Appendix1. English version of the questionnaire (FRESH AIR Uganda)

Please note: This is the English version used in Uganda. In Kyrgyzstan, a Russian translation was used.

Screening Questionnaire FRESH AIR Uganda

Interviewer: Date of screening:

Name patient:	ID number:
Date of birth:	Age:

Married: ☐ yes ☐ no Number of children alive……deceased…….

Gender: ☐ male ☐ female

Weight:……kg Length:……cm BMI:……

Highest education level: ……

Occupation:……Tribal origin:……

Village name:……Parish……County……

Residence: ☐ rural ☐ urban ☐ sub urban

Respiratory symptoms:

Cough

1a .Do you cough several times most day? ☐ yes ☐ no

1b. If 'yes', when do you cough? ☐ I wake up with cough

☐ in the morning

☐ during the day

☐ during the night

2. Is it a chronic cough? ☐ yes ☐ no

3. Do you cough with exertion? ☐ yes ☐ no

4. For how long have you been coughing? ……years

Sputum

5a. Do you bring up phlegm or mucus on most days? ☐ yes ☐ no

5b. If 'yes', when do you bring up phlegm or mucus: ☐ first thing in the morning

☐ during the day

6. Do you have chronic phlegm? ☐ yes ☐ no

7. Do you have phlegm of mucus when you don't have a cold? ☐ yes ☐ no

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Wheezing

8a. Do you wheeze or have any whistling on the chest? ☐ yes ☐ no

8b. For how long do you wheeze or have any whistling on the chest? …… years

9. Do you wake up with wheezing? ☐ yes ☐ no

10. Have you been at all breathless when wheezing was present? ☐ yes ☐ no

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Shortness of breath:

11. Do you get out of breath more easily than others your age? ☐ yes ☐ no

MRC breathlessness Scale

12. Which of the following statements best describes your situation?

☐ *1* *Not troubled by breathlessness except on strenuous exercise*

☐ *2* *Short of breath when hurrying on the level or walking up a slight hill*

☐ *3* *Walks slower than most people on the level, stops after a mile or so, or stops after 15 minutes walking at own pace*

☐ *4* *Stops for breath after walking about 100 yards or after walking a few minutes in level ground*

☐ *5* *Too breathless to leave house, or breathless when undressing*

Exacerbation(s)

13a. Did you have periods of increased breathing difficulty with increased cough with or without sputum during the last 12 months? ☐ yes ☐ no

13b. If 'yes', how many times did you have such a period during the last 12 months?

…….times

Tobacco use:

14a. Do you smoke? ☐ current smoker how many per day……..
☐ former smoker how many per day……..
☐ passive smoker ☐ never smoker

14b. If you currently smoke or have smoked, how many years?……..years

14c. Which products: ☐ cigarettes ☐ cigars
☐ pipes ☐ snuff
☐ chewing tobacco ☐ water pipe
☐ cannabis ☐ leaves
☐ local tobacco products, name: ……

Biomass fuel use

15. ☐ indoor biomass fuel smoke: years of exposure …….

16. ☐ outdoor biomass fuel smoke: years of exposure …….

17. Do you have a chimney in your kitchen? ☐ yes ☐ no

18a. Do you burn wood? ☐ yes ☐ no
18b. Do you burn dung? ☐ yes ☐ no
18c. Do you burn LPG? ☐ yes ☐ no
18d. Do you burn grass? ☐ yes ☐ no
18e. Do you burn crop residues? ☐ yes ☐ no
18f. Do you burn natural gas? ☐ yes ☐ no
18g. Do you burn charcoal? ☐ yes ☐ no
18h. Do you burn kerosene? ☐ yes ☐ no
18i. Do you use electricity? ☐ yes ☐ no

19. Time spent cooking indoor ……hours/day

20. Time spent cooking <u>outdoor</u> ……..hours/day

21. Do you use biomass fuel for heating? ☐ yes ☐ no

22. Where do you sleep?
☐ same room as kitchen
☐ separate room but in the same house as the kitchen
☐ separate house from the kitchen

Tuberculosis

23. Did you ever have tuberculosis?
☐ Yes, I have active TB now.
☐ Yes, I had TB in the past but was treated and I am cured now.
☐ No, I never had TB
☐ I don't know

24a. Is documentation about your TB present? ☐ yes ☐ no 24b. if 'yes', the documentation is a

☐ a TB card
☐ a TB discharge card
☐ lab reports
☐ others……

<u>Disease history:</u>

26. Did you (recently?) have a cold gone to the chest: ☐ yes ☐ no

27a. Do you have allergies: ☐ yes ☐ no

27b. Which allergies do you have?

……

28. How often do you have a chest infection:

- ☐ more than 2 per year
- ☐ 1 or 2 per year
- ☐ less than 1 per year

29. Do you receive treatment for breathing?

- ☐ yes
- ☐ no

30. Did you have pulmonary problems in childhood?

- ☐ yes
- ☐ no

31. What respiratory diagnosis did you receive in the past?

……

Comorbidity

32. Do you have heart failure?

- ☐ yes
- ☐ no

33. Do you have AIDS/HIV?

- ☐ yes
- ☐ no

34 a. Do you have other comorbidities?

- ☐ yes
- ☐ no

34 b. Please describe any other comorbidities

……

Medication:

35a. Do you use medication? ☐ yes ☐ no

35b. What is de name of the medication that you use?.....

……

……

36a. Were you admitted to hospital during the last 2 years? ☐ yes ☐ no

36b. If you were admitted, please describe for what reason(s)

……

……

36c. If you were admitted, please describe how often this happened during the last 2 years:

.....

37a. Did you visit healthcenters during the last 2 years? ☐ yes ☐ no

37b. If you did, please describe for what reason(s)

……
……..

37c. If you did, please describe how often this happened during the last 2 years:

.....

38. CCQ score: Total score ……

Symptom score (number 1, 2, 5 and 6) ……..

Mental state score (number 3 and 4) ……..

Functional state score (number 7, 8, 9 and 10) ……

Spirometry

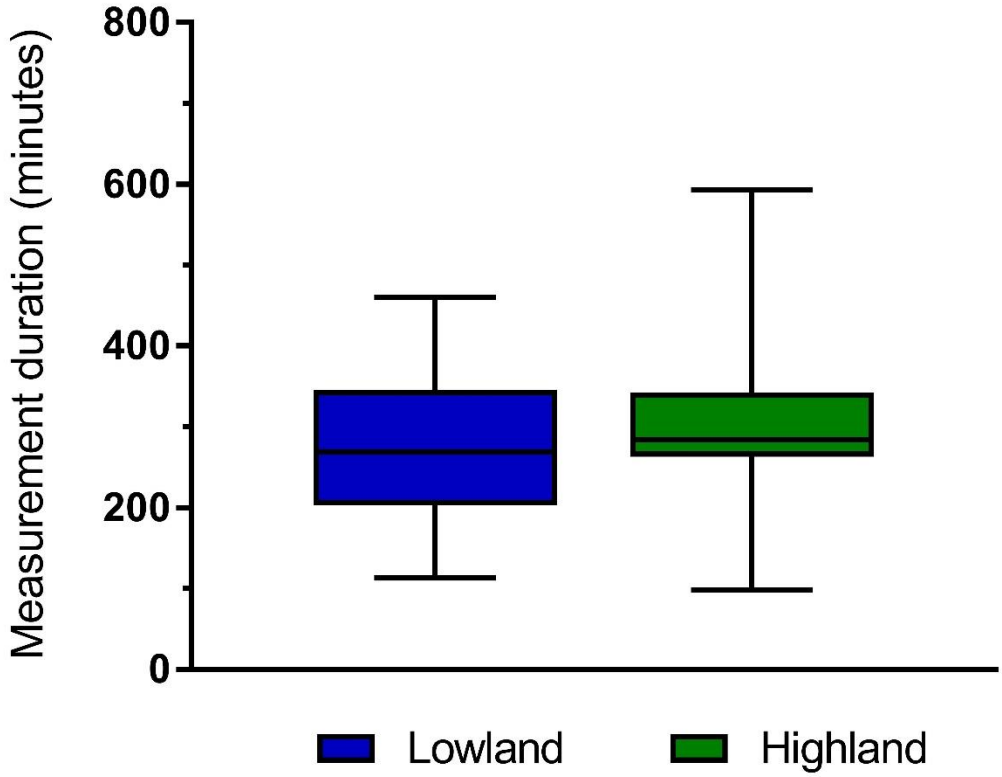
preBD: *FVC……Lt (……%) FEV_1……Lt (……%) FEV_1/FVC ratio……..*

postBD: *FVC……Lt (……%) FEV_1……Lt (……%) FEV_1/FVC ratio……..*

Reversibility……

Diagnosis	☐ *COPD, GOLD stage……. without reversible component*
	☐ *COPD, GOLD stage……. with reversible component*
	☐ *asthma ☐ no objective evidence of obstructive lung disease*
	☐ *restrictive*

Appendix 2. Figure E1. Duration of $PM_{2.5}$-measurements per setting



Appendix 3. Cooking- and heating circumstances

Cooking and heating circumstances relating to household air pollution, across altitudes

Highlanders more commonly used solid fuels for cooking and heating than lowlanders (100% vs. 75.1%; $p<0.001$), particularly dung and wood, and their gas and electricity use was significantly lower (Table E1). Almost all highlanders cooked exclusively on open fires (95.0% vs. 0.0%; $p<0.001$) or griddle stoves (100% vs. 66.3%; $p<0.001$), and less on improved single pot stoves (34.2% vs. 74.1%; $p<0.001$). In both areas, almost all participants cooked indoors (100% in the highlands and 99.0% in the lowlands; $p=0.242$). Highlanders more commonly cooked in the same room used for living and sleeping (62.8% vs. 4.1%; $p<0.001$). Most of the participants had some type of ventilation in the room where the stove was used; in the highlands this was significantly less often an open door or window (46.7% vs. 93.3%; $p<0.001$), while a room with eaves spaces was more popular (54.8% vs. 1.6%; $p<0.001$).

Table E1: Risk factors for household air pollution

	Lowlands n = 193 (%)	Highlands n = 199 (%)	p-Value
Solid fuel use	145 (75.1)	199 (100.0)	<0.001
Heating*	133 (68.9)	199 (100.0)	*<0.001*
- *Dung*	*28 (14.5)*	*199 (100.0)*	*<0.001*
- *Grass*	*0*	*0*	-
- *Crop residues*	*0*	*11 (5.5)*	*0.001*
- *Wood*	*124 (64.2)*	*177 (88.9)*	*<0.001*
- *Coal*	*133 (68.9)*	*109 (54.8)*	*0.004*
Cooking*	46 (23.8)	196 (98.5)	*<0.001*
- *Dung*	*25 (13.0)*	191 (96.0)	*<0.001*
- *Grass*	*0*	*6 (3.0)*	*0.030*
- *Crop residues*	*0*	*3 (1.5)*	*0.248*
- *Wood*	*26 (13.5)*	*100 (50.3)*	*<0.001*
- *Coal*	*24 (12.4)*	*70 (35.2)*	*<0.001*
Non-solid fuel use*	193 (100.0)	82 (41.2)	<0.001
- *Kerosene*	*0*	*7 (3.5)*	*0.015*
- *Gas (LPG)*	*64 (33.2)*	*7 (3.5)*	*<0.001*
- *Electricity*	*193 (100.0)*	*75 (37.7)*	*<0.001*
Stove used for cooking*			
- Open fire	0 (0.0)	189 (95.0)	<0.001
- Surrounded fire	0 (0.0)	19 (9.5)	<0.001
- Improved single pot stove	143 (74.1)	68 (34.2)	<0.001
- Improved multiple pot stove	37 (19.2)	20 (10.1)	0.010
- Griddle stove	128 (66.3)	199 (100.0)	<0.001
Cooking location*			
- Outdoors	4 (2.1)	32 (16.1)	<0.001
- Indoors	191 (99.0)	199 (100.0)	0.242
➢ *Time cooking indoors (hours/day), median [IQR]*	*2.0 [1.0; 2.0]*	*2.0 [0.0; 4.0]*	*0.563*
➢ *In same room as living/sleeping room*	*8 (4.1)*	*125 (62.8)*	*<0.001*
Presence of hood/chimney	157 (81.3)	164 (82.4)	0.784
Ventilation*			
- Closed room	5 (2.6)	3 (1.5)	0.497
- Room with open door/window	180 (93.3)	93 (46.7)	<0.001
- Room with ≤3 walls	5 (2.6)	16 (8.0)	0.017
- Room with eaves spaces	3 (1.6)	109 (54.8)	<0.001

LPG = liquefied petroleum gas; IQR = interquartile range. Values are n (%) unless stated otherwise. *Multiple answers could be given to this question. Sub-questions are shown in italics. There were no missing values.

Appendix 4. COPD and its risk factors

Figure E1: COPD prevalence in lowlands and highlands by sex and smoking status

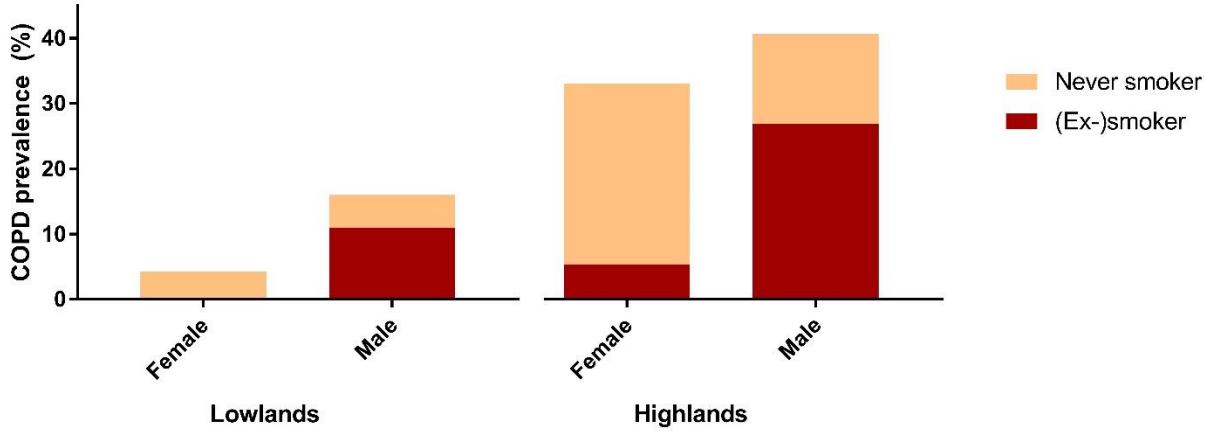


Table E1: Univariable and multivariable predictors for COPD

	Univariable OR (95% CI)	**P-Value**	**Multivariable** OR (95% CI)	**P-Value**
Age (per year increase)	1.055 (1.036-1.073)	<0.001	1.058 (1.037-1.079)	<0.001
Male	1.460 (1.041-2.047)	0.028	1.614 (0.889-2.930)	0.116
Pack years	1.031 (1.011-1.052)	0.002	1.037 (1.005-1.070)	0.024
Higher education*	1.483 (0.800-2.752)	0.211	1.107 (0.376-3.264)	0.853
Working in primary/secondary sector	1.194 (0.699-2.039)	0.516	0.908 (0.432-1.908)	0.798
High altitude	5.064 (2.217-11.568)	<0.001	3.406 (1.483-7.825)	0.004
HAP – middle exposure group (reference = lowest exposure group)	3.433 (1.329-8.866)	0.011	2.372 (0.763-7.377)	0.136
HAP – highest exposure group (reference = lowest exposure group)	6.714 (2.614-17.249)	<0.001	3.174 (1.061-9.493)	0.039

COPD (n = 91) vs. no COPD (n = 293). Generalised Estimating Equation analyses adjusted for a clustering effect within households. *The highest level of completed education above secondary education. Household air pollution (HAP) was categorised into a lowest, middle and highest tertiles of exposure, respectively with time-weighted average concentrations of particulate matter$_{2.5}$ of ≤72, >72-293 and >293 µg/m^3.

Figure E2: Lung function and particulate matter exposure