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Pulmonary Specialist-Supported Health Coaching Delivered by Lay Personnel Improves Receipt of Quality Care for Chronic Obstructive Pulmonary Disease: A Randomized Controlled Trial

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Purpose	Half of people living with chronic obstructive pulmonary disease (COPD) do not receive high-quality, evidenced-based care as described in international guidelines. We conducted secondary data analysis of a previously published study to assess the ability of a model of lay health coaching to improve provision of guideline-based care in a primary care setting.
Methods	As part of a randomized controlled trial, we recruited English- and Spanish-speaking patients with moderate to severe COPD from primary care clinics serving a low-income, predominantly African American population. Participants were randomized to receive usual care or 9 months of health coaching from primary care personnel informed by a pulmonary specialist practitioner. Outcome measures included prescription of appropriate inhaler therapy, participation in COPD-related education, engagement with specialty care, prescription of smoking cessation medications, and patient ratings of the quality of care.
Results	Baseline quality measures did not differ between study arms. At 9 months, coached patients were more likely (increase of 9.3% over usual care; P=0.014) to have received guideline-based inhalers compared to those in usual care. Coached patients were more likely to engage with pulmonary specialty care (increase of 8.3% over usual care with at least 1 visit; P=0.04) and educational classes (increase of 5.3% over usual care; P=0.03). Receipt of smoking cessation medications among patients smoking at baseline in the health coaching group increased 21.1 percentage points more than in usual care, a difference near statistical significance (P=0.06).
Conclusions	Health coaching may improve the provision of quality chronic illness care for conditions such as COPD. (<i>J Patient Cent Res Rev.</i> 2023;10:201-209.)
Keywords	health care quality; evidence-based care; guideline adherence; chronic obstructive pulmonary disease; COPD; health coaching; inhalers; pulmonology; primary care

Chronic obstructive pulmonary disease (COPD) is a leading cause of death and one of the primary contributors to 30-day hospital readmissions in

the United States.¹⁻³ Although adherence to internationally recognized treatment recommendations⁴ has been shown to improve quality of life,^{1,5} more than half of people living with COPD do not receive recommended care.⁶ Care gaps in the management of COPD are even more pronounced for vulnerable low-income and minority patients⁷ and likely contribute to disparities in COPD-related morbidity and mortality.⁸ Reasons for this gap between evidence-based and actual care include clinician, system, and patient factors.

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Most strategies to improve provision of guideline-based care have been met with limited success.⁶ Health coaching is an emerging model that can address the challenges that have posed a barrier to implementation of guideline-based care. Fromer and colleagues proposed that the Chronic Care Model may be applied to improve COPD management.⁹ Health coaching is closely aligned with the principles of the Chronic Care Model. Adding a health coach to the patient care team shifts the focus from reactive care to proactive, planned care. It supports patient self-management, facilitates care coordination across the practice, and connects patients with resources in their community. Health coaches equip patients with the knowledge, skills, and confidence to manage their conditions¹⁰ and engage in shared decision-making.¹¹ In addition, health coaches support patients in recognizing and bringing up concerns and symptoms with their primary care clinicians and in understanding and implementing care plans.^{11,12} Health coaching is therefore a promising model for improving quality of care, including concordance with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines.

While health coaching for COPD has been delivered with some success by nurses and respiratory therapists,¹³⁻¹⁵ these resources are rarely available in resource-limited settings. In the context of the safety net, comprised of federally qualified health centers and look-alikes serving 29 million individuals in the United States,¹⁶ nonlicensed (or lay) health care personnel such as medical assistants or community health workers comprise the majority of health care personnel and are the most readily available to take on enhanced roles in patient support such as health coaching. Lay health coaches have been shown to improve clinical outcomes, treatment adherence, and patient experience for diabetes and cardiovascular care,¹⁷⁻²¹ asthma,²² sleep apnea,^{23,24} and depression.²⁵ Yet, little is known about the efficacy of health coaching by nonlicensed health care personnel working closely with a pulmonary specialist to improve quality of care for COPD in the primary care setting.

The Aides in Respiration (AIR) health coaching study was a multisite randomized controlled trial that sought to improve disease-related quality of life, reduce exacerbations, and increase exercise capacity for people living with COPD. As previously published, improvements in these primary outcomes, while favoring the coached group, were not statistically significant.²⁵ However, coached patients were more likely to adhere to inhaled therapies and were more than 3 times as likely to use correct inhaler technique.²⁶ Patient-reported quality of illness care was more improved in the health coaching arm than the usual care arm.²⁵

We conducted this secondary analysis to determine if there were also improvements in objective measures of quality — such as receipt of guideline-based inhaled therapy, provision of smoking cessation aids, and engagement with pulmonary specialty and educational services — among a low-income, predominantly African American or Latine population living with moderate to severe COPD.

METHODS

The study protocol for the multisite, single-blinded randomized controlled trial dubbed AIR — which yielded the primary outcomes previously reported and these secondary outcomes — was approved by the University of California, San Francisco institutional review board (approval no. 14-12872) and registered with www.clinicaltrials.gov (NCT02234284). The study protocol²⁷ and primary outcomes²⁵ have been previously published.

Setting and Participants

This study was conducted at 7 urban county-operated primary care clinics, including 2 academic residency teaching practices, all of which primarily serve a low-income, publicly insured patient population. Pulmonary specialty care was available through the public hospital that was part of the health network and could be accessed via an electronic consultation system.

Enrollees were English- or Spanish-speaking patients at least 40 years of age who were contactable by telephone and planned to continue to receive care at 1 of the 7 study sites. Clinical eligibility included having COPD, confirmed by post-bronchodilator spirometry FEV1/FVC ratio of <0.70 or review by a pulmonologist, that was moderate to severe, as defined in the published study protocol.²⁷

Health coaches for this study were not required to have training beyond a high school diploma or GED. Both of the coaches used in the study did hold bachelor's degrees from 4-year colleges but were not licensed health care professionals. Both health coaches were fluent in English and Spanish.

Recruitment and enrollment

Potential recruits were identified from targeted diagnoses in billing records or hospital census data, as well as referrals from providers at specialty and primary care sites. Medical chart review and primary clinician review were conducted to determine eligibility based on clinical criteria.

Research assistants contacted potentially eligible patients by telephone using a recruitment script or by letter. They met with eligible patients to secure consent and verbally administer a questionnaire. Participants received up to

\$30 at baseline and \$60 at 9 months in acknowledgment of their participation in the study.

A random binary sequence, created by the project manager, was used to order study arm assignment into sequentially numbered envelopes in a 1:1 ratio. Once baseline measures were complete, the research assistant asked the patient to open a sealed envelope with a randomization card indicating assignment to usual care or health coaching. Study investigators and the data safety monitoring board were blinded to assignment until analyses were finalized.

Pulmonary Specialist-Supported Lay Health Coaching Intervention

Health coaches received over 100 hours of training using a health coaching curriculum (<http://cepc.ucsf.edu/content/health-coaching-curriculum>) supplemented by COPD-specific content. The curriculum covered active listening and nonjudgmental communication, navigating health systems, creating self-management goals, and use of teach-back (“closing the loop”) methods.²⁷ COPD-specific training delivered by pulmonary specialists included the pathophysiology of COPD, assessment and training of inhaler use, pharmacotherapy, prevention and management of symptoms and exacerbations, breathing techniques, the importance of healthy lifestyles, smoking cessation, and the role of COPD action plans.

Health coaches worked with patients for 9 months, with a maximum caseload of 30 patients at any given time. They accompanied patients to visits with primary care and/or pulmonary clinicians, met with them individually in the community or at their home, and conducted phone calls between in-person visits. After enrollment of each patient, the health coach gathered clinical information from the medical record and patient report and met with a supervising pulmonary nurse practitioner to review the case. The pulmonary nurse practitioner made recommendations to optimize care and shared those recommendations with the primary care provider (PCP); if the PCP agreed with the recommendations, the health coach assisted in implementation, including helping the patient acquire and learn correct technique for new medications, navigating referrals for evaluation or educational programs, securing needed immunizations, or helping the patient practice new self-management techniques such as pacing or breathing techniques. Additionally, health coaches addressed barriers to medication adherence and conducted teach-back to improve inhaler technique. The expected minimum frequency of contact was once every 3 weeks. Patient interactions were documented in a database created for the study, including date, time, topics discussed, and

relevant notes. Health coaches met with the supervising pulmonary nurse practitioner at least weekly.

Usual Care

Patients randomized to usual care received any resources provided by their clinic as part of standard care, including, but not limited to, visits with their PCP, referrals to pulmonary clinicians, COPD education classes, pulmonary rehabilitation, and smoking cessation resources.

Data Collection

Upon enrollment and at 9 months, research assistants administered a questionnaire that included the Patient Assessment of Chronic Illness Care (PACIC, the 11-item short version)²⁸ and an instrument assessing symptom burden, the COPD Assessment Test.²⁹ In addition, they abstracted information from the medical record at each time point, including current medications for COPD and visits to pulmonary specialty care or educational classes within the year prior to enrollment and the 9-month period of the study.

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) combined assessment of COPD classification, taken from its 2014 guidelines,⁴ was ascertained based on the symptom score at baseline coupled with spirometric data and exacerbation history in the year prior to enrollment. Specifically, “high risk” was defined by the 2014 GOLD guidelines as having spirometry results indicating a post-bronchodilator forced expiratory volume less than 50% of predicted value, at least 1 exacerbation requiring hospitalization, or at least 2 exacerbations requiring treatment with oral steroids.

Outcomes

For this secondary analysis, the outcome of interest was concordance of prescribed medications for COPD with recommended medication classes based on GOLD category. Additional outcome measures included patient-perceived quality of chronic illness care (as assessed by PACIC), number of visits to pulmonary specialty care or educational classes, and prescription of smoking cessation medications for people who were smoking at baseline.

Statistical Analyses

Baseline participant characteristics were compared between study arms and tested for significance using chi-squared for categorical variables, *t*-tests for normally distributed continuous variables, and nonparametric tests for non-normally distributed continuous variables. Outcomes were compared by group assignment (intention to treat) using generalized linear models with a normal distribution, with identity link for continuous outcomes and binomial distribution with logit link for binary

outcomes. Hypothesis tests were 2-sided, with P-values of <0.05 considered statistically significant. A robust standard error was used to account for clustering and accommodate missing data under the assumption that the outcomes are missing at random. In all models, the baseline level of the outcome was included as a predictor and follow-up level as the dependent variable. Statistical analyses were run using Stata 13.0 (StataCorp LLC) and SPSS Multiple Imputation Procedure (IBM Corporation) software.

RESULTS

Participants in the study included 192 individuals with moderate to severe COPD, constituting 68% of the individuals known to be eligible for the study (Figure 1). Additional information about study retention has been previously described.²⁵

There were no significant differences in participant characteristics at baseline between study arms (Table 1). Participants had a mean age of 61 years, and most self-identified as male (65%) and of a racial or ethnic minority (57% African American, 17% Latine). Nearly half (46%) had an income of less than \$10,000 per year, and 70% were retired or on disability. Many had comorbidities such as substance use (29%), asthma (28%), diabetes (23%), or alcohol abuse (17%). Almost half lived alone (48%).

Most participants (93%) scored ≥ 10 points on the COPD Assessment Test, which is considered indicative of “high symptoms.”^{4,29} Participants were categorized based on GOLD criteria as follows: 4% in Category A (low symptoms and low risk), 46% in Category B (high symptoms and low risk), 3% in Category C (low symptoms and high risk), and 46% in Category D (high symptoms and high risk). At baseline, there were no significant differences between outcome measures of receipt of guideline-based medications, patient reported quality of chronic illness care, or participation in pulmonary or educational visits.

At 9 months, patients assigned to a health coach were significantly more likely to have received guideline-based inhalers compared to those assigned to usual care, when controlling for baseline value and clustering by site (19.2% improvement in the coaching arm vs 9.9% in the control arm, an absolute difference of 9.3 percentage points), with 91.9% of the coached group concordant with medications at the end of the intervention compared to 79.1% for the usual care group; $P=0.014$ (Table 2). This was most prominent in GOLD Group B (high symptoms and low risk), in which 34.8% more of the coaching group vs 21.4% of the usual care group were prescribed guideline-based inhalers at 9 months, an improvement of 13.4 percentage points ($P=.045$), with 91.3% of the coached group concordant with recommendations at the end of the study vs 64.3%

of the usual care group. Greater improvements were also seen in Group D (high symptoms and high risk), but those differences did not reach statistical significance. The most common medication changes bringing coached patients into concordance with guidelines were the addition of a combination inhaled corticosteroid/long-acting beta agonist (59%) or long-acting muscarinic antagonist (50%), or the discontinuation of an inhaled corticosteroid (27%).

Patient-reported quality of care, per PACIC responses, also improved more in the health coaching group (0.35 vs 0.15; adjusted $P=0.02$; Table 2). In terms of nonemergent services, the health coaching group showed a greater increase in engagement with pulmonary specialty care (increase of 8.3% over usual care with at least 1 visit; $P=0.04$) and greater engagement with educational classes (increase of 5.3% over usual care; $P=0.03$). Receipt of smoking cessation medications among patients smoking at baseline increased 44.4% in the health coaching group compared to 23.3% in the usual care group, a difference of 21.1 percentage points that was near the alpha level of statistical significance ($P=0.06$).

DISCUSSION

We found evidence of improved quality of care for patients randomized to work with a lay health coach for a 9-month period. When compared to usual care, patients receiving health coaching were more likely to be prescribed evidence-based inhaled medication therapy, provided higher ratings of the quality of their chronic illness care, and had greater engagement with pulmonary specialty care and educational classes.

We found improvements in receipt of guideline-based inhaled medications. This was most prominent among people classified as GOLD Category B, corresponding to patients with low risk but high levels of symptoms. While we did not capture data that would elucidate the mechanism by which health coaching could result in receipt of guideline-based care, one potential avenue is greater symptom awareness on the part of patients and PCPs. Multiple studies have demonstrated underreporting of COPD symptoms by patients and competing priorities during the medical encounter; so, for people not experiencing exacerbations resulting in emergent care, PCPs may often be unaware of uncontrolled symptoms.³⁰ The health coach role in focusing on COPD and bringing symptoms to the attention of the PCP, as described in previously published qualitative interviews from this study,³¹ may have been effective in elevating the priority of this conversation and escalating therapy.

Multiple steps are required to achieve therapeutic outcomes of medications for COPD, including ensuring

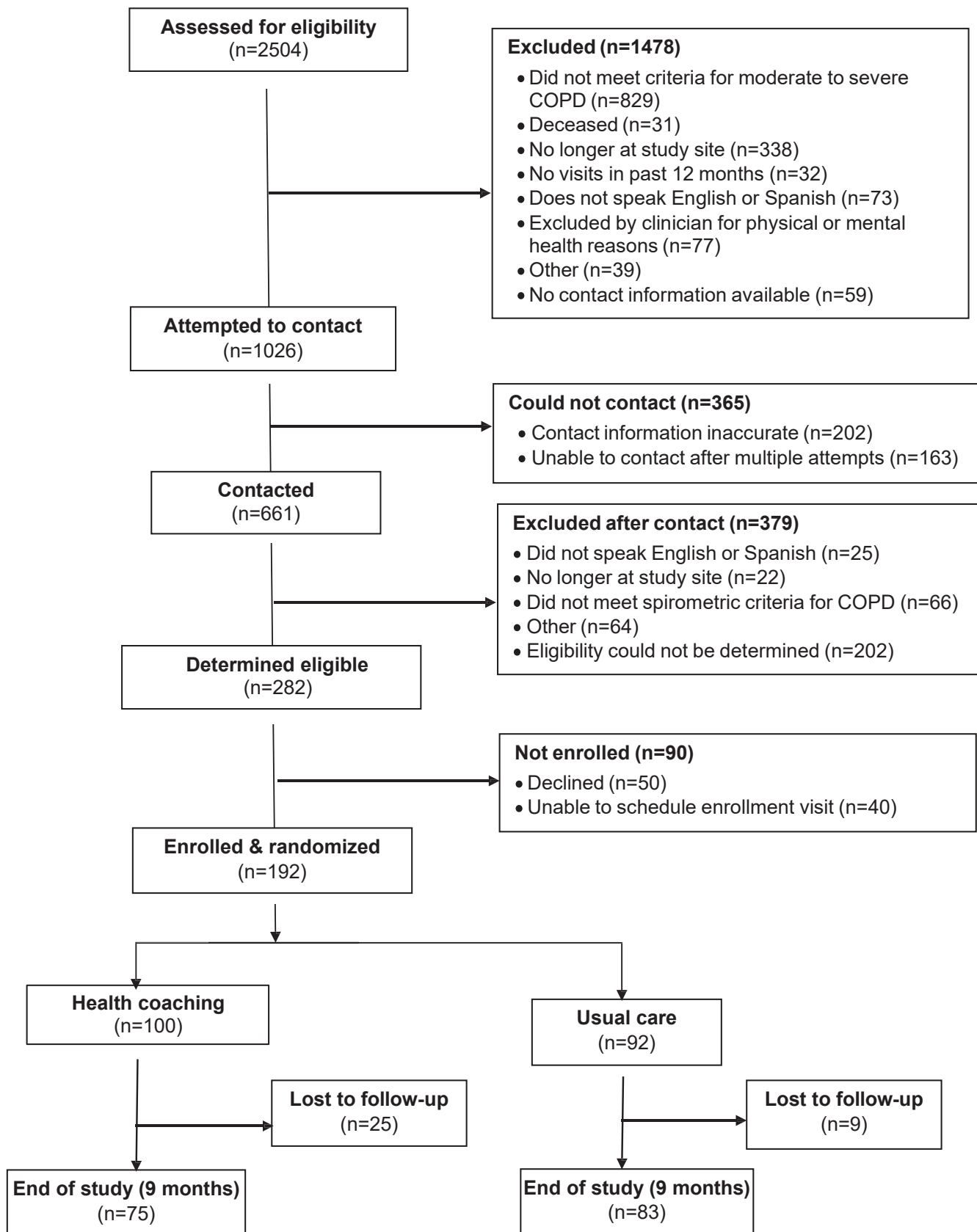


Figure 1. CONSORT diagram. COPD, chronic obstructive pulmonary disease.

Table 1. Characteristics of Participants at Baseline

Characteristic, mean (SD) or n (%)	All (n=192)	Coaching arm (n=100)	Usual care (n=92)
Age	61.3 (7.6)	60.7 (8.0)	61.9 (7.2)
Demographic and medical			
Male	126 (65.5%)	67 (67.0%)	59 (64.1%)
Less than high school education	61 (31.9%)	27 (27.0%)	34 (37.4%)
Married or long-term relationship	65 (34.0%)	36 (36.0%)	29 (31.9%)
Born outside of United States	34 (17.8%)	13 (13.0%)	21 (23.1%)
Spanish Speaker	18 (9.4%)	7 (7.0%)	11 (12.1%)
Employment status			
Works full/part time outside the home	34 (17.8%)	16 (16.0%)	18 (19.8%)
Retired	64 (33.5%)	32 (32.0%)	32 (35.2%)
On disability	69 (36.1%)	38 (38.0%)	31 (34.1%)
Other (homemaker, unemployed)	24 (12.6%)	14 (14.0%)	11 (12.0%)
Income less than \$10,000/year	84 (45.7%)	44 (45.8%)	40 (45.5%)
Race (detailed)^a			
White	41 (21.4%)	29 (29.0%)	12 (13.0%)
African American	109 (56.7%)	53 (53.0%)	56 (60.9%)
Other	42 (21.9%)	18 (18.0%)	24 (26.1%)
Asian	7 (3.7%)	2 (2.0%)	5 (5.4%)
Native American	4 (2.1%)	2 (2.0%)	2 (2.2%)
Pacific Islander	3 (1.6%)	1 (1.0%)	2 (2.2%)
Other	28 (14.6%)	13 (13.0%)	15 (16.3%)
Hispanic/Latino ethnicity	32 (16.7%)	13 (13.0%)	19 (20.7%)
Less than full health literacy ^b	71 (37.2%)	39 (39.0%)	32 (35.2%)
General health less than very good	162 (84.4%)	82 (83.0%)	79 (85.9%)
Medicaid only	108 (56.2%)	59 (59.0%)	49 (53.3%)
Lives alone	91 (47.6%)	49 (49.0%)	42 (46.2%)
Housing insecurity or homelessness	25 (13.0%)	13 (13.0%)	12 (13.0%)
COPD symptoms			
COPD Assessment test, mean (SD)	20.7 (7.9)	20.6 (8.3)	20.9 (7.4)
High symptoms, number with score ≥ 10 (%)	177 (92.7%)	90 (90.9%)	87 (94.6%)
GOLD category			
A: Low symptoms, low risk	8 (4.2%)	5 (5.0%)	3 (3.3%)
B: High symptoms, low risk	88 (45.8%)	46 (46.0%)	42 (45.7%)
C: Low symptoms, high risk	6 (3.1%)	4 (4.0%)	2 (2.2%)
D: High symptoms, high risk	88 (45.8%)	44 (44.0%)	44 (47.8%)
Unable to categorize	2 (1.0%)	1 (1.0%)	1 (1.1%)
Quality-related outcomes			
GOLD-classification inhaler prescription concordance	71.1% (125)	72.7% (72)	69.2% (63)
Patient reported quality-of-care score (per PACIC)	3.42 (1.13)	3.56 (1.02)	3.29 (1.21)
Pulmonary specialty visit in 12 months prior enrollment	31.3% (60)	34.0% (34)	28.3% (26)
Education class in 12 months prior to enrollment	6.3% (12)	7.0% (7)	5.4% (5)
Receipt of smoking cessation medications (for patients smoking at baseline) ^c	35.4% (35)	33.3% (18)	37.8% (17)
Comorbid conditions			
Alcohol abuse	33 (17.2%)	17 (17.0%)	16 (17.4%)
Substance abuse	55 (28.7%)	26 (26.0%)	29 (31.5%)
Coronary artery disease	17 (8.9%)	8 (8.0%)	9 (9.8%)
Heart failure	23 (12.0%)	13 (13.0%)	10 (10.9%)
Diabetes	44 (22.9%)	19 (19.0%)	25 (27.2%)
Asthma	53 (27.6%)	29 (29.0%)	24 (26.1%)
Obstructive sleep apnea	19 (9.9%)	7 (7.0%)	12 (13.0%)

Note: percentages may not add to 100% due to missing data.

^aOnly significant difference between groups at baseline was race/ethnicity with 3 categories: White, Black/African American, Other (P=0.02).

^bDefined as needing someone help read medical information at least a little of the time.

^cAt baseline, 54 people in the coaching arm and 45 people in the usual care arm reported having smoked in the past month.

COPD, chronic obstructive pulmonary disease; GOLD, Global Initiative for Chronic Obstructive Lung Disease; PACIC, Patient Assessment of Chronic Illness Care; SD, standard deviation.

Table 2. Outcomes at 9 Months by Study Arm

Outcomes	Coached (n=100)			Usual care (n=92)			Difference between arms	Adj. P ^a
	Baseline	9 months	Change	Baseline	9 months	Change		
Inhaler prescription concordance with GOLD,^b % (n) or % points								
Overall (All GOLD classifications)	72.7% (72)	91.9% (91)	19.2	69.2% (63)	79.1% (72)	9.9	9.3	0.014
Category A (low risk, low symptoms), n=8	100.0% (5)	100.0% (5)	0	100.0% (3)	100.0% (3)	0	0	— ^c
Category B (low risk, high symptoms), n=88	56.5% (26)	91.3% (42)	34.8	42.9% (18)	64.3% (27)	21.4	13.4	0.045
Category C (high risk, low symptoms), n=6	100.0% (4)	100.0% (4)	0	100.0% (2)	100.0% (2)	0	0	— ^c
Category D (high risk, high symptoms), n=88	84.1% (37)	97.0% (40)	12.9	90.9% (40)	90.9% (40)	0	12.9	0.68
Patient-reported quality-of-care score, mean (SD) or % points	3.56 (1.02)	3.91 (0.95)	0.35	3.29 (1.21)	3.44 (1.17)	0.15	0.20	0.02
Use of nonemergent services,^b % (n) or % points								
Proportion with at least 1 pulmonary specialty visit	34.0% (34)	39.0% (39)	5.0	28.3% (26)	25.0% (23)	-3.3	8.3	0.04
Education classes	7.0%	8.0%	1.0	5.4%	1.1%	-4.3	5.3	0.03
Receipt of smoking cessation meds (for patients smoking at baseline)	20.4%	64.8%	44.4	26.7%	50.0%	23.3	21.1	0.06

^aP-values adjusted for baseline levels of variable and for clustering.

^bData for these items were abstracted from the medical record or class rosters, so all 192 enrollees are included.

^cCell sizes too small to conduct stratified analysis for subgroup.

Adj., adjusted; GOLD, Global Initiative for Chronic Obstructive Lung Disease; meds, medications; SD, standard deviation.

that patients fill prescriptions, adhere to doses and schedules, and self-administer inhaled therapies in a way that effectively delivers medication to the lungs. As described in a previous publication, health-coached participants were significantly more likely to be taking their COPD medications regularly and were 3 times as likely to demonstrate respiratory inhaler technique.²⁶

Our study found a significantly greater improvement in patient-reported quality of care for the health coaching group as compared to the usual care group, as previously reported.²⁷ This is not a measure that has been reported in other health coaching studies for COPD.^{13,15,32-36} A randomized controlled trial of integrated disease management failed to find a difference in care quality as assessed by the same measure (ie, PACIC).³⁷ The improvement in patient-perceived quality of chronic illness care seen in our study may be due to the emphasis of health coaching on several aspects of care quality measured by the PACIC, specifically goal setting, shared decision-making, care planning, and follow-up between visits.³⁸ This finding is consistent with observed improvements in the PACIC in response to lay health coaching interventions for diabetes and cardiovascular disease.¹⁸

We also observed greater engagement in pulmonary specialty visits and COPD-related education for

health-coached patients. COPD education is one of the components of guideline-based care,³⁹ which was a focus of health coaching.

Study Limitations

This study had several limitations, which should be borne in mind when interpreting the results. It was conducted in an urban, low-income population with moderate to severe COPD; generalizability of the intervention to other settings requires additional evaluation. The health coaches in this study were lay coaches who had 4-year college degrees but little or no health care experience, which may be different from the personnel who might take on the role of lay health coaches in safety net settings, such as medical assistants. Several of the outcomes described in this manuscript were not specified a priori. Patient-reported quality of chronic illness care was self-reported; on the other hand, this was counterbalanced by several measures from the medical record, including prescribed medications and the visit history. While receipt of guideline-based therapy has been linked to improved outcomes in other studies,³⁹ the AIR trial did not demonstrate reduced exacerbations or improved quality of life.

International guidelines for the management of COPD are continually evolving. This study was based on 2014 GOLD guidelines; while subsequent studies may

be valuable to vet these findings in the context of new guidelines, there is no reason to believe that they would substantially alter the key findings. We did not capture data that could explain the mechanism by which health coaching improved guideline-concordance medication.

A potentially important limitation of our study design was that patients were randomized, rather than PCPs or clinics. As a result, many PCPs had patients in both study arms — creating a potential “halo effect,” whereby patients in the usual care group may have benefited from the presence of health coaching. For example, PCPs received recommendations to improve medication regimens in accordance with international guidelines, and this may have caused them to change their care of other patients with COPD. Moreover, the pulmonary nurse practitioner specialist working with the health coaches in this model could also receive referrals for patients from the usual care arm of the study. Both of these factors may result in conservative estimates of the intervention impact.

CONCLUSIONS

Patients who received 9 months of health coaching from lay personnel (ie, not health care professionals) were more likely to be prescribed guideline-based medications and reported higher quality of chronic illness care than patients receiving usual care. Given that chronic obstructive pulmonary disease is a leading cause of preventable hospital admissions, health systems have a financial incentive to provide support to improve provision of evidence-based, high-quality care. Health coaching such as that provided through this study protocol may provide a scalable model to improve the quality of care for people living with COPD.

Patient-Friendly Recap

- Patients diagnosed with chronic obstructive pulmonary disease (COPD) who receive health coaching are more likely to adhere to inhaled therapies and use correct inhaler technique.
- In this secondary analysis of a randomized controlled trial, authors sought to determine if health coaching delivered by lay health care staff — relying on guidance from pulmonary specialists — would result in improved care for those with moderate to severe COPD.
- Patients who received 9 months of this unique approach to health coaching were more likely to be prescribed guideline-based medications, engage with pulmonary specialty providers or classes, and report higher quality of chronic illness care than patients receiving usual care.

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Author Contributions

Study design: Willard-Grace, Tsao, Thom, Su. Data acquisition or analysis: all authors. Manuscript drafting: Willard-Grace. Critical revision: Hessler, Thom, Su.

Conflicts of Interest

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