

BMJ Open Characterisation of the rural indigent population in Burkina Faso: a screening tool for setting priority healthcare services in sub-Saharan Africa

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ABSTRACT

Background In Africa, health research on indigent people has focused on how to target them for services, but little research has been conducted to identify the social groups that compose indigence. Our aim was to identify what makes someone indigent beyond being recognised by the community as needing a card for free healthcare.

Methods We used data from a survey conducted to evaluate a state-led intervention for performance-based financing of health services in two districts of Burkina Faso. In 2015, we analysed data of 1783 non-indigents and 829 people defined as indigents by their community in 21 villages following community-based targeting processes. Using a classification tree, we built a model to select socioeconomic and health characteristics that were likely to distinguish between non-indigents and indigents. We described the screening performance of the tree using data from specific nodes.

Results Widow(er)s under 45 years of age, unmarried people aged 45 years and over, and married women aged 60 years and over were more likely to be identified as indigents by their community. Simple rules based on age, marital status and gender detected indigents with sensitivity of 75.6% and specificity of 55% among those 45 years and over; among those under 45, sensitivity was 85.5% and specificity 92.2%. For both tests combined, sensitivity was 78% and specificity 81%.

Conclusion In moving towards universal health coverage, Burkina Faso should extend free access to priority healthcare services to widow(er)s under 45, unmarried people aged 45 years and over, and married women aged 60 years and over, and services should be adapted to their health needs.

Ethics considerations The collection, storage and release of data for research purposes were authorised by a government ethics committee in Burkina Faso (Decision No. 2013-7-066). Respondent consent was obtained verbally.

INTRODUCTION

Universal health coverage (UHC) has been a key objective for the international community since the call made by the United Nations in 2012. However, given resource constraints, countries must determine their

Strengths and limitations of this study

- To our knowledge, this is the first published study that identified those who constitute an indigent population in a sub-Saharan African country.
- The results of the study provided local authorities in Burkina Faso with useful information on populations that need urgent healthcare coverage.
- This study was limited to certain rural areas in Burkina Faso; further research is needed to assess whether these results can be generalised.
- Due to lack of data, we could not perform comparative analyses of the characteristics of people with and without missing data in the study.

own priorities, and UHC does not mean governments will be able to provide access to all possible health services. High-priority health services should, however, be available to everyone.¹ UHC implementation could follow the path of progressive universalism, which involves initially targeting indigents to support them proportionally to their level of disadvantage and offer them high-priority services.² Targeting social benefits in low/middle-income countries has proven challenging.^{3–4} More specifically, identifying indigents is a challenge for healthcare sector reform, particularly in Africa,^{5–6} where two processes have been regularly investigated: community-based targeting (CBT) and proxy mean testing (PMT).^{7–8} Unlike PMT, there are few studies on CBT in sub-Saharan Africa. In Burkina Faso, CBT consists of a process by which the worst-off are selected by a gender-balanced village selection committee of community members appointed by the village health committee. To avoid any capture of local elite,^{9–11} the selection committees' members cannot be administrative officers, village chiefs or health committee

members. Village selection committees produce lists of indigents whom they select based on a consensual definition and with no predetermined criteria: 'Someone who is extremely disadvantaged socially and economically, unable to look after him/herself, and devoid of internal or external resources'. The process and the definition were introduced and validated by Ridde *et al.* in 2007.^{12,13} However, they also showed that user fees exemptions are not enough and that more is needed to ensure indigents benefit from services.¹⁴ Moreover, no study has identified who are those in a state of indigence. Are elderly adults protected informally by their extended families, or do they lack adequate resources to spend on healthcare in the absence of formal government safety nets and old age pensions? What access do poor women have to healthcare in societies where men have the decisional power in the family? In a patriarchal society, is being a woman a driver towards indigence?

In this study, our aim was to identify what makes someone an indigent beyond being recognised by his or her community as needing a card for free healthcare.

POPULATION AND METHODS

Setting

A state-led intervention combining performance-based financing for healthcare with user fees exemptions for indigents was implemented in 10 districts in Burkina Faso in 2014. It provided increased financing to healthcare structures and staff based on quantity and quality of care provided. Higher fee-for-service rates were offered for some services delivered to indigents.¹⁵ To identify indigents in each district, a CBT process was implemented in villages concerned by the intervention. In each village, the selection committee was given the entire responsibility and autonomy to select the worst-off within their community. These committees each developed a list of indigents based on their perception of the definition suggested by Ridde *et al.*¹² These lists were validated by an external committee. The World Bank financed this state-led programme, paying up to 7.2 times more for some consultations for indigents than for those of non-indigents.

The study was conducted in 21 villages in two rural districts of Burkina Faso with an agricultural economy: Diébougou (127 857 inhabitants) in the southwest and Gourcy (208 740 inhabitants) in the north. With only four general practitioners and no specialists in both districts, health services use in these areas is very low. In 2014, the average annual number of health visits per inhabitant was 1.03 in Diébougou and 0.73 in Gourcy.¹⁶ These districts are different in terms of agricultural practices, weather conditions and ethnic composition. They therefore represent a diversity of rural contexts in Burkina Faso. **Table 1** presents the villages' total populations in 2011 as well as the numbers of non-indigents and indigents included in this study.

Table 1 Total population in each village and number of non-indigents and indigents

Villages	Total population in 2011	Non-indigents	Indigents
District of Gourcy (north region)			
Bassi	3140	272	18
Palle	1602	100	12
Garou	627	26	38
Doure	1297	69	36
Kibilo	2799	180	19
Leleguere	765	50	27
Minima	1413	82	24
Zankolga	546	35	32
Ranoua	2190	124	27
Bouloulou	2131	115	32
Rassomde	1940	99	16
District of Diébougou (south-west region)			
Obro	641	47	38
Sorindigui	534	55	38
Bonfesso	633	94	28
Nabere	864	120	35
Tansie	1412	88	166
Olbontoune	312	27	71
Diagnon	264	9	30
Diourao	556	32	53
Tiakoura	216	31	37
Poyo	950	128	27

Study sample

Data were collected between February and April 2015, dry season months when households are more available for interviews than during the agricultural season.

About 10 villages were randomly selected in each district (**table 1**); all households that included an indigent identified by the CBT were included. For comparison, we randomly selected 85% of households without indigence in Diébougou and 45% in Gourcy. Altogether, 2077 non-indigents and 1009 indigents were identified for the study in the two districts.

Data were collected on tablets by trained investigators using Open Data Kit software. The household questionnaire included modules on household composition, education, assets and other dimensions. In households including at least one indigent, an individual health questionnaire survey was administered to the indigent member(s). In households without an indigent, an individual member was randomly selected and administered the same individual health questionnaire.

Study variables

Individual-level variables were selected based on health determinants reported in previous studies in Africa^{17–20}:

- ▶ Demographic characteristics: gender (male, female), age (18–24, 25–34, 35–44, 45–59, 60+), marital status (single, monogamous union or living together, polygamous union, divorced or separated, widowed)
- ▶ Socioeconomic characteristics: highest level of education (none, primary school, secondary school); engaging in income-producing activity in the past 7 days; difficulties satisfying food needs; financial constraints making it difficult to buy food, use the healthcare centre, or buy medicines
- ▶ Health: self-rated health (poor, not poor); self-reported chronic disease; visual impairment
- ▶ Physical functioning: physical disability; limitations in walking 400 m; upper limb strength limitations

Ethics

An ethics committee of the Government of Burkina Faso approved the study (Decision No. 2013-7-066). Respondent consent was obtained verbally.

Statistical methods

χ^2 tests were used to compare socioeconomic characteristics, health status and physical functioning of non-indigents and indigents.

To create classification models (IBM SPSS Statistics V. 22), we used the IBM SPSS Decision Trees procedure. Classification and regression tree analysis is a non-parametric exploratory method that partitions the sample using explanatory variables so that segments obtained are as homogenous as possible with regard to the dependent variable.²¹ Using the Quick Unbiased Efficient Statistical Tree method, we built a model that allowed us to select socioeconomic, health status and physical functioning characteristics that were most likely to split non-indigents from indigents. All variables available for this study were specified in the decision tree model. Fourteen were included in the final model procedure: gender, age, highest level of education, marital status, engaging in income-producing activity, financial difficulties (financial constraints making it difficult to buy food or use the healthcare centre), perceived poor health, chronic disease, visual impairment, disability, ability to walk and physical strength. Variables that did not contribute significantly were automatically removed from the final model.

The target category was 'indigent'. For each split, the association between each covariable and the target category was computed using Pearson's χ^2 test. At each step, the covariable showing the highest association with the target category was selected for splitting.²¹ When specifying the model, we set an equal cost of misclassification for non-indigents and indigents, the value of alpha for splitting nodes at 0.05, minimum parent node size at 50 and parent node size at 25. We also performed a sensitivity analysis setting a higher cost of misclassification for indigents (twice that for non-indigents). We randomly split the sample into two subsamples (both including non-indigents and indigents), and the models were fitted using the first as a training sample and then testing on the

second subsample. Trees were generated to maximum size, where each node contained single-class data or no test offered improvement on the mix of classes at that node, then pruned to avoid overfitting. We also assessed the screening performance of the test tree using CBT as a base-case standard for classification of indigents and non-indigents, since this was the approach adopted by the authorities in Burkina Faso to identify indigents for access to services.

RESULTS

We identified 2077 non-indigents and 1009 indigents for the study in the two districts. A total of 1783 (85.8%) non-indigents and 829 (82.2%) indigents aged 18 years and over with complete questionnaires were considered in the present analysis. Indeed, during the period of the interview, 58 indigents were absent from their house, 13 were sick, 22 were too old to respond to the questionnaire, 49 were disabled, 30 did not complete their interview and 8 indigents had died. A total of 294 non-indigents' questionnaires were incomplete and could not be used for the analyses. Unfortunately, we did not have details on the missing questionnaires for the non-indigents.

Characteristics of the study population

Of the total sample population, 1433 (54.9%) lived in Gourcy, 1555 (59.5%) were women and 574 (22.0%) were aged 60 years and over. Most were illiterate (2312, 88.5%); more than one-third (1004, 38.4%) had difficulties satisfying food needs; 9.4% (246) had difficulties walking 400 m, and 15.5% (406) perceived their health as poor.

Table 2 presents the study sample characteristics by indigent status. Indigents were more likely to be women, older, illiterate and/or widowed. They were also more likely to be in poor health and to find it financially difficult to cover basic needs.

Classification of non-indigents and indigents

Figure 1 presents the test tree diagram. Age, marital status, gender, upper limb strength limitations and financial constraints preventing healthcare centre use and purchase of foodstuffs were the best covariates for separating non-indigents from indigents. All p values for splitting the nodes were below 0.0001. We used colour codes to represent tree nodes according to proportions of indigents: red (nodes 3, 9 and 15, with proportions of indigents above 75%), orange (nodes 1, 5, 8, 11, 18, 19, proportions between 50% and 75%), yellow (proportions between 25% and 50%) and green for groups with proportions under 25%. Red nodes (3, 9 and 15) could be used as screening tests with high specificity. Since the first partitioning variable, aged 45 years and over, was so strongly associated with indigence, we developed separate screening schemes for those aged 45 years and over and those under 45.

Table 2 Comparison of socioeconomic characteristics and health status between non-indigents and indigents

Variables	Total number	Non-indigents		Indigents		p value
		Number	Percentage	Number	Percentage	
District		1783		829		<0.0001
Diébougou	1179	631	35.4	548	66.1	
Gourcy	1433	1152	64.6	281	33.9	
Gender						<0.0001
Male	1057	802	45.0	255	30.8	
Female	1555	981	55.0	574	69.2	
Age (years)						<0.0001
18–24	368	364	20.4	4	0.5	
25–34	555	524	29.4	31	3.7	
35–44	457	328	18.4	129	15.6	
45–59	658	333	18.4	325	39.2	
60+	574	234	13.1	340	41.0	
Highest level of education achieved						<0.0001
None	2312	1522	85.4	790	95.3	
Primary school	213	188	10.5	25	3.0	
Secondary school	87	73	4.1	14	1.7	
Marital status						<0.0001
Single	111	68	3.8	43	5.2	
Monogamous union or living together	1308	1035	58.0	273	32.9	
Polygamous union	715	562	31.5	153	18.5	
Divorced or separated	25	8	0.4	17	2.1	
Widowed	453	110	6.2	343	41.4	
Engaged in income-producing activity in the past 7 days						<0.0001
No	2044	1344	75.4	700	84.4	
Yes	568	439	24.6	129	15.6	
Difficulties satisfying food needs						<0.0001
No	1608	1219	68.4	389	46.9	
Yes	1004	564	31.6	440	53.1	
Financial difficulties that prevent buying foodstuffs						<0.0001
No	1561	1210	67.9	351	42.3	
Yes	1051	573	32.1	478	57.7	
Financial difficulties that prevent going to the healthcare centre						<0.0001
No	1553	1250	70.1	303	36.6	
Yes	1059	533	29.9	526	63.4	
Financial difficulties that prevent buying medicines						<0.0001
No	1610	1280	71.8	330	39.8	
Yes	1002	503	28.2	499	60.2	
Perceived poor health						<0.0001
No	2206	1629	91.4	577	69.6	
Yes	406	154	8.6	252	30.4	
Chronic disease						<0.0001
No	1592	1243	69.7	349	42.1	

Continued

Table 2 Continued

Variables	Total number	Non-indigents		Indigents		p value
		Number	Percentage	Number	Percentage	
Disability						
Yes	1020	540	30.3	480	57.9	
No	2297	1679	94.2	618	74.5	<0.0001
Perceived limitations in ability to walk 400 m						
Yes	315	104	5.8	211	25.5	
No	2366	1702	95.5	664	80.1	<0.0001
Perceived limitations in upper limb strength						
Yes	246	81	4.5	165	19.9	
No	2282	1697	95.2	585	70.6	<0.0001
Visual impairment						
Yes	330	86	4.8	244	29.4	
No	2560	1745	97.9	815	98.3	0.4
Yes	52	38	2.1	14	1.7	

Screening performance of the classification tree

Among those aged 45 and over, two nodes (3 and 15) had high prevalence of indigence. Node 3, which comprised those 45 years and over who were unmarried, contained 150 of the total 332 indigents (45%) in that age group. The sensitivity of 'being unmarried' to detect indigence among those 45 years and over was 45% (150/332), and specificity was 83% (218/264). Node 15, married women aged 60 years and over, had a prevalence of indigence of 81.6% and could be used to screen for indigence among those 45 years and over who were married, with sensitivity of 34% (62/182) and specificity of 94% (204/218). By combining nodes 3 and 15, we obtained a test of indigence among those 45 years and over with sensitivity of 64% and specificity of 77%.

Among those under 45, there was only one red node: node 9, being widowed. The sensitivity of 'being widowed' for indigence was 66% (55/83), and specificity was 99.2% (610/615). Combining these two screening criteria for those 45 years and over and those under 45, we obtained sensitivity of 64.3% and specificity of 92.6%.

Indigence was largely restricted to being old and unmarried. Indeed, the frequency of indigence among young people (<45 years) who were married or living with a partner was only 4.3% (table 3).

Goodness of fit of the classification tree was evaluated by the index value and the gains and index charts. The index value of the model was above 100%, the gains chart was different from the diagonal reference line and the index chart started above 100%. Risk of misclassification was 14.8%. Overall percentage of correct classification was 85.2%. The sensitivity analysis presented in the appendix

figure confirmed that age, gender and marital status were strongly correlated with indigence.

DISCUSSION

Using survey data on individuals in 21 villages of two rural districts in Burkina Faso, we used classification and regression tree methodology to identify the best indicators of indigence, as defined by the community. Results showed that being aged 45 years and over, unmarried and/or a woman were strong indicators of being an indigent, according to the community-based definition. Using simple rules based only on easy-to-obtain indicators of age, marital status and gender, we were able to detect three-quarters of indigents among those aged 45 years and over and six out of seven indigents among those under 45.

Population ageing has emerged as a major demographic trend even in low-income countries like Burkina Faso, posing challenges to social institutions.²² With a population estimated at 17.59 million in 2014 and a poverty headcount ratio of 46.7%, Burkina Faso is one of the poorest countries in the world. Life expectancy has increased in recent years, estimated at 58 years for males and 59 for females in 2013.²³ To our knowledge, in middle and low-income countries like Burkina Faso, despite increases in the older adult population generating a greater burden of chronic conditions,²⁴ social and health policies to adapt to the changing age structure are rare. McEniry and McDermott²⁵ describe low-income countries like Burkina Faso as countries where mortality declined rapidly very late in the 20th century. However, in these countries, the health of older cohorts is shaped by survivorship of poor early-life conditions, resulting in

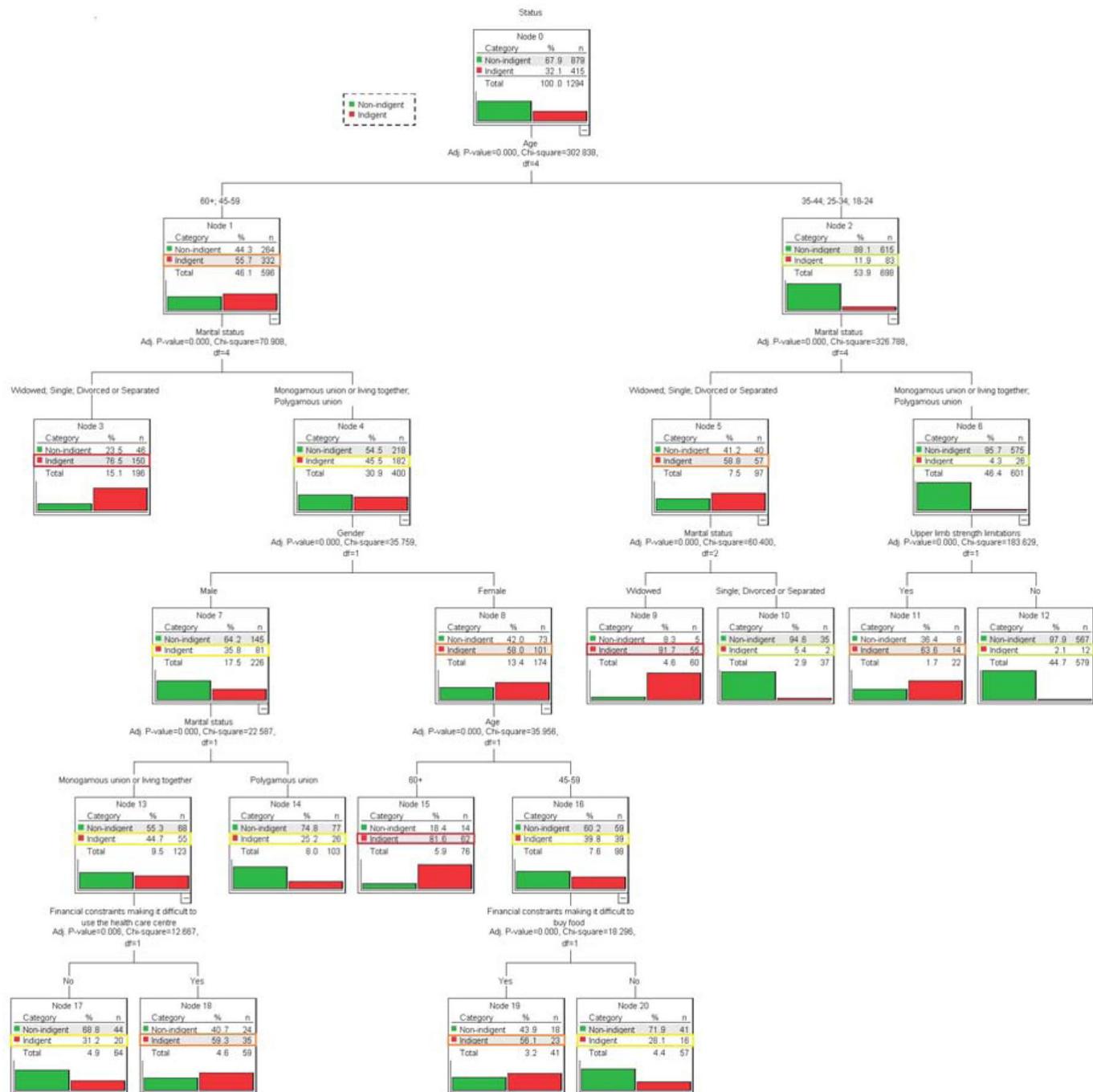


Figure 1 Test tree diagram.

early onset of chronic diseases and high prevalence of frailty. Our study showed that ageing leads to both poor health and deprivation in Burkina Faso. Roth,²⁶ studying intergenerational relations in Burkina Faso, reported that strength, energy and therefore the opportunity to earn one's keep decreased with age. Those who cannot participate in reciprocal exchanges of gifts or services risk social marginalisation. Yet with no social security^{19 27} and without exchange relations, there is no social recognition.

Our study also revealed that unmarried people were more likely to be indigents. As marriage in Africa marks the transition to adulthood, single persons are not

recognised as adults able to assume responsibilities.²⁶ Marriage confers status and dignity,²⁸ providing individuals with a sense of meaning and of obligation to others, while inhibiting risky behaviours and encouraging healthy ones.²⁹ Previous studies have reported that single, divorced or bereaved persons showed higher mortality and morbidity in specific diseases,³⁰⁻³² as well as lower quality of life³³ compared with those who were married or cohabiting. The differences between married and unmarried people may reflect a causal effect of marriage and a selection effect: healthier people may be more likely than others to find mates and marry.³⁴

Table 3 Screening performance of the test tree

Characteristics	Test tree nodes	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Under 45	Red node (9)	0.66 (55/83)	0.99 (610/615)	0.92 (55/60)	0.96 (610/638)
45 years+	Red nodes (3, 15)	0.64 (212/332)	0.77 (204/264)	0.78 (212/272)	0.63 (204/324)
All ages	Red nodes (3, 9, 15)	0.64 (267/415)	0.93 (814/879)	0.80 (267/332)	0.85 (814/962)

Data are percentages, with numbers of non-indigents and/or indigents in parentheses.

Negative predictive value in under 45 was 96% (red and orange nodes) = $\frac{(\text{total non-indigents in node 2}) - (\text{total non-indigents in nodes 5 and 11})}{(\text{total indigents in node 2} - \text{total indigents in nodes 5 and 11}) + (\text{total non-indigents in node 2} - \text{total non-indigents in nodes 5 and 11})} \times 100$.

Sensitivity in under 45 was 66% (red node) = $\frac{(\text{total indigents in node 9})}{(\text{total indigents in this age group; node 2})} \times 100$.

Specificity in all ages was 93% (red nodes) = $\frac{(\text{total non-indigents in node 1}) - (\text{total non-indigents in nodes 3}) + (\text{total non-indigents in node 2}) - (\text{total non-indigents in nodes 5})}{\text{total non-indigents in all ages groups (nodes 1 and 2)}} \times 100$.

Positive predictive value in all ages was 80% (red nodes 3, 9 and 15) = $\frac{(\text{total indigents in red nodes 3, 9 and 15})}{(\text{total non-indigent and indigents in red nodes 3, 9 and 15})} \times 100$.

Widows across the globe share two common experiences: loss of social status and reduced economic circumstances.³⁵ In developed countries, widowhood is experienced primarily by elderly women, while in low/middle-income countries it also affects younger women, many of whom are still rearing children. Widowers, even when elderly, are far more likely to remarry.³⁶ but this is not the case for widows, who, if they do remarry, rarely do so of their own free will. As a result, many women spend a long period of their lives in widowhood, with all its associated disadvantages and stigmas.³⁵ In a recent study, Lloyd-Sherlock *et al* found that the association between widowhood and being in the poorest household wealth quintile was consistent across most countries (China, Ghana, India, the Russian Federation and South Africa).³⁶ In Burkina Faso, the sociocultural context is still marked by beliefs and practices leading to discrimination against women, particularly older women, including widow inheritance, forced marriage and social exclusion of women for witchcraft allegations. Belief in witchcraft is more dominant in rural areas, where poverty usually leads to strained human and in-law relations, and where most illnesses cannot be explained.³⁷ Women victims of such violence and discrimination are mostly seniors, have had no children or only girls, have emigrated or their children have not 'succeeded'. They are widowed or postmenopausal, poor and uneducated.³⁸ In our study, women who were indigents were likely to carry health consequences of their reproductive history. After surviving adolescent childbirth and multiparity, they were at high risk of lower physical performance,³⁹ chronic diseases, incontinence⁴⁰ or fistula.⁴¹ Supporting this line of evidence, Doulogou *et al*³² reported that widows in Burkina Faso were more vulnerable to hypertension than were married women of similar age, education and health behaviours.

The classification tree showed that even married women, if aged 60 years and over, were more likely to be indigents. Power inequalities in gender relationships, affecting access to resources and decision making on sexual and reproductive issues, are frequent in West African societies.⁴² Harmful cultural practices, such as widow cleansing, son preference and others, remain

threats to women's health and well-being.⁴³ Onadja *et al*⁴⁴ reported that being a woman was positively associated with higher odds of cognitive impairment and mobility disability in Burkina Faso, and the size of associations appeared insensitive to adjustment for various life-course socioeconomic and health conditions. Females make up an increasing proportion of the world's poor.⁴⁵ This situation is exacerbated by age and marital status, as shown in this research.

In this study, we considered CBT as a base-case standard for the classification of indigents and non-indigents. According to Conning and Kenave,⁴⁶ CBT may lead to increased conflict and division within the community and places high time costs on community leaders. Programme goals may be subverted to serve elite interests, or local targeting preferences might differ substantially from national or donor preferences. However, the social acceptability, validity and effectiveness of the CBT process have been documented in Burkina Faso.^{47 48} Schleicher *et al*,⁹ who compared decentralised versus statistical targeting of anti-poverty programmes, found that in the sub-Saharan African context community-based targeting is far more cost-effective than any statistical targeting procedure for welfare programme benefits.

Potential limitations of this study include the fact that the results may not be representative of all of Burkina Faso because the study targeted only certain rural areas. Moreover, self-reported health included in this study may say more about people's health awareness, health expectations and overall life satisfaction than about their actual health, especially in a poor population with little engagement with services.

Policy implications

The way the state is organised often exacerbates existing social cleavages, intensifying inequalities between rich and poor. For many vulnerable groups, such as older adults, unmarried adults and widowed women, changes over the past decade have eroded important social safety networks and practices. Targeting the poorest for free access to healthcare or financial assistance has emerged as an alternative to UHC in many low and middle-income

countries. Such targeting requires effective selection strategies. Our results showed that, as identified by the community, the indigent population in some rural areas in Burkina Faso is composed of three groups: widow(er)s under 45, unmarried people aged 45 years and over, and married women aged 60 years and over. Using the country's 2014 Demographic Health Survey data, we selected and described these groups and found they represented 1% of the total population under age 45, 23% of those aged 45 and over, and 45% of people aged 60 and over. Given scarce resources in Burkina Faso, a budget impact analysis is needed to estimate the financial consequences of extending access to free healthcare services to other subgroups of populations. The government's ability and willingness to support and sustain these programmes must be assessed. These analyses should also explore the trade-offs between sensitivity and specificity in the classification of indigents and non-indigents and investigate the consequences of including these groups.

In moving towards UHC, the government of Burkina Faso has implemented, since 2 April 2016, free access to maternal and child healthcare. However, as reported here, there are other vulnerable groups with poor health and limited access to health services. Healthcare in Burkina Faso should include high-priority services to unmarried people under 45 and those aged 45 years and over (as in Senegal, where elderly people have free access to healthcare),⁴⁹ particularly widow(er)s and older women, and services should be adapted to their health needs, including chronic diseases. Extending free access to healthcare services to these vulnerable populations living in rural areas may be a pertinent public health intervention.

Conclusion

Using an original study method, this research sheds light on indigence by presenting the characteristics of indigents as perceived by their own communities. Indigence is rare among the married population under 45 and frequent among unmarried adults and older adults, particularly widows(er)s and older women. Indigent people reported poorer health, chronic disease and limitations in physical functioning. This implies that free priority healthcare services for indigent people must take into account age and gender, as well as the management of chronic conditions.

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Contributors SO performed the statistical analysis, interpreted the results, reviewed the literature and prepared the manuscript. VR was involved in conception of the study design, data collection, statistical analysis, interpretation of results, literature review and manuscript preparation. NA, AS, J-LK and QS participated in conception of the study design, data collection and manuscript preparation. M-VZ was involved in conception of the study design, statistical analysis, interpretation of

results, literature review and manuscript preparation. All authors read and approved the final manuscript.

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