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Prevalence and related assessment practices of adult hospital malnutrition in Africa: A scoping review

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SUMMARY

Background and aims: Globally, hospital malnutrition prevalence is estimated at 20–50%, with little known about the situation in African hospitals. The aim of this scoping review was to appraise the current evidence base regarding the prevalence of adult hospital malnutrition and related assessment practices in an African context.

Methods: A comprehensive and exhaustive search strategy was undertaken to search seven electronic bibliographic databases (including Africa-specific databases) from inception until August 2022 for articles/resources reporting on the prevalence of adult hospital malnutrition in an African setting. Two reviewers independently reviewed abstracts and full-text articles and data extraction was undertaken in duplicate.

Results: We screened the titles and abstracts of 7537 records and included 28 studies. Most of the included studies were conducted in the East African region ($n = 12$), with ten studies from South Africa. Most studies were single-centre studies ($n = 22$; 79%), including 23 to 2126 participants across all studies. A variety of study populations were investigated with most described as medical and surgical populations ($n = 14$; 50%). Malnutrition risk prevalence was reported to be between 23% and 74%, using a variety of nutritional screening tools (including MNA-SF/LF, NRS-2002, MUST, NRI, GNRI). Malnutrition prevalence was reported to be between 8% and 85%, using a variety of tools and parameters, including ASPEN and ESPEN guidelines, SGA, MNA-SF/LF, anthropometric and biochemical indices, with one study using the GLIM criteria to diagnose malnutrition.

Conclusions: Both malnutrition risk and malnutrition prevalence are alarmingly high in African adult hospitalised patients. The prevalence of malnutrition differs significantly among studies, owing in part to the variety of tools used and variability in cut-offs for measurements, underscoring the importance of adopting a standardised approach. Realities in the African context include limited nutritional screening and assessment, poor referral practices, and a unique disease burden. General awareness is needed, and routine nutritional screening practices with appropriate nutrition support action should be implemented as a matter of urgency in African hospitals.

1. Introduction

Although hospital malnutrition is probably as old as hospitals themselves, modern awareness can be traced to 1974, when the now landmark article appeared by Dr Charles E Butterworth, referring to the “skeleton in the hospital closet” [1]. Key publications appeared shortly thereafter, confirming that almost half of medical and surgical patients present with nutritional deficiencies [2,3]. Despite some reported improvements, and many reports later, hospital malnutrition prevalence is still reported to be between 20% and 50%, depending on the country, patient population, and definition and criteria used for diagnosis, making comparisons between settings difficult [4,5]. Data from the nutritionDay (nDay) initiative [6] (a worldwide initiative to fight malnutrition in

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healthcare institutions) indicate that up to 40% of hospitalised patients are affected by disease-related malnutrition, while data from the United States of America (USA) and Europe specifically show that up to a third of patients in hospital have malnutrition or are at risk of malnutrition at the time of hospital admission [7–9]. In terms of malnutrition risk prevalence, a recent systematic review found prevalence varied across the included studies, ranging from 7% to 90% depending on patient population and screening tool used to identify malnutrition risk [10]. This systematic review also found that the prevalence of malnutrition varied depending on the patient population, with older patients, patients in the intensive care unit (ICU), and those with acute kidney disease having higher rates of malnutrition [10]. Recent African studies have revealed a high prevalence of adult hospital malnutrition (approximately 45%), seemingly placing African patients towards the top of the range in relation to the global statistics [11,12].

Although malnutrition is most simply defined as any nutrition imbalance, widespread confusion exists regarding malnutrition definitions and terminology [13,14]. According to the World Health Organization (WHO) [15], malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy or nutrients and includes three groups: undernutrition, micronutrient-related malnutrition, and overweight/obesity. In the clinical setting, malnutrition has been defined as insufficient intake or uptake of nutrients that leads to altered body composition and body cell mass that further contribute to decreased physical and mental function and poor clinical outcome [16]. Disease-related malnutrition (DRM) has been described as a complex syndrome and a specific type of malnutrition caused by a concurrent disease. DRM can be triggered by a disease-specific inflammatory response or by non-inflammatory aetiologic mechanisms [16]. Across studies, malnutrition prevalence and risk prevalence are reported using an array of nutrition screening and assessment tools, and parameters [9,14,17]. Although malnutrition is a common healthcare problem, there is little universal agreement about its definition, prevalence, or method of identification and reporting [10]. To address some of these challenges the Global Leadership Initiative on Malnutrition (GLIM) created a consensus-based framework consisting of phenotypic and aetiologic criteria to document malnutrition in adults [18,19]. The GLIM criteria provide a universal framework and "language" for assessing/diagnosing malnutrition, potentially enabling more meaningful comparisons across settings and regions.

Patients can present to hospital with pre-existing malnutrition due to personal factors (including socio-economic factors) and/or disease/illness related factors [5,20]. In addition, nutritional status can further deteriorate during hospital stay partly due to poor recognition by healthcare professionals, illness-related loss of appetite, treatment-related side-effects, adverse clinical routines, the disease itself, and inappropriate/suboptimal nutrition support, among others [9,21]. The adverse clinical effects of malnutrition have been widely described and well documented, and include low immune competence and infectious complications, pressure ulcers and delayed wound healing, unsteady gait, falls and fractures, impaired mental status and dependence, treatment intolerance, prolonged hospitalisation and frequent readmissions, poor quality of life, and worse morbidity, mortality and prognosis [4,7,10,22]. In addition, malnutrition at admission in Canadian hospitals increases total costs by 31%–38% for moderately to severely malnourished patients respectively, which translates to a cost of between $1500 and $2000 more per hospital stay [23]. Annual costs associated with hospital malnutrition have been calculated as €170 billion for the European continent [4] and $30 billion in additional healthcare costs in Asian countries [24]. Furthermore, nutritional support and hospital-initiated malnutrition interventions have been associated with improved survival, non-elective hospital readmission rates and improved quality of life and should therefore be considered when treating this population [10,25]. Early oral nutrition intervention for malnourished patients, or those at risk of malnutrition, has been shown to result in overall reduced hospital costs, with the highest impact on savings represented by the mean reduction in the length of hospital stay [26]. If hospital malnutrition is recognised timeously and treated appropriately, it can improve clinical outcome and reduce healthcare costs, underscoring the importance of affording it the attention it deserves.

Despite some recent studies, little is known regarding the extent of hospital malnutrition on the African continent. Realities in the African context include limited nutritional screening and assessment, poor referral practices, and probably a limited awareness of the importance and possible benefit of addressing hospital malnutrition [11,12,27]. Furthermore, the continent is experiencing the double burden of malnutrition with high levels of undernutrition and a growing burden of overweight/obesity and diet-related non-communicable diseases [28], as well as a unique additional disease burden in the form of human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) and tuberculosis (TB) (independently associated with malnutrition) [29–31]. Considering all of this, conducting research on the African continent regarding hospital malnutrition and strategies to mobilise efforts to address it, is both timely and appropriate.

To enable this, a review and mapping of the current literature were required to understand the extent of the problem. The aim of this scoping review was therefore to appraise the current evidence base regarding the prevalence of adult hospital malnutrition and related assessment practices in an African context.

2. Methods

We conducted this scoping review using the Joanna Briggs Institute's (JBI) methodology [32] and registered its protocol on the Open Science Framework (OSF) (https://osf.io).

The main research question of this scoping review was: What is the prevalence and related assessment practices of adult hospital malnutrition on the African continent, and what are the current knowledge gaps? The research question was structured based on the population, concept, and context (PCC) framework; the population included hospitalised adult patients, the concept was malnutrition and/or malnutrition risk prevalence, and the context was the assessment methods used to determine malnutrition (risk) prevalence in a hospital setting.

A comprehensive and exhaustive search strategy was undertaken to search seven electronic bibliographic databases (including Africa-specific databases) from inception until August 2022 for articles/resources reporting on the prevalence of adult hospital malnutrition in an African setting. Databases included in the search were Medline (PubMed), CINAHL (EBSCOhost), Africa-Wide Information (EBSCOhost), Web of Science Core Collection (Clarivate Analytics), ProQuest, Epistemonikos, and Sabinet African Journals. We also reviewed the reference lists of included studies and contacted stakeholders and personal contacts for additional resources. Only English-language studies were included.

A broad search string was developed (for Medline) with the help of an information specialist, based on the scoping review research question and aim (Table S1). This search string was based on the following key concepts and terms: "hospital", "Africa" and countries (by name), "adult", "malnutrition or nutritional status" and "prevalence". The African part of the search string was based on the search string developed by Siegfried et al. [33]. The Medline search string was adapted as required for the other databases with the help of an information specialist.

Search results were exported to EndNote Library and imported into Rayyan, a web tool (Beta), designed to assist with the process of screening and selecting studies [34]. Studies pertaining to human adults (≥18 years), of any study design and format (including journal articles, conference proceedings/abstracts and theses and dissertations) were included. Studies were included if they met the pre-determined inclusion and exclusion criteria (Table 1).

Two independent reviewers (JV and LP) determined the eligibility of each paper using a two-stage process. Firstly, titles and abstracts were screened, and all potentially eligible records/papers identified. Subsequently, the full text of potentially eligible records/papers was read to confirm eligibility. Disagreements were resolved by discussion/consensus. A data-charting form was developed and pilot tested before the start of data extraction. The research team determined which variables to extract (based on the study objectives), and included publication details (author, year, journal, format), study details (country and setting), study type and design, patient features (number of patients, age, sex, clinical condition), sampling and quality control measures, results (including malnutrition and malnutrition risk prevalence, method(s) of assessment, clinical indicators/parameters of malnutrition and related cut-offs) and funding sources. Charting was an iterative process, and the data-charting form was refined as the process unfolded. Two reviewers independently extracted data (JV and LP), and disagreements were resolved by consensus. We used descriptive statistics to describe the features of the studies on hospital malnutrition prevalence and used tables and graphs to present the collected data. This scoping review is presented according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist [35].

3. Results

We screened the titles and abstracts of 7537 records, and 28 studies (29 records) met the scoping review's inclusion criteria [11,12,27,36–61]. Figure 1 presents the flowchart of study selection. We recorded reasons for study exclusion in a *Table of Excluded Studies* (Table S2). The main exclusion reasons included studies reporting on patients treated at hospital outpatient clinics ($n = 14$) and studies in which malnutrition prevalence reporting was not part of the primary study aims/outcomes ($n = 13$).

The general features of each of the included studies are presented in Table 2. Studies were published between 1983 and 2022, with most in the last ten years ($n = 19$; 68%). Included records are mostly published manuscripts ($n = 27$; 93%), with two abstracts included [11,39]. Studies were published in both international publications/journals ($n = 15$; 54%) and local/African journals ($n = 13$; 46%). Included studies were conducted across the African continent, with most conducted in the East African region ($n = 12$; 43%), and ten studies included from South Africa (Fig. 2). Most studies were single-centre studies ($n = 22$; 79%), including 23 to 2126 participants across studies. A variety of study populations were investigated with most described as medical and surgical populations ($n = 14$; 50%), followed by the elderly ($n = 5$; 18%), mixed hospital populations ($n = 4$; 14%), neurology and mental health disorders/handicap ($n = 3$; 11%) and infectious diseases specifically ($n = 2$; 7%). Patients of all ages were included, and where reported, all studies included both male and female participants (Table 2). The majority of studies were described to be cross-sectional, descriptive, or observational in nature ($n = 23$; 82%), with five studies described as cohort studies.

Random sampling techniques were only described in three studies (11%) [37,42,47], with other studies undertaking mostly consecutive ($n = 19$; 68%), convenience ($n = 2$; 7%) or census ($n = 2$; 7%) sampling strategies. In two cases (7%) the sampling strategy was not described (Table 2). Sample size calculations were reported in less than a quarter of studies ($n = 6$; 21%) [11,12,48,52,59,61].

Prevalence rates, methods of assessment, relevant cut-offs and quality control measures are presented in Table 3. The *main* prevalence findings, as reported by the authors, are presented here. Malnutrition risk prevalence was reported in 12 of the studies (43%), while malnutrition prevalence was reported in all but two studies [50,53]. Malnutrition risk was reported to be between 23% and 74%, using a variety of nutritional screening tools [including the Mini Nutritional Assessment Short Form/Long Form (MNA-SF/LF), Nutritional Risk Screening 2002 (NRS-2002), Malnutrition Universal Screening Tool (MUST), Nutrition Risk Index (NRI), Geriatric Nutrition Risk Index (GNRI)]. On the other hand, malnutrition prevalence was reported to be between 8% and 85% using various tools and parameters, including the American Society for Parenteral and Enteral Nutrition (ASPEN) and European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines, Subjective Global Assessment (SGA), MNA-SF/LF, anthropometric [weight, weight loss, body mass index (BMI), mid-upper arm circumference (MUAC), triceps skinfold (TSF), arm muscle area (AMA), arm fat area (AFA)] and biochemical (serum albumin and transferrin) indices, with one study using the GLIM criteria to diagnose malnutrition (Table 3).

The MNA-SF/LF was the screening tool most often used ($n = 6$/12; 50%) to report malnutrition risk, followed by the MUST ($n = 4$/12; 33%), the NRI and GNRI (at 17% each) (Fig. 3). For malnutrition diagnosis studies, most employed a variety of tools and parameters, including the BMI ($n = 12$/26; 46%), MUAC ($n = 8$/26; 31%), MNA-SF/LF (6/26; 23%), SGA ($n = 5$/26; 19%), serum albumin ($n = 4$/26; 15%)

Table 1
Scoping review inclusion and exclusion criteria.

Inclusion Criteria
- **Setting:** Hospital, Africa
- **Participants:** Human adults
- **Outcomes:** Nutritional status of patients, prevalence of malnutrition OR prevalence of risk of malnutrition as part of the research question, aim/objective(s), purpose, or primary outcomes; interpretation of nutritional status/malnutrition prevalence
- **Patient population:** In cases of a mix between in- and outpatients: only include if inpatient data described separately; in cases of a mix between adult and paediatric patients: only include if adult patient data described separately

Exclusion Criteria
- Studies reporting on micronutrient malnutrition
- Studies that recruited and/or treated patients via hospital outpatient clinics (only)
- Studies during emergency situations and natural disasters (e.g., drought, famine)
- Studies in pregnant women
- Case studies
- Autopsy studies
- Secondary sources (reviews, systematic reviews)

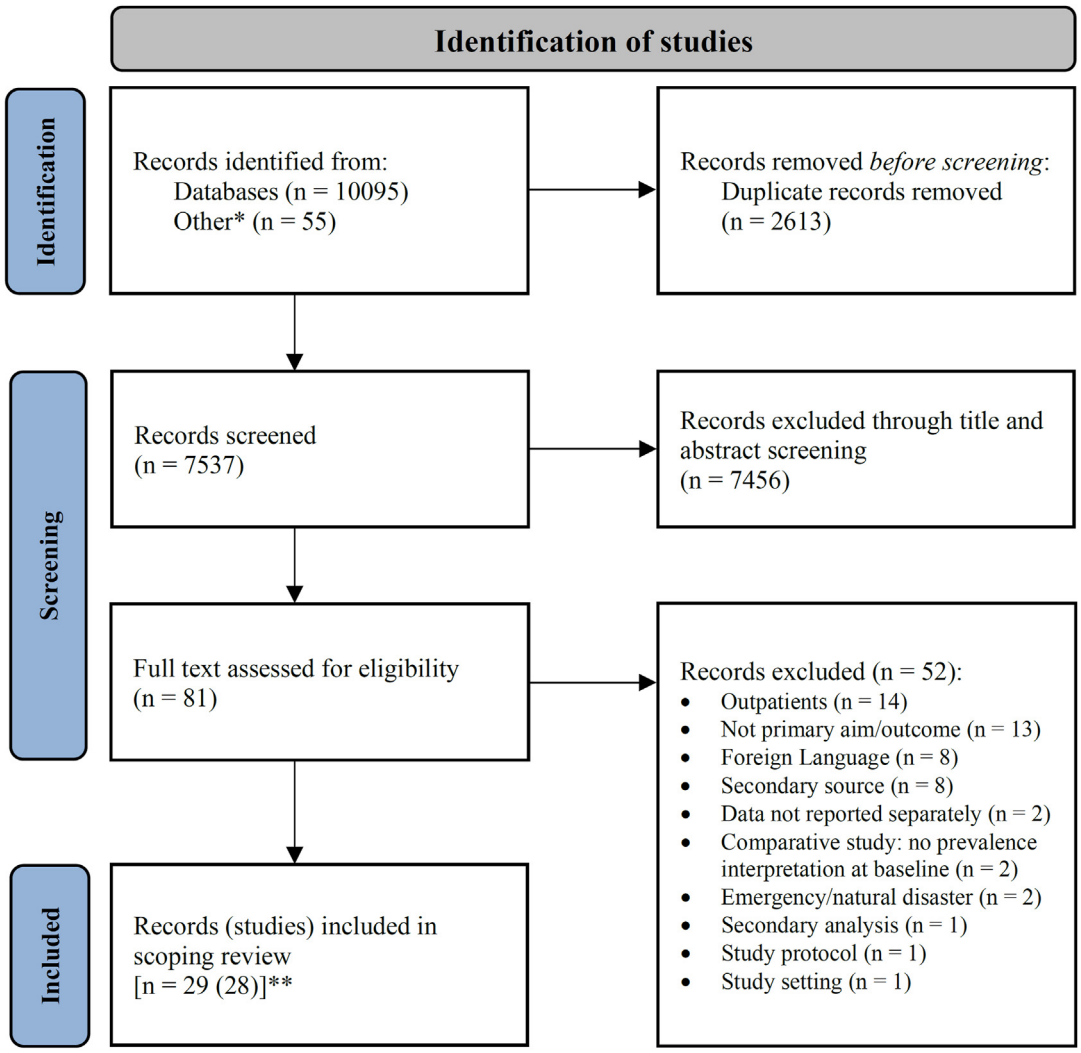

Fig. 1. Flow chart of study selection.

and triceps skinfold measurements (n = 4/26; 15%) (Fig. 3), among others. Interestingly, of the 15 studies that reported malnutrition prevalence at ≤30%, 87% (n = 13/15) used anthropometric measurements and BMI calculations to diagnose malnutrition, with higher prevalence rates generally reported when using other tools. Of the 12 studies that included BMI calculations, five studies utilised only BMI calculations to diagnose malnutrition, with the remaining seven studies using BMI in combination with other parameters and tools.

Quality control measures as reported by the authors included: calibration of equipment (including scales and stadiometers) (n = 6; 21%); training of research assistants (including students, community health workers, data collectors, fieldworkers) (n = 8; 29%); reference to standardised methods/techniques [including anthropometry, standard operating procedures (SOPs)] (n = 14; 50%); using validated tools (e.g. screening tools, questionnaires) (n = 3; 11%); one person conducting measurements (to ensure standardisation and low inter-observer bias) (n = 4; 14%); repeat anthropometric measurements (n = 8; 29%); reference to a pilot study/pre-test of data collection instruments (n = 6; 21%); and data checking (n = 3; 11%) (Table 3).

For nutritional screening tools, the normal cut-offs/categories were used by authors as designed/validated for the particular tools. In some cases, categories were merged before interpretation (Table 3). Cut-offs for other parameters varied between studies, with some overlap observed (Table 3). For BMI, the cut-off for undernutrition was <18.5 kg/m^2 (n = 11) in all but one case, the latter being <20 kg/m^2. Where overweight/obesity was reported, the cut-off was ≥25 kg/m^2. MUAC cut-offs differed between studies and included ≤23 cm (n = 2), <20 cm (n = 1), <23 cm (males) and <22 cm (females) (n = 2), <20 cm (males) and <19 cm (females) (n = 1), <80% of ideal (n = 1) and 23–25.4 cm (moderate malnutrition)/<23 cm (severe malnutrition) (n = 1). Cut-offs for serum albumin used included <3.5 g/dl (n = 3) and <80% of the lower limit of normal. Triceps skinfold cut-offs were described as <2.5 mm, <60% of standard (n = 2) and <15th percentile.

Many studies reported the collection of other potential clinical indicators/parameters of malnutrition (including BMI, MUAC, TSF, AMA, weight loss, dietary intake, serum albumin, serum prealbumin, total protein, serum creatinine, total lymphocyte count, serum total cholesterol and triglycerides) beyond what was required to complete screening and assessment tools, but that was

Table 2
General features of included studies.

Author, Publication Year	Country	Study Type	Patient Population	Study Design	Sample Size (*n*)	Sampling	Patient demographics [age (years), sex (rounded)]
Delikaris 1983 [36]	South Africa	Single Centre	Thoracic surgical patients (elective and acute admissions)	Cross-sectional (assumed)	102	Consecutive	Mean age: 42.5 (range 18–70) (males), 39.6 (range 22–71) (females) Males: 78%
O'Keefe 1983 [37]	South Africa	Single Centre	Medical (emergency cases)	Cross-sectional	803	Random	Mean age: 42 ± 16 (males), 41 ± 19 (females) Males: 69%
O'Keefe 1986 [38]	South Africa	Single Centre	Medical and Surgical	Cross-sectional	605	Consecutive	Not reported
Grobler-Barnard 1997 [39]	South Africa	Single Centre	Medical patients	Cross-sectional	151	Not described (abstract)	Mean age: not reported Males: 63%
Niyongabo 1999 [40]	Burundi	Single Centre	Internal Medicine (45% HIV+)	Cross-sectional	226	Consecutive	Mean age: 34.4 ± 11.9 Females: 58%
Molteno 2000 [41]	South Africa	Single Centre	Mental handicap	Cross-sectional analytical	Not clear ("total hospital population")	Census (random sampling for other outcomes)	Not described
Nyaruhucha 2001 [42]	Tanzania	Single Centre	Elderly	Cross-sectional descriptive	121	Random	Mean age: 70.4 ± 2.5 (males), 68.2 ± 3.3 (females) Males: 55%
Roberts 2005 [43]	South Africa	Single Centre	Pulmonary tuberculosis	Cross-sectional descriptive	30	Census	Mean age: 35 (range 28–44) (males), 31 (range 22–39) (females) Males: 77%
Abd-Al-Atty 2012 [44]	Egypt	Single Centre	Elderly	Cross-sectional	230	Not described	Mean age: 69.3 ± 7.8 (range 60–98), median age: 67 Females: 53%
Abd-El-Gawad 2014 [45]	Egypt	Single Centre	Elderly	Prospective cohort	131	Consecutive	Mean age: 69.32 ± 8.17 Males: 51%
Asiimwe 2015 [46]	Uganda	Single Centre	Acute medical (45% HIV+; 42% TB)	Prospective cohort	318	Consecutive	Median age: 37 (IQR 27–56) Males: 52%
Mhango 2015 [47]	Malawi	Single Centre	Neuropsychiatric in- and outpatients	Cross-sectional analytical	181	Stratified and simple random sampling	Mean age: 29.23 ± 9.70 Sex: not reported separately for inpatients
Mulu 2016 [48]	Ethiopia	Single Centre	HIV/AIDS patients	Cross-sectional (Cohort for clinical outcomes)	109	Convenience (Consecutive)	Mean age: 32.7 ± 8.12 Females: 66%
Luma 2017 [49]	Cameroon	Single Centre	Medical patients	Cross-sectional	251	Consecutive	Mean age: 47 ± 16 Males: 53%
Mambou Tebou 2017 [50]	Cameroon	Single Centre	Abdominal surgery	Cross-sectional analytical	85 (23)[a]	Consecutive	Mean age: 34.9 ± 8.2 (range 19–50) Females: 55%
Diendéré 2018 [51]	Burkina Faso	Multi-Centre	Cerebrovascular accident (stroke)	Prospective cohort	222	Consecutive	Mean age: 60.5 ± 14.2 Males: 55%
Katundu 2018 [52]	Malawi	Single Centre	Patients undergoing laparotomy (surgical)	Prospective observational	25	Consecutive	Median age: 38 (IQR 28.5–49) Males: 52%
Miyoba 2018 [53]	Zambia	Single Centre	Medical and Surgical	Cross-sectional	186	Consecutive	Mean age: 40.72 ± 14.4 Males: 62%
Blaauw 2019 [11] **& Blaauw 2018**[a] [54]	South Africa Kenya Ghana	Multi-Country, Multi-Centre	Mixed	Prospective cohort	2126 (1287)**	Consecutive	Median age ($n = 2126$): 43.11 (IQR 31.95–55.60), Mean age ($n = 1287$): 46.9 ± 16.7 Females: 52%
Van Tonder 2019a [12]	South Africa	Multi-Centre	Mixed	Cross-sectional descriptive (prevalence)	141	Purposive (wards); Consecutive (patients)	Mean age: 47.8 ± 14.7 (range 19–81) Females: 53%
Van Tonder 2019b [27]	South Africa	Multi-Centre	Mixed	Cross-sectional descriptive	266	Consecutive purposive sampling	Mean age: 47.11 ± 15.4 Males: 52%
Abahuje 2020 [55]	Rwanda	Single Centre	Acute care surgery	Prospective descriptive	279	Consecutive	Median age: 38 (IQR 26–54) Males: 72%
Adly 2020 [56]	Egypt	Single Centre	Elderly	Cross-sectional	190	Consecutive	Mean age: 68.67 ± 7.33 Females: 51%
Hussen 2020 [57]	Ethiopia	Multi-Centre	Abdominal surgery	Prospective observational	105	Consecutive	Mean age: 34 ± 9.6 Females: 52%

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Table 2 (*continued*)

Author, Publication Year	Country	Study Type	Patient Population	Study Design	Sample Size (*n*)	Sampling	Patient demographics [age (years), sex (rounded)]
Rasheedy 2020 [58]	Egypt	Single Centre	Elderly	Cross-sectional	150	Consecutive	Mean age: 68.67 ± 7.76 (males), 70.05 ± 7.78 (females) Males: 53%
Nigatu 2021 [59]	Ethiopia	Single Centre	Medical and Surgical	Prospective cohort	417	Stratified (wards and specialties) and Consecutive (patients)	Median age: 34 (range 18–85) (IQR = 26) Males: 54%
Wessels 2021 [60]	South Africa	Single Centre	Pulmonary tuberculosis with/ without HIV co-infection	Cross-sectional	100	Convenience	Median age: 39.2 (range 20.3–63.5) Males: 60%
Chimera-Khombe 2022 [61]	Malawi	Multi-Centre	Mixed	Cross-sectional	112	Consecutive	Mean age: 39.5 ± 14.7 Males: 60%

[a] *Prevalence data available for n=23; ** Secondary analysis (congress abstract) of Blaauw 2019* [11].

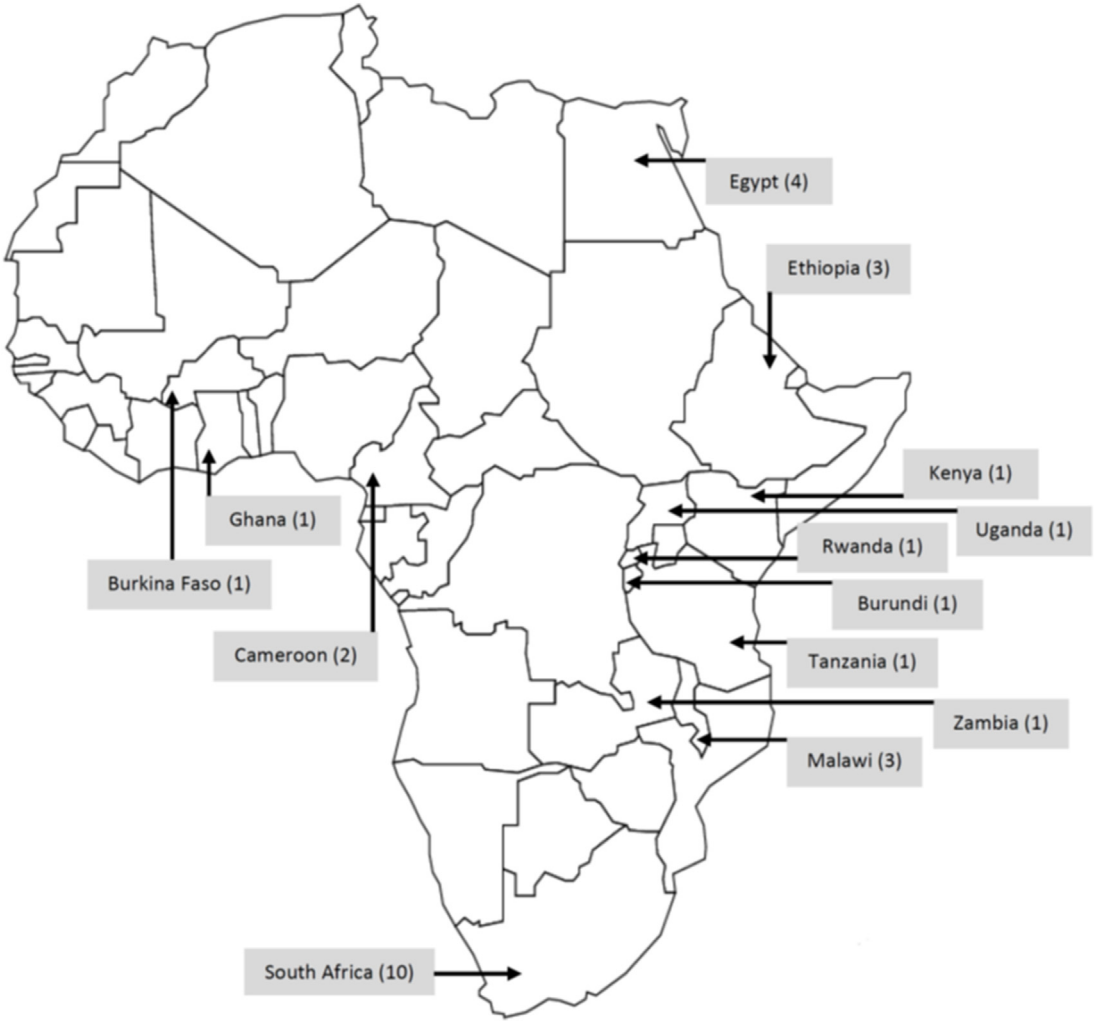

Fig. 2. Distribution of included studies across the African continent (number of studies).

not necessarily reported by the authors in the context of malnutrition prevalence per se [36–38,40,41,43–47,49–51,57,58,60].

[Abbreviations: AMA: Arm Muscle Area, AFA: Mid-upper Arm Fat Area, ASPEN: American Society for Parenteral and Enteral Nutrition, BMI: Body Mass Index, ESPEN: European Society for Clinical Nutrition and Metabolism, GLIM: Global Leadership Initiative on Malnutrition criteria, GNRI: Geriatric Nutrition Risk Index, MNA-SF/LF: Mini Nutritional Assessment Short Form/Long Form, MUAC: Mid-Upper Arm Circumference, MUST: Malnutrition Universal Screening Tool, NRI: Nutrition Risk Index, NRS-2002: Nutritional Risk Screening 2002, SGA: Subjective Global Assessment, TSF: Triceps Skinfold.

In studies that reported follow-up data [11,50,51,55,57], malnutrition risk, or malnutrition prevalence worsened during

Table 3
Methods of assessment and malnutrition (risk) prevalence.

Authors	Patient population	*n*	Malnutrition risk prevalence %	Malnutrition Prevalence %	Method of assessment	Cut-offs	Quality control measures reported
Delikaris 1983 [36]	Thoracic surgical patients	102		30	Weight s-albumin s-transferrin TSF	Below the "normal range" for weight (standard graphs) <80% of lower limit of normal: 30–46 g/l (males), 25–40 g/l (females) <80% of the lower limit of normal: 1,9–4,0 g/l <2,5 mm (One or more of above criteria)	One person conducting measurements; Standardised methods/ techniques; Repeat anthropometric measurements
O'Keefe 1983 [37]	Medical (emergency)	803		82 (males) 55 (females)	TSF	<60% of standard	Standardised methods/ techniques
O'Keefe 1986 [38]	Medical and Surgical	605		20–40 (overall) 20 30 15 40	Weight, TSF, MUAC, s-albumin Weight TSF MUAC s-albumin	Overall <20% of ideal weight <60% of standard <80% of ideal <35 g/l	One person conducting measurements; Standardised methods/ techniques; Repeat anthropometric measurements
Grobler-Barnard 1997 [39]	Medical patients	151		22 *17 (under)* *5 (over)* 77 14 39 28 22	BMI, AMA, AFA, s-albumin BMI, AMA, AFA, s-albumin BMI AMA AFA s-albumin	Under- and overnutrition (BMI <18.5–24.9 and ≥ 25 kg/m^2, AMA and AFA <25th and >75th percentile, albumin <3.5 and >3.5 g/dl) Sub-clinical malnutrition: any 1–3 abnormal criteria (see above) <16 kg/m^2 <5th percentile <5th percentile <2.8 g/dl	Not reported
Niyongabo 1999 [40]	Internal Medicine (45% HIV+)	226		47	% BWL	Severe and moderate malnutrition >10%	Standardised methods/ techniques; Repeat anthropometric measurements
Molteno 2000 [41]	Mental handicap	–		32 (males) 26 (females)	BMI	<20 kg/m^2	Not reported
Nyaruhucha 2001 [42]	Elderly	121		26	BMI	<18.5 kg/m^2	Not reported
Roberts 2005 [43]	Pulmonary TB	30		48 (males) 29 (females)	BMI	<18.5 kg/m^2	Calibration of equipment; Repeat anthropometric measurements; Pilot study
Abd-Al-Atty 2012 [44]	Elderly	230	39	45	MNA-SF	[a]	Not reported
Abd-El-Gawad 2014 [45]	Elderly	131	47 53 41	43 41	MNA-SF MNA-LF GNRI	[a] [a] Severe and moderate risk	Standardized methods/ techniques
Asiimwe 2015 [46]	Acute medical (45% HIV+; 42% TB)	318	33	25 47 59	MUAC BMI MNA-SF	<20 cm (males), <19 cm (females) <18.5 kg/m^2 [a]	Calibration of equipment; Standardised methods/ techniques
Mhango 2015 [47]	Neuropsychiatric in- and outpatients	181		25 *9 (under)* *16 (over)*	BMI	<18.5 kg/m^2 ≥25 kg/m^2	Training of research assistants
Mulu 2016 [48]	HIV/AIDS	109		47 44 77	BMI MUAC s-albumin	<18.5 kg/m^2 <20 cm <3.5 g/dl	Training of research assistants; Calibration of equipment; Repeat anthropometric measurements; Standardised methods/ techniques; Data checking; Pre-test of data- collection instrument

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Table 3 (*continued*)

Authors	Patient population	*n*	Malnutrition risk prevalence %	Malnutrition Prevalence %	Method of assessment	Cut-offs	Quality control measures reported
Luma 2017 [49]	Medical	251		19 12 8	BMI, MUAC BMI MUAC	BMI <18.5 kg/m^2 and MUAC <23 cm (males), <22 cm (females) combined <18.5 kg/m^2 <23 cm (males), <22 cm (females)	One person conducting measurements; Standardised methods/ techniques
Mambou Tebou 2017 [50]	Abdominal surgery	85 (23)	39		NRI	Severe and moderate	Calibrated equipment
Diendéré 2018 [51]	Cerebrovascular accident (stroke)	222		25	BMI	<18.5 kg/m^2	Standardised methods/ techniques
Katundu 2018 [52]	Surgical (laparotomy)	25		80	SGA	SGA B and C	Training of research assistants
Miyoba 2018 [53]	Medical and Surgical	186	60		MUST	Moderate and high risk	Calibrated equipment; Standardised methods/ techniques; Validated tool; Pre-test of data-collection instrument; Data checking
Blaauw 2019 [11] & **Blaauw 2018**[a] [54]	Mixed	1287 2126	61	38 46 57 65	ESPEN GLIM SGA ASPEN NRS-2002	[a] Including all 5 GLIM criteria SGA B and C [a] [a]	Training of research assistants; Standardised methods/ techniques; Calibrated equipment
Van Tonder 2019a [12]	Mixed	141	72	45 27	MUAC BMI MUST	≤23 cm <18.5 kg/m^2	Training of research assistants; Standardised methods/ techniques; Validated tool; Calibration of equipment; Pilot study
Van Tonder 2019b [27]	Mixed	266	23	22 21	MUAC BMI MUST	≤23 cm <18.5 kg/m^2 [a]	Training of research assistants; Calibration of equipment; Standardised methods/ techniques; Validated tool; Pilot study; Pre-test of data-collection instrument
Abahuje 2020 [55]	Acute care surgery	279		35 27	ASPEN SGA	[a] SGA B and C	Training of research assistants
Adly 2020 [56]	Elderly	190	37	18	MNA-SF	[a]	Not reported
Hussen 2020 [57]	Abdominal surgery	105	74	28	BMI NRI	<18.5 kg/m^2 Severe and moderate risk	Calibrated equipment
Rasheedy 2020 [58]	Elderly	150	31 64	39	MNA-LF GNRI	[a] Severe and moderate risk	Repeat anthropometric measurements
Nigatu 2021 [59]	Medical and Surgical	417		62	SGA	SGA B and C	Calibration of equipment
Wessels 2021 [60]	Pulmonary TB with/ without HIV co-infection	100	70	51 50	MUAC TSF MUST	<23 cm (males), <22 cm (females) <15th percentile [a]	One person conducting measurements; Calibrated equipment; Standardised methods/ techniques; Repeat anthropometric measurements; Pilot study
Chimera-Khombe 2022 [61]	Mixed	112		85 62	SGA MUAC	SGA B and C Moderate: 23–25.4 cm and severely malnourished <23 cm combined	Repeat anthropometric measurements; Training of research assistants

Abbreviations: AMA: Arm Muscle Area, AFA: Mid-upper Arm Fat Area, ASPEN: American Society for Parenteral and Enteral Nutrition, BMI: Body Mass Index, ESPEN: European Society for Clinical Nutrition and Metabolism, GLIM: Global Leadership Initiative on Malnutrition criteria, GNRI: Geriatric Nutrition Risk Index, MNA-SF/LF: Mini Nutritional Assessment Short Form/Long Form, MUAC: Mid-Upper Arm Circumference, MUST: Malnutrition Universal Screening Tool, NRI: Nutrition Risk Index, NRS-2002: Nutritional Risk Screening 2002, SGA: Subjective Global Assessment, TSF: Triceps Skinfold.

[a] Normal cut-offs/categories as designed and validated for the tool.

hospitalisation. In studies reporting on diagnostic groupings and malnutrition (risk) prevalence, patients with infectious diseases [11,49,61], cancer [12,49,61], and medical patients [12,38,59] were highlighted as high-risk groups. Fourteen studies declared funding sources (including via universities, research entities, national/international government grants, nutrition-based societies/

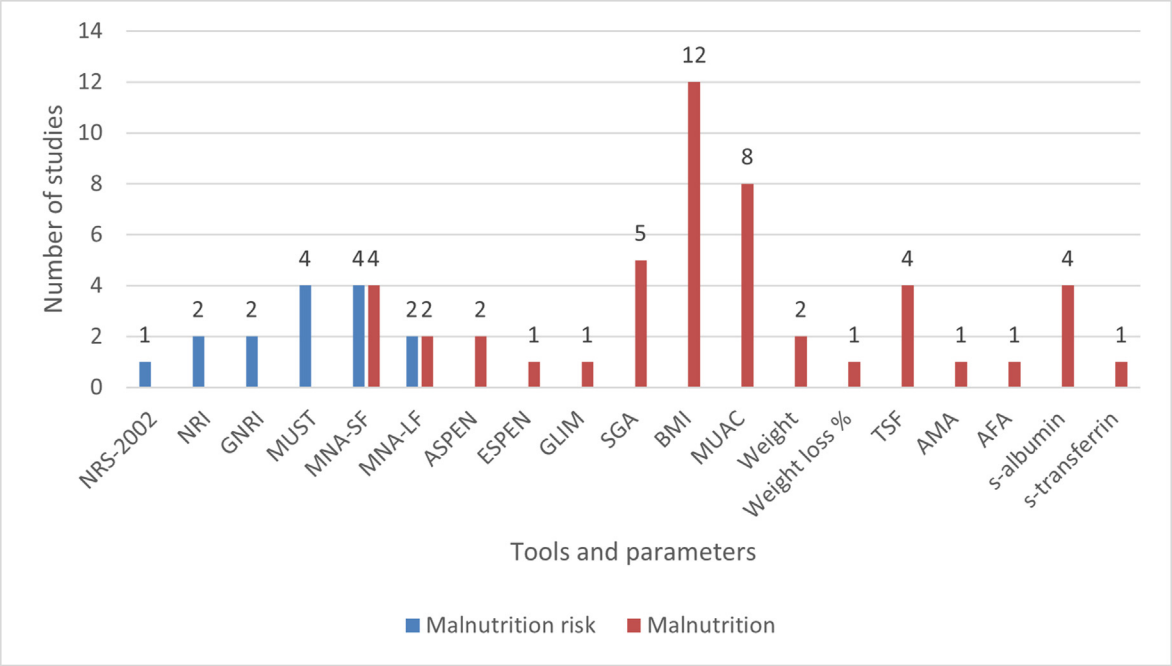

Fig. 3. Tools and parameters used to report malnutrition risk, and malnutrition prevalence [Abbreviations: AMA: Arm Muscle Area, AFA: Mid-upper Arm Fat Area, ASPEN: American Society for Parenteral and Enteral Nutrition, BMI: Body Mass Index, ESPEN: European Society for Clinical Nutrition and Metabolism, GLIM: Global Leadership Initiative on Malnutrition criteria, GNRI: Geriatric Nutrition Risk Index, MNA-SF/LF: Mini Nutritional Assessment Short Form/Long Form, MUAC: Mid-Upper Arm Circumference, MUST: Malnutrition Universal Screening Tool, NRI: Nutrition Risk Index, NRS-2002: Nutritional Risk Screening 2002, SGA: Subjective Global Assessment, TSF: Triceps Skinfold].

organisations, facilities, and industry). Five studies declared not receiving any funding support [44,49,50,58,60], and nine studies did not include a funding declaration [12,27,36,39,41,43,48,52,56].

4. Discussion

This scoping review has identified and mapped the pockets of information available regarding hospital malnutrition prevalence and related assessment practices across the African continent. The included studies represent 13 of the 54 African countries, and thus furnish a glimpse of the extent of the problem. Nevertheless, from the findings it is clear that both malnutrition risk (at 23–74%), and malnutrition prevalence (at 8–85%) are high in African adult hospitalised patients.

International data indicate that 20–50% of hospitalised patients are malnourished [5–8], placing African patients at the top end of this range, and higher in some instances, according to the findings of this scoping review. A recent systematic review found that malnutrition (risk) prevalence varied greatly across the included studies (7–90%) [10], which is in line with our findings (at 8–85%) depending on the patient population, the tools used to diagnose malnutrition and the cut-offs used for anthropometric and other measures. Prevalence is an epidemiological measurement representing the proportion of the population with a disease or particular condition [62]. Using random selection methods increases the chances that the characteristics of the sample will be representative of, or similar to, the characteristics of the population [63]. Prevalence estimates reflect the importance of different diseases/conditions for society and are thus of great importance for health-related decision making, defining priorities for interventions, guideline development, and research [64]. As such, the way in which these studies are conducted is crucially important to ensure the accuracy, validity and generalisability of the findings. A comprehensive set of items classified by domains and various tools are now available that can guide the design of primary prevalence studies, as well as their appraisal [64]. These domains are related to the population and setting, condition measurement, statistics and other factors [64]. As expected in this scoping review, most of the studies had cross-sectional designs, with some cohort studies included that reported prevalence at baseline. Included studies were mostly single-centre studies, relatively small in size (with most recruiting between 100 and 300 patients, and only three recruiting more than 500 patients), some focused on very specific patient populations, few employed random sampling technique, and less than a quarter undertook sample size calculations to ensure an adequate sample size. Funding sources and conflicts of interest of study authors may impact on study design, conduct and reporting, and as such, declarations in this regard are important [64,65]. Just over a quarter of the studies in this review did not include such declarations. Quality control of measurement methods was described to varying degrees in some of the studies, but also sparsely reported or omitted in some cases. Authors of prevalence studies will be well served by consulting available resources and tools [64,66] to ensure high-quality studies representative of the relevant population.

As expected, we found that malnutrition studies utilised a wide range of definitions (and measurement tools) for malnutrition, creating challenges for clinical practice and malnutrition research. Older studies (<2000) typically employed clinical parameters (alone or in combination) such as weight, BMI, TSF, AMA, AFA and biochemical indices (e.g., s-albumin) to diagnose malnutrition, and typically reported lower prevalence rates. More recent studies mostly employed commonly available nutritional screening and/or assessment tools alone or in combination with individual parameters.

Concern has been expressed regarding the use of individual biomarkers (e.g., BMI, serum albumin levels) in studies, and the fact that these measurements are not considered reliable indices of malnutrition by themselves. BMI, for example, fails to account for variations related to sex, age, race, or body type [67]. As the

traditional tool for assessing malnutrition and overweight/obesity, it does not accurately differentiate between important body weight components and therefore should not be used on its own for critical and individual decision making [68]. Serum albumin levels, for example, can be affected by physiological stress and other factors unrelated to a patient's nutritional status [69]. Studies investigating the validity of serum markers as determinants of patients' nutritional status have yielded inconsistent results, and as such, the consensus is that these laboratory markers are not reliable by themselves, but could be used as an adjunct to other measures and tools [69]. This review has found that BMI and MUAC are often used in the African context for their simplicity and based on available equipment/tools. MUAC has increasingly been used to assess nutritional status and determine eligibility for nutrition support among adolescents and adults in low-resource settings [70]. MUAC is a simple screening tool to use, requires no calculations, and it has been proposed that it could be considered a possible alternative to identify adult patients at nutritional risk in African hospitals [12].

Various nutritional screening/assessment tools were used in the included studies, most notably the MNA-SF/LF, MUST, NRI, GNRI, NRS-2002, SGA, ASPEN and ESPEN guidelines and the GLIM criteria. Screening tools are used to identify "at risk" patients, who should then undergo formal diagnosis using a diagnostic tool [71]. Screening tools should ideally be short and easy to complete, in order to facilitate bedside use by nurses and other healthcare professionals. On the other hand, full diagnostic assessments typically require more detailed assessment by a registered dietitian. Determining which tool to use can be challenging as the literature often blurs the distinction between screening and diagnostic assessment by using tools interchangeably [71]. In at least one study in this scoping review, authors reported malnutrition risk (identified via a screening tool) as malnutrition prevalence [57]. These tools are described in detail in the literature in various publications and validation studies [72–74] and should be used in the way they were intended and for which they were validated. Accurate malnutrition diagnosis in hospitalised patients allows clinicians/dietitians to target appropriate nutrition-focused interventions.

Similar to available international data, the malnutrition prevalence findings in this scoping review are difficult to interpret owing in part to the variety of tools used and variability in cut-offs for anthropometric and other measures, underscoring the importance of adopting a more standardised approach. In this regard, the GLIM created a consensus-based framework consisting of aetiologic (reduced food intake, assimilation issues and/or disease burden and inflammatory processes) and phenotypic (weight loss, BMI and reduced muscle mass) criteria to record the occurrence of malnutrition in adults [18] in an international standardised language and in simple terms. In the context of GLIM, the assessment of muscle mass is less commonly performed than other phenotypic malnutrition criteria, and its interpretation may be more complicated, particularly in settings that lack access to body composition methodologies and/or skilled clinical nutrition practitioners (including some African hospitals). To promote the widespread assessment of skeletal muscle mass, the GLIM consortium appointed a working group to provide consensus-based guidance on assessment of skeletal muscle mass [75,76]. This group has proposed that when technology-based devices [bioelectrical impedance analysis (BIA), computerised tomography (CT), dual-energy X-ray absorptiometry (DXA), ultrasound] and the expertise to interpret them are not readily available, then the use of anthropometric measures such as MUAC and calf circumference are supported, as well as physical examination (level of agreement: 92%) [75,76]. This ties in well with current practices related to MUAC usage on the African continent. Only one study included in this scoping review used the GLIM criteria to diagnose malnutrition, but given the fact that the GLIM consensus criteria were established relatively recently, it is likely that not enough time has passed for studies to employ this criteria in trials (that were included in this review). Guidance for performing good-quality validation studies for nutrition measures overall and GLIM in particular is available [77], and currently efforts for the validation of GLIM are ongoing. Despite this, a recent scoping review investigating how the GLIM criteria have been used in published literature found that only 57% of included studies employed all five GLIM criteria, and in most studies, it was not clear how the criteria were combined and how validation was conducted [78]. There is a need for methodologically sound validation studies using the complete GLIM criteria in various patient populations to assess validity for the diagnosis of malnutrition.

In the few studies that reported follow-up data, malnutrition prevalence worsened during hospitalisation. This is in line with findings from a recent systematic review reporting that nutritional deterioration was identified in 10–65% of patients (15 studies), with barriers to nutritional adequacy frequently reported at both institution and patient levels [79]. Encouraging to note is that research suggests that up to 95% of hospital-acquired malnutrition is preventable with appropriate mitigation strategies [80].

This scoping review underscores many known limitations of research on hospital malnutrition, including varied definitions of malnutrition in the literature, diversity of validated tools employed, and uncertainty regarding an accepted reference standard/cut-off for clinical parameters. African researchers used a variety of nutritional screening/assessment tools and parameters, and particularly favoured BMI and MUAC for their simplicity and practicality. In addition, quality aspects and reporting of some studies can and should be improved. Properly designed and adequately powered prevalence studies should be undertaken in future. In relation to the size of the continent, only a relatively small number of studies were eligible to be included, often focusing on very specific populations that provide a hint of the problem at hand. Nevertheless, malnutrition risk and malnutrition prevalence were found to be undeniably high in this scoping review. Considering the additional problems faced in African hospitals (e.g., pre-existing malnutrition, limited nutritional screening, poor referral practices, a unique disease burden, institutional challenges, lack of equipment and nutritional products, among others) [11,12,27,30], this is cause for serious concern. Given the potentially detrimental effects of malnutrition, identifying patients who could benefit from further assessment or an intervention for malnutrition is crucial. Adopting a standardised approach (including the GLIM criteria for malnutrition diagnosis), also on the African continent, will aid our understanding of the extent of malnutrition across different countries in Africa, on other continents, and in various healthcare settings, and will potentially inform future actions and interventions.

This scoping review has some strengths: it followed the Joanna Briggs Institute's (JBI) methodology [32] and did not limit the literature search by date of publication. The protocol is registered on the Open Science Framework and was reported according to the PRISMA-ScR checklist [35]. A comprehensive search strategy was undertaken (also with a focus on African databases), and a broad search string developed to ensure as far as possible that eligible studies were identified and included. A limitation of this scoping review was that foreign language studies (other than English) were excluded but listed in a table of excluded studies (Table S2) for future assessment when possible. Considering the fact that some African countries are French speaking, this language limitation could have impacted on the inclusion of relevant studies that could

have contributed to the comprehensiveness of the data presented. Sourcing funding for translations in future updates of this scoping review will be investigated, so that French (and other language) studies can be considered for study inclusion. Regardless of this limitation, this scoping review provides a relevant and wide map of the evidence related to adult hospital malnutrition prevalence and related assessment practices on the African continent.

5. Conclusion

Both malnutrition risk (at 23–74%) and malnutrition prevalence (at 8–85%) are alarmingly high in African adult hospitalised patients. The prevalence of malnutrition differs significantly between studies, owing in part to the variety of assessment tools used and variability in cut-offs for anthropometric and other measures, underscoring the importance of adopting a standardised approach. Realities in the African context include limited nutritional screening and assessment, poor referral practices, a unique disease burden, and probably a limited awareness of the importance and possible benefit of addressing hospital malnutrition. General awareness is needed, and routine nutritional screening practices with appropriate nutrition support action should be implemented as a matter of urgency in African hospitals.

Statement of authorship

JV, RB, and TC contributed to the conception and design of the study. JV and LP determined the eligibility of each paper and undertook data extraction in duplicate. JV constructed the figures and tables. JV wrote the first draft of the manuscript. All authors critically revised the manuscript, provided their final approval, and agreed to be accountable for all aspects of the work ensuring its integrity and accuracy.

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Data availability statement

The data supporting the findings of this review can be found within this article, as the authors made use of published data sets. Additional data is available in the supplementary material and further enquiries can be directed to the corresponding author.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2024.06.015.

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