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## Impact of spirometry feedback and brief motivational counseling on long term smoking outcomes: A comparison of smokers with and without lung impairment

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### Abstract

**Objective**—We compared long-term outcomes among smokers with and without impaired lung functioning who received brief counseling highlighting their spirometric test results.

**Methods**—Participants in this analysis all received a brief motivational intervention for smoking cessation including spirometric testing and feedback (~20 minutes), were advised to quit smoking, offered free access to a phone-based smoking cessation program, and followed for one year. Outcomes were analyzed for smokers with (n = 99) and without (n = 168) impaired lung function.

**Results**—Participants with lung impairment reported greater use of self-help cessation materials at 6 months, greater use of non-study-provided counseling services at 6 and 12 months, higher 7-day PPA rates at 6 months, and were more likely to talk with their doctor about their spirometry results.

**Conclusion**—Further research is warranted to determine if spirometry feedback has a differential treatment effect among smokers with and without lung impairment.

**Practice Implications**—It is premature to make practice recommendations based on these data.

### MesH keywords

smoking cessation; spirometry; motivation; tobacco; health risk assessment; lung age; carbon monoxide; proactive treatment

## 1. Introduction

Many smokers understand that tobacco use is unhealthy, but underestimate their personal risk [1,2]. To make the risks more salient, and potentially more motivating, it has been suggested that smokers be informed of their personal smoking risks, such as the effects of smoking on their lung health based on spirometric testing. Some have called for routine office-based spirometry with smokers [3] or suggested that cessation counseling should include confronting smokers with their spirometric test results [4,5], and the National Lung Health Education Program concluded that “spirometry testing probably enhances smoking cessation rates,” [6] but the empirical support of this practice is limited and the outcomes mixed [7] [8] [5] [9]

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[10] [11] [12]. One explanation for the mixed findings could be that this intervention strategy is only compelling when one has lung impairment. If so, this has implications for future research.

We report on a *post hoc* analysis of data from the Get PHIT trial, a randomized clinical trial which assessed the impact of providing smokers with feedback on their lung functioning and carbon monoxide (CO) exposure paired with access to cessation treatment. The intervention was no more effective for long-term abstinence than discussing the generic risks of smoking [13]. However, immediately after receiving the intervention, persons with lung impairment had a greater change in their motivation to quit smoking (adjusted  $P = .05$ ), greater perceived disease risk ( $P = .03$ ), and found the information more upsetting ( $P = .0001$ ) [14]. Since perceived risk and worry can mediate increased contemplation of quitting [15], we hypothesized that smokers with lung impairment may be more likely to seek treatment or quit smoking long-term. If outcomes differ significantly by lung function status, it may suggest spirometric feedback is more impactful as a cessation aid among people with lung disease. In this case, further research is warranted. However, if no group differences are observed, spirometric testing may not be a useful cessation treatment component, and routine primary care office-based screening is not warranted for promoting cessation.

## 2. Methods

### 2.1 Setting and Participants

Smokers were recruited and randomized to a one-time brief intervention. The study was promoted as a health risk screening to enroll smokers at all stages of readiness to quit smoking.

Screening and recruitment methods have been reported previously [13,14]. Adult smokers were enrolled if they had no contraindications for spirometry assessment, had an expired carbon monoxide (CO) level indicative of current smoking ( $\geq 10$  ppm), and met other eligibility criteria [13,14]. Eligible smokers were randomized to treatment, completed a baseline survey and health risk screening, and participated in a single brief counseling session. Half of enrollees ( $n = 267$ ) were randomized to the experimental intervention and included in this analysis.

### 2.2 Experimental Intervention

Participants received a written report summarizing their spirometric test results, CO level (expired and estimated COHb level), and self-reported smoking-related symptoms. They were then counseled (15–20 minutes) on quitting smoking using brief motivational interviewing techniques [16,17], advised to quit smoking, and given free access to an empirically-validated phone counseling program which they could enroll in anytime in the next year. CO level was assessed using a Bedfont MicroIII monitor and lung functioning with a Jaeger SpiroPro portable spirometer.

Spirometry feedback focused on three measures: forced vital capacity (FVC); forced expiratory volume ( $FEV_1$ ); and  $FEF_{25-75}$ . Participants' test values were presented with a brief description of each measure and a qualitative interpretation of the test results (i.e., normal functioning, mild impairment, moderate impairment, or severe impairment for FVC and  $FEV_1$ , and normal vs. reduced airflow for  $FEF_{25-75}$ ). If  $FEV_1$  functioning was impaired, lung age was also calculated [18] and presented.

### 2.3 Assessment

Participants were surveyed at baseline, 6, and 12 months post-enrollment. Primary long-term outcomes were confirmed use of a free phone counseling program and self-reported 7 day point prevalent abstinence (PPA). Secondary outcomes were self-reported use of any smoking

cessation treatments, 30 day PPA, presence of an intentional 24-hour quit attempt, self-reported motivation for quitting measured on a 5-point Likert scale, and whether participants spoke with their physician about their spirometry test results. Additional assessment measures included the Fagerstrom Test of Nicotine Dependence (FTND) [19], stage of change [20,21], and self-efficacy for quitting.

## 2.4 Statistical Analyses

Persons with and without evidence of lung impairment (defined as having an abnormal FEV<sub>1</sub>, FVC, and/or FEF<sub>25-75</sub> reading) were compared using t-tests for means and chi-square tests for percentages. PPA was calculated using an intent-to-treat (ITT) analysis in which missing respondents were conservatively counted as smokers and as a respondent-only analysis.

## 3. Results

### 3.1 Participants

Baseline group differences were consistent with heavy smoking and long-term smoke exposure among impaired smokers (Table 1).

### 3.2 Treatment utilization

Impaired smokers reported significantly greater use of self-help materials at 6 months and greater use of non-provided counseling services at 6 and 12 months (Table 2).

### 3.3 Abstinence

Impaired smokers' abstinence rates were nearly twice as high as controls' at 6 months (7 day PPA, 17% vs. 9%; Table 3).

### 3.4 Motivation & Other Indices

Impaired smokers were more likely to have talked with their physician as a result of the intervention, but reported equivalent rates of quit attempts and similar motivation for quitting (see Table 3).

## 4. Discussion and Conclusion

### 4.1 Discussion

Lung impaired-smokers reported greater treatment utilization at each follow-up, greater abstinence at 6 months, and were more likely to have followed up with their physicians by 12 months. In fact, the 7 day ITT PPA rates are comparable to those in meta-analytic review of more intensive individual counseling (16%) and quitline counseling (12.7%) with no medication provided [22]. Given others' findings [11,5] and questions about the utility of spirometric testing for smoking cessation [8], these data make an important contribution to the evidence base. And it is consistent with previous studies which showed a trend toward higher cessation rates after people were informed they had impaired lung function [23,24].

Several potential limitations of this study should be considered. First, the testing was conducted as part of a health risk screening trial. Findings may differ if the screening and feedback were performed by a physician during a clinical encounter, but most likely this would only increase the salience of abnormal test results. Next, we did not biochemically confirm smoking abstinence. However, biochemical verification is not recommended in minimal contact behavioral interventions such as this because it can result in a response bias unrelated to smoking [25]. Prior research has also shown that the rate of under-reporting of smoking,

particularly in brief intervention studies, is minimal [26,27]. Finally, we cannot definitively conclude that the observed group differences were due to a differential treatment effect. It is possible that smokers with impaired lung functioning were more likely to seek treatment or quit smoking independent of the intervention. This seems highly unlikely since impaired participants were heavier smokers and more nicotine dependent at baseline, and therefore, are expected to be less likely to quit smoking. Nevertheless, without a no-intervention control group of impaired smokers, we cannot definitively conclude the outcomes observed were different than would naturally occur in this group over time.

Strengths of this study include the rigorous intervention design, inclusion of all smokers regardless of their interest in quitting smoking, analysis of one year outcomes, and comprehensive examination of treatment utilization using automated records and self-report. This study also lends support to the possibility that health risk communications may be more effective behavioral intervention tools when paired with evidence of relevant health impairment. A potential concern for this intervention was that people with existing health impairments would be nihilistic about their fate and, therefore, less likely to quit smoking when faced with evidence of immutable risk or impairment. Our data do not suggest this was the case; however, we cannot rule out the possibility that being told one had normal lung functioning actually reinforced continued smoking and undermined motivation for quitting.

#### 4.2 Conclusion

The results suggest spirometric testing may be a useful motivational tool when smokers have evidence of impaired lung function, but further research is needed before definitive conclusions can be drawn about the efficacy of this treatment strategy.

#### 4.3 Practice Implications

It is premature to make recommendations for practice based on the current data.

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**Table 1**

Demographic characteristics of study sample at baseline

	Unimpaired % (n = 168)	Impaired % (n= 99)	P value
Female	53.6	53.5	0.99
White	85.6	80.8	0.30
Education			
Some college or greater	76.1	67.7	0.14
Medical insurance	94.1	90.9	0.34
Insurance coverage for tobacco treatment	39.2	45.5	0.54
Stage of change			0.09
Precontemplation	26.5	21.2	
Contemplation	45.8	59.6	
Preparation	27.7	19.2	
Lung Impairment <sup>a</sup>			--
Impaired FVC	--	26.6	
Impaired FEV <sub>1</sub>	--	33.3	
Impaired FEF <sub>25-75</sub>	--	13.1	
	Mean	Mean	P value
Age	49.2	53.8	0.0003
Cigarettes/day	19.5	23.0	0.002
FTND <sup>b</sup>	4.71	5.58	0.0005
Prior quit attempts	9.9	11.6	0.48
Expired CO	25.8	27.1	0.30
Self-efficacy for quitting <sup>c</sup>	3.07	2.99	0.55

<sup>a</sup> Defined as spirometry performance indicative of impairment on FEV<sub>1</sub>, FVC, or FEF<sub>25-75</sub>.

<sup>b</sup> Fagerstrom Test of Nicotine Dependence. Scale scores range from 0 to 10.

<sup>c</sup> Likert scale ranging from 1 to 5 (from 'not at all' to 'extremely').

**Table 2**

Treatment utilization and abstinence among lung impaired and unimpaired smokers

	Unimpaired (n= 168) %	Impaired (n= 99) %	OR (CI) <sup>a</sup>	P
Treatment utilization				
Enrolled in provided phone counseling <sup>b</sup>				
6 months	17.9	24.2	1.46 (0.80–2.70)	0.21
12 months	23.8	28.3	1.26 (0.71–2.21)	0.42
Used self-help materials <sup>c</sup>				
6 months	20.4	33.0	1.92 (1.06–3.47)	0.03
12 months	29.7	40.4	1.60 (0.94–2.75)	0.08
Used other counseling <sup>c</sup>				
6 months	2.0	7.7	4.09 (1.11–19.5)	0.03
12 months	5.2	12.8	2.68 (1.06–7.707)	0.03
Used pharmacotherapy <sup>c</sup>				
6 months	28.2	27.8	0.98 (0.54–1.75)	0.95
12 months	39.0	37.2	0.93 (0.55–1.57)	0.79
Abstinence				
7 Day PPA – ITT <sup>d</sup>				
6 months	8.9	17.2	2.13 (1.04–4.5)	0.05
12 months	11.3	16.2	1.52 (0.73–3.1)	0.26
7 Day PPA – Respondents <sup>e</sup>				
6 months	9.9	18.7	2.09 (0.99–4.49)	0.05
12 months	13.2	18.4	1.48 (0.71–3.06)	0.29
30 Day PPA – ITT <sup>d</sup>				
6 months	4.8	9.1	1.99 (0.74–5.50)	0.16
12 months	8.9	14.1	1.68 (0.77–3.66)	0.19
30 Day PPA – Respondents <sup>e</sup>				
6 months	5.3	9.9	1.96 (0.73–5.45)	0.17
12 months	10.4	16.1	1.65 (0.75–3.62)	0.21

<sup>a</sup>Odds ratio (OR) and 95% confidence interval (CI).<sup>b</sup>Proportion who enrolled in the provided free phone-counseling program by each assessment, based on automated treatment records.<sup>c</sup>Cumulative proportion who self-reported use of other smoking cessation treatments by each follow-up. Counseling included programs other than the provided phone-counseling program. Pharmacotherapy included use of any medications to quit smoking, including: nicotine replacement products, bupropion, and varenicline.<sup>d</sup>ITT PPA = intent to treat point prevalent abstinence.<sup>e</sup>PPA for only those participants who provided smoking status data at follow-up.



**Table 3**

Motivation to quit indices and self-reported medical follow-up among lung impaired and unimpaired smokers

	Unimpaired (n=168)	Impaired (n=99)		
	Mean	Mean	Difference <sup>a</sup>	P
Motivation to quit <sup>b</sup>				
6 months	3.19	3.38	0.19	0.21
12 months	3.12	3.35	0.23	0.13
	%	%	<b>OR (CI)<sup>c</sup></b>	
Quit attempt				
6 months	47.4	56.0	<b>1.42 (0.84–2.40)</b>	0.19
12 months	59.0	65.5	<b>1.32 (0.76–2.31)</b>	0.33
Talk to doctor				
6 months	28.0	41.1	<b>1.8 (1.04–3.12)</b>	0.04
12 months	48.9	63.2	<b>1.79 (1.04–3.12)</b>	0.04

<sup>a</sup>Difference between mean scores.<sup>b</sup>Likert scale ranging from 1 to 5 (from 'not at all' to 'extremely'). Motivation to quit assessed among continuing smokers only.<sup>c</sup>Odds ratio (OR) and 95% confidence interval (CI).