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Lung function and symptoms among indigenous Mayan women exposed to high levels of indoor air pollution

E. Díaz,* N. Bruce,† D. Pope,† R. T. Lie,* A. Díaz,‡ B. Arana,‡ K. R. Smith,§ T. Smith-Sivertsen*

*** Department for Public Health and Primary Health Care, University of Bergen, Bergen, Norway; † Division of Public Health, University of Liverpool, Liverpool, UK; ‡ Center for Health Studies, Del Valle de Guatemala University, Guatemala City, Guatemala; § Department of Environmental Health Sciences, University of California, Berkeley, California, USA**

SUMMARY

SETTING: Indoor air pollution from burning of biomass fuel in open fires is a known risk factor for chronic obstructive pulmonary disease (COPD) in developing countries.
OBJECTIVE: To estimate the prevalence of respiratory symptoms and lung function among women in rural Guatemala and to describe the methods and practical issues associated with the assessment of respiratory health.
DESIGN: Information about respiratory symptoms, lung function and individual measurement of exposure was collected cross-sectionally among 350 Mayan-Indian women aged 15–50 years who used traditional open fires.
RESULTS: These women, exposed to indoor air pollution since birth, had a relatively high prevalence of cough (22.6%), phlegm (15.1%), wheeze (25.1%) and tightness in the chest (31.4%). Respiratory symptoms were positively associated with exposure levels. Lung function was higher than the most feasible reference population (average above predicted forced expiratory volume in 1 s [FEV_1] +4.5% and forced vital capacity [FVC] +4.2%). Only one woman had a FEV_1/FVC ratio lower than 70%.
CONCLUSIONS: According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines, almost one third of these young non-smoking women were at risk (stage 0) of developing COPD. The methodological issues encountered during the study highlight the importance of standardising approaches to local adaptation of established questionnaires to study respiratory health in rural areas of developing countries.
KEY WORDS: indoor air pollution; COPD; spirometry; exposure; developing countries

WORLDWIDE, 2.4 billion people depend on biomass fuel (wood, animal dung or crop wastes) for cooking and heating. Typically burned in open fires or inefficient stoves without appropriate ventilation, biomass fuels emit substantial amounts of health-damaging pollutants, leading to levels of exposure in developing countries at least 10–20 times higher than World Health Organization (WHO) guidelines.[1–3] Women and young children who spend many hours a day near the fire are the most exposed.

A growing body of literature implicates indoor air pollution from biomass fuel as a risk factor for the development of chronic obstructive pulmonary disease (COPD).[4–12] However, most developing countries have no standard protocols for assessing COPD and health services do not adequately cover the poor population at risk of COPD from biomass smoke. Among the obstacles that inhibit epidemiological studies of COPD from being effectively conducted in developing countries are the lack of validated questionnaires adapted to local language, seasonal patterns and cultural circumstances, the limited local training required to obtain high-quality spirometry and the lack of appropriate reference population data.

Previous studies of biomass fuel and COPD have all used observational designs vulnerable to confounding, few have measured lung function and fewer still have used direct measures of exposure, relying instead on surrogates such as time spent near the fire.[13] To address these limitations, RESPIRE (Randomised Exposure Study of Pollution Indoors and Respiratory Effects) used a randomised controlled trial design to assess the impact of reducing indoor air pollution through an improved woodstove (*plancha*) on lung health in a poor rural population in the highlands of Guatemala.[14,15] The main health outcomes were acute lower respiratory infection (ALRI) in children and the respiratory health of their mothers.[14] Detailed measurement of exposure was undertaken. Fieldwork began in October 2002 and ended in December 2004.

This report describes the pre-intervention prevalence of respiratory symptoms and lung function values in 350 non-smoking young women exposed to high levels of indoor air pollution since birth. In addition,

Correspondence to: Esperanza Díaz, Section for General Practice, Department of Public Health and Primary Health Care, University of Bergen, Kalfarveien 31, N-5018 Bergen, Norway. Tel: (+47) 5558 6134. Fax: (+47) 5558 6130. e-mail: esperanza.diaz@isf.uib.no
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the methods used and the practical difficulties associated with assessing respiratory health in this poor, rural, mainly illiterate population are described.

METHODS

The study was conducted in an indigenous Mayan-Indian community in San Marcos Department, Guatemala (altitude 2200–3000 m). Illiteracy is common and few women speak Spanish fluently, the main language being Mam. Household energy for cooking and heating is provided almost exclusively by wood burned in open fires, and women spend on average 5 h a day in a room with a lit fire.[16] Smoking is very infrequent among Mam women.

Extensive pilot work was carried out to ensure the suitability of the study area and community support, acceptability and effectiveness of the stove and methods used for exposure assessment.[17–20] An initial census identified 777 eligible families using an open fire for cooking with either a child aged <4 months or a pregnant woman. After informed consent had been obtained, 535 households were enrolled in RESPIRE. The adult sample comprised the mothers of the study children. Thirty did not provide consent and one, assigned to the control group, was excluded because she had a miscarriage and received a *plancha*. Thus, a total of 504 women (mean age 27.7 years, standard deviation [SD] 7.2) participated in the RESPIRE study.

To avoid extending the geographical study area, participants were recruited in two rounds. Recruitment group A (RGA) (300 households, 153 receiving a *plancha*) was recruited between October and November 2002 and recruitment group B (RGB) (204 houses, 106 receiving a *plancha*) between April and May 2003. Despite several months of preparatory work with the communities to gain acceptance for the study, the response for RGA was 55%, presumably the result of residual fears about the intentions of groups such as ours working for a relatively short period in the area. A higher response was obtained in RGB (90%), probably reflecting a gradually increasing trust between the community and the study team.

Baseline information was gathered using three interviewer-led questionnaires (Figure 1) conducted in each participant's home. Due to an unforeseen overload of work early in the study, the third questionnaire was delayed by approximately 4 months in RGA. By then, most intervention households in this recruitment group had been using the intervention (a locally built woodstove or *plancha* with a metal flue venting outside the house)[21] for a month, and they are therefore not included in this report.

Respiratory symptoms

Questions on airway symptoms (cough, phlegm, wheeze and tightness in the chest) were developed from standard questions on COPD (Medical Research Council/International Union Against Tuberculosis and Lung Disease) and asthma (International Study of Asthma and Allergies in Childhood [ISAAC])[22,23] translated from English to Spanish, and then to Mam, with back-translation. There were, however, considerable difficulties in applying direct translations to this population, for three reasons. First, women found it hard to comprehend the time duration patterns about which standard questionnaires enquired. Second, seasons in Guatemala are different from temperate countries, for which the questionnaires had been designed. Third, identifying the correct local terms for symptoms proved difficult, especially for wheeze. Discussion groups of local women and field staff were used to establish appropriate local terminology and simplify time-recall patterns. For wheeze, this process identified the Mam term 'nxwisen' ('breathing sounds heard in the neck but coming from the chest'). Fieldworkers were trained to use the appropriate Mam translations when interviewing the women. All data collection was doubled-entered and reviewed daily.

* First visit (Group A October–November 2002, Group B April–May 2003)
- Consent
- Baseline Questionnaire-1 (BLQ1):
  - Information about household members
  - Household structure
  - Fuel use
  - Socio-economic status
  - Tobacco use
  - Presence of symptoms while cooking
- Placement of CO tubes for personal indoor air pollution measurement

Randomisation

* Second visit (48 h after first visit)
- Information to the family about which randomising group the household belongs to
- Baseline Questionnaire-2 (BLQ2):
  - Household structural characteristics
  - Energy use
  - Cooking information
  - Local sauna (Temascal) use
- Collection of CO tubes

* Third visit (Group A, March–June 2003, after installation of *planchas* in intervention households, Group B, April–June 2003, before installation of *planchas*)
- Baseline Questionnaire-3 (BLQ3): chronic health symptoms
  - Respiratory symptoms
  - Asthma, rhinitis, eczema
  - Sore eyes, headache, backache
- Spirometry
- Measurement of CO in exhaled breath

Figure 1 Information assessment at baseline for recruitment groups A and B. CO = carbon monoxide.

Lung function measurement

Lung function was measured on completion of interviews. Standing height and weight were measured. Spirometry was performed in accordance with the American Thoracic Society (ATS) guidelines[24] using a Micro Medical Microloop spirometer (Micro Medical Ltd, Rochester, UK). Calibration checks were undertaken weekly. For spirometry, participants were seated without nose clips and measurements were classified as acceptable if the woman had at least three good blows, and if best and second best values of forced expiratory vital capacity (FVC) and forced expiratory volume in 1 second (FEV_1), respectively, did not differ by more than 0.20 l. All lung function data were checked daily by the study physician.

Three local bilingual (Mam and Spanish) fieldworkers were recruited. None had previous experience with spirometry, although two had been health workers. The fieldworkers were trained in spirometry over one month, with additional training before the recruitment of RGB. Fieldworkers were randomly assigned to intervention and control houses. Only two fieldworkers continued in the study from April 2003.

To assess inter-observer variation in July 2003, 20 women not taking part in RESPIRE participated in a repeatability exercise including spirometry and measurement of carbon monoxide (CO) in exhaled breath. Protocols identical to those for the main study were used. Each woman was interviewed and measurements taken by one fieldworker, followed within 1–2 h by the second fieldworker. Half of the women saw fieldworker 1 first, while the other half saw fieldworker 2 first. Bland and Altman plots[25] confirmed that the mean differences between the two observers were under 0.20 l throughout the range of measurements for FEV_1 and for FVC $\geqslant$ 3 l (Figure 2). Mean differences between observers were 0.04 l (standard deviation [SD] 0.10) for FEV_1, and 0.18 l (SD 0.13) for FVC. The mean difference in CO breath measurements between fieldworkers was 0.2 parts per million (ppm) (SD 1.5 ppm).

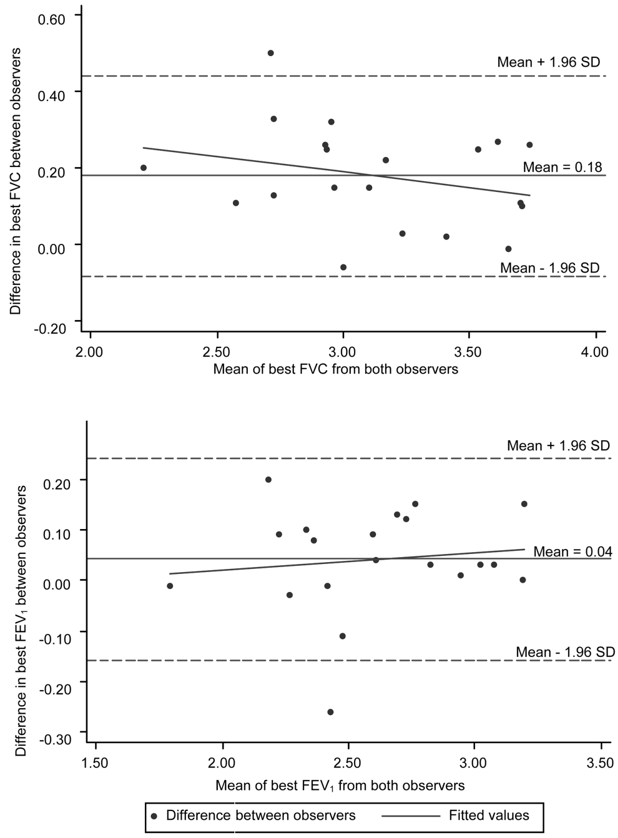

Figure 2 Bland Altman plots for values of FEV_1 and FVC for the two fieldworkers. Plots show differences against mean values for the two observers with mean difference and prediction from a linear regression indicated. FEV_1 = forced expiratory volume in 1 s; SD = standard deviation; FVC = forced vital capacity.

Exposure assessment

Drawing on earlier validation work,[17] two measures were employed to assess exposure to biomass smoke. First, exhaled CO was measured with a Micro CO (Micro Medical Ltd, UK), after spirometry was completed. CO in exhaled breath is a measure of carboxyhaemoglobin, a biomarker of recent exposure to incomplete combustion of carbon-based material.[17] Instrument comparisons were conducted regularly in the field office. After the study, CO monitors were returned to the University of California, Berkeley, California, USA, for comparison against calibration gas, and were found to be accurate.

Second, 48 h personal CO was measured using Gastec 1DL CO passive diffusion tubes (Gastec Corp., Ayase City, Japan) in all women at baseline, but at times different from those for spirometry. The CO tubes were attached to the women's clothes on the upper chest for 48 h. All tubes were read blind to intervention status by two research staff.

Statistical methods

The sample size for RESPIRE, approximately 500 children followed until 18 months of age, was determined primarily for ALRI. For the adult study, the 250 women available per group was calculated as sufficient to detect a reduction in symptom prevalence from 25% to 15% and a difference of FEV_1 of 0.09 l estimated from a population mean of 2.70 l and SD of 0.35 l (power = 80%; 2-sided α = 5%). A total of 350 women using open fires at baseline are included in this report, both intervention and controls in RGB (203 women) and controls in RGA (147 women).

Multiple linear regression was used to study the associations between lung function and respiratory symptoms and between lung function and exposure. Logistic regression was used for the relationship between symptoms and exposure. Analyses were carried out using SPSS version 13 (SPSS Inc, Chicago, IL, USA).

Ethical considerations

The adult component of RESPIRE was approved by the Research Ethics Committees at the Universities of Bergen, Liverpool and Del Valle de Guatemala.

RESULTS

Household and personal information for the 350 women using open fires at baseline, as well as data on personal exposure and meteorological conditions, are presented in Table 1, classified by recruitment group.

Table 1 Baseline characteristics stratified by recruitment group and for all women using open fire at baseline

	Recruitment group A (*n* = 147)	Recruitment group B (*n* = 203)	All (*N* = 350)
Mean age, years (SD)	28.3 (7.3)	27.4 (7.1)	27.8 (7.2)
Pregnant, *n* (%)	11 (7.5)	137 (67.5)	148 (42.3)
Height, cm (SD)	144.5 (4.4)	143.5 (4.4)	143.9 (4.4)
Children <12 years, mean (SD)	3.8 (1.7)	3.7 (1.7)	3.7 (1.7)
Smokes, *n* (%)	1 (0.7)	0	1 (0.3)
Cough while cooking,* *n* (%)	98 (66.7)	135 (66.5)	233 (66.6)
Relative smokes inside, *n* (%)	42 (28.6)	44 (21.7)	86 (24.6)
Cigarettes smoked by husband, mean (SD)	1.06 (0.2)	1.12 (0.3)	1.09 (0.3)
Has Temascal,† *n* (%)	115 (78.2)	191 (94.1)	306 (87.4)
Temascal > once per week, *n* (%)	55 (37.4)	86 (42.4)	141 (40.3)
Kitchen separate from bedroom, *n* (%)	126 (85.7)	171 (84.2)	297 (84.8)
Owns television, *n* (%)	25 (17.0)	43 (21.2)	68 (19.4)
Owns bicycle, *n* (%)	30 (20.4)	50 (24.6)	80 (22.9)
Owns pigs, *n* (%)	102 (69.4)	122 (60.1)	224 (64.0)
Median 48 h CO (tubes), ppm	2.76	2.54	2.60
Median CO exhaled breath,‡ ppm	7.00	8.50	8.00
Mean rainfall, mm/day (SD)	0.24 (0.5)	1.85 (3.8)	1.17 (3.0)
Mean temperature, °C (SD)	11.8 (1.3)	13.4 (0.7)	12.7 (1.3)

* When you are cooking, does the smoke make you cough or irritate your throat? (yes = sometimes/always)
† Local sauna.
‡ Median of mean breath CO values from 2 best readings of 3 blows.
SD = standard deviation; CO = carbon monoxide; ppm = parts per million.

The percentage of pregnant women was higher in RGB, as many women at the end of their pregnancy or with young infants had already been recruited to RGA. Respiratory health for RGA was assessed during the dry, colder season, and for RGB during the wet, warmer season.

Baseline respiratory symptoms

The prevalence of respiratory symptoms is shown separately by recruitment group and by age (Table 2). Respiratory symptoms were commonly reported: cough (22.6%), chronic cough >3 months (16.0%), phlegm (15.1%), chronic phlegm >3 months (10.3%), wheeze

Table 2 Prevalence of symptoms and spirometry results for women using open fires at baseline, classified by age and recruitment group

	Recruitment group A			Recruitment group B		
	Age 15–24 years	Age 25–49 years	All ages	Age 15–24 years	Age 25–49 years	All ages
Respiratory symptoms, *n* (%)						
n	57	89	146	79	124	203
Cough*	10 (17.5)	18 (20.2)	28 (19.0)	22 (27.8)	29 (23.4)	51 (25.1)
Chronic cough†	5 (8.8)	14 (15.7)	19 (12.9)	15 (19.0)	22 (17.7)	37 (18.2)
Phlegm‡	5 (8.8)	9 (10.1)	14 (9.5)	19 (24.1)	20 (16.1)	39 (19.2)
Chronic phlegm§	1 (1.8)	7 (7.9)	8 (5.4)	11 (13.9)	17 (13.7)	28 (13.8)
Ever wheeze¶	9 (15.8)	12 (13.5)	21 (14.3)	21 (26.6)	46 (37.1)	67 (33.0)
Wheeze 12 months#	6 (10.5)	6 (6.7)	12 (8.2)	15 (19.0)	31 (25.0)	46 (22.7)
Tightness**	12 (21.1)	18 (20.2)	30 (20.4)	29 (36.7)	51 (41.1)	80 (39.4)
Chronic cough and phlegm††	1 (1.8)	5 (5.6)	6 (4.1)	8 (10.1)	14 (11.3)	22 (10.8)
Any symptom‡‡	23 (40.4)	30 (33.7)	53 (36.1)	46 (58.2)	81 (65.3)	127 (62.6)
Spirometry (measurements meeting ATS criteria), mean (SD)						
n	41	73	114	66	104	170
FEV_1, litres	2.84 (0.30)	2.60 (0.40)	2.68 (0.38)	2.75 (0.32)	2.57 (0.32)	2.64 (0.33)
Predicted FEV_1%§§	105.4 (9.09)	105.4 (12.4)	105.4 (11.3)	104.7 (9.8)	103.4 (10.6)	103.9 (10.3)
FVC, litres	3.21 (0.33)	3.00 (0.46)	3.08 (0.43)	3.13 (0.38)	3.04 (0.38)	3.08 (0.38)
Predicted FVC%¶¶	105.1 (8.0)	102.9 (11.9)	103.7 (10.7)	105.5 (10.7)	104.0 (11.2)	104.5 (11.0)
FEV_1/FVC %	88.4 (5.36)	86.5 (5.56)	87.2 (5.53)	87.9 (3.86)	84.4 (4.98)	85.8 (4.87)

* Do you cough or have you coughed a lot?
† Chronic cough (morning, day or evening cough lasting for >3 months).
‡ Do you produce or have you produced a lot of phlegm?
§ Chronic phlegm (morning, day or evening phlegm lasting for >3 months).
¶ Have you ever had wheezing/whistling (see text for full explanation of Mam language term for wheeze).
\# During the past 12 months, have you had attacks of wheezing/whistling?
** During the past 12 months, have you once woken up in the morning with the sensation of pressure on your chest?
†† Chronic cough and chronic phlegm.
‡‡ Presence of any of the previously described respiratory symptoms.
§§ Percentage of predicted FEV_1 values compared to Hankinson's population.[26]
¶¶ Percentage of predicted FVC values compared to Hankinson's population.[26]
ATS = American Thoracic Society; SD = standard deviation; FEV_1 = forced expiratory volume in 1 second; FVC = forced expiratory vital capacity.

(25.1%) and tightness in the chest (31.4%). The prevalence of all symptoms in the dry season (RGA) was lower than in the warmer wet season (RGB), significantly so ($P < 0.05$) for all symptoms except cough and chronic cough.

Baseline lung function

Among women using open fires at baseline, spirometry was obtained for 338 (96.6%), of whom 319 (91.1%) performed at least three good blows. In total, 285 (81.4%) participants met the American Thoracic Society (ATS) criteria. Spirometry data are presented stratified by recruitment group and age in Table 2. Only one woman had a FEV_1/FVC ratio <70%.

Lung function data for healthy Mexican-American females, published by Hankinson et al.,[26] were used as a reference. The mean values for both FEV_1 and FVC in our population were higher than predicted values (+4.5% and +4.2%, respectively). More than two thirds of the study women had a FEV_1 and FVC greater than predicted. Only 1.4% and 2.1% of the women had FEV_1 and FVC <80% of the predicted values.

Relationships between symptoms, lung function and exposure

Women with cough, chronic cough, phlegm, chronic phlegm or chronic cough with chronic phlegm had significantly lower FEV_1 values than women without symptoms ($P < 0.05$) after adjusting for age, height, pregnancy, fieldworker, recruitment group, rainfall and temperature (Table 3). Similarly, women reporting any of the symptoms had lower FVC values, with the associations for chronic cough and phlegm achieving statistical significance ($P < 0.05$).

After adjustment in logistic regression analyses, a 1 ppm increase in CO breath was found to be associated with a 5–15% increase in the various symptoms, most associations being statistically significant ($P < 0.05$) (Table 4). Similar results were found for 48 h CO in relation to cough, but somewhat weaker associations with other symptoms. No significant relationship was found between lung function and exposure after adjustment for confounders using linear regression analyses.

Table 4 ORs* with 95%CIs for each respiratory symptom, per 1 unit increase in CO in exhaled breath and CO tubes, ppm

	CO breath OR† (95%CI)	CO tubes OR† (95%CI)
Cough	1.07 (1.01–1.15)	1.11 (1.02–1.20)
Chronic cough	1.10 (1.02–1.18)	1.13 (1.04–1.24)
Phlegm	1.10 (1.02–1.19)	1.05 (0.95–1.17)
Chronic phlegm	1.10 (1.01–1.19)	1.00 (0.88–1.15)
Wheeze	1.04 (0.98–1.11)	1.05 (0.97–1.14)
Tightness in the chest	1.08 (1.01–1.15)	1.04 (0.96–1.13)
Chronic cough and phlegm	1.15 (1.05–1.26)	1.04 (0.92–1.17)

* For women using open fires at baseline.
† Adjusted for age, pregnancy, mean temperature and mean rainfall.
OR = odds ratio; CI = confidence interval; CO = carbon monoxide; ppm = parts per million.

DISCUSSION

This study is the first to measure lung function together with respiratory symptoms in a young, non-smoking Indian-American female population exposed to high levels of indoor air pollution since birth. A number of methodological issues arose in symptom and lung function assessment that are relevant to the interpretation of our findings and are pertinent to the development and comparability of future field studies of respiratory health in developing countries.

We found a relatively high prevalence of respiratory symptoms but apparently normal lung function, which implies[27] that most of the women are at risk (stage 0) of developing COPD. Other conditions such as tuberculosis (TB), for which indoor air pollution has been reported as a risk factor,[28] should also be considered as a potential cause of respiratory symptoms.[29] However, TB tests were not performed in RESPIRE due to the very low occurrence of TB reported in the study area (San Marcos Ministry of Health, personal communication), and it seems likely that TB will have contributed very little to the observed prevalence of respiratory symptoms.

Most of the people exposed to indoor air pollution from biomass fuels in the world live in rural areas of

Table 3 Association of respiratory symptoms with lung function*

	FEV_1 β-coefficient† (95%CI)	FVC β-coefficient† (95%CI)
Cough	−0.078 (−0.151–−0.005)	−0.081 (−0.166–0.003)
Chronic cough	−0.093 (−0.176– −0.010)	−0.103 (−0.199–−0.007)
Phlegm	−0.099 (−0.186–−0.013)	−0.108 (−0.208–−0.008)
Chronic phlegm	−0.113 (−0.211–−0.014)	−0.094 (−0.208–0.020)
Wheeze	−0.040 (−0.115–0.035)	−0.021 (−0.107–0.066)
Tightness	0.013 (−0.058–0.084)	0.023 (−0.059–0.105)
Chronic cough and phlegm	−0.132 (−0.243– −0.020)	−0.096 (−0.226–0.034)
Any symptom	−0.053 (−0.120, 0.014)	−0.036 (−0.114–0.041)

* Analysis conducted for women using open fires at baseline who fulfilled the American Thoracic Society criteria.
† β-coefficient represents change in FEV_1 and FVC (in litres) due to the presence of respiratory symptoms adjusted for age, height, pregnancy, fieldworker, recruitment group, rainfall and temperature.
FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity; CI = confidence interval.

developing countries with low literacy rates, where standard questionnaires, usually validated in industrialised countries, might not be adequate. This study adapted established, validated questions to Mam, the local oral language. Despite the revisions needed, reported symptoms were significantly associated with reduced lung function and increased exposure, which lends support to the terms used for cough and phlegm. The term used for wheeze was more problematic, as the symptom was much more difficult to define in the local Mam language. However, a subsequent study in the same population supports this choice of language.[30] Although the internal consistency in our study suggests that the modified questions were useful, it was not possible to assess whether sensitivity and specificity for COPD are comparable to the original standard instruments. Local adaptations will probably be required for investigations in other developing country settings, and efforts should be made to coordinate and standardise the development of adapted questionnaires to secure the comparability of prevalence and risk estimates.

The variation identified in spirometry results between fieldworkers was only of potential clinical importance for FVC measurements, which were lower for one fieldworker, probably due to suboptimal technique. Results from the follow-up stages of the study showed an improvement in technique over time (not presented here). Although other studies have stressed the importance of training fieldworkers in spirometry technique, none have reported inter-observer repeatability in field conditions.

There are few published references on spirometry for American Indians, with most applying to older women.[26,31,32] The lung function data from our population were higher than the predicted values from the most relevant source identified, Mexican-American women from the USA,[26] making it difficult to use such values to classify COPD. Living at high altitudes has been associated with higher than predicted lung function in the Himalayas and Latin America.[12,33,34] Also, increased pulmonary function associated with body complexion has been reported in Quechuan natives in Bolivia[35] and Ecuador.[6] Developmental acclimatisation and genetic factors together probably explain our higher than expected lung function value findings in a population that, although young, has been exposed to high indoor air pollution since birth.

In conclusion, we found a relatively high prevalence of respiratory symptoms but apparently normal lung function among non-smoking young Mayan-Indian women. Almost one third of these women were at risk (stage 0) of developing COPD, which might still be avoided by means of improved stoves. In addition, the methodological issues encountered during the study highlight the importance of standardising approaches to local adaptation of established questionnaires to study respiratory health in rural areas of developing countries.

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RÉSUMÉ

CONTEXTE : La pollution de l'air de l'habitat provenant du chauffage par des carburants de la biomasse dans des feux ouverts constitue un facteur de risque connu de maladies pulmonaires obstructives chroniques (COPD) dans les pays en développement.

OBJECTIF : Estimer la prévalence des symptômes respiratoires ainsi que la fonction pulmonaire chez les femmes du Guatemala rural et décrire les méthodes et les problèmes pratiques associés à l'évaluation de la santé respiratoire.

SCHÉMA : On a colligé dans une étude transversale les informations concernant les symptômes respiratoires et la fonction pulmonaire ainsi que les mesures individuelles d'exposition chez 350 femmes indiennes Maya âgées de 15 à 50 ans et utilisant des feux ouverts traditionnels.

RÉSULTATS : Chez ces femmes exposées à la pollution de l'air de l'habitat depuis la naissance, la prévalence de la toux est relativement élevée (22,6%), comme celle des crachats (15,1%), des sifflements (25,1%) et de l'oppression thoracique (31,4%). Les symptômes respiratoires sont en association positive avec le degré d'exposition. La fonction pulmonaire est meilleure que celle de la population de référence la plus utilisable (volume expiratoire maximum par seconde [VEMS] +4,5% au dessus des valeurs prédites et capacité vitale forcée [CVF] +4,2%). Chez une femme seulement le rapport VEMS/CVF était inférieur à 70%.

CONCLUSIONS : Selon les directives du Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD), chez près d'un tiers de ces jeunes femmes non-fumeuses le niveau de risque était de degré zéro pour le développement de la COPD. Les problèmes méthodologiques rencontrés pendant l'étude éclairent l'importance de la standardisation des approches pour une adaptation locale des questionnaires existants pour étudier la santé respiratoire dans les zones rurales des pays en développement.

RESUMEN

MARCO DE REFERENCIA : La contaminación atmosférica en el interior producida por la combustión de biomasa en fuegos abiertos es un conocido factor de riesgo para el desarrollo de la enfermedad obstructiva crónica (EPOC) en países en desarrollo.

OBJETIVO : Estimar la prevalencia de síntomas respiratorios y función pulmonar en mujeres en una zona rural de Guatemala, y describir los métodos y problemas prácticos asociados al estudio de la salud respiratoria.

DISEÑO : Estudio transversal de síntomas respiratorios, función pulmonar y medidas de exposición individuales en 350 mujeres Mayas de 15–50 años usando diariamente fuegos abiertos tradicionales.

RESULTADOS : Estas mujeres, expuestas a contaminación

atmosférica en el interior desde su nacimiento, presentaban prevalencias de tos (22,6%), flema (15,1%), sibilancias (25,1%) y opresión en el pecho (31,4%) relativamente altas. Se encontró una asociación positiva entre los síntomas respiratorios y los niveles de exposición. Los niveles de función pulmonar fueron más elevados que los de la población de referencia más adecuada (+4,5% de promedio sobre el volumen expiratorio forzado en 1 segundo [FEV_1] predicho, y +4,2% sobre la capacidad vital forzada [FVC]). Sólo una mujer presentó un ratio FEV_1/FVC < 70%.

CONCLUSIONES: De acuerdo con las pautas de la Iniciativa Global para las Enfermedades Pulmonares Crónicas (GOLD), casi una tercera parte de estas mujeres jóvenes no fumadoras estaría en riesgo (estadio 0) de desarrollar EPOC. Los problemas metodológicos encontrados durante el estudio subrayan la importancia de estandarizar la adaptación de cuestionarios preestablecidos a las comunidades locales para poder estudiar la salud pulmonar en áreas rurales de países en desarrollo.