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Development and Validity Assessment of a Chronic Obstructive Pulmonary Disease Knowledge Questionnaire in Low- and Middle-Income Countries

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Abstract

Rationale: The majority of the morbidity and mortality related to chronic obstructive pulmonary disease (COPD) occurs in low- and middle-income countries (LMICs). Despite the increasing burden of COPD, disease-specific knowledge among healthcare workers and patients in LMICs remains limited. COPD knowledge questionnaires (COPD-KQ) are valid and reliable tools to assess COPD knowledge and can be employed in settings with limited health literacy.

Objectives: To develop and assess the validity and reliability of a COPD-KQ among individuals with COPD in three LMIC settings.

Methods: Twelve questions were generated by an expert team of 16 researchers, physicians, and public health professionals to create an LMIC-specific COPD-KQ. The content was based on previous instruments, clinical guidelines, focus-group discussions, and questionnaire piloting. Participants with COPD completed the questionnaire across three diverse LMIC settings before and 3 months after delivery of a standardized COPD-specific education package by a local community health worker trained to deliver the education to an appropriate standard. We used paired *t* tests to assess improvement in knowledge after intervention.

Results: Questionnaire development initially yielded 52 items. On the basis of community feedback and expertise, items were eliminated and added, yielding a final 12-item questionnaire, with a maximum total score of 12. A total of 196 participants with COPD were included in this study in Nepal ($n = 86$), Peru ($n = 35$), and Uganda ($n = 75$). The mean ± standard deviation baseline score was 8.0 ± 2.5, and 3 months after education, the mean score was 10.2 ± 1.7. The community health worker–led COPD educational intervention improved COPD knowledge among community members by 2.2 points (95% confidence interval, 1.8–2.6 points; $t = 10.9$; $P < 0.001$). Internal consistency using Cronbach's α was 0.75.

Conclusions: The LMIC COPD-KQ demonstrates face and content validity and acceptable internal consistency through development phases, suggesting a reliable and valid COPD education instrument that can be used to assess educational interventions across LMIC settings.

Clinical trial registered with www.clinicaltrials.gov (NCT 03365713).

Keywords: chronic obstructive pulmonary disease; questionnaires; patient education

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A complete list of GECo investigators may be found before the beginning of the References.

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Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide, with over 90% of COPD-related deaths occurring in low- and middle-income countries (LMICs) (1). COPD is a long-term lung disease that affects people exposed to sufficient environmental stimuli, such as exposure to biomass fuels and tobacco smoke (2). The global burden of COPD is expected to increase over the next decade, with LMICs expected to have the largest burden of disease (3).

Chronic management of COPD is complex and based on disease-specific knowledge, including risk factors, symptoms, and exacerbations. To effectively treat and manage their disease, it is important that patients with COPD gain knowledge about COPD and develop self-efficacy, or the agency to implement COPD knowledge and skills into their own self-management. Patients should develop an understanding of disease progression, purposes and types of treatments, methods to manage acute episodes, and how to manage environmental exposures (4, 5). Self-management has been described as formalized patient-education programs that teach skills and provide support for health-promoting behavior (6). In LMICs, COPD disease-management interventions have included health-education sessions, one-on-one counseling, print materials, and inpatient self-management sessions (7). These COPD disease-management programs focusing on patient education have been demonstrated to improve COPD-related knowledge, health-related quality of life, and health-related outcomes, but further research is needed in LMICs (8–11).

Given the current and rising global burden of COPD, there is an increasing focus on the delivery and evaluation of educational interventions, especially in LMICs (10). The aim of this study was to develop and assess the validity and reliability of a COPD knowledge questionnaire (COPD-KQ) to test the effectiveness of an education intervention for use in adult patients with COPD in LMIC settings. Some of the results of these studies have been previously reported in the form of an abstract (12).

Methods

Study Setting

This study was performed in three diverse LMIC settings in Bhaktapur, Nepal; Lima, Peru; and Nakaseke, Uganda (13). Nepal is a low-income country located in Southeast Asia with a total population of 26.5 million, and Bhaktapur, our research site, is located 8 miles east of the capital city of Kathmandu. Peru is an upper-middle-income country located in South America with a population of 30.5 million, of which 78.6% is urban. We conducted our study at Pampas de San Juan de Miraflores, a periurban community in southern Lima, Peru's capital. Uganda is a low-income country located in East Africa with a total population of 42 million. Our study site, Nakaseke, is characterized as a rural, underresourced district in Central Uganda.

Study Design

We conducted this study among adults with COPD identified as part of the ongoing GECo (Global Excellence in COPD Outcomes) self-management trial (13). Participants were individuals over 40 years who resided in Bhaktapur, Nepal; Lima, Peru; and Nakaseke, Uganda; and COPD was diagnosed in participants using quality-assured spirometry. All participants were already enrolled as a part of the larger GECo study (13). Data were collected from January 2018 to June 2020 by trained research assistants using Research Electronic Data Capture (Vanderbilt University) (14). We describe four phases in the development and evaluation of the COPD-KQs: *1*) questionnaire development and item generation, *2*) selection of expert reviewers and initial questionnaire development, *3*) quality assessment and field testing for comprehension of items, and *4*) evaluation of changes in knowledge before and after educational intervention as outlined in Figure 1.

Questionnaire Development and Item Generation

We conducted qualitative interviews with healthcare providers, community health workers (CHWs), and community members with diagnosed COPD to conceptualize experiences surrounding COPD and inform item development (15, 16). Semistructured interviews identified common beliefs and COPD illness representation in the Bhaktapur, Lima, and Nakaseke communities. Interviews

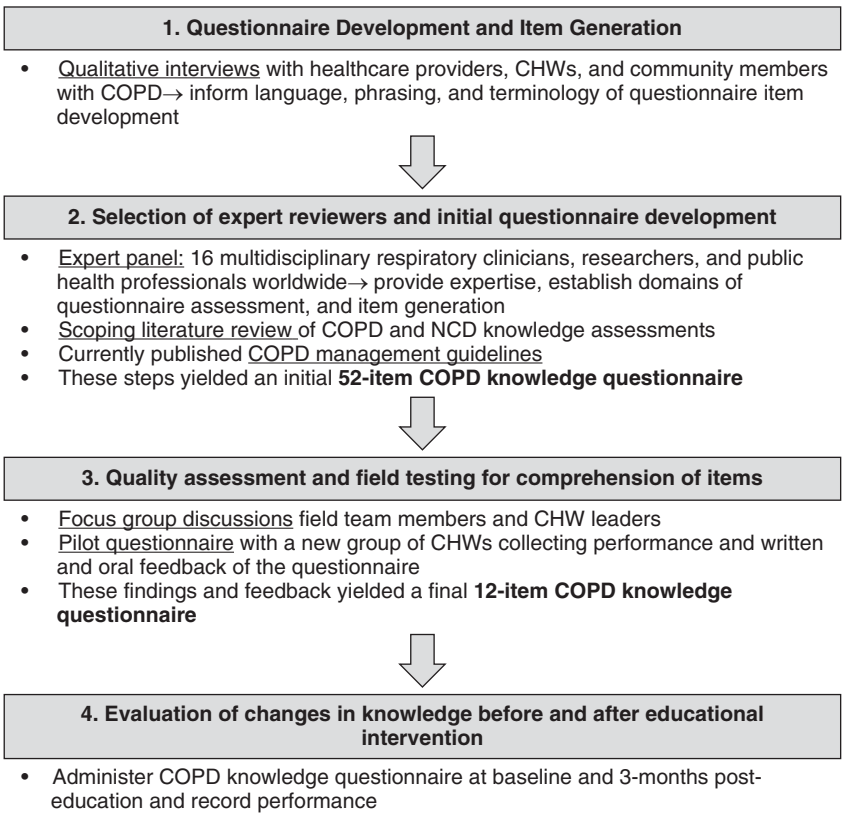


Figure 1. COPD knowledge questionnaire development methodology overview. CHW = community health worker; COPD = chronic obstructive pulmonary disease; NCD = noncommunicable disease.

explored awareness of COPD, causes, symptoms, diagnosis, management, and treatment of COPD, and interactions among healthcare providers, CHWs, and patients with COPD. This qualitative data informed the language, phrasing, and terminology of the initial questionnaire items during development.

Selection of Expert Reviewers and Initial Questionnaire Development

A multidisciplinary expert panel of 16 respiratory clinicians, researchers, and public health professionals from Nepal, Peru, Uganda, the United Kingdom, and the United States discussed the domains to be assessed by the instrument. The expert panel collectively established its aim to assess COPD causes, symptoms of COPD, exacerbation behaviors, and COPD treatment. To develop the COPD-KQ content, a scoping literature review was performed, reviewing current knowledge assessments for COPD and other noncommunicable diseases such as asthma, diabetes, and cystic fibrosis (10, 17–20). Items were based on an expert panel's expertise and COPD-management guidelines (2). Questionnaire development initially yielded 52 items. The item-response categories were determined to be "true," "false," or "I don't know" to increase the reliability of the instrument by reducing guessing between true or false options only (21). The questions were translated from English to the local languages—Nepali, Spanish, and Luganda, respectively—by translators who were familiar with COPD and medical terminology.

Qualitative Assessment and Field Testing for Comprehension of Items

We first performed seven focus-group discussions with local field-team members (outside of the expert panel members) and CHWs with leadership roles (three in Uganda and four in Peru). Each questionnaire item was discussed to achieve lay understanding and clarity as intended by the research team. Subsequently, the questionnaire was piloted with a new group of CHWs (42 in Uganda, 14 in Peru, and 19 in Nepal) at a COPD education training session performed by our research team of local physicians and research staff. After the pilot, local physicians and research staff from the research team solicited written and oral feedback regarding the clarity and content of questions. Questionnaires were scored to evaluate the score distributions and initial performance. Questionnaire items with the lowest accuracy during piloting were eliminated. On the basis of this feedback, we rephrased, eliminated, and added questions through discussions with the expert panel.

On the basis of community feedback, aims, and expertise in the expert panel members' respective fields, items were further eliminated and added, yielding a final 12-item questionnaire (Table 1). The wording of items was reviewed and altered by each panel member upon group agreement. The COPD questionnaire instructions, layout, and individual items were revised to incorporate expert panel member's feedback. The final translations of the resulting LMIC COPD-KQ were then reviewed by teams of local clinicians, field staff, and study investigators at each of the sites to review for syntax and grammar in the language of each study site. The questionnaire was standardized among the three study sites to be applicable to LMIC settings. Input from the 16-person expert panel and feedback from CHW focus-group discussions yielded a final 12-item questionnaire (Table 1). A combination of expert opinion and community input likely led to strong content and face validity covering a satisfactory overview of COPD concepts.

Evaluation of Changes in Knowledge before and after Educational Intervention

We delivered and trained CHWs in standardized COPD education. We performed fidelity checks for each CHW during education delivery to ensure high standards were upheld. After obtaining informed consent, research assistants verbally administered the LMIC COPD-KQ to GECo study participants to gauge baseline knowledge (before intervention) surrounding COPD at recruitment to the trial. To our knowledge, participants had no prior COPD education or formal education in chronic-respiratory-disease risk factors, treatment, and management. CHWs then delivered COPD-specific education to GECo participants across the three sites concerning pathophysiology, common treatments, and guidelines for the diagnosis, prevention, management, and treatment of COPD using flipcharts (13). Each training session was approximately 30–60 minutes and consisted of an additional self-management action plan and 12 months of CHW educational visits for those in the intervention group. After education, at a 3-month follow-up, the LMIC COPD-KQ was administered again to the participants. Participants were given as much time as requested to complete questionnaires to prevent bias from time constraints and forced choice (22).

Ethics approval was granted by the University College London Research Ethics Committee (9661/001) in London, United Kingdom; the School of Medicine of Johns Hopkins University (IRB00139901) in Baltimore, United States; the Nepal Health Research Council (136/2017) in Kathmandu, Nepal; the Charitable Association of Projects in Informatics, Health, Medicine and

Table 1. The COPD knowledge questionnaire developed by the research team and administered to participants

Question	True	False	I Don't Know
1. COPD is preventable.	X	—	—
2. People with COPD often have a cough that won't go away.	X	—	—
3. People with COPD may feel short of breath.	X	—	—
4. Cigarette smoking is a major cause of COPD.	X	—	—
5. Stopping smoking can help to improve symptoms related to COPD.	X	—	—
6. Regular exposure to smoke from burning charcoal, wood, or dung can cause COPD.	X	—	—
7. COPD can be reversed.	—	X	—
8. COPD can be spread from person to person.	—	X	—
9. COPD can be confirmed by breathing tests.	X	—	—
10. People with COPD should get a pneumonia vaccination.	X	—	—
11. The medicine albuterol (inhaler), Ventolin, or salbutamol can be used if you feel more short of breath.	X	—	—
12. People with COPD may be more likely to develop chest infections.	X	—	—

Definition of abbreviation: COPD = chronic obstructive pulmonary disease.
"X" denotes correct questionnaire responses.

Agriculture (CE2147.17) in Lima, Peru; and the Uganda National Council for Science and Technology and the Makerere School of Medicine (School of Medicine Research Ethics Committee [SOMREC] 2017-096) in Kampala, Uganda.

Statistical Analysis

Our analysis aimed to evaluate participant demographics, participant questionnaire performance, questionnaire internal consistency, and questionnaire item performance.

A score of 1 was given to a correct answer, and a score of 0 was given to an incorrect, missing, or I-don't-know answer. Therefore, questionnaire performance was scored on the basis of the number of correct responses. A minimum of over 80% (10 questions) questionnaire completion was required for response to be included in the data analysis

Participant COPD-KQ scores were evaluated for distribution and outliers. To assess questionnaire performance, the paired *t* test was used to compare the total score at baseline and 3 months after education among groups. To evaluate coefficient reliability, Cronbach's α was used to measure the internal consistency of individual LMIC COPD-KQ items. Data were analyzed using IBM Statistical Package for the Social Sciences (version 26.0; IBM Corp.).

Results

Demographic Characteristics of Participants

The demographic characteristics of participants are reported in Table 2. The 196 participants were from Nepal ($n = 86$), Peru ($n = 35$), and Uganda ($n = 75$). The mean age was 67.4 years (standard deviation [SD], 9.4). 58.7% ($n = 115$) of participants were male.

Table 2. Demographic characteristics of participants

Demographic Characteristic	Overall (*N* = 196)	Nepal (*n* = 86)	Peru (*n* = 35)	Uganda (*n* = 75)
Sex, *n* (%)				
Male	115 (58.7)	52 (60.5)	19 (54.3)	44 (58.7)
Female	81 (41.3)	34 (39.5)	16 (45.7)	31 (41.3)
Age, yr, mean (SD)	66.0 (11.1)	67.4 (9.4)	62.0 (11.9)	66.3 (12.2)
History of ever smoking tobacco products, *n* (%)	74 (37.8)	28 (32.6)	16 (45.7)	30 (40.0)
Currently smoke tobacco products, *n* (%)	32 (16.3)	14 (16.3)	4 (11.4)	14 (18.7)
Prior COPD diagnosis by a health professional, *n* (%)	16 (8.2)	16 (18.6)	0 (0)	0 (0)
Ever attended school, *n* (%)	115 (58.7)	23 (26.7)	34 (97.1)	58 (77.3)
Highest educational attainment, *n* (%)				
None	81 (41.3)	63 (73.3)	1 (2.9)	17 (22.7)
Primary school started but incomplete	62 (31.6)	11 (12.8)	9 (25.7)	42 (56.0)
Primary school complete	29 (14.8)	6 (7.0)	11 (31.4)	12 (16.0)
Secondary/high school complete	19 (9.7)	3 (3.5)	14 (40.0)	2 (2.7)
Any higher education	5 (2.6)	3 (3.5)	0 (0)	2 (2.7)
Schooling completed, yr, mean (SD)	3.7 (4.2)	1.7 (3.8)	7.4 (3.7)	4.4 (3.5)
COPD-KQ performance				
Baseline, mean (SD)	7.97 (2.47)	8.92 (1.94)	7.03 (3.29)	7.32 (2.22)
After education, mean (SD)	10.17 (1.67)	10.06 (1.81)	9.77 (1.63)	10.48 (1.48)

Definition of abbreviations: COPD = chronic obstructive pulmonary disease; COPD-KQ = COPD knowledge questionnaire; SD = standard deviation.

COPD-KQ Performance

No participants had more than two missing responses on an administered questionnaire, so none were excluded from analyses. Across all three sites, the mean test score at baseline was 8.0 (SD, 2.5), and 3 months after education the mean test score was 10.2 (SD, 1.7). The CHW COPD education intervention improved COPD knowledge among community members ($t = 10.9$; $P < 0.001$). The intervention improved scores, on average, by 2.20 points (95% confidence interval [CI], 1.8 to 2.6). At baseline, 29.6% ($n = 58$) of participants scored with over 80% (10 or more questions) accuracy on the COPD-KQ, and after education, 67.3% ($n = 132$) of participants scored with over 80% (10 or more questions) accuracy, which was not a statistically significant increase ($P = 0.189$). The proportion of participants who scored with over 80% (10 or more questions) accuracy on the COPD-KQ at baseline and after education increased at all three sites—Nepal (44.2% vs. 65.1%), Peru (28.6% vs. 62.9%), and Uganda (13.3% vs. 72.0%).

In Peru, the mean test score at baseline was 7.0 (SD, 3.3), and 3 months after education, the mean test score was 9.8 (SD, 1.6). Among Peruvian participants, the CHW COPD education intervention improved COPD knowledge by 2.7 points (95% CI, 1.7 to 3.8 points) ($t = 5.4$; $P < 0.001$). In Nepal, the mean test score at baseline was 8.9 (SD, 2.0), and 3 months after education, the mean test score was 10.1 (SD, 1.8). For Nepali participants, the CHW COPD education intervention improved COPD knowledge by 1.1 points (95% CI, 0.6–1.7 points) ($t = 4.4$; $P < 0.001$). In Uganda, the mean test score at baseline was 7.3 (SD, 2.2), and 3 months after education, the mean test score was 10.5 (SD, 1.5). Ugandan participants had the greatest improvement in COPD knowledge scores between the baseline and posteducation questionnaires, with an increase of 3.2 points (95% CI, 2.5–3.8 points) ($t = 9.8$; $P < 0.001$).

Internal consistency of the COPD-KQ using Cronbach's α was 0.75, which is acceptable internal consistency. Acceptably high values of Cronbach's α for group-comparison purposes were obtained for both 12-item questionnaires (Cronbach's $\alpha = 0.75$). The mean ± SD COPD-KQ performance was 9.07 ± 2.38, and there was a mean item variance of 0.094. Participant performance for each item of the LMIC COPD-KQ at baseline and 3 months after education is included in Table 3. When the COPD-KQ was administered at baseline, participants scored lowest on items surrounding the chronic nature of COPD (28.6%), the susceptibility and prevention of pneumonia susceptibility in patients with COPD (36.2%), and the lack of an infectious etiology for COPD (41.8%) (Table 3). At baseline, participants scored with the highest accuracy on items assessing shortness of breath as a symptom of COPD (94.9%), burning biomass as a cause and exacerbating factor of COPD (93.9%), and COPD diagnosis using breathing tests (93.9%). The questions answered with the lowest accuracy at baseline were items suggesting that those with COPD should get a pneumonia vaccine (32.2%) and that COPD can be reversed (34.6%). All items improved in performance from baseline to posteducation testing.

COPD-KQ Performance by Demographic Characteristics

Women had higher mean baseline and posteducation performance than men; however, men had a higher mean improvement in COPD-KQ performance than women. Both men and women had statistically significant ($P < 0.001$) improvement between LMIC COPD-KQ scores at baseline and LMIC COPD-KQ scores 3 months after education (Table 4). Participants with a prior COPD diagnosis had a mean baseline score of 8.94 points and a mean posteducation score of 10.06 points, improving by 1.1 points (95% CI, 0.1–2.2 points), which was statistically significant ($t = 2.3$; $P = 0.040$). Participants without a prior COPD diagnosis had a mean baseline score of 7.9 points and a mean posteducation score of 10.2 points, improving by 2.3 points (95% CI, 1.9–2.7 points), which was statistically significant ($t = 10.7$; $P < 0.001$). Participants that were smokers and nonsmokers independently improved in COPD-KQ performance from baseline to the posteducation period, and results were statistically significant (Table 4). Participants that had "ever" attended school had the greatest mean LMIC COPD-KQ score improvement among demographic subgroups (2.6 points; 95% CI, 2.0–3.1 points), and this was statistically significant ($P < 0.001$). Never-smokers had mean improvement on the LMIC COPD-KQ that was 0.9 points ($t = 2.1$; $P = 0.038$) higher than that of ever-smokers (Table 5). Relative to participants who had never attended school, participants that had ever attended school had a 0.9-point ($t = 2.2$; $P = 0.026$) improvement on the LMIC COPD-KQ.

Discussion

To our knowledge, we have developed and tested the first LMIC COPD-KQ and shown that this can be locally adapted, reliable, and responsive to change during a COPD education intervention.

Patient-centered educational interventions have been shown to benefit patients with noncommunicable diseases such as COPD. By developing one's sense of self-efficacy, affected individuals build confidence in their ability to actively manage their own condition (7, 23, 24). Hence, providing patient education and improving health literacy is an important aspect of these patient-centered interventions. Currently, there are no COPD-KQs specifically tailored to assess COPD health knowledge in LMIC settings, where the COPD burden and mortality are highest. Focus-group discussions, an expert panel, and piloting with CHWs yielded a 12-item questionnaire tested in 196 participants in Nepal, Peru, and Uganda. From the baseline test to the postintervention test 3 months later, the educational intervention improved performance and COPD knowledge, on average, by approximately 2.2 points (95% CI, 1.8–2.6 points).

Our findings are consistent with assessments of COPD knowledge developed in high-income-country settings. Maples and colleagues (2010) developed a 24-item valid and reliable COPD-KQ in the United States with similar internal consistency (Cronbach's α of 0.75) (20). Likewise, the Bristol COPD-KQ, developed in the United Kingdom yielded similar reliability (Cronbach's α of 0.73) (10). Unlike these studies in the United States and the United Kingdom, which consisted of 24 and 65 items respectively, our study involved the development of a 12-item questionnaire for ease of administration and of soliciting feedback from community members and providers (10, 20). In contrast to these currently available COPD-KQs, our questionnaire focuses on the chronic development of COPD, which contrasts with the community perception of COPD having an infectious cause in LMIC settings (20). In addition to tobacco-smoke exposure, our questionnaire items have a unique focus on biomass exposure as etiological factors and areas of prevention, unlike prior COPD-KQs.

COPD-specific education has primarily been delivered in clinical settings in high-income countries (7, 25). A systematic review found that COPD educational interventions were primarily performed in high-income countries in Europe, North America, and Australia, with few studies (4.9%, 4 of 81 studies) being performed in LMIC settings (7). The majority of COPD education was delivered by healthcare professionals (physicians, nurses, physiotherapists), and few interventions were community based. However, our CHW-led COPD education was delivered to community members in their homes and included topics such as COPD risk factors, symptoms, disease progression, and how to avoid exacerbations and maintain general lung health using standardized educational tools (13). Because of increased awareness of the burden of chronic respiratory diseases in low-resource settings, COPD-specific education interventions have now expanded in LMIC settings. In Uganda and Vietnam, a train-the-trainer method was implemented for healthcare providers and CHWs to train community members (26). This COPD education was found to be effective in addressing COPD risk factors such as household air pollution and tobacco smoke.

Table 3. LMIC COPD-KQ item performance

LMIC COPD-KQ Item	Correct Response [*n* (%)]	
	Baseline	After Education
1. COPD is preventable.	120 (61.2)	160 (81.6)
2. People with COPD often have a cough that won't go away.	133 (67.9)	179 (91.3)
3. People with COPD may feel short of breath.	160 (81.6)	186 (94.9)
4. Cigarette smoking is a major cause of COPD.	157 (80.1)	178 (90.8)
5. Stopping smoking can help to improve symptoms related to COPD.	165 (84.2)	178 (90.2)
6. Regular exposure to smoke from burning charcoal, wood, or dung can cause COPD.	171 (87.2)	184 (93.9)
7. COPD can be reversed.	56 (28.6)	110 (56.1)
8. COPD can be spread from person to person.	82 (41.8)	128 (65.3)
9. COPD can be confirmed by breathing tests.	152 (77.6)	184 (93.9)
10. People with COPD should get a pneumonia vaccination.	71 (36.2)	128 (65.3)
11. The medicine albuterol (inhaler), Ventolin, or salbutamol can be used if you feel more short of breath.	139 (70.9)	183 (93.4)
12. People with COPD may be more likely to develop chest infections.	156 (79.6)	183 (93.4)

Definition of abbreviations: COPD = chronic obstructive pulmonary disease; COPD-KQ = COPD knowledge questionnaire; LMIC = low- and middle-income country.

Table 4. LMIC COPD-KQ performance by demographic characteristics

	LMIC COPD-KQ Performance [*Mean (SD)*]		Mean Difference (95% CI)	*t* Statistic	*P* Value
	Baseline	After Education			
Sex					
Male	7.9 (2.6)	10.2 (1.7)	2.2 (1.7–2.8)	7.8	<0.001
Female	8.0 (2.4)	10.2 (1.7)	2.2 (1.6–2.7)	8.0	<0.001
Prior COPD diagnosis by a health professional					
Yes	8.9 (1.7)	10.1 (1.6)	1.1 (0.1–2.2)	2.3	0.040
No	7.9 (2.5)	10.2 (1.7)	2.3 (1.9–2.7)	10.7	<0.001
History of ever smoking					
Smoker	8.04 (2.5)	9.7 (1.8)	1.7 (0.9–2.4)	4.5	<0.001
Never-smoker	7.93 (2.5)	10.5 (1.5)	2.5 (2.1–3.0)	11.0	<0.001
Current smoker					
Smoker	8.28 (2.6)	9.7 (1.9)	1.4 (0.1–2.7)	2.2	0.039
Nonsmoker	7.9 (2.5)	10.3 (1.6)	2.4 (2.0–2.8)	11.5	<0.001
Education					
Ever attended school	7.7 (2.7)	10.2 (1.6)	2.6 (2.0–3.1)	9.1	<0.001
Never attended school	8.4 (2.0)	10.1 (1.8)	1.7 (1.1–2.2)	6.2	<0.001

Definition of abbreviations: CI = confidence interval; COPD = chronic obstructive pulmonary disease; COPD-KQ = COPD knowledge questionnaire; LMIC = low- and middle-income country; SD = standard deviation.

Our findings also support van Gemert and colleagues' (2019) findings that COPD education can be effectively delivered by local CHWs to community members outside of clinical settings (26).

Strikingly, knowledge on COPD substantially improved 3 months after education in those with and without a prior COPD diagnosis; however, the baseline mean scores between the two groups was only 1.06 points. We expected that those with a previous diagnosis of COPD would have had a better concept and understanding of their disease and would have scored higher than others before the educational intervention. Knowledge surrounding COPD in LMICs is limited, and our study reiterates the importance of development and assessment of COPD-specific knowledge tools as well as the need for identifying those with undiagnosed COPD using quality-assured measures and LMIC-appropriate case-finding tools.

Table 5. LMIC COPD-KQ change by demographic characteristics

	Improvement in LMIC COPD-KQ Performance [*Mean (SD)*]	Mean Difference	*t* Statistic	*P* Value
Sex (ref: female)				
Female	2.2 (2.5)	0.1	0.1	0.910
Male	2.2 (3.1)			
Prior COPD diagnosis by a health professional (ref: No COPD diagnosis)				
No COPD diagnosis	2.3 (2.9)	−1.2	1.6	0.113
COPD diagnosis	1.1 (2.0)			
History of smoking (ref: never-smoker)				
Never-smoker	2.5 (2.5)	−0.9	2.1	0.038
Ever-smoker	1.7 (3.2)			
Current smoker (ref: nonsmoker)				
Nonsmoker	2.4 (2.6)	−1.0	1.5	0.151
Smoker	1.4 (3.6)			
Education (ref: never attended school)				
Never attended school	1.7 (2.4)	0.9	2.2	0.026
Ever attended school	2.6 (3.0)			

Definition of abbreviations: COPD = chronic obstructive pulmonary disease; COPD-KQ = COPD knowledge questionnaire; LMIC = low- and middle-income country; ref = reference; SD = standard deviation.

The question-performance differential at baseline was also interesting. We found that participants score with higher accuracy on items surrounding shortness of breath as a symptom of COPD (94.9%), burning biomass as a cause and exacerbating factor of COPD (93.9%), and COPD diagnosis using breathing tests (93.9%). For a questionnaire aimed at LMICs, knowledge surrounding biomass fuels as a cause and exacerbating factor is paramount when looking at tools to aid COPD preventability. Conversely, the questions answered with the lowest accuracy at baseline were items suggesting those with COPD should get a pneumonia vaccine (32.2%) and that COPD can be reversed (34.6%). Limited knowledge surrounding pneumonia vaccines for chronic lung diseases at our study sites was unsurprising given their lack of availability. However, the notion that COPD can be reversed makes an even stronger case for the need for valid and easily implementable COPD education tools. If it is believed that COPD *can* be reversed, that misconception lends itself to an even lower incentive (both personally and more broadly) to minimize and stop exposure, and this will ultimately not help prevent new cases of COPD and tackle the current global burden of COPD. Although LMIC settings vary in their unique profile of COPD risk factors and healthcare systems, targeting the COPD risk factors that are most prevalent in LMIC settings for prevention, diagnosis, treatment, and management is key to effective COPD educational interventions and knowledge assessments.

Implementation of CHW-delivered education interventions in community settings has increased in LMICs to prevent and control noncommunicable diseases. However, there are no studies specifically focusing on COPD, highlighting the need for COPD knowledge tools as COPD education interventions are implemented in LMICs (27). COPD-KQs can serve as a method for evaluating the educational components of COPD interventions in LMICs. As the burden of COPD increases in LMICs and COPD interventions are implemented to address this burden, having an appropriate evaluation tool available is critical.

To our knowledge, this is the first COPD-KQ developed, tested, and found to show face

and content validity and with good internal consistency through development phases, suggesting reliability and validity in LMIC settings. A major strength of this study is that we developed content with provider, CHW, and community-member input to yield a locally adapted COPD-KQ specific to the perspectives and experiences of community members with COPD living in LMICs.

Limitations

The COPD-KQ content was based on expert panel members' thoughts and biases. To limit this, 16 clinicians, researchers, and public health professionals were involved in development. We were not able to conduct focus-group discussions in Nepal, and adaptation and cultural contextualization are therefore likely missing. However, we did pilot the COPD-KQ with Nepali CHWs and consulted local physicians to address this limitation. The COPD-KQ was translated into Nepali, Spanish, and Luganda by translators familiar with medical terminology and experienced in translating research, but the questionnaire was not back-translated. In addition, native speakers gave input on questionnaire wording. During fidelity checks by field supervisors in Nepal, it was recognized that a field team was encouraging participants in order to solicit the correct response. Although refresher training and discussions followed, it is important to highlight this as a potential limitation and risk associated with any questionnaire administration. Another limitation is the high frequency of true as the correct response to the COPD-KQ (10 of 12 questionnaire items), potentially increasing questionnaire performance for participants that guessed true in response to all questions. However, we did a sensitivity analysis to evaluate this and found that less than 0.4% of participants answered true for all questions. In addition, the sample size in Peru was relatively small. Given the novelty of the COPD-KQ study and a lack of alternative questionnaires, concurrent validity could not be assessed. To expand the dissemination of this questionnaire to other LMICs, further validation of the COPD-KQ is needed in diverse populations and LMICs with a varying interplay of COPD risk factors.

Conclusions

The COPD-KQ is a locally adapted instrument with an acceptable internal consistency that differs in participants with a previous COPD diagnosis. With the development and use of this COPD questionnaire, patient knowledge surrounding COPD and its impact on patient-education interventions can be assessed. Healthcare providers and public health professionals alike can use the information generated from patient questionnaire responses to enhance patient-centered education efforts on the basis of individual patient needs in clinical settings and can evaluate the efficacy of educational interventions. We have developed a questionnaire that, when assessed, shows face and content validity with acceptable internal consistency, suggesting reliability and validity. ■

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