Drivers of respiratory healthcare demand in Acre state, Brazilian Amazon: a cross-sectional study

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Abstract

1.1 Background

The scant knowledge on drivers of demand for respiratory healthcare in Brazilian Amazon, where the gap of human and physical healthcare resources is wide, is expanded with two surveys conducted at the west of the region in Acre state. Potential drivers, informed by a review of twelve recent papers, were classified in seven categories comprising the individual, household, community and macroeconomic dimensions.

1.2 Methods

On-field quantitative structured surveys were conducted in 2017 and 2019 based in coupled conglomerate-quota-randomization sampling, with support of community health agents. Adults responded about their own or their children's health. Whether physician care was sought to treat the latest episode of respiratory illnesses or of dry cough was analysed statistically with multiple non-linear regressions having as covariates the potential predictors informed by literature.

1.3 Results

The propensity to seek healthcare and to purchase medication was larger when targeting children rather than adults. Influenza was the most frequent cause of latest episodes of respiratory illnesses and dry cough, what makes the below-40% healthcare seeking rate worrying as it may sustain a considerable local contagion rate. Illnesses' severity, including the pain experienced, were the main predictors, revealing that subjective perception exerted stronger influence than objective individual's and households' characteristics. The insignificance of education indicated that it was not the sole determinant of health literacy, the latter a more important driver, according to literature. Income was insignificant due to respondents relying almost uniquely on free healthcare offered by the Brazilian Health System.

1.4 Conclusions

Results suggest that subjective underestimation of respiratory illnesses' consequences for oneself and for local society could motivate a refusal to seek treatment. This is in line with some previous studies but departs from those overemphasizing the role of objective factors. Social consequences, of, for instance, macroeconomic nature, needs highlighting, based on studies detecting a long-run relationship between healthcare demand, health and economic performance at national level. Microeconomic behavioural policy is needed to change subjective perceptions of symptoms and illnesses with nudges and educational interventions.

Background

2.0 Motivation

Respiratory illnesses are among the main sources of the global burden of disease (according with the Fig. 2 in Vos et al., 2020), the same being true in Brazil where they are the third main cause of mortality (DATASUS, 2021b). A recent large international survey, conducted by Velden et al. (2020), with 5,196 individuals from seven developed and seven developing countries including Brazil, estimated that only 30% of patients with sore throat, a symptom associated with Influenza-like illnesses and acute respiratory illnesses (Zhang et al., 2020), seek a general practitioner. Similarly high rates of refusal and also delay in seeking care were found in national-level surveys (Datiko et al., 2020, Seid and Metaferia, 2018, Zhang et al., 2020, Suka et al., 2016). These behaviours besides prolonging the impairment of own health and labour productivity (Piabuo and Tieguhong, 2017), and increasing risk of own mortality, which already have social consequences, may also increase contagion locally in case of viral and bacterial diseases (Datiko et al., 2020, Seid and Metaferia, 2018).

Such negative social effects are more probable in less developed regions such as the Brazilian Amazon. There, the per capita number of families receiving poverty alleviation cash transfers is 1.5 that of the whole country (MC, 2021, IBGE, 2021) and large scale exposure to pollution from agricultural fires is seasonal and comparable in its intensity to exposure to urban pollution in megacities such as London and Mexico City (Morello, 2021, Gonçalves et al., 2018). Also, the prevalence of both tuberculosis (TB) and Influenza is 1.3 fold larger than the country's average (of six cases per 10,000 inhabitants; SINAN, 2021, IBGE, 2021). Contradictorily, the greater health challenge coincides with a smaller endowment of health resources. In the Amazon, the number of physicians per capita is thirty fold below the world average and 0.09 hospital beds per 1,000 inhabitants are available as compared with 3.2 in the world (WB, 2021, DATASUS, 2021).

Besides the supply-side gap, previous studies in Brazil have also detected demand-side barriers to healthcare, such as low capacity to recognize, both in oneself and in children cared for, diseases, their severity and contagiousness (Passos et al., 2018, Borges et al., 2018), limited capacity to obtain and use health-relevant information, mainly by the low-educated (Apolinario et al., 2013, Almeida et al., 2019), household income incompatible with transport costs required by visiting a health facility, which is more likely for rural residents (Parry et al., 2018), and reliance on self-medication (Arrais et al., 2016).

Nevertheless, none of these studies are based on patient surveys uncovering factors enabling and disabling care seeking for respiratory illnesses, which are rare in Brazil, and, as far as it could be assessed, unavailable for the Amazonian region. Nevertheless, in order to stimulate healthcare seeking, there is need to detect patients' characteristics predicting whether such course of action would be spontaneously carried out or not. This is required for knowing which social groups should be prioritized by specific interventions (Diaz et al., 2013), such as behavioural nudges (Schmidt, 2019) and educational campaigns (Suka et al., 2016), and how these should be designed. Seeking to fill such gaps, this study detects predictors of healthcare seeking among respiratory ill individuals of Acre state, western Amazon.

2.2 Factors of demand for health care

A total of twelve recently published papers were resorted to in order to identify potential factors influencing the demand for healthcare, as basis for selecting covariates for quantitative analysis and for discussing and complementing the results. Summaries of all papers are provided in the Additional Information and here a short overall synthesis and taxonomy are presented.

The papers revised highlighted the relevance of multiple factors including characteristics of patients, of social groups (households and communities), social context and macroeconomic features such as development and economic growth level (Table 1). These factors exert effect through multiple mechanisms at individual (e.g., identification of illness from symptoms), household (e.g., women autonomy to seek care for children), community (e.g., support for seeking care) and macroeconomic level (e.g., economic growth expanding national health systems). Therefore, the demand for health care is both a multidimensional and multi-level process which can hardly be comprehensively apprehended with only one research method. This is clear from the larger diversity of factors in the literature as compared with the datasets used in this paper (Table 1). Nevertheless it is also clear that a significant fraction of factors is captured, with the uncaptured (macroeconomic) factors being left to be accounted for in the results' discussion (Sect. 5). Also, the focus on demand-side variables is coherent with the consulted literature, especially with the finding by Datiko et al. (2020) and Seid and Metaferia (2018) that delay in receiving TB treatment was mostly demand-driven.

Table 1

Classification of factors influencing demand for healthcare in previous studies and in this paper (demand enablers are indicated with “+” and disablers with “-”)

Papers	Class	Factors in the literature	Factors in this paper
DAT20, NAK20, SUK16, SEI18, NGH17, D20, TET17	Individual characteristics	.Education (+) [TET17] .Age (+) [SEI18, DAT20] (population ageing contributes for increased health expenditure at the macroeconomic level) (+) [NGH17] .Income (+) .Poverty (-)	.Education .Age .Income .Poverty .Gender
SUK16, ABD18, NGH17, CHE21, ZHA20	Health level and condition	.Chronic disease (+) .Interaction with ill individuals (+) .Illness stigmatization (-) .Anxiety (a positive predictor of TB stigmatization) [CHE21] (-) .Health level of the community and capacity to support healthcare seeking (+)	.Serious lung diseases (including chronic diseases) .Subjective pain level caused by respiratory illness or dry cough .Symptoms caused by respiratory illness .Duration of respiratory illness and dry cough
D20, DAT20, SEI18, SUK16	Health knowledge	.Ability to identify symptoms, their severity, linkage with illnesses and causes (+) .Limited knowledge about prevention and treatment (-) .Degree of "health literacy" or capacity to obtain and use information in order to ensure good health [SUK16] (+)	Proxied by education

Note: citations are abbreviated as D20 ≡ Dougherty et al. (2020), CHE21 ≡ Chen et al. (2021), DAT20 ≡ Datiko et al. (2020), NAK20 ≡ Nakovics et al. (2020), SUK16 ≡ Suka et al. (2016), PIA17 ≡ Piabuo and Tieguhong (2017), ABD17 ≡ Abdullah et al. (2017), SEI18 ≡ Seid and Metaferia (2018), NGH17 ≡ Nghiem and Conelly (2017), TET17 ≡ Tetteh et al. (2017), ZHA20 ≡ Zhang et al. (2020), DIA13 ≡ Diaz et al. (2013). Detailed summary of papers in the Additional Information.

Papers	Class	Factors in the literature	Factors in this paper
D20, NAK20, CHE21, SUK16	Intra-household relationships, gender and communities	.Mothers' agency to seek healthcare (-) and control of household budget (+); .Household size (-) .Female gender (-/+) .Support from relatives in seeking healthcare and overcoming stigmatization (+) .Social capital [SUK16] (+)	.Household size .Gender of respondent .Gender of child's caregiver
D20, CHE21, NAK20, DAT20, DIA13	Access to care (including relationship with providers and treatment cost)	.Previous contacts (+) and good personal relations with healthcare provider (+), including good patient-physician communication (+) [CHE21] .Health facility distance (-) .Treatment cost (-), co-payment or any out-of-pocket disbursement being required (-) .Opportunity cost of treatment (specifically transport cost) (-) .Waiting time (-)	.Facility distance or travel time .Waiting time .Has at least a moderate amount of time available to seek healthcare .Health insurance
D20, NAK20, TET17, DIA13	Non-professional care (traditional medicine and alternative, self-prescribed and over-the-counter medication)	.Resort to self-made medication (including traditional plant and herb based remedies) (-) and self-medication with either traditional or ordinary drugs (-) [SEI18]; .Resort to traditional healers and "chemists" (medication vendors) (-) .Relative distance of formal and non-formal care options (e.g., "chemist"/drug vendors are inside the community and health facility is outside) (-)	Resort to non-professional healthcare (mostly traditional medication)

Note: citations are abbreviated as D20 ≡ Dougherty et al. (2020), CHE21 ≡ Chen et al. (2021), DAT20 ≡ Datiko et al. (2020), NAK20 ≡ Nakovics et al. (2020), SUK16 ≡ Suka et al. (2016), DIA17 ≡ Piabuo and Tieguhong (2017), ABD17 ≡ Abdullah et al. (2017), SEI18 ≡ Seid and Metaferia (2018), NGH17 ≡ Nghiem and Conelly (2017), TET17 ≡ Tetteh et al. (2017), ZHA20 ≡ Zhang et al. (2020), DIA13 ≡ Diaz et al. (2013). Detailed summary of papers in the Additional Information.

Papers	Class	Factors in the literature	Factors in this paper
PIA17, NGH17	Macroeconomic factors	.GDP (predictor of public health care expenditure) [PIA17] (+) .Labour force (idem) [PIA 17] (+) .Technological progress (which fosters economic growth and thus health expenditure) [PIA 17] (+)	Not addressed
Note: citations are abbreviated as D20 ≡ Dougherty et al. (2020), CHE21 ≡ Chen et al. (2021), DAT20 ≡ Datiko et al. (2020), NAK20 ≡ Nakovics et al. (2020), SUK16 ≡ Suka et al. (2016), PIA17 ≡ Piabuo and Tieguhong (2017), ABD17 ≡ Abdullah et al. (2017), SEI18 ≡ Seid and Metaferia (2018), NGH17 ≡ Nghiem and Conelly (2017), TET17 ≡ Tetteh et al. (2017), ZHA20 ≡ Zhang et al. (2020), DIA13 ≡ Diaz et al. (2013). Detailed summary of papers in the Additional Information.			

2.3 Region of study

Acre state, western Brazilian Amazon, is amongst the least developed and healthcare-endowed states of Brazil, ranking 21st of the countries' 27 states in human development (PNUD, 2021) and 23rd in physicians per capita (DATASUS, 2021, IBGE, 2021). Despite the limited resources, respiratory illnesses are targeted by multiple actions, including annual vaccination campaigns (SI-PNI, 2021), the Family Health primary care program including home visits by community health agents (CHAs), whom provide key advice on, for instance, home-based preventive measures, healthcare seeking and administration of prescribed drugs. Medication for asthma and rhinitis is also subsidized (SUS, 2021).

Method

3.1 Respiratory illness survey

A structured quantitative survey was conducted in Rio Branco (~ 400k inhabitants), the most populous town of Acre state, from March to July 2017, following a pilot wave in October-November 2016 with 146 participants. The goal was to elicit the willingness to pay (WTP) for avoiding the recurrence of the most recent respiratory illness episode. A hypothetical vaccine was offered as a product capable of yielding full prevention. Since WTP estimates are not directly related with the goal of this paper, only the survey's first module, on the description of the illness episode, and the third module, on socioeconomic and health covariates are here detailed.

The sample was selected with a mix of conglomerate-quota-randomization with the help of local CHAs (details are found in Morello et al. 2019, SI, Sect. 4). In the first stage, ten neighbourhoods of Rio Branco urban perimeter were selected, initially randomly, and, afterwards, whether CHA support proved insufficient, new neighbourhoods were introduced as replacements, being selected in order to ensure representativeness of income and respiratory illnesses' prevalence at whole perimeter level. The shares of eight combinations of two genders and four age intervals (0 to 4, 5 to 17, 18 to 65, above 65) in the study

region Census population were moderately altered to end with considerable numbers of sampled children and elderly. Such quotas, after multiplied by 18, which was the number of interviews a CHA could support, were informed to such professionals, whom were instructed to write down a patients' list with a size two to fourfold that of each quota. Research assistants then drew randomly, for each age-gender group, a number of individuals matching the quota. The interviews were then conducted in interviewees' houses, and whether selected individuals were not found or refused to participate, the next listed subject of the age-gender group was approached (what was repeated in case of a new failure). Enumerators were accompanied by CHAs in interviews, what both minimized rejection and helped, whenever needed, in rephrasing questions in ways more understandable to respondents.

A total of 519 interviews that were valid for the purposes of this paper were conducted. In 278 interviews, adults responded about illnesses acquired by them and in the remaining 241, about illness acquired by their children. Caregivers, generally mothers or fathers, were interviewed on behalf of children.

Now turning to the questionnaire, its first module retrieved descriptive data on the most recent illnesses episode, including (i) a sequence of yes/no/can't remember questions on whether 21 symptoms were felt, (ii) a three-point Likert scale on subjective pain experienced, (iii) symptoms beginning date and duration, (iv) whether medical care was sought and (v) diagnosed illness. Children aged above five years were asked to confirm caregivers' responses. The third module asked about age, household size, years of schooling (according with the Brazilian educational system), and household income, which was asked in a comprehensive way comprising six main income sources. This was complemented by the inquiry on the ownership of durable goods that were highly related with income according with the National Household Survey (IBGE, 2016). Additional questions covered smoking, health insurance, distance to the health unit where treatment for first module's illness could be found and seven serious lung diseases (asthma, bronchitis, lung cancer, chronic obstructive pulmonary disease, emphysema, pneumonia and TB).

3.2 Cough survey

From December 2019 to middle March 2020, a new survey designed as an improvement of the one described in the previous section was run also in Acre state, but this time including also its second most populous municipality, Cruzeiro do Sul. The survey consisted in a discrete choice experiment estimating the WTP for a hypothetical remedy able to reduce the number of days with dry cough. Thus, its main particularity was the focus on one single respiratory symptom, which was selected from medical literature as highly recurrent across respiratory illnesses (Balbani, 2011, Morice, 2002). Dry cough was considered because it is more likely that suppression be sought by treatment in the case of dry rather than wet (with phlegm) cough (Equinozzi, 2006, Muckadan et al., 2012, Padma et al., 2013), what made selection of the attributes of the remedy easier (with antitussive drugs being taken as basis).

The same approaches of the respiratory illness survey for sampling and for including children were adopted. The modules used in this paper were near equivalent as in the case of the previous survey, except for focussing on the latest dry cough episode and for having inquired about income in the form of

eight intervals, whose medium points were used in analysis, instead of the open-ended format adopted in the previous survey. Before the final stage of the survey, a pre-pilot comprising 33 interviews was conducted in July 2019 and a pilot with 54 interviews in December 2020. The latter is here included as part of the analysed data due to minor differences with the questionnaire applied in the final stage.

3.3 Data quality and analysis

In the respiratory illness survey, two research assistants were trained by the first author and monitored on-field during the pilot wave. These last-year undergraduate students were also qualified to train enumerators. All questionnaires were revised after applied and, if needed, the enumerator returned to respondents' houses, or the questionnaire was discarded. In the two cases, the decision was based both in the missing or ill-filled fields and in the last questionnaire module, the latter filled by the own enumerator alone, which accessed the quality of the responses received. In the cough survey, similar procedures were adopted, with the exception that the whole team was trained by the first author himself (except for one enumerator that conducted 18 interviews).

Standard central tendency, position and dispersion statistics were applied to describe the data. Proportion difference test, based in the standard normal distribution, was applied to compare adults and children subsamples. Econometric analysis was pursued with standard index multivariate regressions for discrete dependent variables (whether healthcare was sought), whose disturbances followed either the Gaussian cumulative distribution function (probit) or the logistic function (logit). Estimators' standard errors were robust for heteroscedasticity (Cameron and Trivedi, 2003, Chap. 14, Wooldridge, 2002, Chap. 15). Only models that were globally significant, as assessed with a chi-square test of nullity of all covariates' coefficients (Wooldridge, 2002, Sect. 15.5.1) are reported.

Results

4.1 Surveys' description

In the respiratory illnesses survey, the average respondent had 30 years and an income 2.5 fold the minimum wage, near 30% received poverty alleviation cash transfers, and 62% had the lower secondary educational level or above (Table 2). The latest respiratory illnesses reported by participants caused 10 symptoms, lasted 10 days and inflicted moderate to extreme pain in 95% of cases. Only 14% of the episodes occurred in the dry season (i.e., from June to September, in the case of Acre state). Only 38% of respondents sought healthcare, 32% when the illness was acquired by an adult and 46% when a child was the patient, a statistically significant difference ($p\text{-value} < 5\%$). A diagnosis was provided in 98% of cases and Influenza (or cold) was the most recurrent disease (50%). All symptoms with high frequency ($> 50\%$) either attacked the nose, throat, caused cough (dry and wet), fever, headache, body aches, shortness of breath and malaise.

In the cough survey, income was smaller, twofold the minimum wage, in consonance with a higher rate of poverty of 47% and age and education were near-equivalent to the respiratory illness survey (Table 3). In

average, the most recent dry cough episode lasted 10 days, caused moderate to extreme pain in 78% of cases and occurred in the dry season in 38% of cases. Overall healthcare seeking rate was of 33%, 26% for adults and 39% for children, a significant difference at 10% significance level and the rate of (pharmacy-purchased) medication was 66%, 57% for adults and 75% for children, a statistically significant difference at 5% level. Diagnosis was obtained in 95% of cases with Influenza being again the most recurrent disease (47%).

In summary, most of respondents were of low to medium income, reported a moderately painful Influenza episode during 10 days and were more likely to seek care and purchase medication for children rather than for adults.

Table 2
Statistical summary of variables (respiratory illness survey)

Variable	Whole sample		Only children	
	Mean (SD)	Min-max	Mean (SD)	Min-max
Sought medical care	0.38(0.49)	0–1	0.46(0.5)	0–1
Illness' duration	9.83(14.07)	1-180	8.21(6.38)	1–60
Illness' number of symptoms	10.39(4.1)	1–20	10.09(3.87)	2–19
Illness caused extreme pain	0.18(0.38)	0–1	0.14(0.34)	0–1
Age	29.61(23.93)	0.33-89	8.28(4.87)	0.33-17
Age squared	1448.29(1828.93)	0.11–7921	92.19(87.24)	0.11–289
Female	0.5(0.5)	0–1	0.5(0.5)	0–1
Ever had lung disease	0.37(0.48)	0–1	0.35(0.48)	0–1
Years of schooling	7.83(4.3)	0–15	8.81(3.78)	0–15
Household income (log.)	7.49(0.75)	4.61–10.17	7.46(0.76)	4.61–10.17
Household size	3.98(1.85)	1–15	4.51(1.65)	1–15
Poor	0.29(0.45)	0–1	0.4(0.49)	0–1
Has health insurance	0.11(0.31)	0–1	0.1(0.31)	0–1
Distance to health unit (metres)	1535.24(1999.03)	14.94-13648.26	1660.2(2084.22)	25.66-10023.73
Illness occurred in the dry season	0.13(0.34)	0–1		
Female * household size	2.03(2.42)	0–13		
Mother answered			0.74(0.44)	0–1
Father answered			0.11(0.32)	0–1
Note: observations amounted to 519 for the whole sample and 241 for children-only.				

Table 3
Statistical summary of variables (cough survey)

Variable	Whole sample		Only children	
	Mean (SD)	Min-max	Mean (SD)	Min-max
Sought medical care	0.33(0.47)	0–1	0.38(0.49)	0–1
Cough duration	10.36(12.95)	1-120	9.22(8.46)	1–60
Cough caused extreme pain	0.23(0.42)	0–1	0.25(0.43)	0–1
Age	27.67(21.92)	1–81	9.44(4.66)	1–17
Age squared	1243.24(1588.51)	1-6561	110.52(89.25)	1-289
Female	0.52(0.5)	0–1	0.54(0.5)	0–1
Ever had lung disease	0.3(0.46)	0–1	0.28(0.45)	0–1
Years of schooling	7.57(4.29)	0–15	7.99(4.25)	0–15
Household income (log.)	7.2(0.99)	0-9.85	7.2(0.84)	5.02–9.11
Household size	4.49(1.85)	1–11	5.2(1.92)	2–11
Has time to seek healthcare	0.76(0.43)	0–1	0.79(0.41)	0–1
Poor	0.47(0.5)	0–1	0.56(0.5)	0–1
Has health insurance	0.09(0.29)	0–1	0.08(0.27)	0–1
Time to health unit	14.38(14.25)	1-100	15.38(15.31)	2-100
Waiting time in the health unit	89.27(84.24)	1-600	92.99(90.82)	1-600
Resorts to non-professional care	0.05(0.23)	0–1	0.71(0.46)	
Cough occurred in the dry season	0.34(0.47)	0–1		
Female * household size	2.48(2.8)	0–11		
Mother answered			0.71(0.46)	0–1
Father answered			0.1(0.3)	0–1
Note: observations amounted to 168 and, in the case of children-only, 89.				

4.2 Econometric analysis

Three models were estimated for each survey. First, a baseline model with all factors suggested by the literature review that could be retrieved in the surveys (as in Table 1 above). Second, an extended version of the former including a female gender vs household size interaction in order to capture that the more members are in the household, the smaller may be the time female members allocate to domestic tasks

and thus the larger the time available to seek healthcare (this captures intra-household effects as in Table 1). Third, a children only model to test whether the kinship tie between child and respondent, supposedly the caregiver, i.e., whether the latter was the mother, father or other relative, influenced healthcare seeking (which again captures the influence of intra-household phenomena).

Results in Tables 4 and 5 show that healthcare seeking was driven mainly, considering the two surveys, by health condition characteristics, first of all, subjective pain but also severity as measured by number of symptoms (significant only in the respiratory illness survey) or duration. Factors that were significant only in one survey corresponded to respondents' health, specifically whether a lung disease was ever experienced (cough survey) and to individual characteristics, specifically age (respiratory illness survey), and, at last, household characteristics, in the case, household size (cough survey). In addition, in the cough survey, whether the symptom occurred in the dry season increased care seeking, as expected, due to the better condition of roads and thus the easier access to facilities and also because in the colder dry season, cough could happen together with more or severer symptoms (Silva et al., 2009). Factors whose insignificance was less expected were education, revealing that schooling may not capture health knowledge or that the latter was not significantly related with care seeking in the particular context, income, which was due to respondents resorting to free care offered by the public system (what also explains why poverty was irrelevant), distance to health unit, which could have been caused by most respondents living close to units (75% within 2 km in the illness survey and 94% within 30 min in the cough survey), a consequence of the considerable geographical diffusion of primary care facilities and, probably, of CHAs' priority to patients located nearer to facilities in routine home visits. In the case of waiting time inside health unit (cough survey), its non-significance could be also due to insufficient variation (58% waited up to one hour). Resort to non-professional healthcare (cough survey), which mostly captured household-made medication, was non-significant probably because it was not a question made to all respondents, but, instead, a spontaneous statement made as part of the choice experiment whenever medication was not opted for, what probably biased the variable's significance downwards. Household-level phenomena, captured by the interaction of female gender and household size, and also by the relative that answered in behalf of the child (supposedly the caregiver), did not influence significantly the healthcare seeking decision.

Table 4

Multivariate models, respiratory illness survey (dependent variable is whether medical care was sought)

	pro	log	pro_int	log_int	pro_chi	log_chi
Illness' duration	0.0083	0.0187	0.0082	0.0185	0.0456*	0.0792*
	[0.0067]	[0.0180]	[0.0067]	[0.0181]	[0.0177]	[0.0309]
Illness' number of symptoms	0.0624***	0.1010***	0.0625***	0.1011***	0.0861***	0.1428**
	[0.0160]	[0.0266]	[0.0160]	[0.0265]	[0.0253]	[0.0435]
Illness caused extreme pain	0.3723*	0.5957*	0.3743*	0.6009*	0.4777	0.8664
	[0.1604]	[0.2696]	[0.1607]	[0.2703]	[0.3026]	[0.5346]
Age	-0.0531***	-0.0892***	-0.0530***	-0.0894***	-0.0358	-0.0754
	[0.0099]	[0.0169]	[0.0099]	[0.0171]	[0.0720]	[0.1206]
Age squared	0.0006***	0.0011***	0.0006***	0.0011***	-0.0017	-0.0021
	[0.0001]	[0.0002]	[0.0001]	[0.0002]	[0.0039]	[0.0066]
Female	0.18	0.2838	0.0844	0.0517	-0.038	-0.0826
	[0.1208]	[0.2049]	[0.2987]	[0.5447]	[0.1815]	[0.3071]
Ever had lung disease	0.0577	0.109	0.0586	0.1099	0.0719	0.1224
	[0.1275]	[0.2129]	[0.1274]	[0.2127]	[0.1981]	[0.3296]
Years of schooling	-0.0095	-0.0179	-0.009	-0.0165	-0.0332	-0.0595
	[0.0174]	[0.0293]	[0.0175]	[0.0295]	[0.0266]	[0.0460]
Household income	-0.0746	-0.1285	-0.0758	-0.1319	-0.0256	-0.0255
	[0.0906]	[0.1505]	[0.0908]	[0.1510]	[0.1331]	[0.2265]
Household size	-0.0629+	-0.1105	-0.0747	-0.1427	0.0218	0.0345
	[0.0381]	[0.0680]	[0.0575]	[0.1141]	[0.0560]	[0.0951]
Poor	0.1061	0.1763	0.1076	0.1806	0.1717	0.2984
	[0.1375]	[0.2255]	[0.1375]	[0.2253]	[0.2000]	[0.3427]

Note: standard errors in brackets; "pro" denotes probit and "log" logit models, the first two columns contain the baseline model, the model with female * household size interaction is indicated with "int" and the children-only model with "chi". Pseudo-R² is denoted with "r2_p", the statistic and p-value of the chi-square global significance test as "chi2" and "p", and the log-likelihood as "ll".

	pro	log	pro_int	log_int	pro_chi	log_chi
Has health insurance	0.1582	0.3125	0.1596	0.3169	0.0919	0.131
	[0.1990]	[0.3313]	[0.1993]	[0.3322]	[0.3014]	[0.5054]
Distance to health unit	0	0	0	0	0	-0.0001
	[0.0000]	[0.0001]	[0.0000]	[0.0001]	[0.0000]	[0.0001]
Illness occurred in the dry season	-0.0629	-0.0982	-0.0671	-0.1078		
	[0.1746]	[0.2927]	[0.1749]	[0.2942]		
Female * household size			0.0241	0.059		
			[0.0700]	[0.1302]		
Mother answered					-0.08	-0.0907
					[0.2449]	[0.4057]
Father answered					-0.2554	-0.339
					[0.3469]	[0.5909]
Intercept	0.2277	0.4722	0.2765	0.6082	-0.5058	-0.8943
	[0.6733]	[1.1343]	[0.6981]	[1.1981]	[1.0677]	[1.8154]
N	519	519	519	519	241	241
r2_p	0.1155	0.117	0.1157	0.1174	0.1653	0.1669
chi2	66.1068	59.975	66.0322	59.6461	40.7541	36.3801
p	0	0	0	0	0.0003	0.0016
ll	-305.6186	-305.0764	-305.5477	-304.936	-138.804	-138.5359
Note: standard errors in brackets; “pro” denotes probit and “log” logit models, the first two columns contain the baseline model, the model with female * household size interaction is indicated with “int” and the children-only model with “chi”. Pseudo-R ² is denoted with “r2_p”, the statistic and p-value of the chi-square global significance test as “chi2” and “p”, and the log-likelihood as “ll”.						

Table 5
Multivariate models, cough survey (dependent variable is whether medical care was sought)

	pro	log	pro_int	log_int	pro_chi
Cough duration	0.0211*	0.0345+	0.0202*	0.0328	0.0547**
	[0.0096]	[0.0191]	[0.0100]	[0.0204]	[0.0202]
Cough caused extreme pain	0.8242**	1.3778**	0.8748**	1.4805**	0.6636+
	[0.2855]	[0.4963]	[0.3012]	[0.5317]	[0.4021]
Age	-0.0459+	-0.0739+	-0.0458*	-0.0750+	-0.3453*
	[0.0234]	[0.0432]	[0.0228]	[0.0410]	[0.1735]
Age squared	0.0006+	0.0009	0.0006+	0.0009	0.0166+
	[0.0003]	[0.0007]	[0.0003]	[0.0006]	[0.0090]
Female	-0.0791	-0.148	-0.743	-1.3225	0.187
	[0.2346]	[0.4182]	[0.7103]	[1.2908]	[0.3326]
Ever had lung disease	0.6274*	1.0551*	0.5731*	0.9722*	0.4161
	[0.2627]	[0.4666]	[0.2662]	[0.4708]	[0.3831]
Years of schooling	-0.0409	-0.0674	-0.0435	-0.0708	-0.0186
	[0.0323]	[0.0555]	[0.0319]	[0.0540]	[0.0379]
Household income	-0.0096	-0.0428	-0.0162	-0.0506	-0.3177
	[0.1333]	[0.2424]	[0.1314]	[0.2346]	[0.2529]
Household size	0.2210**	0.3729**	0.1237	0.2002	0.1513+
	[0.0769]	[0.1378]	[0.1259]	[0.2264]	[0.0874]
Has time to seek healthcare	0.0565	0.0548	0.0388	0.0259	-0.1728
	[0.2674]	[0.4498]	[0.2665]	[0.4471]	[0.3553]
Poor	0.0394	0.05	0.0233	0.0109	-0.0046
	[0.2919]	[0.5255]	[0.2930]	[0.5267]	[0.3930]
Has health insurance	0.4803	0.7895	0.4547	0.7318	-0.0821
	[0.4039]	[0.6859]	[0.4011]	[0.6775]	[0.6626]

Note: children model with dummies indicating the child's relative that responded the questions was not globally significant neither in logit nor probit form, being thus omitted. Without such variables, only the probit model was globally significant.

	pro	log	pro_int	log_int	pro_chi
Time to health unit	-0.0006	0.0004	0.0019	0.0044	-0.0035
	[0.0098]	[0.0198]	[0.0099]	[0.0195]	[0.0107]
Waiting time in the health unit	-0.002	-0.0034	-0.0022	-0.0037	-0.0006
	[0.0015]	[0.0026]	[0.0015]	[0.0027]	[0.0016]
Resorts to non-professional care	-1.0307+	-1.7512+	-1.0017	-1.7174	
	[0.6113]	[1.0464]	[0.6240]	[1.0696]	
Cough occurred in the dry season	0.7812**	1.2846**	0.8089***	1.3378**	
	[0.2439]	[0.4284]	[0.2455]	[0.4315]	
Female * household size			0.1463	0.2572	
			[0.1494]	[0.2683]	
Intercept	-1.3504	-2.0615	-0.8489	-1.1943	2.0861
	[0.9920]	[1.7160]	[1.0788]	[1.8517]	[2.1098]
N	168	168	168	168	89
r2_p	0.2538	0.249	0.2585	0.2539	0.208
chi2	55.8248	46.4543	55.6801	46.5984	24.4023
p	0	0.0001	0	0.0001	0.0409
ll	-79.2711	-79.7813	-78.7682	-79.2529	-46.8759
Note: children model with dummies indicating the child's relative that responded the questions was not globally significant neither in logit nor probit form, being thus omitted. Without such variables, only the probit model was globally significant.					

Conclusions

5.1 Subjective vs objective factors

It should be highlighted the worryingly low level of care seeking, that did not exceed 40% of respondents, in contradiction with the severity of the respiratory conditions respondents experienced, which lasted 10 days, involving ten symptoms in average, or at least dry cough, and majorly causing moderate or extreme pain. What, it should be noted, is not at odds with previous studies (Zhang et al., 2020, Velden et al., 2020, Suka et al., 2016). Attenuation was provided by the larger likelihood of care seeking in the case of children, which nevertheless did not exceed 50% of cases.

The significance of duration, severity and subjective pain, and the insignificance of individual, household and facility characteristics, in models explaining whether an episode of respiratory illness or, of dry cough, was addressed with a medical visit, reveals that subjective, rather than objective factors, play a key role in driving healthcare seeking. This is line with the revised literature. In Suka et al. (2016), expecting that relatives and friends would support care seeking was a significant predictor of opting for it and also symptoms that were believed to be of a somatic rather than a psychological nature, and thus less stigmatized, were more likely to trigger a stated intention to seek healthcare. In similar fashion, disease stigma was emphasized as a demand-side delayer of TB treatment by Chen et al. (2021) and Datiko et al. (2020). These two papers imply that subjective misevaluation of disease severity, which may be related with the level of pain experienced, affects care seeking. In Tetteh et al. (2017), the subjective value of administration mode, of dosing, of risk of adverse events and of the interruption of daily routine, were shown to influence demand for medication.

Objective factors such as gender, income and access to health facilities were also found by other studies to be insignificant predictors (Seid and Metaferia, 2018, Tetteh et al., 2017, Datiko et al., 2020, Diaz et al., 2013). Notwithstanding, education is generally found to be relevant (Tetteh et al., 2017, Seid and Metaferia, 2018) but it is not fully correlated with health literacy (i.e., the capacity to recognize symptoms and illness and to make decisions to prevent or manage them) which may be a stronger force behind healthcare demand (Suka et al., 2016).

5.2 Other factors not controlled for and policy implications

Some words are merited on the macroeconomic factors that were not directly controlled for. The linking of results with the macroeconomic evidence provided by Piabuo and Tieguhong (2017) and Abdullah et al. (2017) suggest that subjective factors preventing respiratory ill individuals to seek healthcare (such as pain being sensed as tolerable) have macroeconomic implications as the duration of the temporary human capital reduction is extended at individual level, and, possibly, also at social level, in the case of viral and bacterial diseases (Datiko et al., 2020). Economic growth may be diminished through the long-run relationship that connects it with health care demand and health level, according with the mentioned articles.

Results also support the conjecture that supply-side policy recommendations, such as performance-based increase of government expenditure on health care (suggested by Abdullah et al., 2017), may bring less-than-expected results due to demand-side barriers. One clear barrier is the subjective underestimation of respiratory illnesses' consequences both for own health and for the broader society suggested both by a rate of care seeking below 40% and by the dominant role of subjective covariates. For this, simultaneous implementation of microeconomic behavioural policies seeking to change subjective perception of symptoms and illnesses, via nudges (Schmidt, 2015) but also through educational health interventions (as proposed by Suka et al. 2016 and Seid and Metaferia, 2018), is advisable. One possibility, suggested by the lower likelihood of adults to seek care for respiratory illnesses, as compared to children, is CHAs' educational actions stressing that adults' illnesses, whether contagious, could be acquired by their children. Influenza vaccination campaigns which achieve over 80% coverage in Acre

state (SI-PNI, 2021) could also better inform about symptoms and contagiousness (as recommended for TB by Seid and Metaferia, 2018) and the need to seek care even whether vaccinated or experiencing tolerable pain. A specific study on alternatives to increase healthcare usage during the wet season is needed, what requires assessing the possibility of temporarily expanding health workers' teams in rural areas when rain is intense enough to prevent rural-urban displacements.

To finish, the results here achieved are generalizable only to other developing countries that also have a public health system targeting universal coverage and offering free healthcare (as Malawi; Nakovics et al., 2020).

Abbreviations

TB: tuberculosis; CHA: community health agent; WTP: willingness to pay; SD: standard deviation

Declarations

6.1 Ethics approval and consent to participate

Ethical approval for conducting the two surveys was obtained from the Federal University of ABC's ethical committee, on behalf of the National Council of Research Ethics (CONEP). An informed consent document was signed by all participants before questionnaire was applied, and after detailed explanation of the voluntary nature of participation, of research goals, benefits, costs, anonymity and confidentiality, and first author's contact information. Illiterate participants had the document signed by a relative or witness. A copy of the document, signed by the first author, was handed to participants. All methods were carried out in accordance with the Brazilian standards of ethics in research involving human subjects, which are based in the Helsinki declaration.

6.2 Consent for publication

Not applicable, there are no data about individual participants in the manuscript.

6.3 Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due the confidentiality commitment contained in the informed consent document signed by participants, which forbids public data sharing, but are available from the corresponding author on reasonable request.

6.4 Competing interests

The authors declare that they have no competing interests.

6.5 Funding

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6.6 Authors' contributions

TM collected and analysed data and wrote the manuscript except for literature review. ASL revised the literature, formulated table 1, and supported the writing of the manuscript. RGS supported data collection and research planning and contributed for the writing of final version of the manuscript. All authors read and approved the final manuscript.

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