RESEARCH

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Abstract

Background Sepsis is defined as invasion of pathogens into the blood stream together with the host response to this invasion. Thus, sepsis consists of the systemic inflammatory response syndrome (SIRS)caused by infection. It is a life-threatening condition that requires prompt detection and early definitive medical intervention. Globally, sepsis is common, with an estimated 31.5 million cases per year. Sepsis accounts for a significant in-hospital mortality rate of 17% in high-income countries, while in Malawi, it ranges from 17 to 50%. For Malawi, the trend can be reversed with improvements in patient referral system within the healthcare system. The study sets out to establish factors associate with delay referral of patients with sepsis from primary healthcare to tertiary hospitals and to understand healthcare workers and patients' perspectives on barriers associated with delayed referral of patients with sepsis from primary to tertiary healthcare.

Methods A qualitative descriptive study in six health centres within Blantyre District health office. In-depth interviews were conducted with 22 respondents: healthcare providers [n=12]; patients [n=10] using semi-structured interview guides. Purposive sampling techniques were used in selecting healthcare providers (health centre in charges) and patients.

Results The study demonstrating that the main referral pathways for patients with sepsis include community-to-facility and facility-to-facility referrals. Ambulances and personal transport are common transportation mode used during referrals. Primary care facilities face several challenges that delay referrals from primary to tertiary health facility of patients with sepsis, such as lack of referral transport, poor communication, poor road network, shortage of skilled healthcare workers, patient preferences, delayed treatment-seeking action, and ambulances prioritising maternal conditions.

Conclusions Patients' delay and failure to access prompt and timely referral services result from the healthcare system's lack of transport, communication problems, bad road networks and shortage of well-trained personnel. Referral delays have deleterious effects on patient-care outcomes.

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Keywords Sepsis, Referral pathway, Primary health care, Tertiary hospital, Delay referral

Background

Sepsis is defined as invasion of pathogens into the blood stream together with the host response to this invasion. Thus, sepsis consists of the systemic inflammatory response syndrome (SIRS) caused by infection [1]. There is currently no viable biochemical approach for distinguishing between sepsis and non-infectious inflammation. Procalcitonin (PCT) is the most studied biomarker for this purpose [1]. Its related deaths account for 19.7% of all global deaths annually [2]. Most of the worldwide burden of sepsis occurs in low- and middle-income countries (LMICs), where nearly 85% of an estimated 48.9 million annual cases of sepsis occur [3]. In 2017, sepsis incidence and mortality varied substantially across regions, with the highest burden in Africa, Oceania, South Asia, East Asia, and Southeast Asia [4]. Is a lifethreatening illness that requires prompt identification and early definitive medical intervention [5].

The names of the referral pathways commonly used in Malawi and sub-Sahara Africa region include community-to-facility referral and facility-to-facility referral. The health centre has a motorbike or ambulance for transporting referred clients to the district hospital and tertiary hospitals [6]. The Malawian healthcare system is 4-tiered and comprises community, primary, secondary, and tertiary levels of care, and is connected by a wellestablished referral system [7].

Studies in Africa identified a range of barriers encountered in the referral process include referral transportation system, referrer-receiver communication barriers, inadequate infrastructure and supplies and insufficient health personnel. Some highlights of the problem included inadequate use of ambulance services, poor management of patients during transit, lack of professional escort, unannounced emergency referrals, lack of adequate information and feedback and limited supply of beds, drugs and blood [8–10].

In Malawi, severe cases of sepsis are referred to tertiary health facilities for specialist care. However, sepsis cases are frequently diagnosed too late, resulting in a high sepsis-related in-hospital mortality between 17 and 50% [11]. This study aimed to explore factors associated with delayed referrals of patients with sepsis from primary to tertiary healthcare in Blantyre, Malawi.

Theoretical frameworks

This study categorised the collected data using the adopted "Three Delays' theoretical framework [12]. The Three Delays Model has been widely applied to understand maternal mortality but it has not been systematically applied to the context of medical conditions more

broadly. This model could serve as a useful framework for Identifying factors associated with delay referral of medical conditions including sepsis from one level of care to another referral hospital. The study discovered that the three delays described by Thaddeus and Maine (1994) were delays in seeking, reaching, and receiving care [13].

Methods

Research design

This cross-sectional qualitative descriptive study comprised in-person in-depth interviews (IDIs) with two participant groups: patients recovering from sepsis and healthcare workers (HCWs). This study was conducted at six Blantyre District Health Office (DHO) health centres selected randomly, namely, Madziabango, Pesulu, Lirangwe, Bangwe, Ndirande, and Zingwagwa health centres.

Sampling procedure

We used a non-probability purposive sampling of the study respondents and interviewed 22 participants. Purposive sampling was used to select the sample based on the population characteristics and the objective of the research [14]. Inclusion criteria were adult patients referred from the health centre to Queens Elizabeth central hospital (QECH) with sepsis and discharge and recovering at home and Health centre in charge (nurse and clinician) providing direct and indirect care of patients with sepsis .The final sample size was determined through saturation; thus, until the information collected from each subsequent interview was repeated [15]. A simple random sampling method (casting of lots) was used to select three urban and three rural primary healthcare centres from the Blantyre District Health Office (DHO) [16].

Data collection

Data were collected using a semi-structured interview topic guide containing questions that elicited free responses. After obtaining written consent, patient interviews were conducted in the local language (Chichewa), whereas interviews with HCWs were conducted in English or Chichewa, depending on the interviewee's preference. The interviews were conducted in a private room within the health facility. The interviews were conducted between 1 May 2023 and 16 May 2023, with ten patients (6 males and 4 females) and 12 HCWs (9 females and 3 males). The principle of saturation was used in this study as a criterion for determining when to stop sampling participants. We therefore stopped collecting data when the research question was answered comprehensively and there was no emergence of new codes and

themes. An experienced principal investigator (SK)conducted audio-recorded interviews lasting approximately 30 min. Researcher probed for more information where necessary and clarified the questions to obtain relevant information.

Data analysis

The interviews were audio-recorded, and field notes taken. To ensure privacy, unique identification codes were assigned to each interview. The recorder used during the in-depth interviews and the transcripts were kept in a lockable cabinet accessed only by the researcher. Data were analyzed using thematic analysis. The coding framework was both deductive, where we identified quotations related to the study objective and the Three Delays' theoretical framework, and inductive, reflective of pertinent issues raised by the data alone [17].The next step was examining coded and collated data extracts to look for potential themes of broader significance. The NVivo software version 12 was used in generating codes from the data and organizing these codes into various themes.

Ethical consideration

Participants were enrolled in the study after the protocol was approved by the College of Medicine Research and Ethics Committee (COMREC Number: P.12/22/3928). Principal investigator obtained institutional approval to conduct the study at Ndirande, Zingwagwa, Bangwe, Pensulo, Lirangwe, and Madziabango Health Centres. The study followed Good Clinical Practice guidelines, and individuals were not expected to be physically harmed. Participants voluntarily signed informed consent forms before participating in the study. The interviews were done in local language for both patients and Healthcare workers in a closed/private room that offered visual and oral privacy. Each participant provided with Chichewa version written informed consent after reading the form. Participants had the right to withdraw from the

Table 1 Patients' social demographic characteristics

study or withdraw their data from the study at any stage without stating a reason.

Results

From the analysis, seven key themes emerged: (1) Poor communication, (2) poor road network, (3) low socioeconomic status, (4) ambulance prioritization (5) patient and guardian preferences (6) delayed treatment-seeking action, and (7) a shortage of healthcare workers. Below we synthesize the key findings according to the different levels of the three delays model include the delay in seeking care, the delay in reaching care and the delay in receiving care which informed our analytical process and supported by direct quotations from study participants. The characteristics of the patients interviewed are provided in Table 1 while those of key informants are in Table 2.

Phase 1: the delay in seeking care *Socio-economic status*

A few healthcare workers stated that the low socioeconomic status of patients with sepsis is one of the causes of delay in referral pathways, especially when the patients are asked to use their transport other than when they are using an ambulance. The majority (65%) of patients indicated that socioeconomic status directly affects the referral pathway of patients with sepsis to seek advanced care. Most participants stated that some patients were asked to use their means of transport because the Blantyre District Health Office (DHO) does not have enough ambulances to transport all patients requiring ambulance transfers. For example:

"Some patients they don't afford to use their own transport money to seek healthcare service to advanced hospital after referral, they don't receive it well because they have already spent maybe 2000 or 3000 Malawi Kwacha from community to primary health care, so they feel overburdened to use their transport to a referral hospital". (CL 02)

ID	Age	Gender	Occupation	Education	Catchment area
P 01	46	Male	Farmer	Junior Certificate of Education	Blantyre rural
P 02	37	Male	Shop clerk	Malawi School Certificate of Education	Blantyre rural
P 03	50	Male	Farmer	Standard 8	Blantyre rural
P 04	39	Female	Primary Teacher	Teaching certificate	Blantyre rural
P 05	30	Female	Small business	Form 3	Blantyre rural
P 06	40	Male	Farmer	Standard 2	Blantyre rural
P 07	32	Female	Farmer	Standard 8	Blantyre rural
P 08	36	Male	Small Business	Standard 2	Blantyre rural
P 09	40	Male	Farmer	Standard 5	Blantyre rural
P 10	29	Female	Farmer	Standard 8	Blantyre rural

P: Patient

ID	Age	Gender	Cadre/Occupation	Education	Work Experience	Catchment Area
CL 01	38	Female	Medical Assistant	Certificate in Clinical Medicine	9	Blantyre rural
CL 02	30	Male	Medical Assistant	Certificate in Clinical Medicine	4	Blantyre rural
CL 03	37	Female	Clinical Technician	Diploma in Clinical Medicine	15	Blantyre urban
CL 04	31	Female	Clinical Technician	Diploma in Clinical Medicine	3	Blantyre rural
CL 05	39	Female	Clinical Technician	Diploma in Clinical Medicine	17	Blantyre urban
CL 06	31	Male	Clinical Technician	Diploma in Clinical Medicine	5	Blantyre urban
NU 01	35	Male	Nurse and Midwifery Technician	Diploma in Nursing and Midwifery	12	Blantyre rural
NU 02	27	Female	Nurse and Midwifery Technician	Diploma in Nursing and Midwifery	2	Blantyre rural
NU 03	32	Male	Diploma in Nursing and Midwifery	Diploma in Nursing and Midwifery	8	Blantyre urban
NU 04	49	Female	Diploma in Nursing and Midwifery	Diploma in Nursing and Midwifery	23	Blantyre rural
NU 05	40	Female	Diploma in Nursing and Midwifery	Diploma in Nursing and Midwifery	9	Blantyre urban
NU 06	32	Female	Nursing Officer	Bachelor of science in science in Nurs- ing and Midwifery	7	Blantyre urban

Table 2 Healthcare Workers' Social demographic characteristics

(1) CL: Clinician, (2) NU: Nurse

However, some patients felt that asking patients to use their transport from primary health centres to referral hospitals overburdens them because they have already spent a lot of money travelling from their homes to the health centre. Circumstances of this kind, delay patients from receiving sepsis treatment because, in most cases, they return home to raise money for transportation to a referral hospital.

"They gave me the referral letter, and I told them that I should first go back home and get ready in terms of transport". (P 03)

Some Health care workers expressed that patient who did not have money were delayed in being referred to the central hospital because they did not have adequate funds to sustain themselves while receiving treatment at the district hospital. Health workers spend much time convincing patients that they will find well-wishers to assist them. However, if the patient insists on not going to the referral hospital, in this case, they receive treatment at the primary health centre, waiting for the patient to source money for their survival at the referral hospital.

"The challenge that we face is that most patients refuse referral; they say they do not have money, how am I going to stay even if an ambulance is here, they refuse to go saying they don't have money. We convince them you cannot lack food and the like if you go there. Some well-wishers are going to help you". (CL 01)

Patient and guardian preference

A few healthcare workers said that patients and their guardians delayed the referral. When an ambulance is unavailable, guardians and patients are asked to find their means of transport to get to a referral hospital; therefore, some guardians would prefer to go home first before going to the referral hospital, so they stay longer at home.

"Sometimes the guardians themselves tell us to release them to go home. They complain that they have other duties and have left children at home. We see it as a challenge because the patient might be very sick, but they prefer to go home first than minding about the health of the patients, so it's a challenge. This is so because when they go home, they delay very much such that when they go to QECH, it is difficult to document time, it might seem as if you have referred them late yet it's them who have delayed". (CL 01)

Delay treatment-seeking action

About half (54%) of the interviewees reported that treatment-seeking behaviour contributed to a delay in referring patients to tertiary hospitals. For instance, patients opted to buy medicines from a drugstore to self-medicate or use herbs before seeking medical treatment at a referral hospital in a primary health facility.

"I took bwamoto herbs (local medicine) and the blue gum leaves, mixed them, and took the mixture. After that, it never worked out; that's when people hired a motorbike to take me to the clinic." (P 05)

Persistent symptoms made study participants seek medical care at a primary healthcare/health centre, where they tested negative for malaria, which made the health workers (HCW) refer the patient to QECH for further investigation and management.

Most participants stated that the other pattern used before seeking medical treatment was a religious belief that before going to the health facility to seek medical treatment, people took them somewhere for prayers. Still, the persistence of the symptoms made them visit the primary hospital to seek medical care.

"So, when they came, they prayed for me, and after prayer, a motorbike from my relative came to pick me up. We all rode on that motorbike (name of the health centres), and when we got there, I fainted. After that, they started finding means of transport for us to come here". (P 02)

After the tests were conducted at the primary hospital, the patient was referred to the Queen.

Elizabeth Central Hospital (QECH) because sepsis was suspected.

Phase 2: the delay in reaching care Long distance to health facility

Some participants in hard-to-reach communities reported that it is difficult for them to follow the referral pathway due to the distance and geographical position. They prefer to be referred to the closest health care centres of their choice which is not feasible at times. This has an impact on monitoring the patients and if they are going to follow through with the treatment

'The closest hospital to my home is Chikhwawa Hospital, not Queen Elizabeth Central Hospital. So, can you just help me, like write me a referred to Chikhwawa?". (CL 02)

Ambulance prioritisation

Most patients felt ambulances were prioritised for maternal and obstetric patients rather than the Out-Patient Department (OPD). When a gynecology's and obstetrics emergency patient need to be referred, a health worker (HCW)calls for an ambulance, as usual. However, patients with sepsis take advantage of ambulance comes to pick up that patient maternal condition, according to the findings of this study, an ambulance was not sent for suspected sepsis. However, it is sent in the case of an obstetric case/patient.

"Let us say you have an OPD that needs a referral; you will be lucky if an ambulance comes, but not that it was sent for that OPD. Even if you tell them that the patient has fainted, they don't send an ambulance". (CL 04)

"If we happen to have a patient from maternity and at the same time there is a patient from OPD, they use the same transport". (NU 02)

"If you mention that it's maternal, then it comes, but not with OPD". (NU 04) A few (5%) of the health care workers (HCW) mentioned instances where a nurse had to lie that they had a maternal condition patient from maternity for an ambulance to come.

"It happens (to lie) they shout at us, the driver shouts, and we tell them, the patient has given birth already, and so you can just pick this one, so they pick the patient". (NU 04)

Poor road network

All healthcare (100%) mentioned that an ambulance did not go to a particular health centre during the rainy season because of poor road networks. Most of the patients cited that when roads get muddy, the ambulance does not reach the facility; and it stops at one point, so the patient with maternal have to walk about 8 km to get to where the ambulance stops.

"During the rainy season, the ambulance doesn't come here because of the road's poor condition, so it stops at Manyowe township, and our patients walk from here to get to where the ambulance is". (CL 04) "Our roads are in poor condition, and most cross rivers without bridges, rendering them impassable during the rainy season". (P 04)

One participant stated that if the patient with suspected maternal sepsis was seriously sick and had no means of transport, the patient was carried on a stretcher to get to where the ambulance was.

" They are carried on the stretcher up there". (NU 03)

Phase 3: the delay in receiving care *Communication*

Most healthcare workers (53%) indicated that poor communication between healthcare workers and transport officers contributed to delayed referrals of suspected patients with sepsis. Some health care workers stated that when a patient is present at a centre, it is managed at the health centre. Healthcare workers, through the flying squad group, call a transport officer to send an ambulance for a suspected patient with sepsis to be referred. This study found that ambulances were not sent immediately. Sometimes, it takes several hours for healthcare workers to be told that ambulances are not coming, delaying the referral of patients with suspected sepsis.

"Sometimes they even call you to say tell them to find their means of transport, an ambulance will not come, for example, last year, we had a patient whom we called for an ambulance, we were told it was coming but, at around 4 o'clock, we were told that they should find their means transport, sometimes you can refer the patient at 8 am, and the ambulance can be coming at 4 pm afternoon". (NU 04)

Most healthcare workers (HCW) (60%) reported receiving only occasional or no feedback from the referral hospital after patients had been referred. Interview respondents in primary healthcare stated that this was not standard practice. The referral system sometimes lacked effective reporting procedures and feedback systems, which hindered communication between the primary health facility, referral hospital and the patients with sepsis.

"I have never received feedback from referral hospital after discharge from referral hospital. If I want to get feedback, I use my unit [phone credit]". (CL 02)

The only formal provision is dedicated space in a referral letter for writing feedback. Healthcare workers (HCW) explained that even when filled in, patients usually return to their homes after discharge from the referral hospital; therefore, these documents are typically lost to the system, and feedback relies on the initiative of the more proactive clinicians who follow up via phone.

Shortage of healthcare workers

A few 35% healthcare workers reported that understaffing contributed to referral delays for patients with suspected sepsis. Sometimes, patients must wait before they are attended to because only two healthcare workers are on duty that day, and these two should attend to all departments available in that facility.

"Shortage of staff makes us not treat the patient well; we can say on a day, only two clinicians are assigned on duty, and there is Antiretroviral therapy that needs to be attended, a patient can faint when you are somewhere, then you rush to see that patient, so we delay the services for the patients". (CL 01)

Another factor affecting the provision of quality referral care at the primary healthcare level, leading to self-referral and bypassing primary healthcare institutions, was a shortage of competent healthcare professionals, equipment, and medications.

"Shortage of staff is a problem; patients have to wait for a long time, and some conditions worsen in the waiting queue". (P 06)

Discussion

Timely referral and treatment of patients with sepsis to tertiary hospital are critical, as delays can significantly increase the risk of mortality and morbidity [18]. Severe patients with sepsis who visit the emergency department and later transferred to intensive care unit (ICU) exhibit high mortality rate of (10%) [18]. Sepsis causes substantial morbidity and mortality in hospitalized patients. Malawi's intensive care units are responsible for 40% of the mortality [19]. This qualitative study demonstrate that timely detection and early referral interventions can lead to expedited delivery of care to patients with sepsis for intravenous fluid and antibiotics administered. Hence, this study aim explores barriers to referral and referral pathways and experiences of patients with sepsis from primary healthcare to tertiary hospitals. Furthermore, it explained healthcare workers' perspectives on the barriers associated with delayed referral of patients with sepsis in primary healthcare. The study revealed that the main referral pathways for patients with sepsis include community-to-facility referral and facility-to-facility referral. The main mode of transport includes ambulances and personal vehicles. Referral from facility to facility / hospital has improved health outcomes for several sepsis patients, such as a reduction in time of recovery and mortality rate. Similar findings were also noted in study of common referral pathways in Malawi [6].Despite the above strengths, facility to facility referral model presents some challenges. Reflecting on the 3-delays model as the main theoretical framework, this study identified several barriers to the functionality of the medical conditions including patients with sepsis referral system in Malawi: lack of referral transport, poor communication, poor road network, shortage of skilled healthcare workers, patient preferences, and delayed treatment-seeking action. Consistent with our findings, several studies in Africa identified referral transportation system, referrerreceiver communication barriers, inadequate infrastructure and supplies and insufficient health personnel. Some highlights of the problem included inadequate use of ambulance services, poor management of patients during transit, lack of professional escort [8, 9].

Lack of appropriate transport for sepsis cases was identified as a major challenge by all the respondents for the study. This, however, falls out of the requisites for a successful sepsis referral system from primary health care. Most patients with sepsis use personal transport and taxis as common referral transport. More than 50% of health facilities in Ghana arranges with private parties (taxi) for emergency referral [20]. In low-income countries, ambulances remain scarce but possess key benefits in clinical settings. The use of ambulances helps to ensure continuity of care during the transit period by nurses and guards against delays in travelling.

Effective communication is essential for early referral and emergency preparedness at the receiving facility [21]. This study also identified the issue of poor feedback from the receiving institution, which could cause referral facilities to repeat errors. The findings are consistent with those of previous African studies, in Malawi [6], Ghana [12], Kanye [13] and Rwanda [22], which found poor communication between the referring and receiving facilities before and after patient transfer. Likewise, a study in Ethiopia [23], noticed that it was common to see no referral or feedback letters in low-resource countries. Wanjau et al. [24], reported that good communication during the referral process can help improve the quality of referral healthcare services, including the healthcare of sepsis patients. Another major issue affecting sepsis patients to receive advance care is poor referral coordination between sending and receiving facilities reported by respondents is the scarcity of adequately equipped ambulances in primary healthcare and limited fuel for transporting patients to higher levels. Providing formal feedbacks to referring facilities were mostly ignored in this study and this confirms results from study in Nigeria [9]. The computerised referral system in healthcare has been shown to strengthen the link between first-level and specialised care and reduce waiting times [25]. Ensuring an effective referral system will thus need a strong collaboration and coordination among the various levels of care. Appropriate measures should be put in place to address communication barriers so as to help address some of the problems identified in the transfer of patients with sepsis.

The study found that bad roads were one of the factors that worsened transport problems for patient referrals, leading to unnecessary complications and deaths. Similar findings were reported by Afari et al. [10], who noted that available ambulances could not reach most areas because the roads were not tarred. Studies have shown that poor road networks cause hiccups in referral pathways, especially when the patients are asked to use their transport rather than when they are using an ambulance. This study demonstrated that a good road network facilitates a smooth referral process to improve and prevent deaths occurring due to road network problems.

The study also identified that understaffing contributes to referral delays for patients with suspected sepsis, as most patients experience a long waiting time before attending and eventually make a decision for referral for advance care, thereby leading to unnecessary complications and deaths. This finding was consistent with studies in Malawi [22] and Uganda [26] which also reported a shortage of well-trained personnel and diagnostic equipment as barriers to seeking care from primary-level facilities to referral hospitals. Studies further reveal that patients are affected by the provision of quality referral care at the primary healthcare level, which leads to selfreferral and bypassing of primary healthcare facilities because of a shortage of skilled healthcare workers, equipment, and drugs. A study conducted in Botswana [27] noted that to address the scarcity of healthcare workers, the country should train adequate healthcare workers and distribute them equally sufficiently resourced healthcare facilities.

Study strengths and limitations

This study provides information on the referral of patients with sepsis from primary health care to a tertiary health facility in Malawi. In Malawi where there is little research on the referral process and other obstacles faced when receiving care at tertiary health facilities, the study adds to the body of information regarding referrals for patients with sepsis to tertiary hospitals.

The cross-sectional nature of the study did not capture changes over time but captured experiences and perceptions in a specific context. The translated participants' quotes from Chichewa to English might have lost the original meaning. Another limitation is that, as with any qualitative research, this study had a limited sample of respondents and, therefore, cannot represent all challenges of the referral system in primary healthcare in Malawi but may portray a picture of what is happening in primary healthcare with similar characteristics.

Conclusion

Within the framework of resource-constrained health systems. From the findings of this study, it was concluded that the referral system in Blantyre District needs to be adequately resourced to provide quality primary referral healthcare services. This is reflected in the factors identified in the interviews. It was concluded that patients' delays and failure to access prompt and timely referral services were mainly due to the system's lack of transportation, communication problems, bad road networks, and shortage of healthcare workers. Multilevel interventions are required to address failures at both ends of the referral pathway. This study captured new insights into longstanding problems in referral systems in resourcelimited settings, contributing to a better understanding of building more functional systems to optimise the continuum and quality of sepsis care for rural populations in similar settings.

Appendix 1: English interview guide for Health Manager

In-depth questions for health managers /in-charge.

1. Explain your positions and responsibilities (What does your day look like?).

- 2. Can you explain the referral pathway for patients with sepsis from primary healthcare to tertiary healthcare?
- 3. Which referral pathway do you think works well now and why?
- 4. Are there any stages at which you feel that improvement is needed? If yes, please explain; if not, explain.
- 5. Do you think of strategies that can be considered to improve your experience at these stages? If yes, please explain.
- 6. Do you face challenges in providing care to patients with sepsis? If yes, what are the challenges that you face? If not, why do you think you do not face any challenges?
- 7. How do you know that a patient has suspected sepsis?
- 8. Initially, what kind of treatment do you give to patients with suspected sepsis?
- 9. How long does it take for a patient to be referred to a tertiary hospital for medical assistance?
- 10.What mode of transport do patients use to visit a tertiary hospital? (Probe: do they have a hospital ambulance? If a hospital ambulance is used, how long does it take to reach the facility?
- 11.Do you encounter any challenges when referring patients? If yes, what are the challenges that you face? If not, why do you think you don't face challenges?
- 12. Are there times when you were you were unsure if a patient had suspected sepsis? If yes, what did you do?
- 13. Who do you consult when you are unsure?

Appendix 2: English interview guide for in-depth interviews with patients

- 1. Can you tell me your story about when you first suspected something was wrong?
- 2. What symptoms did you have?
- 3. Did you receive help at home, if any? Probe: If yes, what was your service? If not, then why.
- 4. If you received any treatment from home, how did you feel after receiving it?
- 5. How long did it take for you to visit your local hospital after you noticed that you were unwell? (Probe: if the patient has taken too long, a request for factors that led the patient to take time.)
- 6. How long does it take to reach the hospital from your house (timeframe)?
- 7. Which mode of transport did you use?

Experience questions.

8. When you arrived at your local hospital, how were you received?

- 9. Did you incur any costs when going to the hospital? Probe: If yes, what is this? How much did they pay?
- 10. What kind of help did you receive at the local hospital (probe: what type of test or drugs were given to the patient?).
- 11.How did you feel after receiving help from a local hospital? (Probe to see what other help the patient received after the first treatment)
- 12. After how long did your local medical personnel refer you to Queen Elizabeth (from when you were first diagnosed to when you were referred)?
- 13. What mode of transport did you use after you were referred to Queens?
- 14.Did you use a hospital ambulance? If so, how long did the ambulance reach the local hospital?
- 15. What was your experience during the referral?
- 16.Did you face any challenges during your referral to the central hospital? If so, what are these challenges? If not, why do you think there are no challenges?
- 17.Please tell me how your family members have received it. Probe: Do you face backlash from your family members? If yes, how did this happen? If not, why?

Appendix 3: Chichewa Topic Guide for Health Managers /In-charge

zokambirana ndi akulu akulu a pachipatala.

- 1. Mungandifotokozere zokhuzana ndi udindo wanu komanso ntchito yomwe mukugwira? (kodi tsiku lanu limayenda bwanji?)
- 2. Mungandifotokozere za momwe odwala nthenda ya tidzilombo ta m'magazi (sepsis) amatumidzilidwa kuchokera ku chipatala chaching'ono kupita ku chipatala chachikulu?
- 3. Ndi njira iti yabwino yotumizira odwala kuchokera chipatala chaching'ono kupita chipatala chachikulu yomwe mukuganiza kuti ikuthandiza padakali pano? Nanga ndi chifukwa chani?
- 4. kodi pali pena pomwe mukuganiza kuti pakonzedwe? Ngati ndi choncho, fotokozani. Ngati si choncho, fotokozani ndi chifukwa chani?
- 5. kodi mukuganizirapo za njira zopititsira patsogolo ndondomeko iriyonse yotumizira odwala? Ngati ndi choncho, fotokozani njira zomwe mukudziona kuti ndi zothandiza kupititsa patsogolo dongosolo lotumiza odwala.
- 6. Kodi mumakumana ndi zovuta zilizonse popereka thandizo kwa odwala matenda a tidzilombo ta m'magazi (sepsis)? Ngati ndi choncho; ndi mavuto anji omwe mumakumana nawo? Ngati sichoncho, ndi chifukwa chani simukumana ndi mavuto alionse.
- 7. Kodi mumadziwa bwanji kuti odwalayu ikhoza kukhala nthenda ya tidzilombo ta m'magazi (sepsis)?

- 8. Ngati mukuganizira kuti odwala ali ndi nthenda ya tidzilombo ta m'magazi (sepsis) kodi mumampatsa thandizo lanji?
- 9. Kodi zimatenga nthawi yaitali bwanji kuti odwala atumidzidwe ku chipatala chachikulu kuti akapitilize kulandira thandizo?
- 10.Kodi odwala amagwiritsa ntchito mayendedwe anji kupita chipatala chachikulu? (funsitsani; kodi ali ndi ambulance, ngati amagwiritsa ntchito ambulance, kodi imatenga nthawi yaitali bwanji kuti ifike p.a. chipatala?
- 11.Kodi mumakumana ndi mavuto alionse potumiza odwala ku chipatala chachikulu Ngati ndi choncho; ndi mavuto anji omwe mumakumana nawo? Ngati sichoncho; ndi chifukwa chani simukumana ndi mavuto alionse?
- 12.Kodi ziripo nthawi zina zomwe inuyo simumatsimikiza ngati odwala ali ndi nthenda ya tidzilombo ta m'magazi (sepsis)? Ngati zili choncho; mumachita chani?
- 13.Ngati simumatsimikidzika, Kodi alipo yemwe mumamufunsa? Ngati ndi choncho; kodi mumafunsa ndani? Ngati palibe yemwe mumamufunsa, mumachita chiyani?

Appendix 4: Chichewa Topic Guide for Patient's Version

M'chezo ndi odwala.

- 1. Mungandiuze chani zokhuzana ndi nthawi yomwe munaganizira koyamba kuti china chake sichilibwino?
- 2. Ndi dzidzindikiro zanji zomwe mumaona?
- 3. Munalandira thandizo lirilonse panyumba? Ngati inde, ndi thandizo lanji lomwe munalandira panyumba? Ngati ayi, ndi chifukwa chani simunalandire thandizo lirilonse panyumba?
- 4. Ngati munalandila thandizo lirilonse panyumba, munamva bwanji mutalandira thandizoli?
- kodi panatenga nthawi yaitali bwanji kuti mukafike kuchipatala mutadzindikira kuti simuli bwino? (funsitsani: ngati odwala adatenga nthawi yaitali, funsani zifukwa zake)
- 6. Mongoyerekeza, kodi zimakutengerani nthawi yaitali bwanji kuchokera panyumba yanu kukafika ku chipatala? (time frame)
- 7. Mudagwiritsa ntchito mayendedwe anji? mafunso okhuzana ndi zokumana nazo (experiences).
- 8. Kodi munalandiridwa bwanji mutafika ku chipatala cha m'dera lanu?
- 9. Kodi chiripo chomwe mudalipira kapena kugula popita ku chipatala? (funsitsani Ngati inde, chidali chani? Mudalipira kapena kugula ndalama zingati?)

- 10.Ndi thandizo lanji lomwe mudalandira ku chipatala cha m'dera lanu? (funsitsani; adayezedwa chani Ndi mankhwala anj omwe adapatsidwa)
- 11.kodi mudamva bwanji mutalandira thandizo kuchokera p.a. chipatala cha m'dera lanu? (funsitsani; ndi thandizo lina liti loonjezera lomwe odwala analandira atalandira thandizo loyamba)
- 12.Kodi a dotolo a pachipatala cha m'dera lanu adakutumizani ku chipatala cha Queen Elizabeth patadutsa nthawi yaitali banji? (kuchokera nthawi yomwe munaunikidwa koyamba kufikira nthawi yomwe mumatumizidwa)
- 13.Kodi munagwiritsa ntchito mayendedwe anji kufika ku chipatala cha Queens chomwe munatumidzidwa?
- 14.Kodi munagwiritsa ntchito ambulances? Ngati ndi choncho; kodi padatenga nthawi yaitali bwanji kuti ambulance ifike p.a. chipatala cha m'dera lanu? Ngati ayi; mudagwiritsa ntchito mayendedwe anji? Ndipo ngati mudalipira mayendedwe, mudalipira ndalama zingati? Adalipira ndani? Ngati mudalipira nokha, ndalama mudaipeza bwanji?
- 15.Kodi mudakumana ndi zotani p.a. nthawi yomwe munatumizidwa?
- 16.Mudakumana ndi zovuta zilizonse p.a. nthawi yomwe mumatumizidwa? Ngati ndi choncho; ndi mavuto anji omwe mudakumana nawo? Ngati sichoncho; mukuganiza kuti ndi chifukwa chani simudakumane ndi zovuta zilizonse?
- 17.sssMungandiuze momwe aku banja lanu adachilandilira? (Funsitsani; mudakumana ndi m'nyozo ulionse kuchokera ku banja lanu? Ngati ndi choncho; zidakhala bwanji? Ngati sichoncho; ndi chifukwa chani.

Abbreviations

BDHO	Blantyre District Health Office
COMREC	College of Medicine Research and Ethics Committee
DHO	District Health Office
HCW	Health care worker
LMICS	Low Middle Income Countries
OPD	Outpatient Department
PHC	Primary Health care
QECH	Queen Elizabeth Central Hospital

Supplementary Information

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Supplementary Material 1

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Author contributions

S. K. did data collection , data analysis and writing main manuscript E.U. Review manuscript.

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Data availability

Data is available through my private email but not yet available for public.

Declarations

Ethical approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations. Full ethical approval for this study was obtained from the College of Medicine Research Ethics Committee (COMREC Number: P.12/22/3928). COMREC is the ethics body of the Kamuzu University of Health Sciences (formerly known as the College of Medicine). Informed consent was obtained from all participants of the study.

Consent for publication

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