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Health-related quality of life among patients with sepsis in Blantyre, Malawi: an observational cohort study

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Abstract

Background

Sepsis is a life-threatening condition with high mortality, especially in sub-Saharan Africa (SSA). Sepsis survivors may face long-term consequences and experience poor health-related quality of life (HRQoL). By comparing HRQoL trajectories between sepsis cases and matched controls, we sought to identify the longitudinal impact of sepsis on HRQoL in the SSA context.

Methods

This study was nested within a longitudinal adult sepsis cohort admitted to the hospital in Blantyre, Malawi. Two reference control groups matched to cases by age, sex, and geographical location were recruited: (1) hospital inpatients without sepsis and (2) community controls with no current illness. All participants were followed up to 180 days post-enrolment. HRQoL was assessed using the EQ-5D-3L questionnaire and a visual analogue scale (VAS). Regression analysis was conducted to examine factors associated with HRQoL among sepsis survivors.

Results

A total of 425 participants: 225 sepsis cases, 100 hospital controls, and 100 community controls were recruited. HIV prevalence was higher among sepsis cases (143/225, 63.6%) compared to hospital controls (12/100, 12.0%) and community controls (18/100, 18.0%), $p < 0.001$. At baseline, sepsis cases had lower health utility scores (median 0.596, IQR 0.365–0.734) compared to hospital controls (0.666, IQR 0.611–0.722) and community controls (0.900, IQR 0.833-0.900). Over time, sepsis cases exhibited fluctuating HRQoL, with a marked decline in utility scores at day 180 (0 IQR: 0–0) compared to relatively stable scores in both control groups. Regression analysis identified age, sex, duration of illness before admission and baseline utility score as significant predictors of HRQoL in the sepsis group.

Conclusion

The findings reveal a severe and persistent reduction in HRQoL among patients admitted with sepsis in Malawi, suggesting a substantial post-discharge burden among survivors. These results highlight the need for evidence-based prevention, early recognition of sepsis, and post-sepsis support programs in SSA.

Background

Sepsis is a life-threatening condition causing over 11 million deaths annually, with the highest burden in low and middle-income countries (LMICs), particularly in sub-Saharan Africa (SSA). Yet, its long-term consequences remain poorly understood in these settings. (1–3). Sepsis leads to significant short and long-term morbidity among survivors. Beyond the acute phase, individuals often experience persistent physical, psychological, and functional impairments that compromise their health-related quality of life (HRQoL) ((1, 2). In low-resource settings like Malawi, where sepsis prevalence among hospitalised patients ranges from 7.1% to 24% (4, 5), and where young adults living with HIV are commonly affected (6, 7)These consequences may be especially pronounced.

While global evidence increasingly recognises long-term impairments after sepsis, most data come from high-income settings. (8–11). In sub-Saharan Africa (SSA), there is limited understanding of post-sepsis outcomes, particularly regarding HRQoL. In Malawi, late post-hospital mortality among sepsis patients has been reported, suggesting ongoing functional decline and compromised quality of life. (6, 7). However, empirical data to quantify this burden and explore contributing factors are lacking.

Several HRQoL assessment tools have been developed, many of which have been adapted into multiple languages. (12). The EQ-5D-3L is particularly well-suited for economic evaluations, as it enables the calculation of quality-adjusted life years (QALYs). This metric allows self-reporting and integrates both HRQoL (quality) and survival duration (quantity). The tool is a generic measure, not disease-specific, and is suitable for sepsis, a syndromic condition with multiple underlying etiologies.

This study estimates the impact of sepsis on HRQoL over six months using the EQ-5D-3L, a methodology consistent with other studies. (13, 14). We compare HRQoL trajectories among sepsis cases, hospitalised controls without sepsis, and community controls, while also identifying key determinants of long-term HRQoL outcomes among sepsis cases. By addressing a critical knowledge gap in SSA, particularly in Malawi, our findings will inform post-sepsis rehabilitation strategies, with a focus on improving HRQoL outcomes.

In this study, we utilise data from a prospective cohort of adult patients admitted with sepsis at Queen Elizabeth Central Hospital in Blantyre, Malawi, to assess HRQoL over six months following hospitalisation. We compare outcomes between sepsis survivors, matched non-sepsis hospital controls, and matched community controls. Our primary aim is to describe HRQoL trajectories and identify factors associated with poor HRQoL in sepsis survivors. We hypothesise that sepsis cases have significantly lower HRQoL compared to hospitalised non-sepsis patients and community controls, with the most significant impairment observed among sepsis survivors over time. The general community reflects better HRQoL outcomes, serving as a valid comparator for sepsis-related disability.

Materials and methods

Study setting and design

This study was conducted at Queen Elizabeth Central Hospital (QECH) in Blantyre, Malawi, a government-operated tertiary referral hospital with approximately 1,350 beds. The hospital serves as the primary teaching hospital, providing both inpatient and outpatient services to Blantyre's population. The study was a prospective observational cohort study conducted from February 2017 to January 2019. This study is a health economic (HE) analysis conducted as a follow-up to a larger observational cohort study (parent study) on sepsis in Malawi (6). The parent study aimed to characterise sepsis in Malawi, including causative pathogens, treatment administered, and 180-day mortality outcomes. Prior publications have detailed the aetiology, clinical characteristics, and laboratory findings of sepsis patients in this cohort study. (15). The study was conducted in accordance with recommended guidelines for conducting and reporting HRQoL by self-reported measures.(16) A checklist is provided as supplementary material (**one checklist is included)**.

Study population

The cohort study was conducted among patients admitted through the emergency department of QECH. The study included three groups: sepsis cases (Group 1), non-sepsis inpatients (Group 2, serving as hospital controls), and community members (Group 3, serving as community controls). The inclusion and exclusion criteria are presented (Table 1). The control groups were also matched 1:1 by age (± 5 years) and sex to group 1 (sepsis cases), and for community controls, geographic location was also matched.

Table 1
Eligibility criteria for study participants.

Group	Inclusion Criteria	Exclusion Criteria
Sepsis Cases (Group 1)	- Patients ≥ 16 years presenting at QECH emergency department - Evidence of infection (fever > 37.5°C or history of fever in the past 72 hours) - At least one organ dysfunction marker - Oxygen saturation < 90% -Respiratory rate > 30 breaths/min -Systolic BP < 90 mmHg Glasgow Coma Scale (GCS) < 15	- Unable to provide informed consent (no available guardian) - Unable to speak Chichewa or English - Residing > 30 km from Blantyre - Clinical decision to discontinue active care
Non-Sepsis Inpatients (Hospital Controls, Group 2)	- Patients ≥ 16 years admitted to QECH medical wards - No sepsis diagnosis (did not meet sepsis criteria) - No antimicrobial therapy exposure before admission	- Same as Group 1
Community Controls (Group 3)	- Individuals ≥ 16 years from the same geographic area as Group 1 - No suspicion of infection in the past four weeks - No recent antimicrobial therapy (except cotrimoxazole preventive therapy, CPT, or anti-tuberculosis (TB) chemotherapy	-Unable to provide informed consent - Unable to speak Chichewa or English

Study recruitment procedures

Participants were recruited between February 19, 2017, and October 2, 2018. Recruitment took place at QECH's emergency department and medical wards from Monday to Friday, 07:00–17:00. Patients were screened in the emergency department as soon as possible, and consecutive recruitment of sepsis cases (group 1) was conducted daily. At the same time, a matching list was generated for Non-sepsis inpatient controls (group 2), where matching participants were listed from the emergency attendees and then recruited after consenting and fitting the criteria. Sepsis cases (group 1) were screened and recruited at the Emergency Department. Hospital controls (group 2) were also recruited from the Emergency Department. Community controls (group 3) were identified by random geographic matching, starting from a sepsis participant's household and proceeding in a randomly selected direction (determined by spinning a bottle).

Sepsis cases (group 1) and hospital Controls (group 2) were assessed at baseline (day 0), days 7, 28, 90, and 180. Community Controls (group 3) were evaluated at: baseline (day 0), day 28 and day 180. Making a total of 5 assessments for Sepsis cases, hospital controls and 3 assessments for community controls. A variation of plus and minus 3 days was considered.

HRQoL was assessed using the EQ-5D-3L questionnaire (17), which has been validated in Chichewa and approved by the EuroQol Research Foundation, a non-profit organisation based in the Netherlands dedicated to the development and application of standardised measures for HRQoL. The tool consists of a five-dimensional health status index: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension was rated on a three-level severity scale: Level 1, no problem; Level 2, some problems; and Level 3, severe problems. The tool is accompanied by a Visual Analogue Scale (VAS), which is a self-rated health score from 0 (worst health) to 100 (best health). In LMICs, generic HRQoL tools such as the EQ-5D-3L and Short Form 36 (SF-36) (18–22) are recommended due to their ease of administration and cross-population comparability (23). These instruments have been widely used in health economic (HE) evaluations, facilitating comparisons of health gains and losses.

Data collection and handling

Clinical, demographic, and socioeconomic data were collected using standardised electronic data collection forms using Open Data Kit (ODK)(24). Data were collected through face-to-face interviews, where the research assistant administered the EQ-5D-3L tool using hard-copy questionnaires. Research assistants would ask the questions and allow participants to respond, recording individual scores for all dimensions of the EQ-5D-3L. Participants were asked to indicate their current health status by marking a point on the EQ Visual Analogue Scale (EQ-VAS), a vertical scale ranging from 0 ('the worst health you can imagine') to 100 ('the best health you can imagine'). Investigations to determine the aetiology of sepsis were performed as described in (15)HIV infection status and prior or current tuberculosis were ascertained at enrolment.

The data were captured on the Tele Form (OpenText, Waterloo, Canada) system, which was then scanned. Data queries were resolved by examining the original forms. The data were stored in a SQL database and extracted as CSV files for later export to STATA version 17 for analysis.

Statistical analysis

Descriptive analyses were performed to summarise participant demographic and clinical characteristics, EQ-5D dimensions, and EQ-VAS scores, reporting the following: absolute values, percentages for categorical variables, and medians (with interquartile ranges) for continuous variables.

Utility score calculations were performed, and EQ-5D-3L scores were converted into a health utility score using Zimbabwe's value. (13) Set. Value sets are population-specific weights that reflect how individuals in a particular country or region value different health states. These are used for converting EQ-5D responses into a single summary score (the utility value). Since no value set is currently available for Malawi, we used the Zimbabwean EQ-5D-3L value set, which is the only one available from SSA with a similar context to Malawi.

Health utility scores of one reflect perfect health, zero reflects a state equivalent to death, and a score less than zero is considered a state worse than death. Medians and interquartile ranges were reported for utility scores, while means and 95% confidence intervals are presented in the **Supplementary material two, additional results** (**S2** Table 1**)**

To assess factors associated with HRQoL among sepsis survivors, we conducted separate generalised multivariable linear mixed-effects regression models for EQ-5D utility scores and VAS scores. We used the identity link function on a logit-transformed scale because EQ-5D utility scores include negative values. The VAS score ranged up to 100, so we first rescaled all scores to fall strictly within the (0, 1) interval using a min-max transformation. A complete case analysis was conducted using participants with available data for the variables included in the study, which accounted for repeated measures across multiple time points while considering individual variability using random effects at the patient level. Therefore, the models included a random intercept for each participant to account for repeated measures over time. Independent variables included demographic factors (age, sex, education, and employment status), as well as clinical factors (days unwell, HIV status, and active TB status). We included days of follow-up (the time from the day of recruitment to the last available assessment for each participant) as a covariate to adjust for differences in the timing of data collection and hence variation in follow-up duration across individuals. This allowed us to control for potential confounding due to variable follow-up duration, while focusing on the effect of other predictors.

This model estimated average associations between predictors and HRQoL outcomes. To address missing data, we included only participants with at least one follow-up assessment. Given the varying degrees of missingness across time points, mixed models were chosen to maximise available data without requiring complete cases at all time points. To aid in the interpretation of model results, we considered the minimal significant difference (MID) for EQ-5D utility and EQ-VAS scores, which reflects the slightest change in score that is perceived as necessary.(25). For EQ-5D utility values, we referenced previously used MID thresholds ranging from 0.03 to 0.05 and for EQ-VAS, a difference of 7 to 10 points on the 0–100 scale. (26, 27). These thresholds were used to interpret whether statistically significant findings also reached a magnitude likely to be relevant for clinicians and patient outcomes.

In a subsequent analysis, we aimed to explore whether baseline HRQoL could predict recovery trajectory over time among sepsis survivors. We included an interaction term between the baseline EQ-5D utility score and the number of days of follow-up in the mixed-effects model. This allowed us to assess whether the rate of change in HRQoL varied by initial EQ-5D utility scores, thereby identifying individuals at risk of persistently poor HRQoL outcomes. This model focused on the predictive value of baseline utility while adjusting for relevant covariates and accounting for within-subject correlation over repeated timepoints.

Additionally, we conducted separate multivariable linear regression analyses to investigate factors associated with HRQoL at both the baseline and final assessments. Each study was conducted independently to obtain EQ-5D utility scores and VAS scores. As part of sensitivity analyses, we re-estimated mixed-effect models and baseline multivariable linear regression models for EQ-5D utility and VAS scores, incorporating the Universal Vital Assessment (UVA) score to account for illness severity among sepsis participants. HIV status was excluded from these models to avoid redundancy, as it is already included in the UVA score. This analysis aimed to examine whether baseline illness severity confounded the observed associations with HRQoL.

To compare the differences in demographic and clinical characteristics, utility scores, and VAS scores among groups, the chi-square test was used for categorical variables. For continuous, non-normal distribution variables, comparisons are done using the Kruskal-Wallis Test and the Mann-Whitney U test to compare between 3 and 2 groups, respectively. A p-value < 0.05 was considered statistically significant. In **S2 Supplementary results (S2** Table 1**)**, we also provide mean comparisons for the EQ-5D Utility score and VAS score variables, which are performed using one-way ANOVA and independent t-tests. A comprehensive case analysis was conducted using participants with available data for the variables included in each specific analysis. All analysis was done using STATA version 18(28) and in **(S2** Table 2**)** we summarise EQ5D missing data.

Results

Participant demographics and clinical characteristics

The study included 225 sepsis cases, 100 hospital controls, and 100 community controls. Table 2 summarises participant demographics and clinical characteristics. The median age was 35.9 years (IQR: 27.8–43.5) in sepsis cases, 40.4 years (IQR: 29.1–48.4) in hospital controls, and 32.5 years (IQR: 23.9–38.4) in community controls ($p < 0.001$). Among sepsis cases, 143 (63.6%) were HIV-positive, compared to 12 (12.0%) in hospital controls and 18 (18.0%) in community controls, and HIV status was unknown for 60 (60.0%) of community controls ($p < 0.001$). Tuberculosis (TB) was reported in 37 (16.4%) of sepsis cases, 5 (5.0%) of hospital controls, and 4 (4.0%) of community controls ($p < 0.001$). 180 (80%) of sepsis cases were severely ill (UVA), and at 180 days of follow-up, 62 (27.6%) had died.

Table 2
Participants' demographics and clinical characteristics

	Sepsis cases: Group 1	Hospital controls: Group 2	Community controls: Group 3	
	N = 225 (%)	N = 100 (%)	N = 100 (%)	P value
Median age, years (IQR)	35.9 (27.8–43.5)	40.4 (29.1–48.4)	32.5 (23.9–38.4)	< 0.001
Sex				
Female	111 (49.3%)	49 (49.0%)	60 (60.0%)	0.169
Male	114 (50.7%)	51 (51.0%)	40 (40.0%)	
Record of past hospitalisation				
Yes	18 (8.0%)	1 (1.0%)	0 (0%)	0.001
No	207 (92.0%)	99 (99.0%)	100 (100.0%)	
HIV status				
Positive	70 (31.1%)	77 (77.0%)	22 (22.0%)	< 0.001
Negative	143 (63.6%)	12 (12.0%)	18 (18.0%)	
Unknown	12 (5.3%)	11 (11.0%)	60 (60.0%)	
Active TB status				
Yes	37 (16.4%)	5 (5.0%)	4 (4.0%)	< 0.001
No	188 (83.6%)	95 (95.0%)	96 (96.0%)	
Tobacco use				
Current	12 (5.3%)	1 (1.0%)	8 (8.0%)	0.061
Ex	17 (7.6%)	6 (6.0%)	2 (2.0%)	
Never	196 (87.1%)	93 (93.0%)	90 (90.0%)	
Alcohol use				
Yes	51 (22.7%)	16 (16.0%)	18 (18.0%)	0.325
No	174 (77.3%)	84 (84.0%)	82 (82.0%)	
Education status				
No formal schooling	16 (7.1%)	13 (13.0%)	4 (4.0%)	0.089
Primary incomplete or complete	97 (43.1%)	50 (50.0%)	42 (42.0%)	
Some secondary education	47 (20.9%)	18 (18.0%)	30 (30.0%)	
Secondary school completed	48 (21.3%)	16 (16.0%)	19 (19.0%)	
College or higher	17 (7.6%)	3 (3.0%)	5 (5.0%)	
Occupation (Job)				
Currently employed	65 (28.9%)	26 (26.0%)	18 (18.0%)	0.081
Retired	1 (0.4%)	2 (2.0%)	0 (0%)	
Self-employed	56 (24.9%)	32 (32.0%)	35 (35.0%)	
Student	21 (9.3%)	6 (6.0%)	15 (15.0%)	
Unemployed	82 (36.4%)	34 (34.0	32 (32.0%)	
Universal vital assessment				
Low risk (UVA 0–1)	0 (0%)	NA	NA	

Note: This table presents the demographic and clinical characteristics of participants, comparing sepsis cases (Group 1), hospital controls (Group 2), and community controls (Group 3). Data are presented as absolute numbers (n) and percentages (%), except for continuous variables, which are summarised as medians with interquartile ranges (IQR). Chi-square test was used to compare categorical variables across the three groups (sex, record of hospitalisation, HIV status, active TB status, tobacco use, alcohol use, education, occupation). Kruskal-Wallis' test was used to compare continuous non-normally distributed variables across the three groups (age). The Mann-Whitney U test was used for pairwise comparisons of continuous variables between two groups where applicable (e.g., days of hospitalisation between sepsis and hospital controls). P-values indicate the statistical significance of differences between groups.

	Sepsis cases: Group 1	Hospital controls: Group 2	Community controls: Group 3	
Medium risk (UVA 2–4)	45 (20%)	NA	NA	NA
High risk (UVA > 4)	180 (80%)	NA	NA	
Days unwell before admission.				
Median IQR	7 (3–14)	N (%)	NA	
Days of hospitalisation				
Median IQR	5 (2–10)	2 (2–7)	NA	0.002
Mortality at 180 days	62 (27.6%)	23 (23.0%)	0 (%)	NA

Note: This table presents the demographic and clinical characteristics of participants, comparing sepsis cases (Group 1), hospital controls (Group 2), and community controls (Group 3). Data are presented as absolute numbers (n) and percentages (%), except for continuous variables, which are summarised as medians with interquartile ranges (IQR). Chi-square test was used to compare categorical variables across the three groups (sex, record of hospitalisation, HIV status, active TB status, tobacco use, alcohol use, education, occupation). Kruskal-Wallis' test was used to compare continuous non-normally distributed variables across the three groups (age). The Mann-Whitney U test was used for pairwise comparisons of continuous variables between two groups where applicable (e.g., days of hospitalisation between sepsis and hospital controls). P-values indicate the statistical significance of differences between groups.

EQ-5D-3L dimensions, proportions, and trends

Table 3 summarises EQ-5D dimensions across assessments, baseline (day 0), day 7, day 28, day 90, and day 180. At baseline, mobility impairment was reported in 138 (68.6%) of sepsis cases, 43 (53.0%) of hospital controls, and 11 (12.1%) of community controls ($p < 0.001$). Self-care difficulties were present in 117 (58.0%) of sepsis cases, 25 (30.5%) of hospital controls, and 1 (1.1%) of community controls ($p < 0.001$). Usual activity limitations were reported in 142 (72.0%) of sepsis cases, 54 (65.0%) of hospital controls, and 4 (4.4%) of community controls ($p < 0.001$). Pain and discomfort were noted in 138 (71.5%) of sepsis cases, 42 (56.8%) of hospital controls, and 14 (15.1%) of community controls ($p < 0.001$). Anxiety and depression were reported in 83 (43.2%) of sepsis cases, 34 (43.6%) of hospital controls, and 24 (26.1%) of community controls ($p = 0.002$).

Table 3
EQ-5D-3L Health dimensions across groups at baseline and follow-up assessments

		Sepsis cases				Inpatient control				Com cont	
Baseline	N	No problems	Moderate/some problems	Unable/extreme problems	N	No problems	Moderate/some problems	Unable/extreme problems	N	No problems	Mod prob
Mobility	201	63 (31.3%)	105 (52.2%)	33 (16.4%)	81	38 (46.9%)	34 (42.0%)	9 (11.1%)	91	80 (87.9%)	11 (1
Selfcare	202	85 (42.1%)	79 (39.1%)	38 (18.8%)	82	57 (69.5%)	16 (19.5%)	9 (11.0%)	92	91 (98.9%)	1 (1.
Usual activity	197	55 (27.9%)	84 (42.6%)	58 (29.4%)	83	29 (34.9%)	32 (38.6%)	22 (26.5%)	92	88 (95.7%)	4 (4.
Pain and discomfort	193	55 (28.5%)	99 (51.3%)	39 (20.2%)	74	32 (43.2%)	33 (44.6%)	9 (12.2%)	93	79 (85.0%)	14 (1
Anxiety and depression	192	109 (56.8%)	77 (40.1%)	6 (3.1%)	78	44 (56.4%)	26 (33.3%)	8 (10.3%)	92	68 (73.9%)	24 (2
Day 7											
Mobility	153	74 (48.4%)	63 (41.2%)	16 (10.5%)	54	34 (63.0%)	17 (31.5%)	3 (5.6%)	NA	NA	NA
Selfcare	150	82 (54.7%)	54 (36.0%)	14 (9.3%)	51	39 (76.5%)	9 (17.7%)	3 (5.9%)	NA	NA	NA
Usual activity	145	56 (38.6%)	57 (39.3%)	32 (22.1%)	52	18 (34.6%)	26 (50.0%)	8 (15.4%)	NA	NA	NA
Pain and discomfort	151	62 (41.1%)	72 (47.7%)	17 (11.3%)	51	29 (56.9%)	21 (41.2%)	1 (2.0%)	NA	NA	NA
Anxiety and depression	147	84 (57.1%)	54 (36.7%)	9 (6.1%)	52	32 (61.5%)	18 (34.6%)	2 (3.9%)	NA	NA	NA
Day 28											
Mobility	106	67 (63.2%)	35 (33.0%)	4 (3.8%)	30	22 (73.3%)	8 (26.7%)	0 (0%)	56	52 (92.9%)	4 (7.
Selfcare	105	77 (73.3%)	25 (23.8%)	3 (2.9%)	30	25 (83.3%)	5 (16.7%)	0 (0%)	57	57 (100.0%)	0 (0
Usual activity	106	57 (53.7%)	32 (30.2%)	17 (16.0%)	28	18 (64.3%)	9 (32.1%)	1 (3.6%)	58	55 (94.8%)	3 (5.
Pain and discomfort	107	55 (51.4%)	47 (43.9%)	5 (4.7%)	30	16 (53.3%)	13 (43.3%)	1 (3.3%)	57	46 (80.7%)	11 (1
Anxiety and depression	103	63 (61.2%)	35 (34.0%)	5 (4.9%)	28	23 (82.1%)	5 (17.9%)	0 (0%)	58	46 (79.3%)	12 (2
Day 90											
Mobility	56	40 (71.4%)	15 (26.8%)	1 (1.8%)	14	9 (64.3%)	5 (35.7%)	0 (0%)	NA	NA	NA
Selfcare	59	48 (81.4%)	10 (17.0%)	1 (1.7%)	14	11 (78.6%)	3 (21.4%)	0 (0%)	NA	NA	NA
Usual activity	59	43 (72.9%)	11 (18.6%)	5 (8.5%)	15	9 (60.0%)	5 (33.3%)	1 (6.7%)	NA	NA	NA
Pain and discomfort	60	33 (55.0%)	26 (43.3%)	1 (1.7%)	13	5 (38.5%)	8 (61.5%)	0 (0%)	NA	NA	NA
Anxiety and depression	60	45 (75.0%)	13 (21.7%)	2 (3.3%)	15	8 (53.3%)	7 (46.7%)	0 (0%)	NA	NA	NA
Day 180											
Mobility	26	17	9 (34.6%)	0 (0%)	10	8 (80.0%)	2 (20.0%)	0 (0%)	25	22	3 (12

Note: This table presents comparisons of ordinal EQ-5D-3L health dimensions (Mobility, Self-care, Usual Activities, Pain/Discomfort, and Anxiety/Depressior (Baseline, day 7, day 28, day 90, and day 180) among sepsis cases, hospital controls, and community controls. Data are presented as frequency counts (N) a dimension level (No problems, Moderate/Some problems, Unable/Extreme problems). The Kruskal-Wallis (KW) test was used to compare ordinal EQ-5D-3L d (sepsis cases, hospital controls, and community controls). The Wilcoxon Rank-Sum (Mann-Whitney U) test was used for pairwise comparisons between two controls). P-values indicate the statistical significance of differences between groups at each time point.

		Sepsis cases				Inpatient control				Com cont
		(65.4%)							(88.0%)	
Selfcare	25	21 (84.0%)	3 (12.0%)	1 (4.0%)	10	10 (100%)	0 (0%)	0 (0%)	25	24 (96.0%)	1 (4.
Usual activity	26	18 (69.2%)	6 (23.1%)	2 (7.7%)	11	8 (72.7%)	3 (27.3%)	0 (0%)	25	23 (92.0%)	2 (8.
Pain and discomfort	24	18 (75.0%)	6 (25.0%)	0 (0%)	9	7 (77.8%)	2 (22.2%)	0 (0%)	26	19 (73.1%)	7 (26
Anxiety and depression	26	21 (80.8%)	4 (15.4%)	1 (3.9%)	10	7 (70.0%)	2 (20.0%)	1 (10.0%)	26	21 (80.8%)	5 (19

Note: This table presents comparisons of ordinal EQ-5D-3L health dimensions (Mobility, Self-care, Usual Activities, Pain/Discomfort, and Anxiety/Depressior (Baseline, day 7, day 28, day 90, and day 180) among sepsis cases, hospital controls, and community controls. Data are presented as frequency counts (N) a dimension level (No problems, Moderate/Some problems, Unable/Extreme problems). The Kruskal-Wallis (KW) test was used to compare ordinal EQ-5D-3L ((sepsis cases, hospital controls, and community controls). The Wilcoxon Rank-Sum (Mann-Whitney U) test was used for pairwise comparisons between two controls). P-values indicate the statistical significance of differences between groups at each time point.

Figure 1 illustrates the trend in proportions of participants reporting no problems, moderate/some problems, and unable/extreme problems across five EQ-5D-3L dimensions at various time points (baseline, day 7, day 28, day 90, and day 180). Sepsis cases had the highest proportion of impairments, with gradual improvement over time, but persistent limitations remained at day 180. Hospital controls showed similar trends but with fewer reported problems, while community controls consistently reported minimal health issues throughout the study. Across all assessments, usual activity remained the most affected domain among sepsis cases, with limitations persisting up to day 180. Anxiety and depression were the next most frequently reported impairments. While mobility, self-care, and usual activities improved over time, some residual disability persisted at day 180.

Table 4 summarises median utility scores and VAS scores across groups and assessments. At baseline, median utility scores were 0.596 (IQR: 0.365–0.734) in sepsis cases, 0.666 (IQR: 0.611–0.722) in hospital controls, and 0.900 (IQR: 0.833–0.900) in community controls. By day 180, the median utility score for sepsis cases declined to 0 (IQR: 0–0), while hospital controls improved to 0.900 (IQR: 0.900–0.900).

Table 4
Participants' summary of utility scores and VAS scores at baseline and follow-up assessments.

	Sepsis cases (including deceased)	Hospital control	Community controls	P value
	[N]Median (IQR)	[N]Median (IQR)	[N]Median (IQR)	
Baseline Utility score	[189] 0.596 (0.365–0.734)	[76] 0.666 (0.611–0.722)	[91] 0.900 (0.833–0.900)	< 0.001
Day 7 Utility score	[134] 0.790 (0.642- 0.900)	[40] 0 .789 (0.688–0.900)	NA	0.661
Day 28 Utility score	[124] 0.642 (0–0.900)	[21] 0.844 (0.734–0.900)	[53] 0.9 (0.854–0.900)	< 0.001
Day 90Utility score	[88] 0 (0–0.839)	[13] 0.9 (0.833–0.900)	NA	< 0.001
Day 180 Utility score	[71] 0 (0–0)	[2] 0.9 (0.900–0.900)	[20] 0.900 (0.900–0.900)	< 0.001
Baseline VAS score	[210] 62.5 (50–80)	[87] 65 (45–80)	[93] 90 (80–90)	< 0.001
Day 7 VAS score	[157] 70 (60–85)	[55] 75 (60–90)	NA	0.348
Day 28 VAS score	[107] 80 (70–90)	[31] 80 (70–90)	[59] 90 (85–90)	< 0.001
Day 90 VAS score	[61] 85 (70–90)	[15] 80 (70–90)	NA	0.217
Day 180 VAS score	[27] 90 (70–95)	[11] 90 (75–95)	[26] 90 (80–95)	0.985

Note: Data are presented as median (interquartile range, IQR) with the number of participants [N] in each group. Kruskal-Wallis' test was used to compare utility and VAS scores across all three groups (sepsis cases, hospital controls, and community controls) at each time point. The Mann-Whitney U test was used for pairwise comparisons between two groups (sepsis cases vs. hospital controls). P-values indicate the statistical significance of differences between groups. NA (Not Applicable) indicates time points where data were not collected for the group.

S2 Table 1 presents mean utility and VAS scores across assessments. Mean baseline utility scores were 0.539 (95% CI: 0.500–0.578) in sepsis cases, 0.666 (95% CI: 0.611–0.722) in hospital controls, and 0.861 (95% CI: 0.850–0.874) in community controls. By day 180, mean utility scores declined to 0.133 (95% CI: 0.059–0.208) in sepsis cases, while hospital controls improved to 0.900 (95% CI: 0.900–0.900). Utility scores declined most in sepsis cases, while hospital and community controls remained stable (**S2** Fig. 1**)**. VAS scores improved over time for sepsis cases (**S2** Fig. 2**)**.

Figure 2 presents box plots of EQ-5D utility scores across five time points (day 0, day 7, day 28, day 90, and day 180) for sepsis cases, hospital controls, and community controls. Utility scores improved for days 7 and 28, then declined in the assessments at days 90 and 180 in sepsis cases, while hospital and community controls showed stable or improving trends. VAS scores increased over time for sepsis cases, while hospital controls maintained relatively high VAS scores, and community controls consistently reported the highest VAS scores (Fig. 3**).**

Factors associated with HRQoL in sepsis patients.

In the multivariable mixed effects regression models to examine HRQoL among sepsis cases at multiple time points, Table 5, Increased duration of illness before admission was significantly associated with lower HRQoL, with each additional day unwell predicting a small but statistically significant decline in logit-transformed EQ-5D scores ($\beta = -0.006$, $p < 0.004$). Additionally, participants with unknown HIV status reported significantly higher EQ-VAS scores ($\beta = 1.15$, $p = 0.023$). Sepsis survivors who report higher HRQoL at baseline are more likely to continue reporting better HRQoL across follow-up ($\beta = 0.465$, $p < 0.001$). Associations persisted even with the inclusion of UVA in the model.

Table 5
Socio-demographic and clinical factors associated with HRQoL for sepsis cases (multivariable mixed effect regression model)

	Utility score β (95% CI) P value N = 606	Utility score + UVA β (95% CI) P value N = 545	VAS score β (95% CI) P value N = 562	VAS score + UVA β (95% CI) P value N = 504
Age (years)	-0.012(-0.035,0.011); p = 0.293	-0.015 (-0.041, 0.010); p = 0.252	-0.000 (-0.019, 0.020); p = 0.987	-0.007 (-0.026, 0.012); p = 0.493
Sex (Ref female				
Male	0.105 (-0.442, 0.651); p = 0.707	0.186 (-0.383, 0.754); p = 0.522	0.278 (-0.179, 0.736); p = 0.233	0.310 (-0.120, 0.739); p = 0.158
HIV status (Ref negative)				
Positive	-0.244 (-0.799, 0.311); p = 0.390	-	-0.020 (-0.480, 0.438); p = 0.929	-
Unknown	0.619 (-0.509, 1.746); p = 0.282	-	1.154 (0.162, 2.145); p = 0.023	-
Active TB status (Ref no)				
Yes	-0.162 (-0.789 0.464); p = 0.611	-0.123 (-0.747, 0.501); p = 0.699	-0.056 (– 0.595, 0.482); p = 0.838	-0.035 (-0.524, 0.454); p = 0.889
Education status (Ref college or higher)				
No formal schooling	-0.310 (-1.541, 0.920); p = 0.621	-0.505 (-1.884, 0.874); p = 0.473	0.039 (-1.090, 1.167); p = 0.946	0.028 (-1.124, 1.179); p = 0.963
Primary incomplete or complete	-0.080 (-0.991, 0.832); p = 0.864	-0.107 (-1.049, 0.834); p = 0.823	0.146 (-0.647, 0.938); p = 0.719	-0.022 (-0.777, 0.732); p = 0.954
Secondary school completed	0.119 (-0.848, 1.086); p = 0.809	-0.071 (-1.066, 0.924); p = 0.890	0.190 (-0.640, 1.019); p = 0.654	-0.031 (-0.822, 0.760); p = 0.939
Some secondary education	0.197 (-0.766, 1.160); p = 0.689	-0.091 (-1.109, 0.928); p = 0.862	0.547 (-0.270, 1.364); p = 0.190	0.104 (-0.690, 0.898); p = 0.798
Occupation (Ref currently employed)				
Retired	3.303 (-0.553, 7.160); p = 0.093	3.562 (-0.297, 7.421); p = 0.070	-0.328 (-3.038, 2.382); p = 0.937	-0.306 (-2.77, 2.162); p = 0.808
Self-employed	-0.137 (-0.826, 0.550); p = 0.695	0.091 (-0.628, 0.811); p = 0.803	-0.330 (-0.911, 0.251); p = 0.265	-0.033 (-0.584, 0.519); p = 0.908
Student	0.125 (-0.862, 1.113); p = 0.803	0.186 (-0.869, 1.241); p = 0.729	-0.417 (-1.227, 0.392); p = 0.312	-0.333 (-1.124, 0.458); p = 0.410
Unemployed	0.008 (-0.711, 0.695); p = 0.981	-0.009 (-0.733, 0.714); p = 0.980	-0.394 (-0.985, 0.196); p = 0.191	-0.337 (-0.889, 0.214); p = 0.230
Days unwell before admission	-0.006 (-0.010, -0.002); p = 0.004	-0.009 (-0.018, -0.000); p = 0.046	-0.003 (-0.006, 0.001); p = 0.102	-0.004(-0.012, 0.003); p = 0.234
UVA	-	-0.095 (-0.254, 0.064); p = 0.243	-	0.023 (-0.102, 0.149); p = 0.715
Baseline HRQoL score	0.465 (0.339, 0.591); p < 0.001	0.440 (0.305, 0.576); p < 0.001	0.813 (0.606, 1.022); p < 0.001	0.826 (0.612, 1.041); p < 0.001

Note: This table presents the results of the linear mixed-effects regression model, showing the coefficients (95% Confidence Intervals, CI) and p-values for factors associated with EQ-5D utility scores and VAS scores. Random effects were included at the patient level to account for within-subject correlation across time. A negative coefficient indicates a decrease in utility or VAS score associated with that variable. A positive coefficient indicates an increase in utility or VAS score associated with that variable.

Multivariable linear regression model: Male sex was associated with higher baseline utility scores (p = 0.050). Increased days of illness before hospital admission were negatively associated with baseline utility scores (p = 0.013). Age and duration of illness were also significant predictors at day 180, with older age negatively impacting utility scores (p = 0.013 and p = 0.003, respectively) (S2 Table 3). Associations persisted even with the inclusion of UVA in the models. However, on bivariable analysis between baseline utility score and UVA alone (unadjusted), higher UVA scores were significantly associated with lower baseline EQ-5D utility scores (β = -0.030 (-0.056, -0.005), p = 0.020).

Discussion

This study provides critical insights into the long-term HRQoL outcomes among sepsis survivors in Malawi. Sepsis survivors in Malawi experience significant and prolonged impairments in quality of life, which persist well beyond hospital discharge. These findings reinforce existing evidence that sepsis survivors experience prolonged physical and mental health challenges. (29).The impact of sepsis extends long after the acute phase and may influence survivors' ability to live independently and participate fully in daily life (14). Further research work is required to explore context-specific interventions that address both physical and mental health outcomes in sepsis survivors, particularly in low-resource settings. We recommend that future sepsis interventions and research prioritise not only survival but also long-term quality of life as a key outcome measure. (30).

Our study found that sepsis leads to a significant and sustained deterioration in HRQoL across physical, psychological, and functional domains. Across all EQ-5D dimensions, sepsis survivors reported persistent impairments through 180 days, with mobility, pain/discomfort, and usual activities most affected. Compared to hospital and community controls, sepsis survivors had markedly lower utility scores from baseline to day 180, highlighting a prolonged burden. While EQ-VAS scores improved modestly, utility scores declined over time, reflecting a disconnect between perceived and actual functional recovery. We also found that delays in hospital presentation and lower baseline EQ-5D utility scores were significantly associated with worse post-sepsis HRQoL. Older age and female sex were associated with lower scores, aligning with the broader literature on post-acute outcomes.

Our findings are consistent with other studies in demonstrating long-term physical and psychological impairments in sepsis survivors. Regarding physical impact, Yende et al. (2016) reported that one-third of previously independent sepsis survivors were unable to return to independent living within six months, with common impairments in mobility (37.4%) and usual activities (43.7%) (31). Similar to our findings, these impairments persisted or worsened over time, indicating that physical recovery post-sepsis is slow and often incomplete, particularly in resource-limited settings (8, 32, 33). Over 30% of our participants experienced mobility limitations at six months, similar to other studies, which identify physical disability as one of the most persistent sequelae of sepsis(9, 33). In our study, pain and discomfort were also prevalent, aligning with research that associates sepsis with chronic pain and therefore reduced HRQoL (30). Psychological distress, including anxiety and depression, remained a significant concern, supporting the need for psychosocial interventions. Prior research, such as that involving hepatitis B patients, has shown that strong social support can improve mental health outcomes, suggesting that similar models may benefit sepsis survivors (11). While there is evidence of partial psychological recovery by six months (33), our findings suggest that mental health challenges may be more prolonged in low-resource settings, where access to psychosocial care is often limited (30, 34). The findings indicate that sepsis not only impacts individuals but also may affect families and society, through increased caregiving needs, reduced productivity, and ongoing dependency (35, 36). For example, in Malawi, hospitalisations for bloodstream infections have been associated with substantial economic impacts, with resistant infections incurring significantly poorer HRQoL (14).

Su et al. (2018) also identified female sex and older age as predictors of poorer QoL factors, which mirrors our regression results. (37). Furthermore, there has been an association of age and sex to significantly impact HRQoL outcomes, with older age and female sex associated more specifically with worse physical health scores.(8, 38)In our study, these factors were associated with lower utility and VAS scores. Some studies, however, argue that sepsis survivors show higher rates of chronic conditions; therefore, the impact on HRQoL for older people may be due to pre-existing trajectories rather than sepsis itself. (39). Evidence on elderly populations in low-resource settings has shown that other socioeconomic factors, such as income, education, and social support, significantly influence general QoL, highlighting the need for holistic interventions for older adults. (40). Overall, sepsis has substantial long-term impacts on survivors' quality of life and independence. (35, 36).

In both EQ-5D utility and EQ-VAS models, we identified factors associated with meaningful differences in health-related quality of life among sepsis survivors. For EQ-5D, a longer duration of illness before admission was significantly associated with lower utility scores. Although the per-day effect was modest ($\beta = -0.0061$), the cumulative impact over 30 days approached a reduction of 0.04 units, which is within the commonly accepted MID range of 0.03–0.05 (26, 27). This suggests that delays in care may have a clinically significant effect on post-sepsis HRQoL. Patients with higher baseline EQ-5D scores consistently experienced a better quality of life throughout the follow-up, suggesting that a simple EQ-5D assessment during admission could be a valuable tool for identifying individuals at risk and planning targeted follow-up for sepsis survivors with low baseline HRQoL. In the EQ-VAS model, participants with unknown HIV status reported significantly higher self-rated health compared to those with known status. While the predicted difference exceeded the MID threshold of 7–10 points for EQ-VAS, this result may reflect selection or reporting bias, given the small subgroup size.

EQ-VAS scores showed a trend of improvement over time, while EQ-5D utility scores declined. This discrepancy is consistent with prior literature and reflects the conceptual differences between the two measures. EQ-VAS captures patients' single reading subjective perceptions of health and is therefore sensitive to psychological and emotional adaptation, which may improve during recovery even if functional limitations persist. In contrast, EQ-5D utility scores are derived from predefined multiple health dimensions and anchored to population preferences, which may remain low due to residual impairments such as pain, anxiety, or limited mobility. These findings reinforce the value of using both instruments to capture different aspects of health-related quality of life in post-sepsis populations.(41, 42) Therefore, EQ-VAS may reflect psychological adaptation, while EQ-5D captures ongoing functional deficits.

While most global studies describe HRQoL impairments, few have explored sepsis outcomes in sub-Saharan Africa. Our data indicate a sustained decline in HRQoL in sub-Saharan Africa, with a severe and progressive decrease in utility scores among sepsis survivors in Malawi by day 180. This contrasts with findings from Granja et al. and Su et al., where HRQoL either remained stable or improved over time and was comparable to that of other ICU survivors (37, 43). This difference may potentially be due to structural and contextual factors. For instance, a high proportion of sepsis survivors in our study had pre-existing HIV or TB infections, conditions known to delay recovery and increase post-sepsis morbidity. (7, 44). In addition, the lower baseline QoL in SSA populations may contribute to steeper declines after critical illness. (45). Furthermore, unlike high-income countries, where post-sepsis care pathways, including physiotherapy and mental health services, are well established, such services are not. (46)They are limited or absent in Malawi. These systemic gaps likely compound the effects of sepsis on HRQoL and recovery. These findings highlight the urgent need for context-specific interventions to improve long-term outcomes for sepsis survivors in Malawi and SSA at large. As recommended by other studies (47, 48) Future strategies should integrate rehabilitation programs; although they may not decrease mortality, they may improve quality of life. Given the significant impact of sepsis on survivors'

quality of life, our findings suggest that both mortality and HRQoL should be considered when designing interventions and endpoints for sepsis studies and care. (30).

Strengths of the study

This study is one of the first in SSA to assess long-term HRQoL outcomes in sepsis survivors, providing valuable regional data. The inclusion of both hospital and community controls strengthens the study's comparative design. The inclusion of community controls enabled us to demonstrate that sepsis survivors start from a lower baseline and diverge further over time, unlike in other studies where HRQoL was benchmarked against that of other hospital survivors only. Additionally, most global reports exclude the EQ-VAS; yet, we demonstrate its value in capturing subjective recovery distinct from functional change.

Limitations of the study

This study focused on hospitalised sepsis cases, which may underestimate the burden in community-managed cases and introduce selection bias. Mortality and high loss to follow-up may have led to an underestimation of HRQoL recovery over time. However, its generalisation in SSA is limited, and value sets for many African populations, including those in Malawi, are unavailable. It was necessary to use Zimbabwean value sets due to the lack of Malawi-specific utility weights. Although this approach is commonly used in such contexts, it may introduce some minor estimation errors, as preferences for health states may differ between Zimbabwean and Malawian populations. The Zimbabwean value set for EQ-5D-3L is the only one available from SSA. The absence of alternative SSA value sets also limited our ability to conduct sensitivity analyses comparing how the use of different value sets might influence our findings.

While our models accounted for repeated measures over time using random intercepts, we did not include random slopes for time, which would have allowed us to characterise individual variation in longitudinal recovery trajectories fully.

Conclusion

This study provides evidence of the long-term HRQoL deficits among sepsis survivors in Malawi, with the persistent impact on physical and mental well-being. Our findings highlight the urgent need for post-sepsis rehabilitation strategies, particularly in resource-limited settings like Malawi. By integrating both clinical and quality-of-life measures, we can enhance post-sepsis care and reduce the long-term disease burden in vulnerable populations.

Our findings emphasise the need for structured post-sepsis care models in SSA, which could include physiotherapy, mental health support, and pain management services. Post-COVID-19 rehabilitation programs in improving HRQoL suggest that similar approaches could be applied to sepsis survivors in SSA.(49). Future research should focus on developing tailored interventions that address pain management, mobility recovery, and mental health support, ultimately improving long-term outcomes for sepsis survivors in SSA. Also, research should focus on developing Malawi-specific EQ-5D-3L value sets to enhance the accuracy of HRQoL assessments and evaluating cost-effective rehabilitation interventions to improve long-term outcomes for sepsis survivors.

Abbreviations

Abbreviation
Full term
ANOVA
Analysis of Variance
CI
Confidence Interval
CPT
Co-trimoxazole Preventive Therapy
CSV file
Comma-Separated Values File
EQ-5D
EuroQol 5-Dimension Instrument
EQ-5D-3L
EuroQol 5-Dimension, 3-Level Version
EQ-VAS
EuroQol Visual Analogue Scale
EuroQol
European Quality of Life Group
HE
Health Economics
HIV
Human Immunodeficiency Virus
HRQoL
Health-Related Quality of Life
ICU
Intensive Care Unit
IQR

Interquartile Range
LMIC
Low- and Middle-Income Countries
MID
Minimally Important Difference
NIHR
National Institute for Health and Care Research
ODK
Open Data Kit
QoL
Quality of Life
QALYs
Quality-Adjusted Life Years
QECH
Queen Elizabeth Central Hospital
SQL database
Structured Query Language Database
SSA
Sub-Saharan Africa
STATA
Data Analysis and Statistical Software
TB
Tuberculosis
UK
United Kingdom
USA
United States of America
UVA
Universal Vital Assessment

Declarations

Ethical approvals and consent to participate

All study procedures were conducted in accordance with the Declaration of Helsinki and relevant national regulations. The study was approved by the University of Malawi College of Medicine research ethics committee (approval number P.11/16/2063) and the Liverpool School of Tropical Medicine (approval number 16-062). EuroQol gave an authorisation with registration number 74197 to use the Malawi (Chichewa) EQ-5D-3L Paper Self-Complete Version, EuroQol Group, Netherlands.

After explaining the aim of the study and its associated procedures, research assistants sought written consent from participants or their legal guardians for proxy consent to participate in the study.

Consent for publication

Not applicable

Clinical trial registration

Not applicable.

Availability of data and materials

All data underlying the findings of this study are fully available without restriction. The datasets have been deposited in publicly accessible repositories and can be accessed via the following links:

https://github.com/joelewis101/blantyreESBL and https://github.com/joelewis101/blantyreSepsis

Competing interests

The authors declare no competing interests.

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Authors contributions

N.M.Y., J.M.L., M.P.R., E.W., R.M., J.R., and N.A.F. contributed to the conceptualisation of the study. J.M.L., G.K., and J.M. were responsible for data curation. N.M.Y. and L.R. conducted the formal analysis. J.M.L., M.P.R., E.W., J.R., N.A.F., and B.M. acquired funding. The investigation was conducted by N.M.Y., J.M.L., M.P.R., E.W., and R.M. Methodology development was led by N.M.Y., J.M.L., M.P.R., E.W., R.M., J.R., and N.A.F. E.W. oversaw project administration. Resources were provided by J.M.L., M.P.R., E.W., G.K., J.M., J.R., and N.A.F. J.M.L., M.P.R., E.W., R.M., J.R., and N.A.F. supervised the study. Visualisation was conducted by N.M.Y., J.M.L., M.P.R., E.W., and R.M. N.M.Y. wrote the original draft of the manuscript. All authors reviewed and edited the manuscript.

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Figures

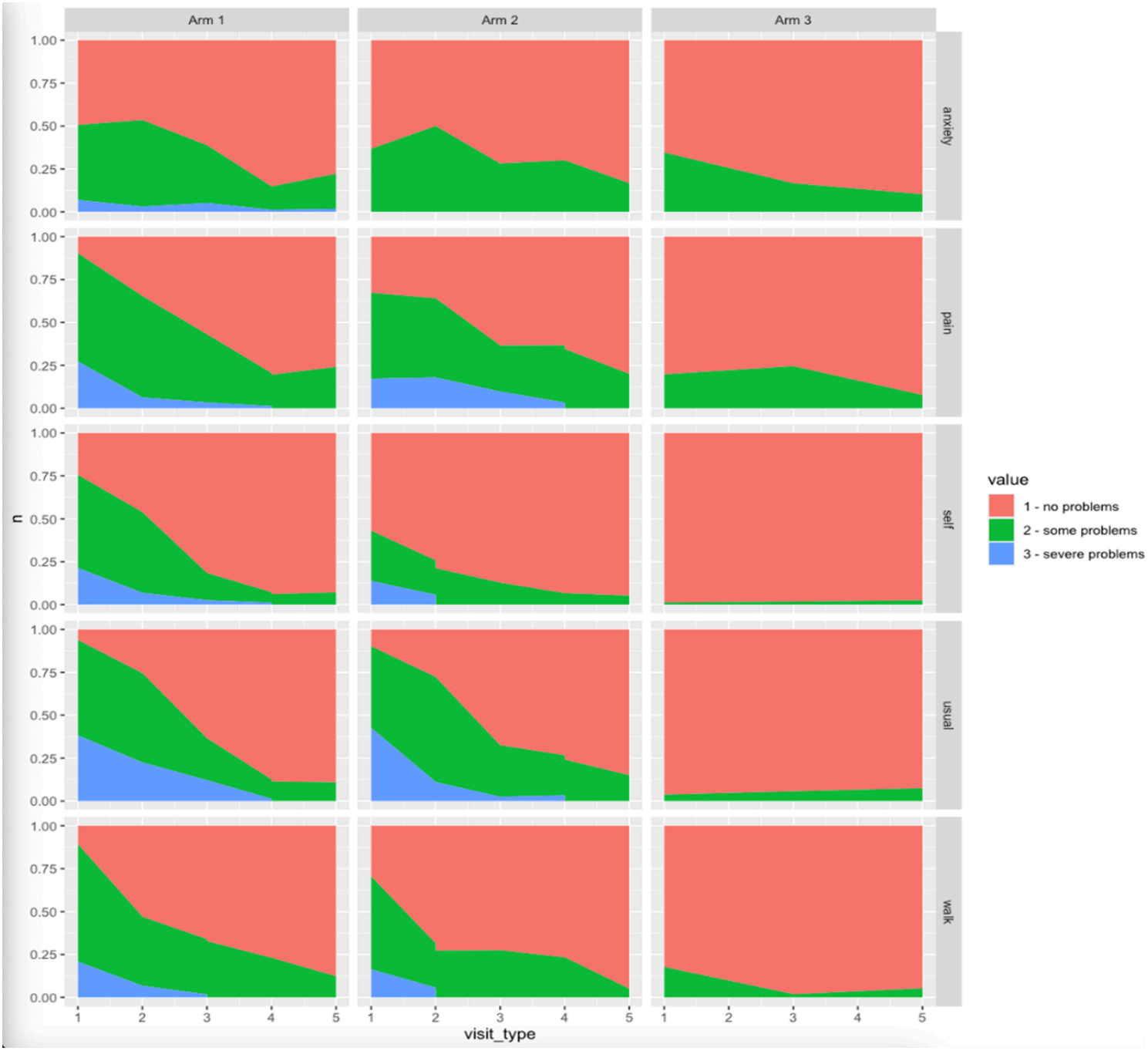


Figure 1

Proportions of participants with no problems, moderate/some problems and unable/extreme problems among groups across assessment.

Note: A stacked area plot utility scores and visual analogue scale scores (VAS scores). Arm 1 = Sepsis cases, Arm 2= Inpatient controls. Arm 3 = Community controls

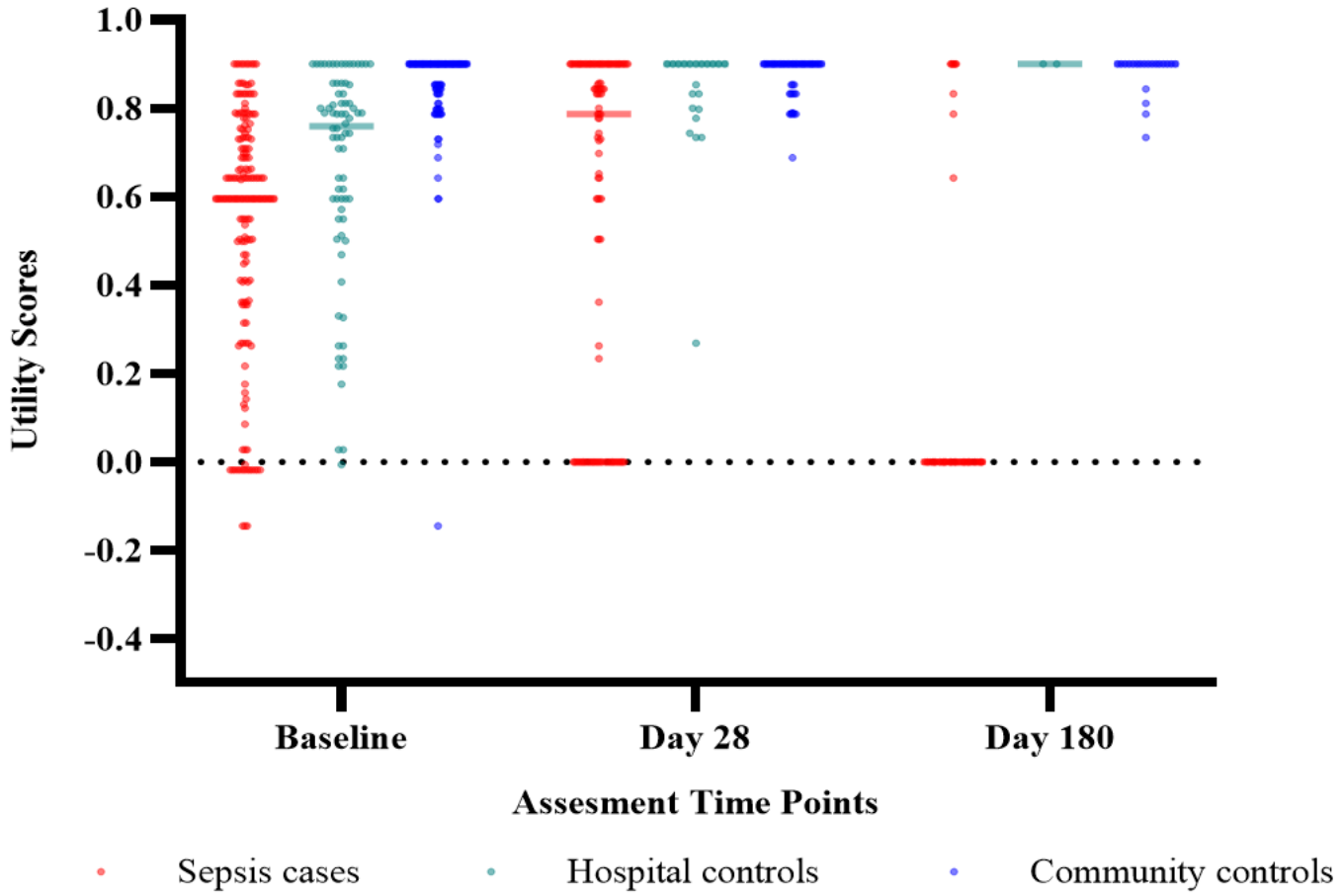


Figure 2

Longitudinal trends in EQ-5D utility scores across 180 days in sepsis cases, hospital controls, and community controls

Note: The scatter dot plot demonstrates individual EQ-5D utility scores for sepsis cases (red), hospital controls (green), and community controls (blue) at baseline, day 28, and day 180. Each dot represents an individual participant's utility score, with horizontal bars indicating median values for each group. Utility scores ranged from -0.4 to 1.0. Sample sizes vary by time point: baseline (sepsis cases n=201, hospital controls n=81, community controls n=91), day 28 (sepsis cases n=124, hospital controls n=21, community controls n=53), day 180 (sepsis cases n=71, hospital controls n=2, community controls n=20).

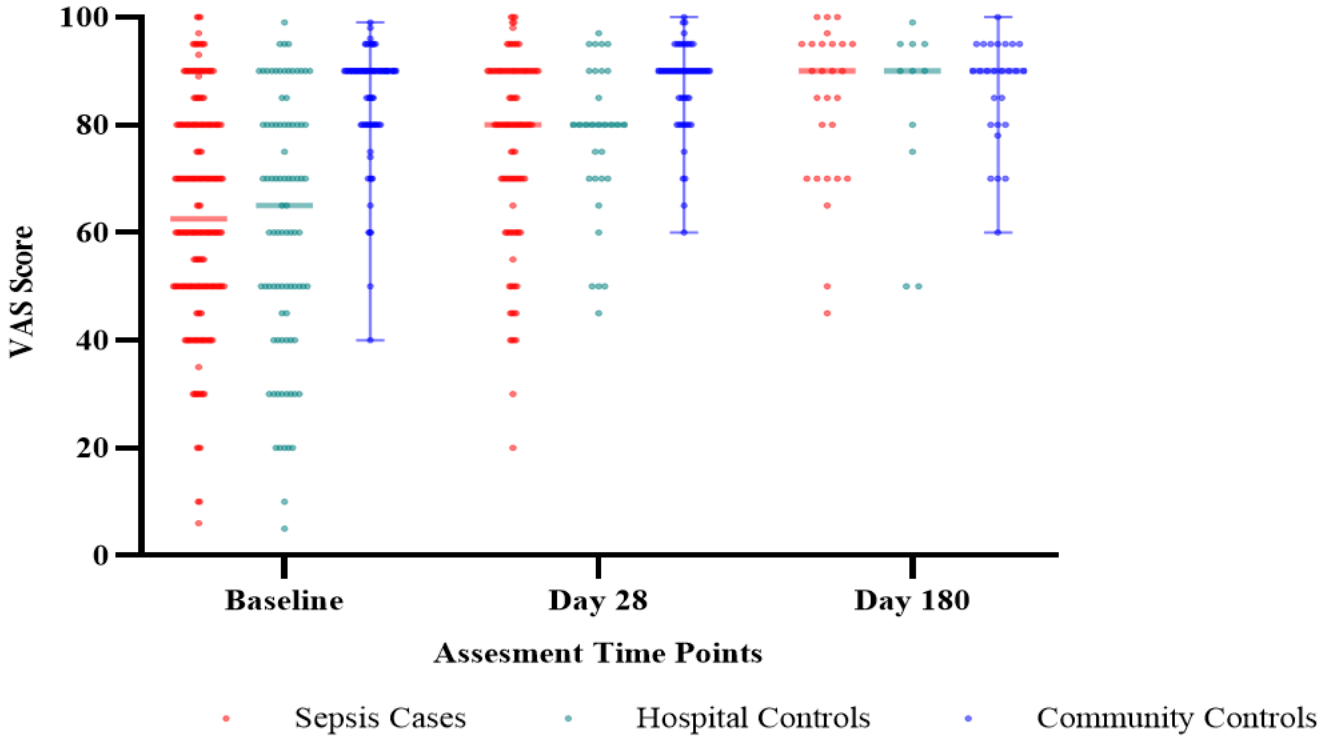


Figure 3

Longitudinal trends in EQ-VAS scores across 180 days in sepsis cases, hospital controls, and community controls

Note: The scatter dot plot demonstrates individual EQ-5D VAS scores for sepsis cases (red), hospital controls (green), and community controls (blue) at baseline, day 28, and day 180. Each dot represents an individual participant's self-rated health score, with horizontal bars indicating median values for each group. Sample sizes vary by time point: baseline (sepsis cases n=210, hospital controls n=87, community controls n=93), day 28 (sepsis cases n=107, hospital controls n=31, community controls n=59), day 180 (sepsis cases n=27, hospital controls n=11, community controls n=26).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementarymaterial1checklist.docx
- Supplementarymaterial2additionalresults.docx