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Determinants of health seeking behaviour in South Sudan: a cross-sectional household survey

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Abstract

Background Access to healthcare is a major challenge in South Sudan, but evidence on the factors influencing health seeking behaviour (HSB) and the magnitude of their effect is limited. This study aims to identify which determinants are associated with seeking care for perceived health needs and with seeking care at private or public healthcare facilities in South Sudan.

Methods A cross-sectional household survey was conducted in three purposefully-selected states (Central Equatoria, Western Equatoria and Warrap). A multi-stage, cluster sampling design was used. Univariable and multivariable logistic regression models were computed to explore the relationships between seeking care for perceived health needs and choice of facility, and individual and household characteristics based on an adapted Levesque framework.

Results We identified that individuals who obtained medication (OR 2.45, 95% CI 1.15–5.23), obtained and paid for medication (OR 4.26, 95% CI 2.08–8.74), lived in Western-Equatoria (OR 9.05, 95% CI 2.35–34.54), and were aware of community health workers (CHWs) (OR 1.70, 95% CI 1.08–2.67), were significantly more likely to seek care for a perceived health need. Individuals who obtained and paid for medication (OR 3.03, 95% CI 1.59–5.81) and who lived further from a public health centre (OR 1.19, 95% CI 1.09–1.31) were more likely to seek care at a private facility, while individuals who had used the provider before (OR 0.52, 95% CI 0.34–0.78), lived in Western Equatoria (OR 0.24, 95% CI 0.13–0.46), lived in a rural household (OR 0.40, 95% CI 0.23–0.70) and had a longer travel time to the visited health facility, were less likely to seek care at a private facility.

Conclusions Survey respondents' state of residence and awareness of CHWs were associated with health seeking, while their state of residence, age, whether they paid for medication or not, travel time and distance to facilities were associated with choice of facility. Our results suggest differences in patterns of HSB between states, but studies with larger sample sizes are needed to analyse this. Furthermore, qualitative studies into access to healthcare in South Sudan could help characterise the nature of determinants and their relationship.

Keywords Health seeking behaviour, Healthcare access, Healthcare utilisation, Determinants, South Sudan, Health systems, Health systems strengthening, Fragile states, Household survey

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Introduction

Decades of underfunding and chronic conflict have severely impaired the health system in South Sudan and access to care remains highly constrained [1, 2]. Faced with an ongoing humanitarian crisis, the country has some of the worst health indicators globally, with an under-five mortality rate of 96 deaths per 1,000 live births and 75% of child deaths due to preventable diseases, such as diarrhoea, malaria, and pneumonia [2, 3]. Furthermore, maternal mortality is 789 per 100,000 live births, and fewer than 8% of deliveries are attended by skilled birth attendants [1, 3]. Only 26% of inhabitants live within one hour's walking distance of a health facility and have consistent access to primary care services [4]. Reaching a provider is only one dimension of accessing care; even arriving at a facility does not guarantee appropriate care [5]. This is illustrated by patient feedback surveys that found low satisfaction with the availability of drugs and over 30% of respondents being referred to higher-level facilities due to complications, lack of expertise or medication at the health facility first visited [6].

Access to healthcare consists of the possibility to identify one's healthcare needs, to seek healthcare services, to reach healthcare resources, to utilise healthcare services and to be offered services as appropriate for their needs [7]. Accessing care is also influenced by the characteristics of individuals demanding care, such as their health literacy, personal and social values, living environment, and income, as well as the characteristics of the providers supplying care, such as their quantity and location, approachability, acceptability and costs [7]. Improving service availability and provision in line with people's needs and expectations thus partly depends on understanding the underlying factors influencing a person's health-seeking behaviour (HSB) [8].

Previous studies from the Eastern African region suggest that people's sociodemographic characteristics such as age, educational level and income are associated with their HSB [9–14], as well as the type of disease (chronic or acute) and the perceived severity of disease [9–11, 15]. Furthermore, people residing in rural households and people living further away from healthcare facilities seem less likely to seek care [9–13, 16, 17]. On the provider side, the type of facility (private or public), costs of services, availability of medicines and quality of care were associated with people's HSB [12, 13, 15–17].

Healthcare in South Sudan is provided by a complex network of domestic and international partners, with 70% of health services provided by non-governmental (NGOs) and faith-based organizations (FBOs) [5]. With the government of South Sudan only contributing 16% of total health expenditure, the largest single funder of health services in the country at present is the Health Pooled Fund (HPF), a multi-donor fund currently in its third phase, led by the United Kingdom's Foreign and Commonwealth Development Office [18, 19]. The HPF supports delivery of approximately 80% of health services in eight out of the country's ten states [20]. This fund includes support for the Boma Health Initiative (BHI), a community health scheme designed to strengthen the linkages between communities and primary health facilities [1, 18, 21]. The initiative is based on previous community health programmes and has not yet been implemented in all counties [21]. Community health workers (CHWs), called boma health workers (BHWs) in South Sudan, are trained to provide a standard package of promotional, preventive, and select curative health services at the lowest administrative (Boma) level with a focus on child health, communicable disease control, safe motherhood, the health management information system, and surveillance [1].

Despite external support for the health system, health services remain underfunded with an annual per capita health expenditure of 23 US dollars [22]. While public healthcare services are officially free of charge at the point of delivery, some evidence suggests that people still face costs at public facilities for goods, such as medicines, and as informal payments to health workers; or incur costs at private facilities because drugs, equipment or services are not available at public facilities [23]. An evaluation of the HPF programme in 2018 identified several potential barriers to accessing healthcare, including geographical access, quality of care, availability of drugs, costs and social exclusion [6]. However, this evaluation did not assess the relative weight of these barriers' influence on HSB and how the associations might differ from those in other Eastern African countries with different social and political histories.

Knowing the determinants influencing HSB in South Sudan can help identify ways to address the barriers that limit people's demand for and access to healthcare [24]. Specifically, understanding the differences in HSB towards private and public health providers and the impact of provider quality can assist policy makers and programme implementers in prioritising resources and investments to local healthcare providers [25]. Therefore, this cross-sectional household survey aims to define which determinants are associated with seeking care for perceived needs in three HPF supported states of South Sudan, and with seeking care at private or public healthcare providers specifically.

Methods

Study design and setting

This study was based on a cross-sectional household survey on healthcare access and utilization in three states of South Sudan, which formed part of a larger mixed-methods study of the same focus [26].

The survey was conducted in three HPF-supported states: Central Equatoria, Western Equatoria, and Warrap (Fig. 1, Box 1). These three states were chosen because of the differences in social, economic, cultural, and political realities. Selection criteria for the states were: implementation of HPF-supported services and the level of BHI implementation; accessibility and relative security six months prior to the survey preparations; presence of both urban and rural areas; absence of Protection of Civilian or other internally displaced person camps[1]; and, to include a variety of ethnic groups and livelihoods, characteristic of people living in the regions, such as being pastoralists or settled farmers.

Box 1 Contextual background on the included states

Central Equatoria

Central Equatoria is the state in which the capital city Juba lies. It has both rural and urban areas. The state is inhabited by a mix of different ethnic groups [27]. A USAID state strategic plan from 2012 characterised some of the state's healthcare challenges, describing widespread poverty, low educational levels, inadequate access to clean water and sanitation facilities, and poor access to health services, contributing to a high prevalence of preventable diseases, such as malaria and diarrhoea [28]. Conflict and poor road infrastructure affect access to and provision of healthcare [28]. The number of bomas, the smallest administrative unit in South Sudan, that have implemented the BHI in Central Equatoria is relatively low.

Warrap

Warrap is a rural state and among the most underdeveloped states in South Sudan in terms of public infrastructure and services. The population is predominantly Dinka, one of the largest ethnic groups in the country [29], and agro-pastoralism is the main source of income [30]. Social services are generally underdeveloped, with education, health, water, and sanitation being basic or lacking [31]. Healthcare access is a major problem, with logistical constraints, such as inaccessible roads, lack of public transport, or lack of financial means, and lack of qualified personnel and medicine, affecting many communities [29–31]. Access to water and particularly improved drinking water is insufficient [32]. A high number of bomas has implemented the BHI.

Western Equatoria

Western Equatoria is mostly rural and populated by diverse ethnic groups. Many of its inhabitants rely on subsistence farming. Western Equatoria has the highest prevalence of malaria, HIV and typhoid in South Sudan and high maternal and child mortality rates [33, 34]. The six hospitals in the state face challenges with inadequate personnel, infrastructure, equipment and medical consumables [35]. Infrastructure in the state is limited, with many roads becoming impassable during the rainy season [35]. Insecurity is a challenge in the state due to the presence of various rebel groups fighting the government [36]. The number of bomas that have implemented the BHI is relatively high.

Sample size and sampling design

The target population was all households in the three states in which at least one household member had been sick or had needed care in the three months prior to the survey. The survey collected household-level data and individual-level data for all household members. A household was defined as a person or a group of people, related or unrelated, who live together and share common cooking arrangements.

The sample size was calculated to provide representative estimates at the state level for health seeking behaviour. The following equation was used to determine the sample size for each state:

$$N = \frac{Z^2 * p * (1-p) * Deff}{C^2 * R * P * HH}$$

Where Z is the z-statistic corresponding to a confidence level of 95% and a precision (C) of 5% (z=1.96). The expected proportion p was set to 50% as this yields the most conservative sample size. A design effect (*Deff*) of 1.5 was used based on the 2010 household health survey in South Sudan [33]. P is the expected proportion of the population that was expected to have a health need in the past three months. Based on Demographic and Health surveys in DRC and Afghanistan, we assumed that 30% of the surveyed population required healthcare in the 3 months prior to the survey [37, 38]. *HH* is the average household size estimated at 6.3 (rural) and 7.1 (urban) by the World Bank in 2015/16, but set to 5 in this calculation to ensure that the required sample size is met [39]. This yields a sample size of 384 households and 1921 individuals per state. Using a sample size of 21 households per cluster requires selection of 18 clusters per state. The total sample size across the three states was 5,763 individuals across 1,152 households.

Sampling was performed using a multi-stage clustered sampling approach with random, systematic, and purposeful selection of sampling units (Fig. 2). First, six accessible and HPF-supported counties were purposively selected across the three states to achieve a diverse representation of relevant characteristics such as urbanicity, security, and implementation of the BHI. Within each county, 18 settlements were randomly sampled across eligible payams (the second-lowest administrative division in South Sudan). That is, payams that were safe, accessible, and supported by the HPF3 programme at the time of data collection. Settlements were selected proportional to the population size of the eligible payams. This means that payams with larger population estimates were allocated a higher number of settlements. Within each settlement, 21 households were selected using a systematic random sampling approach. Lastly, in households with more than 10 household members who had needed care in the previous three months, the survey software randomly selected 10 household members to complete the remainder of the survey to limit the time

[1] In one of the included states—Central Equatoria—there was one settlement where an internally displaced person camp was set up, however, this was not known at prior phase of survey design.

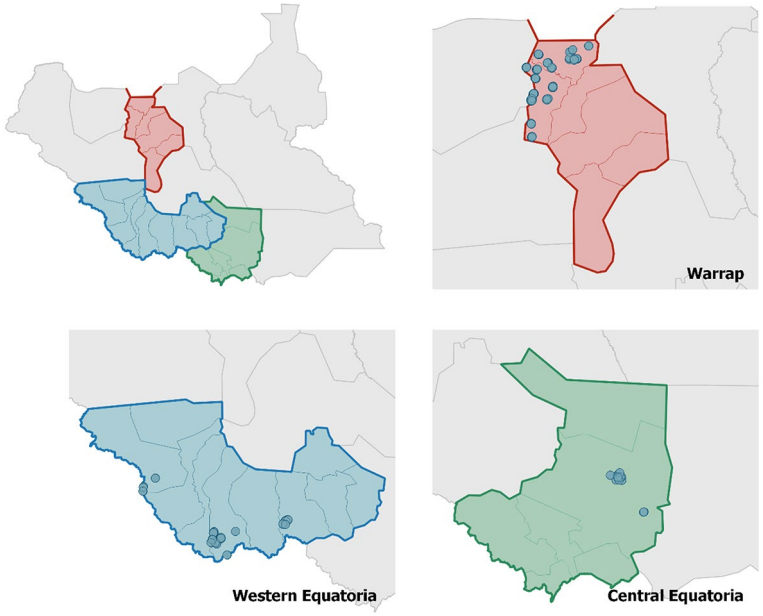

Fig. 1 Sampled households (blue dots) in Western Equatoria, Central Equatoria and Warrap in South Sudan

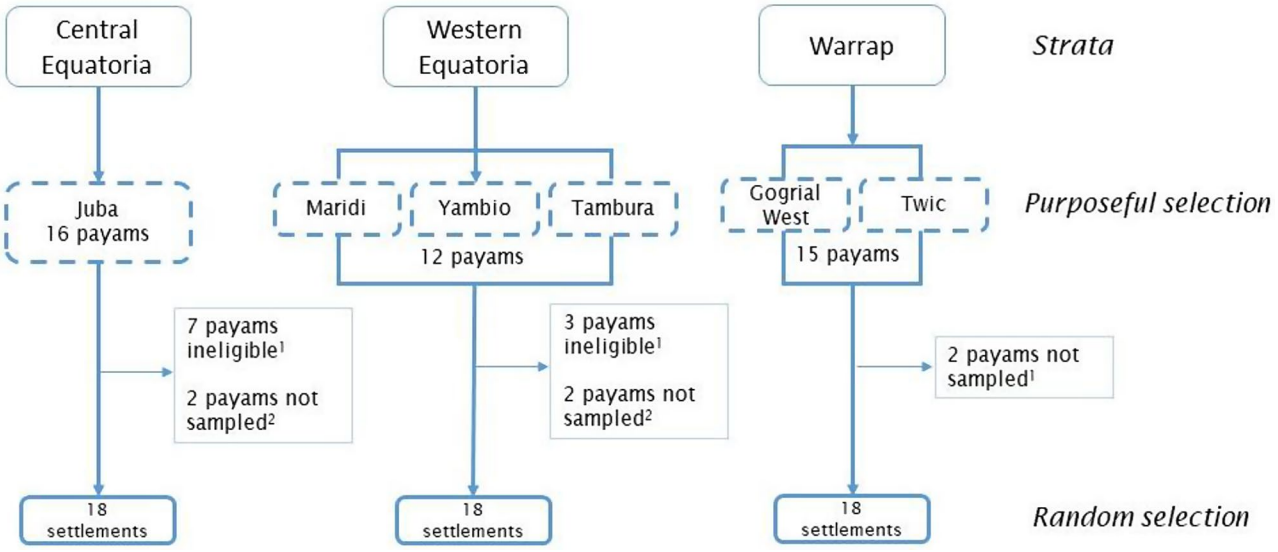

Fig. 2 Stages of sampling. 1. Eligible payams are safely accessible and supported by HPF3. 2. Per population size sampling of settlements can lead to exclusion of payams if no clusters are sampled in those payams

needed to complete it. For settlements that were found to be uninhabited or abandoned during enumeration, a replacement was selected by choosing the next-nearest sufficiently populated settlement in the same payam, to maintain the sample size at payam level.

Data collection

Data were collected between January and March 2021. Surveys were conducted at the households by fieldwork teams that consisted of a supervisor and four enumerators. While data collection took place during the COVID-19 pandemic, visits took place during periods when no lockdowns preventing social interaction or interstate movement were in place. Data collectors took precautions when conducting household visits to limit physical contact and were tested prior to travelling to the field. Both supervisors and enumerators attended a three-day training prior to data collection, which included, among other topics: the project background, the household survey questionnaire, selection and recruitment of participants, informed consent, use of tools, and quality assurance. Enumerators were from the same state as the respondents, ensuring they spoke the same language. The survey respondents were the head of households

(HoHs) or main caregivers, who answered questions on the health seeking behaviour of all household members. Respondents did not receive compensation for participation in the survey. Informed consent was solicited from respondents for their participation in the survey. An information sheet was read out verbatim by enumerators detailing the purpose of the study, the study procedures and use of their data, the potential risks and discomforts, benefits, confidentiality, safeguarding and reporting procedures, voluntary nature of consent, and contact information for the study team. Consent could be provided in writing or verbally, which in the latter case required the enumerators' signature as witnesses. Respondents under the age of 18 also required a signature from their parent or guardian to participate.

The survey was divided into three modules: [1] individual and household characteristics, [2] healthcare needs, and [3] care that was sought. Whether a household member had been sick or needed care and whether a household member sought care in the previous three months determined which modules were completed by the household. Modules on demographic and socioeconomic information were based on the 2008 population census questionnaire [40]. The other modules were based on the framework of Levesque et al. [7]. Data were collected electronically with questionnaires programmed in Open Data KIT (ODK) on the SurveyCTO platform [41]. All data were collected on tablets and uploaded to the server at the end of each collection day. GPS coordinates were captured by enumerators for every household. The questionnaire was piloted prior to data collection.

Quality assurance procedures consisted of checking enumerator averages, flagging inconsistencies in the responses (e.g., age and education level), and the distribution of coordinates. Additionally, the fieldwork team's supervisor revisited a selection of surveyed households and asked a small selection of the questions to check the consistency with the original interview. Where inconsistencies were identified during the quality assurance phase, field teams were asked to provide context and offer corrections and, if possible, perform call backs. Eventually, five households were excluded due to inconsistencies that could not be resolved through call-backs.

Variables

The primary outcome measure was seeking care for a perceived health need, which was defined as whether or not an individual sought care for a disability, illness, or another healthcare need (e.g., immunisation or family planning) in the three months prior to the survey. To assess which determinants were associated with seeking care at private facilities, the outcome was the type of facility (public or private) at which a person sought care for a perceived health need in the three months prior to the survey. The healthcare providers were grouped into public and private providers (Additional file 1: Table 6). A secondary outcome was the perceived quality of care of households who predominantly visited public providers (i.e., more than half of household members sought care at this type of facility) and households who predominantly visited private providers. This was determined based on 13 different aspects related to quality of care.

Explanatory variables were selected based on dimensions of Levesque's conceptual framework of access to healthcare and previous literature on HSB from sub-Saharan Africa (Table 1) [7].

An index for socioeconomic status (SES) was generated with principal component analysis for all households combined, including the following household-level variables related to SES: type of dwelling, main source of lighting, cooking fuel and place, main source of water, toilet facility, main source of household income, ownership of durable assets and ownership of livestock/ husbandry assets. This index was grouped into quintiles (poorest, lower, middle, higher, highest).

Euclidean distances between households and the nearest HPF-supported health facility were calculated in QGIS V3.22.4 for public health centres and hospitals separately [42].

Statistical analysis

To describe the characteristics of respondents, categorical and continuous variables were summarised by percentages or means/medians and standard deviations/ interquartile ranges (IQRs), respectively. Separate logistic regression analyses were performed to test the relationships between explanatory variables and two outcomes: [1] whether or not a person sought care for a perceived health need, and [2] the type of facility at which a person sought care (private vs. public). First, univariable logistic regression was performed to test the hypothesised relationships. Subsequently, all variables were included in multivariable logistic regression models to determine their joint effect on the two outcomes. Prior to building the multivariable models, collinearity of variables was tested using Pearson's correlation coefficient for numerical variables and Cramer's V for categorical variables. If two variables were strongly correlated ($r \geq 0.80$), only one was included in the model. Lastly, to determine how much of the variation could be explained by the multivariable model, the Nagelkerke R^2 was calculated.

To assess the difference in satisfaction with care between households who predominantly visited private facilities and households who predominantly visited public facilities, components of quality of care were summarised using percentages and compared with chi-squared tests for trend.

Table 1 Definitions of explanatory variables

Variable	Definition
Individual level	
Sex	Sex of the individual
Age	Age of the individual
Medication	Whether or not an individual obtained any medication in relation to their health need and whether or not they had to purchase this medication
Reason for needing care	The reasons an individual had for needing to visit health services grouped into eight categories according to the prevalence of diseases and the main goals of the Health Pooled Fund.
Action prior to seeking care	Whether or not a person took any action in relation to their illness prior to visiting a health provider
Delay seeking care	How long after having the need to visit a health provider an individual visited a health provider
Type of service needed	The type of services an individual used at the last visit to a health provider
Used provider before	Whether or not an individual had used the provider they visited before
Travel time to visited provider	The travel time to the provider that was visited
Safe while travelling	Whether or not an individual felt safe while travelling to the health facility
Household level	
State	The state where the household is located according to the enumerator
Household size	The number of individuals living in the household
Residence	Whether the household lies in a rural or urban environment according to the enumerator
Sex head of household or main caregiver	Sex of the head of household or main caregiver
Religion head of household or main caregiver	Religion of the head of household or main caregiver
Education head of household or main caregiver	The educational level of the head of household or main caregiver
Wealth quintiles	The wealth index of the head of household determined using principal component analysis including nine socioeconomic status-related household characteristics and grouped into quintiles
Distance hospital	Euclidean distance of the household to the nearest HPF supported hospital
Distance public health centre/ unit	Euclidean distance of the household to the nearest HPF supported public health centre/ unit

A significance threshold of $p<0.05$ was utilised. Complete case analysis was performed, no imputation strategies were applied, but the number of respondents excluded due to missing data from each analysis was reported. All statistical analyses were performed in R 4.1.2 [43]. To account for unequal selection probabilities due to the sampling design, clustering, and stratification, survey settings were applied in all analyses, and weighted numbers were analysed and presented.

Ethical considerations

Ethical approval was granted by the Research Ethics Committee of the Royal Tropical Institute (S-114, May 13, 2020) and the Ethics Committee of the Ministry of Health in South Sudan (MoH/ERB5/2020). Informed consent was asked of all respondents, and they were informed that they could refuse to answer questions and stop participation at any time without any repercussions. Respondents did not have to give a reason for not consenting. Only the research team had access to the data, which was stored on a password-protected server. Personal data (e.g., names) that was not necessary for analyses was destroyed, while other personal data needed were kept separately from the questionnaire data (e.g., GPS coordinates).

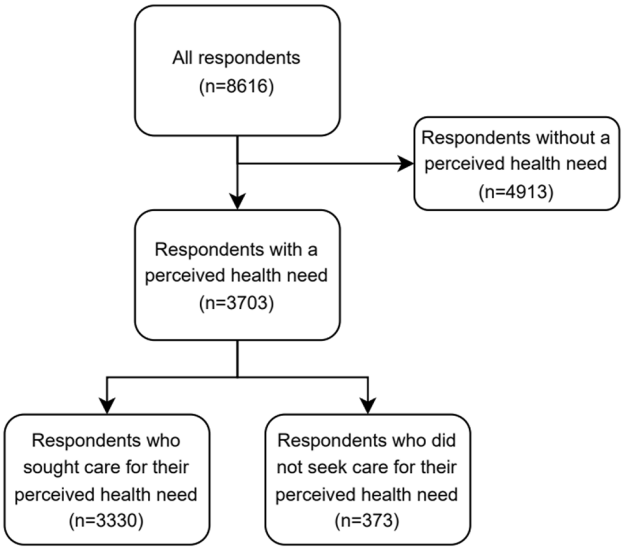

Fig. 3 Flowchart of respondents included in the analysis

Results

A total of 8,616 household members from 1,223 households participated in the survey (Fig. 3). Of these respondents, 3,703 (43%) had a perceived health need and 3,330 (90%) of these had sought care for this need.

The majority of the respondents with a perceived health need were female (57.7%), and the mean age

was 18 (IQR 6–32) (Table 2). The largest proportion of the respondents was from Western Equatoria (56.7%) and from rural households (54.9%). The majority of the households was male-headed (59.3%) and identified as Christian (89.9%). About half of the HoHs did not receive formal education (46.9%) and the majority was from lower wealth quintiles. The median distance to public hospitals was 5.3 km (IQR 2.4–25.6), and the median distance to public health centres 1.8 km (IQR 1.0-3.9). These figures are similar when only looking at those who sought care for their perceived health need (Table 2).

Table 2 Individual and household level characteristics of respondents with a perceived health need ($n=3703$) and respondents who sought care for their perceived health need ($n=3085$)

Characteristics	Perceived health need[1] ($n=3703$)	Sought care for perceived health need in formal sector[1,2] ($n=3085$)
Individual level		
Sex (%)		
Female	2135 (57.7)	1789 (58.0)
Male	1568 (42.3)	1296 (42.0)
Median age[3] (IQR)	18 (6–32)	18 (7–32)
Age group[3] (%)		
< 5	664 (17.9)	562 (18.2)
5–9	584 (15.8)	495 (16.0)
10–14	366 (9.9)	307 (9.9)
15–19	390 (10.5)	325 (10.5)
20–29	591 (16.0)	496 (16.1)
30–39	465 (12.6)	386 (12.5)
40–49	249 (6.7)	201 (6.5)
≥ 50	369 (10.0)	296 (9.6)
Household level		
State (%)		
Central Equatoria	726 (19.6)	553 (17.9)
Western Equatoria	2099 (56.7)	1939 (62.9)
Warrap	878 (23.7)	593 (19.2)
Median household size (IQR)	7 (5–10)	7 (5–10)
Residence (%)		
Urban	1671 (45.1)	1436 (46.6)
Rural	2032 (54.9)	1649 (53.4)
Sex HoH (%)		
Female	1453 (40.7)	1327 (41.4)
Male	2113 (59.3)	1876 (58.6)
Religion (%)		
Christian	3327 (89.9)	2827 (91.6)
Muslim	58 (1.6)	43 (1.4)
None	306 (8.3)	207 (6.7)
Other/ Don't know	12 (0.3)	8 (0.3)
Education HoH[3] (%)		
None	1674 (46.9)	1454 (45.4)
Primary or intermediate	894 (25.1)	835 (26.1)
Secondary or above	976 (27.4)	892 (27.9)
Don't know	23 (0.6)	21 (0.7)
Wealth quintiles (%)		
Poorest	911 (24.6)	767 (24.8)
Lower	907 (24.5)	789 (25.6)
Middle	821 (22.2)	687 (22.3)
Higher	596 (16.1)	496 (16.1)
Highest	468 (12.6)	346 (11.2)

Determinants of seeking care for a perceived health need

Respondents who obtained and paid for medication, and who obtained and did not pay for medication were more likely to seek care as compared to those who did not obtain medication, with odds ratios (OR) of, respectively, 3.80 (95% CI 2.38–6.04) and 4.96 (95% CI 3.17–7.75) (Table 3). Geographical differences in care seeking can be observed; respondents from Western Equatoria were more likely to seek care compared with those from Central Equatoria (OR 12.88, 95% CI 4.81–34.43). Respondents with a HoH who attended primary or secondary schooling were more likely to seek care than those whose HoH had no education (OR 2.14, 95% 1.34–2.98 and OR 1.95, 95% CI 1.40–3.29, respectively). Furthermore, the percentage of respondents who sought care was higher among those with a HoH aware of BHWs (93.5%) compared to those with a HoH who was not (87.0%) (OR 2.13, 95% CI 1.33–3.33). The percentage of respondents with a non-religious HoH who sought care (75.1%) was lower compared to the percentage of respondents with a Christian HoH who sought care (91.4%). This difference was statistically significant (OR 0.28, 95% CI 0.16–0.48). Lastly, those who sought care appeared to be from lower wealth quintiles than those who did not seek care.

In the multivariable model, respondents who either obtained and paid for the medication (OR 2.45, 95% CI 1.15–5.23) or did not pay for medication (OR 4.26, 95% CI 2.08–8.74) were more likely to seek care as compared to respondents not taking any medication (Table 3). At the household level, those from Western Equatoria were more likely to seek care than those from Central Equatoria (OR 9.01, 95% CI 2.35–34.54). Lastly, respondents with a HoH who was aware of BHWs were more likely to seek care than respondents with a HoH who was not (OR 1.70, 95% CI 1.08–2.67). The pseudo R^2 of this multivariable model was 0.31.

The reasons for needing care did not largely differ between those who did and did not seek care, except for those with typhoid and diarrhoea which were reported more frequently as a reason among people who did seek care (respectively 20.9% vs. 9.3%, $p<0.001$ and 19.4% vs. 9.8%, $p=0.01$) (Table 4). The percentage of respondents

Table 2 (continued)

Characteristics	Perceived health need[1] (*n* = 3703)	Sought care for perceived health need in formal sector[1,2] (*n* = 3085)
Median distance hospital (km) (IQR)	5.3 (2.4–25.6)	5.0 (2.3–19.8)
Median distance public health centre/ unit (km) (IQR)	1.8 (1.0-3.9)	1.8 (1.1–3.9)

HoH: head of household, IQR: interquartile range

1: Weighted numbers are reported, which are rounded, the total numbers per variable may show a minor deviation from the denominator of the column representing the total number of people with a perceived health need and/or those who sought care for this perceived health need

2: Excluded are 245 people who sought care in the informal sector or whom had missing data on visited sector

3: Excluded of the descriptive statistics of age and age group, were 25 individuals with a missing for age

younger than five who needed healthcare was higher among those who did not seek care (3.6% vs. 12.8%, $p = 0.09$), but this did not reach the threshold for statistical significance.

Determinants of seeking care in private facilities compared to public facilities

Respondents in older age groups appeared to be more likely to visit private providers as compared to those in the youngest age group (Table 5). Respondents who obtained and paid for medication were more likely to seek care at private facilities as compared to those who did not obtain any medication (OR 2.81, 95% CI 1.81–4.36), while those who did not pay for medication were less likely to visit private facilities (OR 0.44, 95% CI 0.24–0.81). The likelihood of visiting private facilities appeared to increase with the educational level of the HoH and wealth index. Conversely, respondents who had visited their provider before were less likely to visit private facilities than those who did not (OR 0.38, 95% CI 0.26–0.56). The likelihood of a respondent visiting a private facility seemed to decrease with increasing travel time to the visited facility. Respondents from Western Equatoria and Warrap were less likely to visit private facilities as compared to respondents from Central Equatoria (OR 0.20, 95% CI 0.12–0.33 and OR 0.20, 95% CI 0.13–0.31, respectively). The percentage of respondents visiting private facilities was significantly lower among those from rural households (17.2%) than among those from urban households (40.2%) (OR 0.31, 95% CI 0.19–0.49). Lastly, respondents living further from hospitals (OR 0.98, 95% CI 0.96–0.99) and primary public health centre facilities (OR 0.92, 95% CI 0.85–0.99) were less likely to visit private facilities than public facilities.

In the multivariable model, those who paid for medication were more likely to visit private facilities than those who did not obtain any medication (OR 3.03, 95% CI 1.59–5.81) (Table 5). Respondents living further from public health facilities were more likely to visit private facilities (OR 1.19, 95% CI 1.09–1.31). On the other hand, those who had visited the provider before (OR 0.52, 95% CI 0.34–0.78) or had longer travel time to the closest health facility were less likely to seek care at private facilities. Respondents from Western Equatoria were less likely to seek care from private providers than those from Central Equatoria (OR 0.24, 95% CI 0.13–0.46). Lastly, those from rural households had a lower likelihood of seeking care (OR 0.04, 95% CI 0.23–0.70). The model had a pseudo R^2 of 0.22.

Quality of care

For the majority of measured components of satisfaction with care, the difference in satisfaction between households who predominantly visited private providers and households who predominantly visited public providers was small (Additional file 2: Table 7). However, households predominantly visiting private providers were significantly more satisfied with the cleanliness of the facility ($p = 0.01$).

Discussion

From the 3,703 respondents of 1,223 households that completed the survey, we found that obtaining medication, obtaining and paying for medication, and a household's awareness of BHWs were associated with seeking care. We found that obtaining and paying for medication, the distance to public health centre facilities and travel time to the visited facility, rural residency, and having used the provider before were associated with seeking care at a private facility as compared to a public facility. Respondents from Western Equatoria were more likely to seek care in general compared to the other two states, and less likely to seek care from private compared to public facilities.

Obtaining and paying for medication was associated with both seeking care and seeking care at a private provider. In both cases, obtaining and paying for medication may not be a cause of these outcomes but a consequence, as seeking care possibly causes people to obtain more medication. Accordingly, obtaining and paying for medication might not be a determinant for seeking care at a private facility, but could indicate that those seeking care at private facilities are more likely to receive medication and/or are more likely to have to pay for their medication. Our results show there is a slightly higher likelihood of obtaining medication when visiting a private provider, although this also occured when people had to pay for the medication. Therefore, we are unable to disentangle the difference in likelihood of obtaining medication between the private and public sectors alone. Unfortunately, as we do not have information on the supply chains of private

facilities, we do not know whether there are differences in the availability of medication between private and public providers. Evidence from studies elsewhere in sub-Saharan Africa suggest that when facilities have a shortage of drugs, people are less likely to seek care [16, 17, 44]. Shortages of drugs are a large-scale problem in South Sudan that, according to a qualitative evaluation of the HPF, influences HSB [6, 45–47]. One health worker mentioned that when someone with a healthcare need does not get drugs due to shortages, this discourages others in the community to seek care [47]. This could indicate that, indirectly, obtaining medication might have a positive effect on seeking care.

There is a slight increase in the percentage of people seeking healthcare those from higher wealth quintiles, but this was not statistically significant Many previous studies have shown associations between socioeconomic factors, such as income and occupation, and seeking care, with those with higher SES being more likely to seek care [9–14, 17, 48]. In a univariable model, we also found a trend of more care seeking at private facilities among people in the higher wealth quintiles, but this disappeared when adjusting for potential confounders. State and urbanicity seemed to influence this association particularly. This could be explained by the fact that private providers are generally concentrated in urban areas (such as Juba county in Central Equatoria), which might influence the choice of provider, as distance to a health provider is an established determinant of seeking care [7, 49, 50]. Previous studies found an association between an individual's level of education and seeking care [9, 11–14, 48]. In our univariable model, we found an association between the educational level of the HoH and seeking care, but when adjusting for potential confounders it became insignificant. In a secondary analysis we found that especially state might be confounding the relationship between educational level of the HoH and seeking care (Additional file 3: Tables 8, 9 and 10; Additional file 4: Tables 11 and 12).

The finding that respondents with a HoH aware of the BHWs are twice as likely to seek care, might suggest that BHWs have a positive effect on access to care. BHWs are intended to play an important role in health education, motivating appropriate HSB, and provide basic treatment for priority diseases and referral to specialised healthcare providers, based on good community health practices elsewhere [1, 21]. This is also corroborated by evidence from other low- and middle income countries (LMICs) that suggests that community health worker programmes can be (cost-)effective in reducing burden of disease and improving service utilization [51, 52]. However, the identified association could work in both directions. We did not find an association between awareness of BHWs and seeking care at private compared to public facilities.

Respondents from Western Equatoria sought care more readily and sought care more frequently at public providers compared to private providers. This suggests that there are regional differences in HSB and choice of provider. The identified associations between the determinants and seeking care might be modified by state, as a sensitivity analysis showed that obtaining (and paying for) medication and household's wealth status interacted with state. Since the sample size was not powered to facilitate state-level analysis, it was not possible to assess the associations between these determinants and seeking care stratified by state. There are other factors that may differ between states that could influence HSB and choice of provider that were not included in the analysis, such as differences in the perception of when it is necessary to seek care. The distribution of private and public providers could also explain differences in choice of provider between states, since private providers are generally concentrated in urban areas, such as Central Equatoria [49, 50].

While distance to health facilities is an established barrier for seeking care in literature, this was not confirmed by this study [7, 9, 10, 12, 13, 16, 17]. However, we did find that people who live further away from public health centre facilities are more likely to seek care at private providers as compared to public providers. This could mean that people who live closer to a private health facility are more likely to seek care at a private provider, and there may be differences between states in the availability of private providers which could have influenced the results [49, 50]. As private facilities were mostly concentrated in urban areas, where the distance to a facility is in general shorter, respondents in less densely populated areas are less likely to have a private facility as their closest [49, 50]. This could mean that respondents in less densely populated areas (Warrap and Western Equatoria) were more likely to visit a public provider. However, as the sample size was insufficient to perform a state-wise analysis, it was not possible to confirm this hypothesis. Yet as distance to public health centre facilities is only just above the threshold for statistical significance, caution in drawing conclusions should be taken. Related to distance, people travelling longer to the nearest health facility were less likely to seek care at a private facility, as were rural households. Notably, the median distance to hospitals and public health facilities supported by the HPF was lower than expected in South Sudan, as a previous study showed that only 28.6% of people lived within 5 km to the nearest public health facility [4]. A possible explanation could be that only secure and accessible regions were sampled in the study, which naturally have shorter distances to health facilities than remote and unsafe areas. Additionally, Euclidean distances to health facilities were used. This does not take into account the geography and

Table 3 Individual and household level characteristics of respondents with a perceived health need ($n=3703$) and the association (expressed in odds ratios) between these characteristics and seeking care

	Sought care for perceived health need				
Characteristics	**Yes[1] ($n=3330$)**	**No[1] ($n=373$)**	**Total[1] ($n=3703$)**	**cOR[2] (95% CI)**	**aOR[3] (95% CI)**
Individual level					
Sex (%)					
Female	1922 (90.0)	214 (10.0)	2136 (100.0)	1	1
Male	1409 (89.9)	159 (10.1)	1568 (100.0)	0.98 (0.78–1.24)	1.08 (0.84–1.38)
Age group[4] (%)					
< 5	603 (91.0)	60 (9.0)	663 (100.0)	1	1
5–9	529 (90.6)	55 (9.4)	584 (100.0)	0.96 (0.71–1.29)	1.06 (0.72–1.56)
10–14	333 (91.0)	33 (9.0)	366 (100.0)	1.01 (0.71–1.45)	1.39 (0.90–2.14)
15–19	350 (89.7)	40 (10.3)	390 (100.0)	0.87 (0.55–1.37)	1.31 (0.79–2.16)
20–29	538 (91.0)	53 (9.0)	591 (100.0)	1.01 (0.70–1.47)	1.55 (1.03–2.32)
30–39	415 (89.2)	50 (10.8)	465 (100.0)	0.84 (0.62–1.13)	1.08 (0.73–1.25)
40–49	219 (88.3)	29 (11.7)	248 (100.0)	0.75 (0.48–1.18)	1.20 (0.73–1.98)
≥ 50	323 (87.5)	46 (12.5)	369 (100.0)	0.70 (0.47–1.06)	1.03 (0.65–1.63)
Medication (%)					
Not obtained	253 (73.5)	91 (26.5)	344 (100.0)	1	1
Obtained and paid for	2426 (91.3)	230 (8.7)	2656 (100.0)	**3.80 (2.38–6.04)**	**2.45 (1.15–5.23)**
Obtained and not paid for	643 (93.2)	47 (6.8)	690 (100.0)	**4.96 (3.17–7.75)**	**4.26 (2.08–8.74)**
Other	8 (66.7)	4 (33.3)	12 (100.0)	NA[5]	NA[5]
Household level					
State (%)					
Central Equatoria	609 (83.9)	117 (16.1)	726 (100.0)	1	1
Western Equatoria	2068 (98.5)	31 (1.5)	2099 (100.0)	**12.88 (4.81–34.43)**	**9.01 (2.35–34.54)**
Warrap	653 (74.4)	225 (25.6)	878 (100.0)	0.56 (0.31-1.00)	0.16 (0.03–1.01)
Median household size (IQR)	7 (5–10)	7 (6–9)	NA	1.02 (0.98–1.06)	1.00 (0.95–1.06)
Residence (%)					
Urban	1542 (92.3)	129 (7.7)	1671 (100.0)	1	1
Rural	1788 (88.0)	244 (12.0)	2032 (100.0)	0.61 (0.31–1.22)	0.59 (0.73–3.93)
Sex HoH (%)					
Female	1327 (91.3)	127 (8.7)	1453 (100.0)	1	1
Male	1876 (88.8)	237 (11.2)	2113 (100.0)	0.76 (0.50–1.15)	1.21 (0.78–1.88)
Missing	127 (93.0)	10 (7.0)	137 (100.0)	NA[5]	NA[5]
Religion (%)					
Christian	3043 (91.4)	285 (8.6)	3328 (100.0)	1	1
Muslim	50 (84.7)	9 (15.3)	59 (100.0)	0.55 (0.22–1.34)	1.04 (0.61–1.77)
None	229 (75.1)	76 (24.9)	305 (100.0)	**0.28 (0.16–0.48)**	1.19 (0.67–2.09)
Other/ Don't know	8 (72.3)	3 (27.2)	11 (100.0)	NA[5]	NA[5]
Education HoH (%)					
None	1454 (86.9)	219 (13.1)	1674 (100.0)	1	1
Primary or intermediate	835 (93.4)	59 (6.6)	894 (100.0)	**2.14 (1.40–3.29)**	1.07 (0.66–1.72)
Secondary or above	892 (91.4)	84 (8.6)	976 (100.0)	1.61 (0.92–2.79)	0.96 (0.54–1.71)
Don't know	21 (94.7)	1 (5.3)	23 (100.0)	NA[5]	NA[5]
Missing	127 (93.0)	10 (7.0)	137 (100.0)	NA[5]	NA[5]
Wealth quintiles (%)					
Poorest	824 (90.5)	86 (9.5)	910 (100.0)	1	1
Lower	848 (93.5)	59 (6.5)	907 (100.0)	1.49 (0.79–2.82)	1.71 (0.78–3.75)
Middle	733 (89.3)	88 (10.7)	821 (100.0)	0.87 (0.40–1.87)	1.07 (0.48–2.37)
Higher	549 (92.1)	47 (7.9)	596 (100.0)	1.23 (0.63–2.29)	1.99 (0.80–4.94)
Highest	376 (80.3)	92 (19.7)	468 (100.0)	**0.43 (0.25–0.72)**	0.97 (0.29–3.24)
Median distance hospital (km) (IQR)	5.1 (2.3–20.5)	11.6 (3.5–28.6)	5.3 (2.4–25.6)	0.99 (0.98-1.00)	1.02(1.00-1.05)
Median distance public health centre/ unit (km) (IQR)	1.8 (1.1–3.9)	1.9 (0.8–4.8)	1.8 (1.0-3.9)	0.99 (0.87–1.13)	1.00 (0.83–1.21)
Aware BHWs (%)					

Table 3 (continued)

	Sought care for perceived health need				
Characteristics	**Yes[1] (*n* = 3330)**	**No[1] (*n* = 373)**	**Total[1] (*n* = 3703)**	**cOR[2] (95% CI)**	**aOR[3] (95% CI)**
Yes	1530 (93.5)	107 (6.5)	1637 (100.0)	1	1
No	1796 (87.0)	266 (12.9)	2062 (100.0)	**2.13 (1.33–3.33)**	**1.70 (1.08–2.67)**
Refused to answer	4 (100.0)	0 (0.0)	4 (100.0)	NA[5]	NA[5]

Odds ratios in bold are those that are statistically significant

BHWs: boma health workers, HoH: head of household, IQR: interquartile range, NA: not applicable, because a category was not assessed in the statistical model

1: Because weighted numbers are reported, which are rounded, the number of respondents per variable may show a minor deviation from the denominator of the column representing the number of respondents who sought care or who did not seek care for their perceived health need

2: Crude odds ratio, resulting from univariable logistic regression

3: Adjusted odds ratio, resulting of multivariable logistic regression in which all variables in the table of which a crude odds ratio was calculated were included

4: The descriptive statistics and odds ratio for the age groups exclude 25 individuals with missing age data

5: For the variables medication, religion, education HoH, and aware BHWs, the categories other/ don't know / refused to answer were not included in the statistical models because of low numbers and as these associations would not be meaningful

Table 4 Reasons for visiting health services of individuals with a perceived health need (*n* = 3703)

	Sought care for perceived health need		
Reason for needing care[1]	**Yes (*n* = 3330)**	**No (*n* = 373)**	**p-value**
Malaria	1922 (57.9)	200 (54.2)	0.46
Fever	1011 (30.5)	109 (29.6)	0.91
Typhoid	694 (20.9)	34 (9.3)	**< 0.001**
Diarrhoea	646 (19.4)	36 (9.8)	**0.01**
Acute respiratory infections	488 (14.7)	53 (14.5)	0.89
Maternal health	108 (3.3)	17 (4.6)	0.42
Child health (< 5years)	23 (3.6)	9 (12.8)	0.09
Other	1635 (49.2)	164 (44.5)	0.19

1: The reason for seeking care is a multiple response categorical variable. In this table the proportion of people who indicated the category is shown

infrastructure in the area and will hence not accurately reflect travel times in all situations. However, together with the variable on travel time to the closest facility it does give a general indication of travel distance.

Respondents who used the same provider before were two times less likely to visit private providers. But caution should be taken when drawing conclusions since the formulation of the question in the questionnaire, whether the respondent had used the provider before, without specifying what was meant with the provider, allowed for multiple interpretations.

A factor potentially influencing provider choice is the quality of care at the facility. In our analysis, we identified only one component of satisfaction with care that was higher in households predominantly visiting private providers, which was cleanliness of the facility. This might suggest that quality of care is not a key determinant of provider choice. Studies from neighbouring Kenya and Ethiopia, however, suggest that the perceived quality of care is higher among people visiting private providers as compared to people visiting public providers [53–55]. A possible explanation of the discrepancy between our findings and other evidence could be that since data on perceived quality of care was gathered at the household level, we could only perform an aggregated analysis at household level, which might not be representative for satisfaction and decisions of individuals. Furthermore, the questions on quality of care were answered by the HoH, who might not have been the main user of care.

In this study, the percentage of respondents who indicated typhoid or diarrhoea as their reason for needing care was higher among those who did seek care than among those who did not. Potentially, infectious diseases are common reasons to seek care among communities, compared to other lesser known conditions. Other studies have shown that people with an acute or severe disease are more likely to seek care than those with a chronic or less severe disease; a pattern that we could not assess in this study [9, 10].

Strengths and limitations

Variables were chosen based on Levesque's framework for access to care and previous literature on determinants of HSB [7]. We assessed many characteristics related to HSB, both on the individual and household level, and as such could adjust our estimates for potential confounders. Furthermore, to create a representative measure for SES, the wealth status of households was assessed based on a large variety of factors related to SES, as was done in the last survey of the MoH [33]. The chosen factors approximated SES in contextually relevant ways, such as the possession of livestock and main source of dwelling, as opposed to purely financial wealth [56]. Enumerators and fieldwork teams conducting the surveys were extensively trained in a three-day course before data collection in which the questionnaire was also piloted. As enumerators were from the states as the respondents, the questionnaires could be conducted in local languages as needed. In addition, to safeguard the quality of the data, quality assurance checks were performed both during and after data collection to validate and correct identified mistakes.

Table 5 Individual and household level characteristics of respondents who sought care for their perceived health needs in the formal sector ($n=3085$) and the association (expressed in odds ratios) between these characteristics and seeking care at a private facility

	Type of facility				
Characteristics	**Public[1] ($n=2224$)**	**Private[1] ($n=861$)**	**Total[1] ($n=3085$)**	**cOR[2] (95% CI)**	**aOR[3] (95% CI)**
Individual level					
Sex (%)					
Female	1311 (73.3)	478 (26.7)	1789 (100.0)	1	1
Male	913 (70.4)	383 (29.6)	1296 (100.0)	1.15 (0.95–1.40)	1.12 (0.87–1.46)
Age group[4] (%)					
< 5	455 (81.0)	107 (19.0)	562 (100.0)	1	1
5–9	360 (72.7)	135 (27.3)	495 (100.0)	1.59 (0.93–2.73)	1.62 (0.76–3.44)
10–14	211 (68.7)	96 (31.3)	307 (100.0)	**1.93 (1.22–3.04)**	1.76 (0.99–3.13)
15–19	237 (72.7)	89 (27.3)	326 (100.0)	**1.59 (1.04–2.47)**	**1.69 (1.01–2.85)**
20–29	350 (70.4)	147 (29.6)	497 (100.0)	**1.78 (1.15–2.77)**	1.51 (0.98–2.33)
30–39	258 (66.7)	129 (33.3)	387 (100.0)	**2.12 (1.23–3.65)**	**2.07 (1.02–4.23)**
40–49	140 (69.7)	61 (30.3)	201 (100.0)	1.84 (0.99–3.43)	1.7 (0.91–3.16)
≥ 50	200 (67.6)	96 (32.4)	296 (100.0)	**2.03 (1.36–3.04)**	**1.89 (1.19–3.01)**
Reason for needing care[4,5] (%)					
Malaria	1289 (58.1)	507 (59.0)			
Fever	759 (34.2)	186 (21.7)			
Typhoid	425 (19.2)	224 (26.1)			
Diarrhoea	450 (20.3)	148 (17.3)			
Acute respiratory infections	326 (14.7)	125 (14.5)			
Maternal health	70 (3.2)	32 (3.7)			
Child health (< 5 years)	20 (4.1)	0 (0.0)			
Other	1090 (49.1)	419 (48.8)			
Medication (%)					
Not obtained	181 (84.2)	34 (15.8)	215 (100.0)	1	1
Obtained and paid for	1493 (65.7)	779 (34.3)	2272 (100.0)	**2.81 (1.81–4.36)**	**3.03 (1.59–5.81)**
Obtained and not paid for	547 (92.4)	45 (7.6)	592 (100.0)	**0.44 (0.24–0.81)**	0.54 (0.23–1.27)
Other	4 (57.1)	3 (42.9)	7 (100.0)	NA[6]	NA[6]
Action prior to seeking care (%)					
No	1800 (73.4)	651 (26.6)	2451 (100.0)	1	1
Yes	424 (66.9)	210 (33.1)	634 (100.0)	1.37 (0.90–2.09)	0.85 (0.52–1.38)
Delay seeking care[4] (%)					
Same day	1142 (71.6)	454 (28.4)	1596 (100.0)	1	1
< 2 days	776 (72.6)	293 (27.4)	1069 (100.0)	0.95 (0.70–1.28)	1.47 (0.91–2.39)
2–7 days	217 (72.6)	82 (27.4))	299 (100.0)	0.95 (0.62–1.45)	1.19 (0.75–1.9)
1–4 weeks	24 (61.5)	15 (38.5)	39 (100.0)	1.61 (0.89–2.92)	1.48 (0.55–3.94)
> 4 weeks	48 (77.4)	14 (22.6)	62 (100.0)	0.71 (0.40–1.25)	0.89 (0.35–2.29)
Type of service needed[4,5] (%)					
Outpatient	1584 (75.0)	527 (25.0)	2111 (100.0)		
Family planning	10 (83.3)	2 (16.7)	12 (100.0)		
Antenatal care	38 (88.3)	5 (11.6)	43 (100.0)		
Maternal/ child care	100 (75.2)	33 (24.8)	133 (100.0)		
HIV/ TB service	125 (88.0)	17 (12.0)	142 (100.0)		
Laboratory	290 (57.3)	216 (42.7)	506 (100.0)		
Other/ don't know/ refused to answer -	33 (73.3)	12 (26.7)	45 (100.0)		
Used provider before (%)					
No	77 (51.0)	74 (49.0)	151 (100.0)	1	1

Table 5 (continued)

Characteristics	Type of facility				
	Public[1] (*n* = 2224)	Private[1] (*n* = 861)	Total[1] (*n* = 3085)	cOR[2] (95% CI)	aOR[3] (95% CI)
Yes	2136 (73.2)	784 (26.8)	2920 (100.0)	**0.38 (0.26–0.56)**	**0.52 (0.348–0.78)**
Other/ don't know	13 (86.7)	2 (13.3)	15 (100.0)	NA[6]	NA[6]
Travel time visited facility[4] (%)					
< 0.5 h	786 (63.9)	445 (36.1)	1231 (100.0)	1	1
0.5–1 h	691 (76.6)	211 (23.4)	902 (100.0)	**0.54 (0.33–0.89)**	**0.50 (0.29–0.87)**
1–2 h	411 (77.8)	117 (22.2)	528 (100.0)	**0.50 (0.27–0.95)**	0.49 (0.24–1.02)
2 h - half a day	252 (89.0)	31 (11.0)	283 (100.0)	**0.21 (0.11–0.41)**	**0.23 (0.11–0.49)**
> half a day	38 (88.4)	5 (11.6)	43 (100.0)	**0.26 (0.15–0.44)**	**0.19 (0.07–0.50)**
Don't know	26 (61.9)	16 (38.1)	42 (100.0)	NA[6]	NA[6]
Safe while travelling[4] (%)					
Yes	2093 (72.9)	779 (27.1)	2872 (100.0)	1	1
No	107 (70.4)	45 (29.6)	152 (100.0)	0.88 (0.55–1.41)	1.44 (0.64–3.22)
Don't know	5 (83.3)	1 (16.7)	6 (100.0)	NA[6]	NA[6]
Household level					
State (%)					
Central Equatoria	233 (42.1)	320 (57.9)	553 (100.0)	1	1
Western Equatoria	1525 (78.6)	414 (21.4)	1939 (100.0)	**0.20 (0.12–0.33)**	**0.24 (0.13–0.46)**
Warrap	466 (78.6)	127 (21.4)	593 (100.0)	**0.20 (0.13–0.31)**	1.01 (0.28–3.68)
Median household size (IQR)	7 (5–10)	7 (5–10)	NA	0.98 (0.96-1.00)	0.97 (0.92–1.02)
Residence (%)					
Urban	859 (59.8)	578 (40.2)	1437 (100.0)	1	1
Rural	1366 (82.8)	283 (17.2)	1649 (100.0)	**0.31 (0.19–0.49)**	**0.40 (0.23–0.70)**
Sex HoH (%)					
Female	930 (75.1)	309 (24.9)	1239 (100.0)	1	1
Male	1227 (71.1)	499 (28.9)	1727 (100.0)	1.22 (0.88–1.71)	0.97 (0.63–1.52)
Missing	67 (56.1)	52 (43.9)	119 (100.0)	NA[6]	NA[6]
Religion (%)					
Christian	2043 (72.3)	784 (27.7)	2827 (100.0)	1	1
Muslim	27 (62.8)	16 (37.2)	43 (100.0)	1.55 (0.43–5.64)	0.56 (0.18–1.71)
None	149 (71.6)	59 (28.4)	208 (100.0)	1.03 (0.68–1.57)	1.51 (0.69–3.30)
Other/ Don't know	5 (71.4)	2 (28.6)	7 (100.0)	NA[6]	NA[6]
Education HoH (%)					
None	1046 (78.0)	295 (22.0)	1341 (100.0)	1	1
Primary or intermediate	568 (73.1)	209 (26.9)	777 (100.0)	1.31 (0.87–1.96)	1.38 (0.74–2.58)
Secondary or above	527 (63.7)	301 (36.3)	828 (100.0)	**2.02 (1.12–3.65)**	1.42 (0.65–3.12)
Don't know	16 (80.9)	4 (19.1)	20 (100.0)	NA[6]	NA[6]
Missing	67 (56.1)	52 (43.9)	119 (100.0)	NA[6]	NA[6]
Wealth quintiles (%)					
Poorest	610 (79.6)	156 (20.4)	766 (100.0)	1	1
Lower	631 (80.0)	158 (20.0)	789 (100.0)	0.98 (0.50–1.90)	1.03 (0.57–1.88)
Middle	519 (75.5)	168 (24.4)	687 (100.0)	1.26 (0.40–3.94)	1.27 (0.39–4.11)
Higher	335 (67.5)	161 (32.5)	496 (100.0)	1.87 (0.92–3.80)	1.54 (0.68–3.49)
Highest	128 (37.0)	218 (63.0)	346 (100.0)	**6.63 (3.59–12.27)**	1.86 (0.83–4.15)
Median distance hospital (km) (IQR)	6.2 (2.5–26.8)	2.8 (2.1–6.2)	5.0 (2.3–19.8)	**0.98 (0.96–0.99)**	0.98 (0.95–1.01)
Median distance public health centre/ unit (km) (IQR)	1.9 (1.2–4.3)	1.6 (0.9–2.7)	1.8 (1.1–3.9)	**0.92 (0.85–0.99)**	**1.19 (1.09–1.31)**

Table 5 (continued)

Characteristics	Type of facility				
	Public[1] (*n* = 2224)	Private[1] (*n* = 861)	Total[1] (*n* = 3085)	cOR[2] (95% CI)	aOR[3] (95% CI)
Aware BHWs					
Yes	1016 (71.2)	411 (28.8)	1427 (100.0)	1	1
No	1206 (72.9)	449 (27.1)	1655 (100.0)	1.07 (0.81–1.47)	1.18 (0.72–1.93)
Refused to answer	3 (75.0)	1 (25.0)	4 (100.0)	NA[6]	NA[6]

Odds ratios in bold are those that are statistically significant

BHWs: boma health workers, HoH: head of household, IQR: interquartile range, NA: not applicable, either because a variable or category was included in the statistical model, or because it was not possible to calculate the row total from a multiple response categorical variable

1: Because weighted numbers are reported, which are rounded, the number of respondents per variable may show a minor deviation from the denominator of the column

2: Crude odds ratio, resulting from univariable logistic regression

3: Adjusted odds ratio, resulting of multivariable logistic regression in which all variables in the table of which a crude odds ratio was calculated were included

4: Of the following variables, individuals were excluded from the descriptive statistics and regressions because of missing values: age group ($n=17$), reason for needing care ($n=8$), delay seeking care ($n=20$), type of service needed ($n=92$), travel time to visited facility ($n=60$) and safety while travelling ($n=55$)

5: The reason for seeking care and type of service needed are multiple response categorical variables. In this table, the number and percentage of people who indicated the category are shown. No inferential statistics were performed of these variables and therefore odds ratios are not presented

6: For the variables medication, used provider before, travel time visited facility, safety while travelling, religion, education HoH, and aware BHWs, the categories other/ don't know / refused to answer were not included in the statistical models because of low numbers and because studying these association would not be meaningful

A limitation of the study was that the choice and measurement of variables involved trade-offs in terms of feasibility and specificity. For example, in the estimation of households' distance to HPF supported facilities, a longer distance to the nearest facility may have been assigned to some households as coordinates were not available for all facilities. However, no signs of unexpectedly large distances were found when describing distance to health facilities. In addition, the analysis of individuals' reason for needing care was difficult since response options included both symptoms and diagnoses, which were not mutually exclusive, as symptoms could indicate several diseases. Although we adjusted the estimates of our associations for several important confounders, there may have been residual confounding by unmeasured variables. Furthermore, no imputation strategies were applied to handle missing values, and only those observations without missing values for a certain variable were included in the analysis of that variable. Nevertheless, for most variables the number of missing values was low (<5%). While we stratified the visited providers into private and public providers, this division might not be meaningful in South Sudan. Among private providers, for example, FBOs managed by the Catholic church that receive funding from the HPF fall into this category, yet so do private for-profit organizations ranging from small drug sellers to large private clinics. The categorisation of providers we used is also not so clear cut given some private facilities and FBOs can receive funding from HPF. Another limitation of the study was the cross-sectional design, which makes it impossible to assess causality between the measured determinants and seeking care. Additionally, this study only assessed quantifiable determinants of HSB and there are many other characteristics that may influence HSB, such as perceptions of when care is needed, expectations and experiences of care and decision-making processes within a household. For example, we analysed the educational level of the head of household instead of the individual. Although we assumed the head of household greatly influences the decision to seek care, the person involved in decision-making likely differs between households. Lastly, because only reasonably safe and accessible counties were included in the sample, the results are not generalizable to those living in the most remote areas and the areas most affected by conflict. These groups could, both, have higher needs for care and face more barriers to accessing it. County health departments and other health administrators must rely on their relationships with healthcare and humanitarian providers serving these groups in order to address this knowledge gap, and plan health resources accordingly.

Conclusions

The results of this household survey in South Sudan provide insights to design and prioritise strategies to improve access to healthcare in South Sudan. This study suggests that people's awareness of BHWs increased their likelihood of seeking care. Distance to health facilities seemed to influence the choice of provider. While our results suggest differences between states, we could not analyse these in detail and studies with larger sample sizes are needed. We found that 30% of the variance in seeking care could be explained by the variables in our model, which shows that there should be other determinants that influence HSB, all of which may not be easy to quantify. To better understand the mechanisms by which

these established determinants influence HSB, qualitative evidence into access to healthcare is needed.

Abbreviations

BHI	Boma health initiative
BHW	Boma health worker
CHW	Community health worker
FBO	Faith based organization
HoH	Head of household
HPF	Health pooled fund
HSB	Health seeking behaviour
IQR	Interquartile range
LMIC	Low- and middle income countries
NGO	Non-governmental organization
ODK	Open data kit
OR	Odds ratio
SES	Socioeconomic status

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

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Author contributions
EJ, MS and GL conceptualised and designed the larger study into healthcare access of which this study forms part, as well as writing the study protocol and submitting it to ethics review bodies. Data collection and management was coordinated and supervised by HC, MS and EJ. The statistical analysis plan for this study was principally drafted by IO, with supervision from MvG and MS, and IO also carried out the analysis. IO wrote the first draft of the manuscript with review and editing from all other authors. Supervision for the project was provided by EJ.

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Data availability
The datasets generated and analyzed during the current study are available in the Data Archiving and Networking Services (DANS) repository of the Royal Netherlands Academy of Arts and Sciences (https://doi.org/10.17026/dans-24a-edf7).

Declarations

Ethics approval and consent to participate
The research protocol received ethical approval by both the Royal Tropical Institute's Research Ethics Committee (S-114, May 13, 2020) as well as South Sudan's Ministry of Health (MoH/ERB5/2020). All research procedures were in accordance with the Declaration of Helsinki. Informed consent was obtained from all research participants and respondents, which included informing them of their rights to withdraw from the study at any time without any consequences. Confidentiality and privacy were assured as a safeguard against any harm to the participants and respondent.

Consent for publication
Not applicable.

Competing interests
At the time of the study KIT Royal Tropical Institute was the operational research partner for the Health Pooled Fund (third phase) programme, which is responsible for delivery of the majority of health services in the study sites. The affiliated authors feel that this does not constitute a substantive conflict. The authors declare that they have no conflicting or competing interests.

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