the literature that providing smokers with their PFT results, particularly if they are abnormal may increase their smoking abstinence rates [15, 18], it will nevertheless provide them with more information about their health status. Discussing PFT results may also prompt the physician to initiate and prioritize smoking cessation during the consultation.

The process of physician-patient communication of disease diagnosis, PFT results and management plans in our institution is informal with no protocol in place and we believe such a

Table 2. Respondents Beliefs Relating to Pulmonary Function Tests.

| | Subjects with Known Chronic respiratory disease (N = 131) | Subjects without Known Chronic respiratory disease (N = 169) | p-value |
|---|---|--|---------|
| I suffer from a lung disease | 98 (74.8) | 45 (26.6%) | <0.001 |
| I don't know the severity of my lung disease | 69 (53%) | 143 (85%) | <0.001 |
| I have had PFTs before | 110 (84%) | 107 (63%) | <0.001 |
| My previous PFT results were explained to me* | 57 (52%) | 56 (52%) | 1.000 |
| I would like to know the results of my PFTs | 128 (97.7%) | 169 (100%) | 1.000 |
| I only want a doctor to explain the PFT results to me | 37 (28.2%) | 70 (41.4%) | 0.021 |
| I found it difficult to perform the PFTs | 35 (26.7%) | 23 (13.6%) | 0.005 |
| I am willing to have a PFT again | 130 (99.2%) | 167 (98.8%) | 1.000 |

* Only subjects who had PFTs in the past were included

doi:10.1371/journal.pone.0126617.t002

practice is common in other institutions as well. Interestingly, Litchfield also reported that most practices also lack any systematic protocol for communicating the results of even commonly performed laboratory tests to patients [24]. A lack of a systematic approach to patient evaluation and communication has been found to be associated with increased patient dissatisfaction, particularly for COPD patients [28]. There is a need for the development of newer models of care for the management of patients with chronic respiratory disease, where there is sufficient time and resources to canvass patients health beliefs, provide adequate information and implement effective management and treatment plans.

One strategy that has been suggested is to strengthen the role of a nurse practitioner to complement the role of the physician in the management of patients with chronic respiratory diseases [29]. The scope of the nurse practitioner within a multi-disciplinary team could include diagnosis, discussing PFT results, education and patient monitoring [29]. In our study, 64% of study subjects stated that they were willing to discuss their PFT results with a health care professional other than a doctor. This implies that there is scope for non-physician members of a multi-disciplinary disease management team to be more proactively involved in the diagnosis and management of patients with chronic respiratory disease. The feasibility of such an approach requires further study.

While it was not one of our study objectives, it was interesting to note that almost 80% of subjects performed complete lung volume measurement assessments. A recent study by Pretto et al, also identified this practice of routinely assessing complex lung function measurements [21]. This is concerning because the clinical utility and significance of lung volume measurements over and above spirometry, has not been categorically demonstrated. Also in our study we found that a little over a quarter of subjects with chronic respiratory disease found it difficult to perform PFTs. Physicians may need education and support regarding the appropriateness of routinely requesting complete lung volume measurements with little consideration to the costs involved both to the patients and health service in general.

Strengths of this study include the good response rate and ability to assess a previously unanswered question about patient preferences for PFT test result communication. Limitations of the study include the lack of generalizability since the survey was only conducted at two PFT laboratories. Also, the study did not explore physician preferences about PFT result communication. It was also beyond the scope of the study to evaluate the clinical impact of the PFT

result on patient management. It is possible that PFT results indeed may have been communicated to a much higher proportion of study subjects and the subjects simply do not remember the discussion. It has been previously noted that patients forget 40–80% of medical information provided by health professionals [30]. Nevertheless, we found that subjects who stated that their PFT results were communicated to them, had a moderately strong correlation between self-perception of pulmonary disease and their actual PFT results. Our results suggest that there is at least moderate effectiveness of PFT result communication on patients' understanding of their pulmonary health.

Future research should assess the ability of allied health professionals to appropriately communicate with patients regarding their test results, disease diagnosis and management patients in order to improve patient satisfaction. This may provide an opportunity for improvements in patient satisfaction and health care delivery for patients with both acute and chronic diseases.

Acknowledgments

We are grateful to the patients of the Gold Coast Hospital Health Service, Gold Coast, Australia for their participation in this study.

Author Contributions

Conceived and designed the experiments: DZ KBS. Performed the experiments: DZ JH AB. Analyzed the data: DZ KBS. Contributed reagents/materials/analysis tools: DZ JH AB. Wrote the paper: DZ KBS.

References

1. Chang C. Unmet Needs in Respiratory Diseases. *Clin Rev Allergy Immunol*. 2013; 45(3):303–13. doi: [10.1007/s12016-013-8399-2](https://doi.org/10.1007/s12016-013-8399-2) PMID: [24293395](https://pubmed.ncbi.nlm.nih.gov/24293395/)
2. Bateman ED, Hurd SS, Barnes PJ, Bousquet J, Drazen JM, Fitzgerald M, et al. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J*. 2008; 31(1):143–78. doi: [10.1183/09031936.00138707](https://doi.org/10.1183/09031936.00138707) PMID: [18166595](https://pubmed.ncbi.nlm.nih.gov/18166595/)
3. Vestbo J, Hurd SS, Agusti AG, Jones PW, Vogelmeier C, Anzueto A, et al. Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease, GOLD Executive Summary. *Am J Respir Crit Care Med*. 2013; 187(4):347–65. doi: [10.1164/rccm.201204-0596PP](https://doi.org/10.1164/rccm.201204-0596PP) PMID: [22878278](https://pubmed.ncbi.nlm.nih.gov/22878278/)
4. Raghu G, Collard HR, Egan JJ, Martinez FJ, Behr J, Brown KK, et al. An Official ATS/ERS/JRS/ALAT Statement: Idiopathic Pulmonary Fibrosis: Evidence-based Guidelines for Diagnosis and Management. *Am J Respir Crit Care Med*. 2011; 183(6):788–824. doi: [10.1164/rccm.2009-040GL](https://doi.org/10.1164/rccm.2009-040GL) PMID: [21471066](https://pubmed.ncbi.nlm.nih.gov/21471066/)
5. Gibson P, Powell H, Wilson A, MJ A, Haywood P, Bauman A, et al. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database of Systematic Reviews*. 2002; 3 (CD001117). doi: [10.1002/14651858.CD001117](https://doi.org/10.1002/14651858.CD001117) PMID: [CD001117](https://pubmed.ncbi.nlm.nih.gov/CD001117/).
6. Zwerink M, Brusse-Keizer M, van der Valk Paul D, Zielhuis Gerhard A, Monninkhof Evelyn M, van der Palen J, et al. Self management for patients with chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews*. 2014; 3(CD002990). doi: [10.1002/14651858.CD002990.pub3](https://doi.org/10.1002/14651858.CD002990.pub3) PMID: [CD002990](https://pubmed.ncbi.nlm.nih.gov/CD002990/).
7. Bourbeau J, Bartlett SJ. Patient adherence in COPD. *Thorax*. 2008; 63(9):831–8. doi: [10.1136/thx.2007.086041](https://doi.org/10.1136/thx.2007.086041) PMID: [18728206](https://pubmed.ncbi.nlm.nih.gov/18728206/)
8. Cram P, Schlechte J, Rosenthal GE, Christensen AJ. Patient Preference for Being Informed of Their DXA Scan Results. *Journal of Clinical Densitometry*. 2004; 7(3):275–80. <http://dx.doi.org/10.1385/JCD:7:3:275>. PMID: [15319497](https://pubmed.ncbi.nlm.nih.gov/15319497/)
9. Elder NC, Barney K. But What Does It Mean for Me? Primary Care Patients' Communication Preferences for Test Results Notification. *Joint Commission Journal on Quality and Patient Safety*. 2012; 38(4):168–76. PMID: [22533129](https://pubmed.ncbi.nlm.nih.gov/22533129/)
10. Grimes GC, Reis MD, Budati G, Gupta M, Forjuoh SN. Patient Preferences and Physician Practices for Laboratory Test Results Notification. *The Journal of the American Board of Family Medicine*. 2009; 22(6):670–6. doi: [10.3122/jabfm.2009.06.090078](https://doi.org/10.3122/jabfm.2009.06.090078) PMID: [19897696](https://pubmed.ncbi.nlm.nih.gov/19897696/)

11. Leekha S, Thomas KG, Chaudhry R, Thomas MR. Patient Preferences for and Satisfaction with Methods of Communicating Test Results in a Primary Care Practice. *Joint Commission Journal on Quality and Patient Safety*. 2009; 35(10). PMID: [19886092](#)
12. Lind S, Kopans D, Good M-J. Patients' preferences for learning the results of mammographic examinations. *Breast Cancer Res Treat*. 1992; 23(3):223–32. doi: [10.1007/BF01833519](#) PMID: [1463862](#)
13. Mangano MD, Rahman A, Choy G, Sahani DV, Boland GW, Gunn AJ. Radiologists' Role in the Communication of Imaging Examination Results to Patients: Perceptions and Preferences of Patients. *Am J Roentgenol*. 2014; 203(5):1034–9. doi: [10.2214/AJR.14.12470](#) PMID: [25341142](#)
14. Nelson M, Hamilton HE. Improving In-Office Discussion of Chronic Obstructive Pulmonary Disease: Results and Recommendations from an In-Office Linguistic Study in Chronic Obstructive Pulmonary Disease. *The American Journal of Medicine*. 2007; 120(8, Supplement 1):S28–S32. <http://dx.doi.org/10.1016/j.amjmed.2007.04.010>. PMID: [17678941](#)
15. Górecka D, Bednarek M, Nowinski A, Puscinska Eb, Goljan-Geremek A, Zielinski J. Diagnosis of airflow limitation combined with smoking cessation advice increases stop-smoking rate. *Chest*. 2003; 123(6):1916–23. doi: [10.1378/chest.123.6.1916](#) PMID: [12796168](#)
16. McBride CM, Emmons KM, Lipkus IM. Understanding the potential of teachable moments: the case of smoking cessation. *Health Educ Res*. 2003; 18(2):156–70. doi: [10.1093/her/18.2.156](#) PMID: [12729175](#)
17. Bednarek M, Gorecka D, Wielgomas J, Czajkowska-Malinowska M, Regula J, Mieszko-Filipczyk G, et al. Smokers with airway obstruction are more likely to quit smoking. *Thorax*. 2006; 61(10):869–73. doi: [10.1136/thx.2006.059071](#) PMID: [16809415](#)
18. Stratelis G, Mölstad S, Jakobsson P, Zetterström O. The impact of repeated spirometry and smoking cessation advice on smokers with mild COPD. *Scand J Prim Health Care*. 2006; 24(3):133–9. doi: [10.1080/02813430600819751](#) PMID: [16923621](#).
19. Kotz D, van Schayck CP, Huibers MJH, Wesseling GJ. Assessing the efficacy of spirometry for smoking cessation. *Thorax*. 2007; 62(8):742. PMID: [17687104](#)
20. Parkes G, Greenhalgh T, Griffin M, Dent R. Effect on smoking quit rate of telling patients their lung age: the Step2quit randomised controlled trial. *BMJ*. 2008; 336(7644):598–600. doi: [10.1136/bmj.39503.582396.25](#) PMID: [18326503](#)
21. Pretto JJ, Brazzale DJ, Guy PA, Goudge RJ, Hensley MJ. Reasons for Referral for Pulmonary Function Testing: An Audit of 4 Adult Lung Function Laboratories. *Respir Care*. 2013; 58(3):507–10. doi: [10.4187/respcare.01958](#) PMID: [22906854](#)
22. Koning C, Maille A, Stevens I, Dekker F. Patients' opinions on respiratory care: do doctors fulfill their needs? *J Asthma*. 1995; 32(355–63). PMID: [7559276](#)
23. Baldwin D, Quintela J, Duclos C, Staton E, Pace W. Patient preferences for notification of normal laboratory test results: A report from the ASIPS Collaborative. *BMC Family Practice*. 2005; 6(1):11. doi: [10.1186/1471-2296-6-11](#) PMID: [15755328](#)
24. Litchfield IJ, Bentham LM, Lilford RJ, Greenfield SM. Test result communication in primary care: clinical and office staff perspectives. *Fam Pract*. 2014; 31(5):592–7. doi: [10.1093/fampra/cmu041](#) PMID: [25070182](#)
25. Bize R, Burnand B, Mueller Y, Rège-Walther M, Camain J-Y, Cornuz J. Biomedical risk assessment as an aid for smoking cessation. *Cochrane Database of Systematic Reviews* [Internet]. 2012; (12:). Available from: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004705.pub4/abstract>.
26. White P. Spirometric screening for COPD: wishful thinking, not evidence. *Thorax*. 2007; 62(8):742–3. PMID: [17687104](#)
27. Wilt TJ, Niewoehner D, Kane RL, MacDonald R, Joseph AM. Spirometry as a Motivational Tool to Improve Smoking Cessation Rates: A Systematic Review of the Literature. *Nicotine & Tobacco Research*. 2007; 9(1):21–32. doi: [10.1080/14622200601078509](#)
28. Miravittles M, Ferrer J, Baró E, Leonart M, Galera J. Differences between physician and patient in the perception of symptoms and their severity in COPD. *Respir Med*. 2013; 107(12):1977–85. <http://dx.doi.org/10.1016/j.rmed.2013.06.019>. doi: [10.1016/j.rmed.2013.06.019](#) PMID: [23890959](#)
29. Spencer P, Hanania NA. Optimizing safety of COPD treatments: role of the nurse practitioner. *Journal of Multidisciplinary Healthcare*. 2013; 6(53–63). doi: [10.2147/JMDH.S35711](#) PMID: [23459224](#)
30. Kessels RPC. Patients' memory for medical information. *J R Soc Med*. 2003; 96(5):219–22. PMID: [12724430](#)