Scientific Research Publishing

Pharmacology & Pharmacy, 2026, 17(11), 338-370
https://www.scirp.org/journal/pp
ISSN Online: 2157-9431
ISSN Print: 2157-9423

Clinical Pharmacy Practice in African Hospitals: A Scoping Review

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How to cite this paper: Dibri, G.W., Fofana, S., Kagone, A.Y., Guembre, A., Noali, E.B.P., Ouattara, L.I., Ouedraogo, M. and Youl, E.N.H. (2026) Clinical Pharmacy Practice in African Hospitals: A Scoping Review. *Pharmacology & Pharmacy*, **17**, 338-370.
https://doi.org/10.4236/pp.2026.1711019

Received: October 18, 2026
Accepted: November 20, 2026
Published: November 23, 2026

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Abstract

Clinical pharmacy is growing in African hospitals, but the data describing these practices are scattered. Our review aimed to map the documented clinical pharmacy activities in African hospitals, their methods, indicators and outcomes. We followed the Joanna Briggs Institute framework and the PRISMA-ScR checklist; PubMed, ScienceDirect and Google Scholar (including African Journals Online) were searched for the period 2000-2025, with citation screening and targeted searches. Eighty-five studies from 13 countries were included; 57.6 per cent (n = 49) were published in 2020 or later. The most common activity was the pharmaceutical review of medical prescriptions with intervention with the prescriber, reported in 42 studies. This was followed by therapeutic education (29 studies), pharmaceutical care in consultations (22 studies), programmes on the appropriate use of antimicrobials (8 studies) and training for healthcare professionals (8 studies), participation in patient visits (6 studies) and medication reconciliation (6 studies). In 36 studies, the acceptance rate for pharmaceutical interventions was reported, with a median of 91.1 per cent. The 15 randomised trials, all conducted in chronic disease clinics, mostly reported improvements in glycated haemoglobin, blood pressure or treatment adherence; however, some outcomes did not differ from the control group, such as quality of life, viral load and blood pressure control at 12 months. Clinical pharmacy in African hospitals relies primarily on pharmaceutical analysis, although this is accepted by doctors; comparative studies are needed among hospitalised patients.

Keywords

Clinical Pharmacy, Hospital Practice, Africa

1. Introduction

The profession of pharmacy has undergone profound changes over recent decades, with increasing clinical involvement and the integration of pharmacists into multidisciplinary teams [1] [2]. Clinical pharmacy is a patient-centred pharmaceutical discipline and practice aimed at optimising drug therapy [3]. It emerged in the early 1960s with the aim of contributing to the optimal use of medicines and encompasses all stages of the medication use process [4]-[8].

Pharmacists' activities, such as treatment reconciliation and patient education, reduce medication errors and readmissions, whilst their involvement in medical consultations reduces medication-related problems [9]-[11]. In Africa, the development of clinical pharmacy varies from country to country and data are scattered. In Burkina Faso, research carried out at the Charles De Gaulle Paediatric University Hospital Centre has demonstrated the value of these activities in detecting medication errors and preventing iatrogenic adverse drug reactions [12]-[14].

Our research question, which focused on the scope and nature of documented activities rather than on the effectiveness of a specific intervention, justified this scoping review [15]. Our aim was to map documented clinical pharmacy activities in hospital settings across Africa, including how they are implemented, the indicators used and the reported outcomes.

2. Methodology

To conduct this review, we followed the framework developed by Arksey and O'Malley, as refined by the Joanna Briggs Institute (JBI), and reported our findings in accordance with the PRISMA-ScR guidelines [16]-[19]. Our protocol was not registered.

2.1. Research Question

We formulated our research question using the Population-Concept-Context (PCC) acronym: which clinical pharmacy activities were being implemented in African hospitals, and what were their methods, indicators and outcomes?

- Population: Pharmacists (clinical or non-clinical) or pharmacy students in their fifth year or above, carrying out clinical work with patients receiving care in hospital, regardless of the patients' age, gender or condition.
- Concept: Clinical pharmacy activities, *i.e.*, activities carried out by the pharmacist alone or as part of the healthcare team to optimise pharmacotherapy.
- Context: Hospitals in 54 African countries, including inpatient wards, outpatient clinics and the dispensing of medicines within the hospital.

2.2. Search Strategy

The search was conducted in July 2026 in PubMed, ScienceDirect and Google Scholar. Aligned with the research question, the strategy combined three groups of terms: clinical pharmacy activities and pharmacists, the hospital setting, and Africa, represented by the term "Africa" and the names of the 54 African countries. The "Medical Subject Headings" (MeSH) descriptors, their synonyms and free-text terms were used in PubMed. The strategy was then adapted to the specific features of each database (Table 1). Google Scholar was searched using the Publish or Perish software, and the first 300 results from each query were selected [20]; articles published in African Journals Online (AJOL) were identified amongst these results. We subsequently supplemented the search by reviewing the references and citations of the included studies, documents provided by the team, and a targeted web search for open-access articles.

Table 1. Search queries by database.

Database	Search query	Result (s)
PubMed	("Pharmacy Service, Hospital"[Mesh] OR "Pharmacists"[Mesh] OR "Pharmaceutical Services"[Mesh] OR "Medication Reconciliation"[Mesh] OR "Antimicrobial Stewardship"[Mesh] OR "clinical pharmac*"[tiab] OR "pharmaceutical care"[tiab] OR pharmacist*[tiab] OR "pharmaceutical intervention*"[tiab] OR "medication review*"[tiab] OR "medication reconciliation"[tiab] OR "drug-related problem*"[tiab] OR "drug therapy problem*"[tiab] OR "antimicrobial stewardship"[tiab] OR "antibiotic stewardship"[tiab]) AND ("Hospitals"[Mesh] OR "Inpatients"[Mesh] OR "Hospitalisation"[Mesh] OR "Outpatient Clinics, Hospital"[Mesh] OR hospital*[tiab] OR inpatient*[tiab] OR outpatient*[tiab] OR ambulatory[tiab] OR clinic[tiab] OR clinics[tiab] OR ward[tiab] OR wards[tiab] OR "intensive care"[tiab] OR "emergency department*"[tiab] OR "health facilit*"[tiab] OR "tertiary care"[tiab]) AND (("Africa"[Mesh] OR africa*[tiab] OR Algeria*[tiab] OR Angola*[tiab] OR Benin*[tiab] OR Botswana*[tiab] OR Burkina*[tiab] OR Burundi*[tiab] OR "Cabo Verde"[tiab] OR "Cape Verde*"[tiab] OR Cameroon*[tiab] OR "Central African Republic"[tiab] OR Chad*[tiab] OR Comoros[tiab] OR Congo*[tiab] OR "Côte d'Ivoire"[tiab] OR "Ivory Coast"[tiab] OR Ivorian[tiab] OR Djibouti*[tiab] OR Egypt*[tiab] OR "Equatorial Guinea*"[tiab] OR Eritrea*[tiab] OR Eswatini[tiab] OR Swazi*[tiab] OR Ethiopia*[tiab] OR Gabon*[tiab] OR Gambia*[tiab] OR Ghana*[tiab] OR Guinea*[tiab] OR Kenya*[tiab] OR Lesotho[tiab] OR Liberia*[tiab] OR Libya*[tiab] OR Madagascar[tiab] OR Malagasy[tiab] OR Malawi*[tiab] OR Mali[tiab] OR Malian[tiab] OR Mauritania*[tiab] OR Mauritius[tiab] OR Mauritian*[tiab] OR Morocco*[tiab] OR Mozambique*[tiab] OR Namibia*[tiab] OR Niger[tiab] OR Nigeria*[tiab] OR Nigerien*[tiab] OR Rwanda*[tiab] OR "São Tomé"[tiab] OR Senegal*[tiab] OR Seychelles*[tiab] OR "Sierra Leone*"[tiab] OR Somali*[tiab] OR "South Africa*"[tiab] OR "South Sudan*"[tiab] OR Sudan*[tiab] OR Tanzania*[tiab] OR Togo*[tiab] OR Tunisia*[tiab] OR Uganda*[tiab] OR Zambia*[tiab] OR Zimbabwe*[tiab]) OR ("Algeria"[ad] OR "Angola"[ad] OR "Benin"[ad] OR "Botswana"[ad] OR "Burkina Faso"[ad] OR "Burundi"[ad] OR "Cabo Verde"[ad] OR "Cape Verde"[ad] OR "Cameroon"[ad] OR "Central African Republic"[ad] OR "Chad"[ad] OR "Comoros"[ad] OR "Congo"[ad] OR "Côte d'Ivoire"[ad] OR "Ivory Coast"[ad] OR "Djibouti"[ad] OR "Egypt"[ad] OR "Equatorial Guinea"[ad] OR "Eritrea"[ad] OR "Eswatini"[ad] OR "Ethiopia"[ad] OR "Gabon"[ad] OR "Gambia"[ad] OR "Ghana"[ad] OR "Guinea"[ad] OR "Kenya"[ad] OR "Lesotho"[ad] OR "Liberia"[ad] OR "Libya"[ad] OR "Madagascar"[ad] OR "Malawi"[ad] OR "Mali"[ad] OR "Mauritania"[ad] OR "Mauritius"[ad] OR "Morocco"[ad] OR "Mozambique"[ad] OR "Namibia"[ad] OR "Niger"[ad] OR "Nigeria"[ad] OR "Rwanda"[ad] OR "São Tomé"[ad] OR "Senegal"[ad] OR "Seychelles"[ad] OR "Sierra Leone"[ad] OR "Somalia"[ad] OR "South Africa"[ad] OR "South Sudan"[ad] OR "Sudan"[ad] OR "Tanzania"[ad] OR "Togo"[ad] OR "Tunisia"[ad] OR "Uganda"[ad] OR "Zambia"[ad] OR "Zimbabwe"[ad]))	2604

Continued

Science Direct	26 queries (field "Title, abstract or author-specified keywords"): [set A or B] AND [country group]. Set A: ("clinical pharmacy" OR "pharmacist" OR "pharmaceutical intervention" OR "pharmaceutical care") Set B: ("drug-related problems" OR "medication reconciliation" OR "antimicrobial stewardship" OR "pharmaceutical intervention") Group 1: (Algeria OR Angola OR Benin OR Botswana) Group 2: ("Burkina Faso" OR Burundi OR "Cape Verde" OR Cameroon) Group 3: ("Central African Republic" OR Chad OR Comoros OR Congo) Group 4: ("Côte d'Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt) Group 5: ("Equatorial Guinea" OR Eritrea OR Eswatini OR Ethiopia) Group 6: (Gabon OR Gambia OR Ghana OR Guinea) Group 7: (Kenya OR Lesotho OR Liberia OR Libya) Group 8: (Madagascar OR Malawi OR Mali OR Mauritania) Group 9: (Mauritius OR Morocco OR Mozambique OR Namibia) Group 10: (Niger OR Nigeria OR Rwanda OR Senegal) Group 11: ("Sierra Leone" OR Somalia OR "South Africa" OR Sudan) Group 12: (Tanzania OR Togo OR Tunisia OR Uganda) Group 13: (Zambia OR Zimbabwe)	377
Google Scholar including AJOL	Publish or Perish software, "Keywords" field, years 2000-2025; first 300 results selected per query. GS01: "clinical pharmacy" hospital Africa GS02: "clinical pharmacist" hospital Africa GS03: "pharmaceutical care" hospital Africa GS04: "pharmacist intervention" hospital Africa GS05: "drug-related problems" hospital pharmacist Africa GS06: "medication reconciliation"—pharmacist, Africa GS07: "antimicrobial stewardship"—hospital pharmacist, Africa GS08: "clinical pharmacy" in hospitals in Africa GS09: "pharmaceutical intervention" in hospitals in Africa AJOL records identified by their address (n = 23)	2435

2.3. Eligibility Criteria

2.3.1. Inclusion Criteria

We included in our review original, observational or interventional studies describing a clinical pharmacy activity carried out by a pharmacist or by fifth-year pharmacy students or above, in an African hospital (inpatient care, outpatient consultations or hospital dispensing), published in French or English between 1 January 2000 and 31 December 2025, and for which the full text was available.

2.3.2. Exclusion Criteria

We did not include: literature reviews, clinical case reports, guidelines, editorials, posters and conference presentations; opinion or satisfaction surveys; studies in which the activity was not carried out by a pharmacist or was not described. Furthermore, studies conducted in pharmacies, primary care centres or community settings; programme reports lacking a study design; and studies for which the full text could not be obtained were not included.

2.4. Selection of Studies

References from the three databases were collated and duplicates removed. We then examined the titles and abstracts against the eligibility criteria; potentially relevant references were assessed by two independent reviewers; agreement was measured using Cohen's kappa coefficient and disagreements were resolved by consensus. The full texts of the selected references were then read and assessed. Where a single study had been published in multiple papers, these were grouped together and counted as a single study. The PRISMA flow chart was used to present the search results and the reasons for excluding articles.

2.5. Data Extraction and Synthesis

Data were extracted from the full text using a standardised form designed by the authors. The variables included: authors, year of publication, country, department or clinical setting (inpatient or outpatient), methodology, duration and sample size, clinical pharmacy activity, and outcomes. Data were extracted by one author, WGD and checked against the full text by a second author, AYK; disagreements were resolved by discussion and, when needed, by a third author, SF. Activities were classified into categories, based on the European Society of Clinical Pharmacy's definition of clinical pharmacy [3] and the French Society of Clinical Pharmacy's classification of pharmaceutical interventions (PIs); a study could fall into several categories.

2.6. Data Analysis

A descriptive summary of the results was presented in the form of tables, figures and a narrative summary by type of activity. Variables were described using frequencies and percentages. The acceptance rate of PIs was summarised using the median, interquartile range and range. For each study, we used the proportion of PIs fully accepted by the prescriber among the PIs communicated to the prescriber; partially accepted PIs were not counted as accepted. When a study reported a rate per PI and a rate per patient, the rate per PI was used. When a study reported rates for several phases or periods, the overall rate was used; when no overall rate was given, the mean of the phase-specific rates was used, and when only per-patient rates were given, their mean was used. Each study contributed a single value. In accordance with the recommendations of the JBI and PRISMA-ScR, we did not assess the methodological quality of the included studies.

3. Results

3.1. Study Selection

A search of the databases identified 5416 references. After removing duplicates (919), 4497 references were screened. Agreement between the two reviewers was excellent (kappa = 0.94). A total of 4386 references were excluded, and full-text copies of 111 articles were sought, of which 19 could not be obtained. Of the 92 articles read, we excluded 4. Ultimately, a total of 81 studies were selected from the databases and 4 via other methods, making a total of 85 included studies (**Figure 1**).

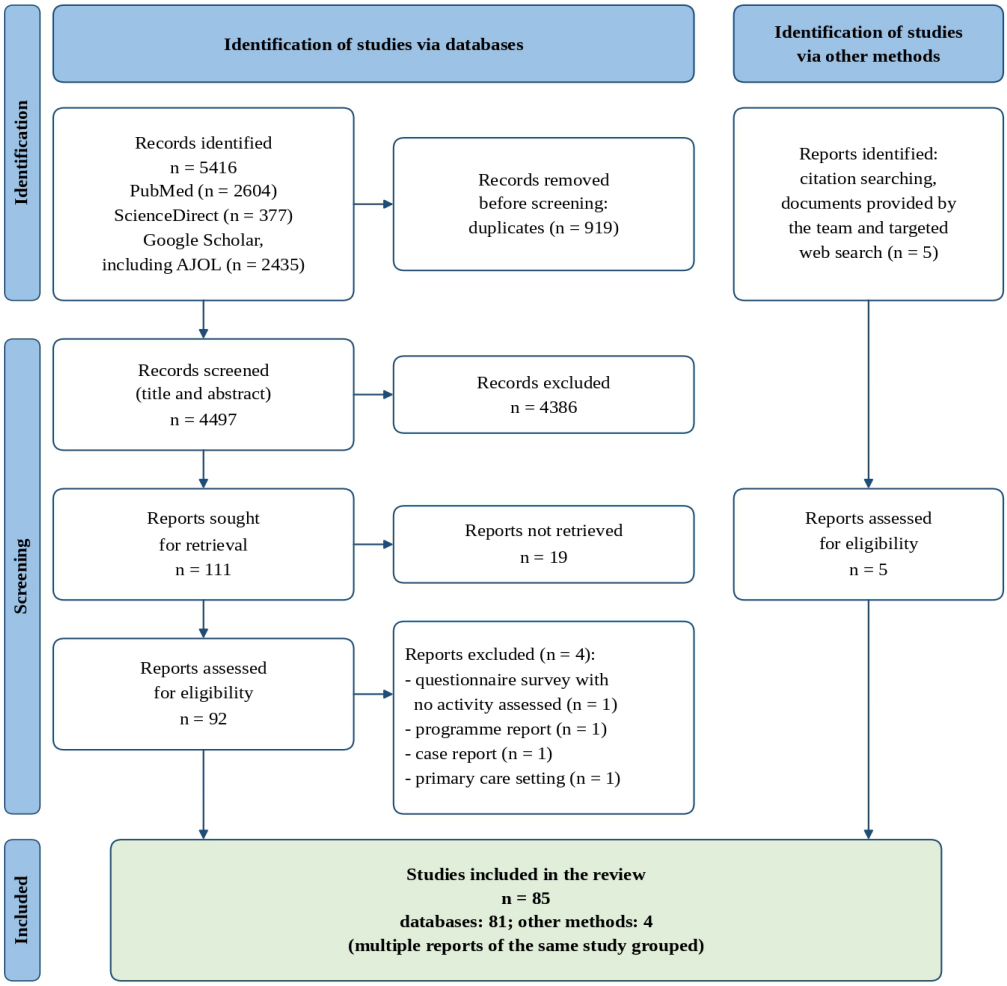


Figure 1. PRISMA flow chart.

3.2. General Characteristics of the Studies

The studies included in our review were published between 2008 and 2025, with 57.6% (n = 49) published since 2020. They originated from 13 countries (Figure 2). The most represented countries were Ethiopia (n = 19), Nigeria (n = 17) and Egypt (n = 13). North Africa and West Africa each accounted for 34.1 per cent of the studies (n = 29), East Africa for 23.5 per cent (n = 20) and Southern Africa for 8.2 per cent (n = 7). The majority of the included studies, namely 56.5 per cent (n = 48), involved hospitalised patients, whilst 43.5 per cent (n = 37) involved patients receiving outpatient care or hospital-based treatment. With regard to the clinical context, consultations for chronic diseases were the most common (n = 28), followed by infectious diseases (including human immunodeficiency virus (HIV) infection), multi-disciplinary studies and internal medicine (Figure 3). In terms of methodology, 48.2 per cent (n = 41) were descriptive studies, 34.1 per cent (n = 29) were non-randomised studies and 17.6 per cent (n = 15) were randomised controlled trials (RCTs). The characteristics of the 85 studies are shown in Table 2.

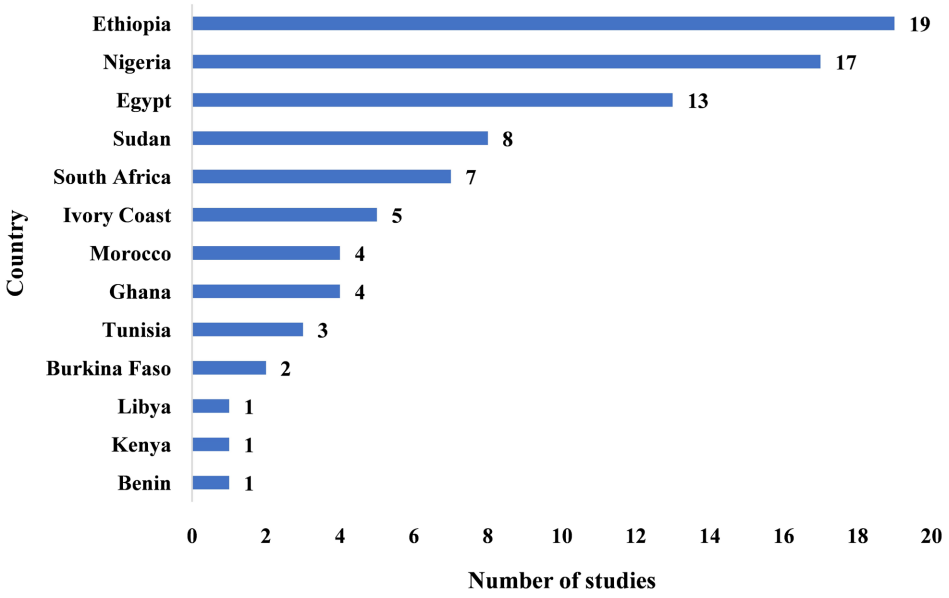


Figure 2. Distribution of studies by country.

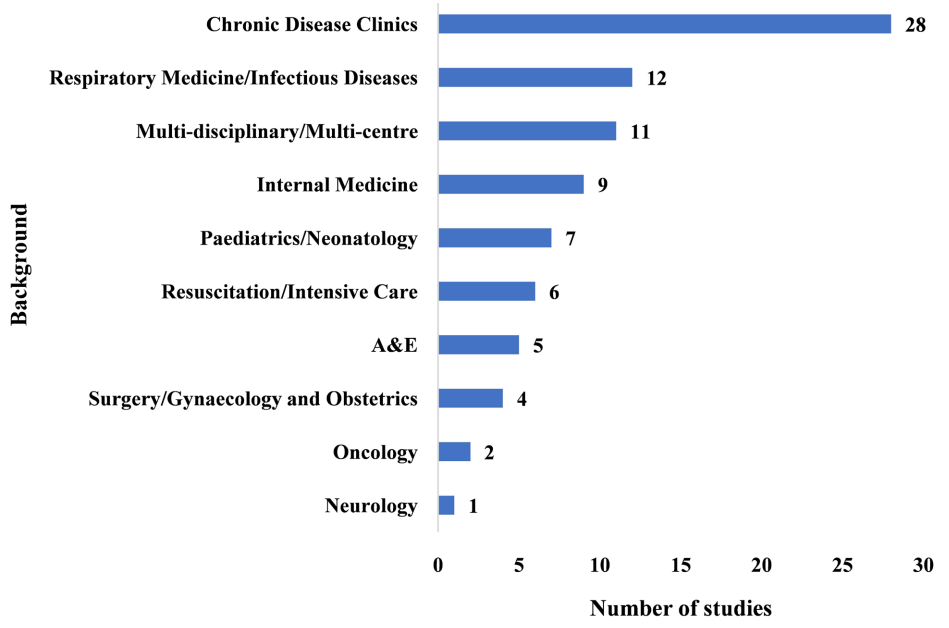


Figure 3. Distribution of studies by department or clinical setting.

Table 2. Characteristics of the included studies.

Author(s)/ Country	Department/ Setting	Design, duration, sample size	Activity(ies)	Main results
Abdelhamid E *et al.*, 2008 [21], Sudan	A&E and specialist clinic (asthma) (outpatient)	Single-centre RCT; 22 weeks' follow-up; 100 patients (60 intervention/40 control)	- Pharmaceutical care - Therapeutic education	Intervention group: - Significant reduction in acute attacks, night-time symptoms, weekly use of β2-agonists and sick days; - Improved inhalation technique and greater knowledge.

Continued

Oparah AC *et al.*, 2015 [22], Nigeria	Diabetes clinic at a Nigerian hospital (outpatient)	Single-centre RCT; 3 months; 99 patients (50/49)	- Pharmaceutical care - Therapeutic education	- Pre-meal blood glucose: 9.0 → 5.6 mmol/L; - Postprandial blood glucose: 12.4 → 7.6 mmol/L ($p < 0.0001$); - Improved knowledge of self-management.
Alagha HZ *et al.*, 2011 [23], Egypt	Paediatric intensive care unit (12 beds)	Non-randomised, before-and-after study without a control group; 139 patients before/101 after; 1417/1097 prescriptions	Training for healthcare staff	- Prescriptions with ≥1 error: 78.1% → 35.2%; - Potentially serious errors: 29.7% → 7%; - Decrease in all types of errors.
Manji I *et al.*, 2011 [24], Kenya	Anticoagulation consultations managed by pharmacists (outpatient)	Descriptive, retrospective review of records; 18 months (February 2009-July 2010); 178 patients	Pharmaceutical care	- Time within the therapeutic range 64.6%; - Major haemorrhages 1.25% per year; - Thromboses 5% per year; - Not inferior to benchmarks in high-income countries.
Adibe MO *et al.*, 2013-2014 [25]-[27], Nigeria	Diabetes clinics, 2 university hospitals (outpatient)	RCT; 12 months; 220 randomised, 192 analysed	- Pharmaceutical care - Therapeutic education	- HbA1c 7.23% vs 7.77%; - Improved fasting blood glucose and lipid levels; - Improved quality of life; - RCUI 88,525 NGN ($571) per QALY gained.
Mekonnen AB *et al.*, 2013 [28], Ethiopia	Internal medicine	Prospective descriptive study; 2 months (16 days of attendance); 48 patients with MRPs out of 300 admitted	- Pharmaceutical analysis - Participation in consultations	- 149 medication-related problems (MRPs); 133 pharmaceutical interventions (PIs); - Acceptance rate 68.4% (+2.3% partial); - Impact rated by a panel: major 48.9%, moderate 26.6%, minor 19.2%, extreme 5.3%.
Nwaozuzu EE *et al.*, 2013 [29], Nigeria	HIV clinic at a tertiary hospital in south-eastern Nigeria (outpatient)	Non-randomised, before-and-after study; 9 months; approximately 1473 patients	- Pharmaceutical care; - Pharmaceutical analysis (outpatient clinic)	- Significant reduction in the frequency of necessary interventions and problems after 9 months; - Improved adherence and satisfaction.
Abah IO *et al.*, 2014 [30], Nigeria	Adult HIV clinic (outpatient)	Prospective descriptive study; 12 months (July 2010-June 2011); 64,839 prescriptions, 9320 patients	Pharmaceutical analysis (clinic)	- PI in 85 patients (1.31 per 1000 prescriptions); - Viral load < 400 copies: 29.4 → 67.1%; - CD4 200 → 361/mm^3 ($p < 0.001$); - Only accepted PIs were documented.
Ebid AHIM *et al.*, 2014 [31], Egypt	Cardiology consultations (outpatient)	RCT; 3 months (March-October 2013); 280 randomised, 232 analysed	- Pharmaceutical care - Therapeutic education	- Systolic blood pressure (SBP) 8.2 mmHg, - Diastolic blood pressure (DBP) −5.4 mmHg compared with controls; - Better blood pressure control ($p = 0.018$); - Improved adherence, knowledge/ attitudes/practices and quality of life.
El Borolossy R *et al.*, 2014 [32], Egypt	Paediatric haemodialysis unit (outpatient)	Stratified RCT; 9 months (from December 2011); 50 children on haemodialysis (25/25)	- Pharmaceutical care; - Pharmaceutical analysis (consultation); - Therapeutic education	- 74 MRPs (interactions 40.5%, non-adherence 20.3%); - Reduction in blood pressure, phosphorus and PTH levels compared with controls; improved satisfaction.

Continued

Ahmad AD *et al.*, 2015 [33], Sudan	Medical services and consultations (12-month follow-up) (outpatient)	RCT (2:1); 12 months; 330 included, 300 analysed (200/100)	- Pharmaceutical care - Therapeutic education	- Postprandial blood glucose 7.4 vs 10.4 mmol/L; - Target HbA1c achieved: 10.5% → 52% (intervention group); - Improved satisfaction.
Messina AP *et al.*, 2015 [34], South Africa	33 private hospitals	Non-randomised, multicentre before-and-after study; 60 weeks; 32,985 patients assessed	Appropriate use of antimicrobials	Administration within one hour of prescription: 42.1% → 78.4%.
Ojeh VB *et al.*, 2015 [35], Nigeria	HIV clinic (outpatient)	Prospective descriptive intervention study; 8 months (January-August 2012); 42,416 prescriptions, 9339 patients	Pharmaceutical analysis (clinic)	- 420 medication errors in 401 patients (1 error per 100 prescriptions); - Omissions 21.2%, unnecessary medicines 13.1%; - 93 per cent of recommendations accepted.
Abrogoua DP *et al.*, 2016 [36], Côte d'Ivoire	Pulmonology (tuberculosis)	Cross-sectional descriptive study; 10 months; 130 patients	Pharmaceutical analysis	- 57 MRPs/57 PIs; - Acceptance rate 100% (participating doctors classified as supportive); - Significant impact 59.6%, highly significant 14.1%.
Abrogoua DP *et al.*, 2016 [37], Côte d'Ivoire	Paediatric outpatient consultations (ambulatory)	Cross-sectional descriptive study; 8 months; 150 patients	Pharmaceutical analysis (clinic)	- 63 MRPs/63 PIs (88.9% "administration methods"); - Acceptance rate 93.7% (59/63, no refusals); - Impact rated as significant for 100% of accepted PIs.
Abrogoua DP *et al.*, 2017 [38], Côte d'Ivoire	Paediatrics (inpatient)	Cross-sectional descriptive study; 8 months; 76 patients who received PIs	Pharmaceutical analysis	- 116 MRPs/116 PIs; - Acceptance rate 94.8%; - Impact (as rated by recipient doctors): significant 67.3%, very significant 16%, vital 0.9%.
Abrogoua DP *et al.*, 2016 [39], Côte d'Ivoire	Dispensing of antiretrovirals, Cocody University Hospital pharmacy (outpatient department)	Cross-sectional descriptive study; 5 months (March-July 2013); 235 patients	Pharmaceutical analysis (clinic)	- Prescription notes were mainly explanatory and advisory in nature (47%); - 17.9% of patients had a pharmaceutical information request forwarded to the prescriber, all of which were accepted; - IP0 92.8%; impact assessed separately by a pharmacist and a prescriber (no difference).
Acheampong F *et al.*, 2016 [40] [41], Ghana	All departments	Retrospective descriptive study; 3 years; 448 intervention reports (24 pharmacists)	Pharmaceutical analysis	- 1019 PIs (76.1% treatment changes); 90.5% accepted and implemented; - Interviews (companion report): barriers = attitudes of doctors and nurses, workload, insufficient clinical training.
Ayadi F *et al.*, 2016 [42], Tunisia	Cardiovascular and Thoracic Surgery (CCVT); orthopaedics	Prospective descriptive study; 4 months	Pharmaceutical analysis	- 68 MRPs; 92 PIs (68 PIs + 24 solicited opinions); - Acceptance rate 82.6% (71.5% in CCVT, 89.5% in orthopaedics); - Impact (Hatoum): significant 68.5%, highly significant 12%, vital 7%.

Continued

Brink AJ *et al.*, 2016 [43], South Africa	47 private hospitals	Non-randomised, before-and-after study with segmented regression; 60 months; 116,662 patients on antibiotics	Appropriate use of antimicrobials	- 7934 treatment courses (39% of which were of excessive duration); - Consumption 101.38 → 83.04 DDD/100 patient-days (−18.1 per cent).
Rebecca S *et al.*, 2017 [44], Nigeria	2 tertiary hospitals and 2 secondary hospitals	Prospective descriptive study; 6 months; 104 documented MRPs	- Pharmaceutical analysis - Training of healthcare staff	- 104 medication errors (choice of medicine 35.6%, dosage 33.9%, adverse effects 22.8%); - 77% of medication errors accepted; - 77.2% of medication errors resolved (tertiary hospitals).
Ahmed NO *et al.*, 2017 [45], Sudan	Anticoagulant consultation (outpatient)	Non-randomised, before-and-after study on the same patients (historical control); 12 months; 135 patients	- Pharmaceutical care - Therapeutic education	- INR within target range: 51.5% → 68.3%; - Bleeding: 39.2% → 27.4%; - Warfarin-related hospitalisations: 10.4% → 3.7%.
Bello SI, 2018 [46], Nigeria	HIV clinic (outpatient)	Non-randomised, longitudinal, pre-post study without a control group; 9 months' follow-up; 269 patients	Therapeutic education	Improved quality of life across all domains at 6 and 9 months ($p < 0.001$).
Brink AJ *et al.*, 2017 [47], South Africa	Operating theatres and surgical departments, 34 private hospitals	Non-randomised, multicentre before-and-after study (14 months pre-implementation, 16 months post-implementation); 24,206 surgical procedures audited	Appropriate use of antimicrobials	- Composite compliance 66.8% → 83.3% ($p < 0.0001$); - Surgical site infection (SSI) 2.46 → 1.97 per 1000 procedures (−19.7 per cent; $p = 0.0029$).
Erku DA *et al.*, 2017 [48], Ethiopia	Diabetes clinic (outpatient)	RCT; 6 months (February-July 2016); 127 patients (62/65)	- Pharmaceutical care - Therapeutic education	- High adherence: 9.2% → 61% (vs 13.2% → 30.2%; $p < 0.01$); - Hospitalizations: 23 vs 48 (−52 per cent; $p < 0.001$).
Toumi A *et al.*, 2017 [49], Tunisia	Pharmacy, Farhat Hached University Hospital (Sousse): haematology, infectious diseases, respiratory medicine, general surgery, cardiology	Retrospective descriptive study; 15 months; 255 inpatients	Pharmaceutical analysis	- 255 patient episodes: non-compliance with guidelines 29.4%, over-dosing 25.1%, under-dosing 16.5%; dosage adjustment requested in 60.8%; - 79.6% accepted.
Allabi AC *et al.*, 2018 [50], Benin	Internal medicine	Prospective descriptive study; 4 months; 171 patients	- Pharmaceutical analysis - Participation in consultations	- 163 MRPs; 132 PIs; - Acceptance rate 87.9%.
Belayneh YM *et al.*, 2018 [51], Ethiopia	Medicine (Dessie Referral Hospital)	Prospective descriptive study; 3 months; 147 patients	- Pharmaceutical analysis - Attendance at appointments	- 159 MRPs confirmed by a pharmacist and a doctor; - 75.5% of patients with ≥1 MRP.

Continued

Elkassas N *et al.*, 2018 [52], Egypt	General intensive care unit (13 beds)	Non-randomised, before-and-after study in 3 phases; 18 months; 805 patients	- Appropriate use of antimicrobials - Pharmacy analysis - Training for healthcare staff	- 412 in-patient prescriptions for antibiotics; - Acceptance 33.9% → 62.5% → 67.3% depending on the phase ($p < 0.001$); - Overall consumption increased, whilst consumption of third-generation cephalosporins (C3G) and carbapenems decreased.
Ghedira D *et al.*, 2018 [53], Tunisia	Mother and Child Centre: obstetrics and gynaecology, neonatology, anaesthesia and intensive care	Prospective descriptive study; 9 months; 13,644 prescriptions	Pharmaceutical analysis	- 145 MRPs/145 PIs; - Acceptance rate 92.4%; - Impact: significant 70 per cent, highly significant 30 per cent.
Mekonnen AB *et al.*, 2018 [54], Ethiopia	A&E	Non-randomised before-and-after study without a concurrent control group; 6 months; 123 patients (49 before/74 after)	Medication reconciliation	- Patients with ≥1 unintentional discrepancy: 59% → 10.5%; - Reduction in potentially serious discrepancies.
Ali MA *et al.*, 2018 [55], Egypt	Neurology and neurological intensive care	Prospective descriptive study; 6 months; 1421 patients reviewed, 285 with MRPs	Pharmaceutical analysis	- 414 MRPs/414 PIs; - Acceptance rate 89.4%.
Terblanche A *et al.*, 2018 [56], South Africa	Sebokeng Hospital, secondary care hospital	Non-randomised, interventional before-and-after study (18 months before/18 months during); questionnaires for healthcare staff	- Pharmacovigilance - Training of healthcare staff	- Healthcare professionals reporting an adverse reaction: 12.1% → 33.8% ($p < 0.0001$); - Improved knowledge and number of reports.
Abubakar U *et al.*, 2019 [57], Nigeria	Obstetrics and gynaecology (2 university hospitals)	Non-randomised, before-and-after study; 2 × 3 months; 226 out of 238 surgical procedures	- Appropriate use of antimicrobials - Training of healthcare staff	- Administration within 60 minutes prior to incision: 14.2% → 43.3%; - Duration in accordance with guidelines: 0% → 21.8%; −3.8 DDD and −4.2 USD per procedure; - Surgical site infections remained unchanged (4% vs 3.4%).
Akonoghrere RO *et al.*, 2020 [58], Nigeria	Outpatient (ambulatory) consultation	Descriptive, prospective, non-randomised, single-centre study; 6 months; 65 patients with hypertension	- Pharmaceutical care - Therapeutic education	- 104 MRPs, mainly due to non-adherence (51.5%); - 69% resolved at 6 months; - 53.7% of patients received education only.
Eshiet UI *et al.*, 2019-2022 [59]-[61], Nigeria	Neurology and general practice consultations (outpatient)	Open-label RCT; 6 months; 193 randomised (95 SP/98 usual care), 157 analysed	- Therapeutic education - Pharmaceutical care	- Improved knowledge and understanding of epilepsy (2019); - Improved quality of life at 3 and 6 months (2021); - Reduced frequency and severity of seizures (2022).
Alaoui AM *et al.*, 2020 [62], Marocco	Medical emergencies	Prospective descriptive study; 8 months; 482 patients, 1622 prescriptions	Pharmaceutical analysis	- 304 MRPs/304 PIs; - Acceptance rate 95%; - Impact: significant 77%, very significant 18%, vital 4%.

Continued

Gebretekle GB *et al.*, 2020 [63] [64], Ethiopia	Internal medicine and paediatrics	Non-randomised during vs after cessation of the intervention (no pre-intervention phase); 15 months; 1109 patients	Appropriate use of antimicrobials	- Adherence to recommendations 96.4% (54% = discontinuation of antibiotics); AFTER cessation: - Duration of antibiotic treatment 8.7 days → 12.8 days; - DOT 754 → 1549 per 1000 patient-days; - Length of stay 19.8 → 24.1 days; - Mortality 6.9% → 14.7%.
Hailu BY *et al.*, 2020 [65], Ethiopia	Medical and surgical departments	Prospective descriptive interventional study; 4 months (April-July 2017); 200 patients aged ≥65 years	- Pharmaceutical analysis - Attendance at appointments	- 82% of patients with ≥1 MRPs; - 380 MRPs; 670 PIs; - 91.7% accepted by prescribers.
Mostafa LS *et al.*, 2020 [66], Egypt	Emergency surgical hospital	Non-randomised, uncontrolled before-and-after study; duration not reported; 2049 patients	- Training of healthcare staff - Safeguarding of administration	Administration errors: 34.2% → 15.3% (452 → 185 errors; $p < 0.001$).
Sorbor GN *et al.*, 2020 [67], Nigeria	Dadin Kowa Comprehensive Health Centre, secondary (outpatient) facility	Non-randomised, before-and-after study; 1 month; 51 patients with hypertension	- Pharmaceutical care - Therapeutic education	- SBP 146.6 → 137.7 mmHg; - DBP 88.8 → 85.8 mmHg.
Tefera GM *et al.*, 2020 [68], Ethiopia	Surgery Department	Descriptive observational and prospective interventional study; 3 months (April-July 2017); 300 patients	Pharmaceutical analysis	- MRP in 76% (449 MRPs; dosage too low 27.6%, too high 18.0%); - 86.2% of MRPs were subject to PIs; - Acceptance rate: 78% (per MRP), 85.2% (per patient).
van den Bergh D *et al.*, 2020 [69], South Africa	39 public and private hospitals (community-acquired pneumonia)	Non-randomised, multicentre before-and-after study; 12 months; 2464 patients	Appropriate use of antimicrobials	- Overall compliance 47.8% → 53.6%; - Diagnostic compliance 49.1% → 54.6%; - AMS process 45.3% → 51.6%; - Mortality unchanged (4.4% vs 3.9%).
Yismaw MB *et al.*, 2020 [70], Ethiopia	Paediatric haematology-oncology	Prospective observational study with interventions; 4 months (June-October 2018); 156 children	- Pharmaceutical analysis - Therapeutic education	- Adherence to medication in 68.6% of children (correct dosage 39.3%, need for additional treatment 27.2%); - PIs accepted: 92.2% in full, 3.7% in part, 4.1% refused.
Ahmed KO *et al.*, 2021 [71], Sudan	Heart failure clinic (outpatient)	Non-randomised, single-group before-and-after study; 6-month follow-up; 125 included, 110 analysed	Pharmaceutical care	Target dose achieved: - ACE inhibitors 0 → 77.4%; - ARB 6.8 → 85.4%; - NSAIDs 0 → 55.6%; - Beta-blockers 8.6 → 66.1%; - Improved LVEF and NYHA class.
Amorha KC *et al.*, 2021 [72], Nigeria	Respiratory departments (outpatient)	Single-blind, three-arm RCT; 6 months (March 2016-September 2017); 78 patients (13 per arm per hospital)	Therapeutic education	- Therapeutic education arm: better ACT score at 3 and 6 months (21.8 vs 19.6; $p = 0.003$) and better adherence; - "Support" arm showed no significant effect.

Continued

David EA *et al.*, 2021 [73], Nigeria	Diabetes clinic (outpatient)	Single-blind, parallel-group RCT; 6 months; 108 patients (54/54), all analysed	- Pharmaceutical care - Therapeutic education	- HbA1c −0.75% vs +0.15% ($p < 0.001$); - HbA1c < 7%: 42.6 per cent vs 20.8 per cent (ORa 2.72).
Ipingbemi AE *et al.*, 2021 [74], Nigeria	Endocrinology clinic (2 university hospitals) (outpatient)	Non-randomised (groups formed according to HbA1c); 6 months; 201 patients	Therapeutic education	Intervention group: - HbA1c 8.7 → 7.8%; - PAS 136.9 → 131.0 mmHg; - Better adherence to dietary guidelines; - Direct costs unchanged. The "control" group consists of patients with well-controlled diabetes.
Jackson IL *et al.*, 2021-2022 [75] [76], Nigeria	HIV clinic (outpatient)	Open-label, parallel-group RCT; 12 months (August 2018-October 2019); 206 randomised, 182 analysed	- Pharmaceutical care - Therapeutic education	- Blood pressure control 53.4% vs 25.2% (ORa 3.20); - SBP −16.7 mmHg vs −0.9; - Improved adherence to ARVs and antihypertensives; - Viral load unchanged; - Companion report (2022): improved knowledge, quality of life and satisfaction.
Kamenan TAB *et al.*, 2021 [77], Côte d'Ivoire	Care unit for people living with HIV (outpatient follow-up)	Cross-sectional descriptive study; 6 months; 59 patients on tenofovir	Pharmaceutical analysis (clinic)	- 115 MRPs/115 PIs (mainly biological monitoring); - 100% acceptance rate; IP0 44.3%, PI1 54 per cent, PI2 1.7%.
Kwakye AO *et al.*, 2021 [78], Ghana	Medical consultation (diabetes) (outpatient)	RCT, interventional with control group (randomised allocation, 144 vs 194); 6 months (August 2018-June 2019); 338 patients	Therapeutic education	- Improved knowledge and adherence ($p < 0.0001$); - Reduction in body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP) and fasting blood glucose in the intervention group.
Moukafih B *et al.*, 2020 [79], Morocco	Medical oncology	Prospective descriptive study; 12 months; 526 patients, 3542 prescriptions	Pharmaceutical analysis	- 450 MRPs/450 PIs (analgesics 31.5%, antineoplastic agents 10.4%); - Acceptance rate 98%; - Significant impact 38.2%, very significant 19.6%, vital 15.8%, none 26.4%.
Sheleme T *et al.*, 2021 [80], Ethiopia	Follow-up of diabetic patients (outpatient)	Prospective observational study; 4 months (April-August 2019); 330 patients	- Pharmaceutical analysis (consultation) - Therapeutic education	- 84.5% with ≥1 MRP (455 MRPs); 865 PIs; - 79.8% accepted.
Amankwa Harrison M *et al.*, 2022 [81], Ghana	Internal medicine (hypertension, heart failure)	Prospective cross-sectional study; 6 months; 134 patients	Pharmaceutical analysis	- 247 MRPs; 235 PIs; - Average acceptance rate per patient 71.6%; - 70.6% of accepted PIs were implemented.
Billoro BB *et al.*, 2022 [82], Ethiopia	Diabetes follow-up consultation (outpatient)	Non-randomised, single-group before-and-after study; 6 months; 100 patients (87 analysed)	- Pharmaceutical care - Therapeutic education	- Fasting blood glucose −47.3 mg/dL; - Systolic blood pressure −22.6 mmHg; LDL −31.4 mg/dL; - Improved adherence (all $p < 0.001$).

Continued

Dagnew SB *et al.*, 2022 [83], Ethiopia	Medicine, 5 specialist hospitals (participants aged 60 years or over)	Prospective, multicentre, descriptive study; 4 months; 389 patients	Pharmaceutical analysis	- 503 MRPs (68.4% of patients); - Acceptance rate 84.7%; - 67.4% of MRPs fully resolved; - Main factor: polypharmacy (OR 3.06).
Ebid AI *et al.*, 2020 [84], Egypt	Diabetes clinic (outpatient)	RCT (1:1); 6 months; 100 patients analysed (125 randomised)	- Pharmaceutical care - Therapeutic education	- HbA1c −1.6 vs −0.3 points; - Fasting blood glucose −46 mg/dL vs −1.4 mg/dL; - Improvement in lipid profile, adherence and self-management.
Ibrahim DM *et al.*, 2022 [85], Egypt	Intensive Care Unit	Non-randomised, three-phase interventional study (retrospective followed by prospective); 2 years (2018-2019); 234 patients (190/44)	Pharmaceutical analysis	- Inappropriate prescriptions 83.6% → 16%; - Reduction in albumin consumption and cost.
Moges TA *et al.*, 2022 [86], Ethiopia	Internal medicine, 2 specialist hospitals	Prospective cross-sectional study; 3 months (May-July 2021); 635 patients	Medication reconciliation	- 39.1% of patients had ≥1 unintentional discrepancy (omission 41.8%, incorrect dose 21.9%); - 75.3% of medication plans accepted.
Moutaouakkil Y *et al.*, 2022 [87], Morocco	Various departments, Mohammed V Military Hospital	Prospective descriptive study; 4 months; 19,200 prescriptions	Pharmaceutical analysis	2152 medication regimens (11.2% of prescriptions), of which 752 contained errors (47.9% involving drug interactions).
Ofei-Palm CNK *et al.*, 2022 [88], Ghana	COVID-19 isolation centre	Retrospective descriptive study; 4 months (May-August 2020); 53 patients	- Pharmaceutical analysis - Therapeutic education	- 145 prescriptions (2.7 per patient): advice on discontinuation 32.4%, untreated indication 10.3%, omission 9%; - 95.2% accepted.
Okoro RN *et al.*, 2022 [89] [90], Nigeria	Nephrology consultations, 2 hospitals in Maiduguri (outpatient)	Double-blind, parallel-group RCT; 12 months (November 2019-January 2021); 147 patients (73/74)	- Pharmaceutical care - Therapeutic education	- SBP −7.1 mmHg vs control group ($p = 0.020$); - Blood pressure control 20.5% vs 8.1% at 12 months (NS); - Excellent adherence OR 2.11; - Creatinine 245.9 vs 291.7 μmol/L ($p = 0.025$) (2023 report).
Sefera B *et al.*, 2022 [91], Ethiopia	Department of Medicine (heart failure)	Prospective descriptive interventional study; 8 months (September 2020-May 2021); 237 patients	- Pharmaceutical analysis - Participation in visits	- 66.2% of patients with ≥1 MRP; - 283 MRPs; 408 PIs (38.7% at prescriber level, of which 93.0% were accepted); - 72.1% of MRPs resolved.
Shawki MA *et al.*, 2022 [92], Egypt	Government hospital, COVID-19 patients	Non-randomised, before-and-after study; March-September 2020	- Pharmaceutical analysis - Training of healthcare staff	Prescription errors 1054 → 148, 14.7 → 2.56 per 1000 patient-days ($p < 0.001$).
Wondesen A *et al.*, 2022 [93], Ethiopia	Adult cardiology outpatient clinic	Non-randomised, quasi-experimental single-group before-and-after study; 6 months (July-December 2019); 423 patients with heart failure	- Pharmaceutical care - Therapeutic education	- MRPs 1.3 → 0.67 per patient ($p < 0.001$); - 254 patients with heart failure: 58.2% fully accepted, 26.8% partially accepted, 15% refused; satisfaction rate 80.4%.

Continued

Bronkhorst E *et al.*, 2023 [94], South Africa	Internal medicine, teaching hospital (HIV-positive adults)	Prospective descriptive study; 3 months; 41 patients	Pharmaceutical analysis	101 MRPs (2.46 per patient); 7 clinically significant interactions.
Hida A *et al.*, 2022 [95], Morocco	COVID-19 intensive care	Prospective descriptive study; 4 months; 132 patients, 720 prescriptions	Pharmaceutical analysis	- 362 MRPs/362 PIs; - Acceptance rate 90%; - Impact: significant 64.9%, highly significant 35.1%, none critical.
Shaker HO *et al.*, 2023 [96], Egypt	A&E	Prospective descriptive interventional study; 2 months (September-November 2020); 161 patients	Medication reconciliation	- Complete medical history obtained by pharmacists in 75.2% of cases versus 50.3% by A&E doctors; - 585 discrepancies (3.6 per patient); - 33.5% in categories D - F (NCC MERP).
Adisa R *et al.*, 2024 [97], Nigeria	Respiratory consultation (asthma, COPD) (outpatient)	Non-randomised, alternating allocation; 2 months; 130 patients (119 analysed)	Therapeutic education	Intervention group: - Optimal adherence 33.3% → 63.3%; - Correct technique 22.8% → 80.7%; - Asthma control 35.3% → 60.4% ($p < 0.001$).
Ahmed NA *et al.*, 2024 [98], Egypt	Neonatal resuscitation	Prospective descriptive study; 4 months (August-November 2023); 316 newborns	Pharmaceutical analysis	- 1723 medication errors in 283 newborns (5.5 per patient), mainly relating to dose selection; - 2149 treatment recommendations: 98.8% accepted, 93% implemented; 92% of treatment recommendations resolved.
Badi S *et al.*, 2024 [99], Sudan	Diabetes clinic (military hospital) (outpatient)	RCT (1:1); 12 months; 364 patients	Therapeutic education	- Improved satisfaction compared with controls (+0.9 vs −0.4 out of 36; $p < 0.001$); - No difference in quality of life.
Bronkhorst E *et al.*, 2024 [100], South Africa	4 internal medicine departments (PLHIV)	Prospective observational study; 14 weeks; 180 patients, 453 consultations	Pharmaceutical analysis Medication reconciliation	- 466 errors (missed doses 56.9%, dosage errors 22.1%); - 58.2% resolved within <24 hours; - 73.8% resolved in total.
Bulo B *et al.*, 2024 [101], Ethiopia	Nephrology consultation (hypertension) (outpatient)	Non-randomised, single-group before-and-after study; 10 months; 304 patients (279 analysed)	Pharmaceutical care	- Patients with ≥1 MRP: 63.3 → 31.5%; - SBP 136.7 → 131.4 mmHg; - Target blood pressure (BP) achieved: 52.7% → 72.4%.
Elamin MM *et al.*, 2024 [102], Sudan	Internal medicine	Non-randomised controlled trial; 9 months (January-September 2023); 350 patients (180 medication reconciliation by pharmacists/170 by doctors)	Medication reconciliation	- Discrepancies detected: 39% of medicines (2.2 per patient) vs 12% (doctors); - 83% resolved; 98% of treatment plans accepted, 86% implemented.
Hamadalneel YB *et al.*, 2024 [103], Sudan	Intensive care	Prospective descriptive study; 6 months; 123 patients	Pharmaceutical analysis	510 treatment protocols (safety 34.1%); acceptance 96.7%.
Kassem AB *et al.*, 2024 [104], Egypt	Public COVID-19 isolation hospital	Non-randomised, interventional before-and-after study; 6 months (June-December 2021); 499 prescriptions	Pharmaceutical analysis Appropriate use of antimicrobials Training of healthcare staff	- 47.7% of prescriptions contained errors (mainly relating to prescription: incorrect choice 57.9%, overdosing 29.9%); - 315 PIs, all accepted; expenditure reduced by 66.3 per cent.

Continued

Tadesse TA *et al.*, 2024 [105], Ethiopia	Anticoagulation service (outpatient)	Non-randomised, quasi-experimental (group comparison); July 2021-June 2023; 525 patients (175 managed by pharmacists/350 standard care)	Pharmaceutical care	- Median TTR 60.9% vs 53.7% ($p < 0.001$) - TTR ≥ 65%: 41.7% vs 31.7%; - Odds ratio (OR) for inadequate TTR: 0.57; - Fewer visits to A&E.
Tsige AW *et al.*, 2024 [106], Ethiopia	Medical referral consultation (outpatient)	Non-randomised, before-and-after study; 6 months (July-December 2022); 423 patients with heart failure	Therapeutic education	Average adherence: - 54.6% before; after intervention: high 36.4%, average 61.9%; - Main barriers: cost, availability, missed doses.
Alsetohy WM *et al.*, 2025 [107], Egypt	4 private hospitals	Retrospective descriptive study + cost modelling; 6 years; 492,612 patients reviewed	Pharmaceutical analysis	- 19,240 inpatient admissions; - Adherence rate 82.1%; - Modelled cost savings: USD 8.6 million (USD 447 per inpatient); - Return on investment 760% (expert assumptions, no observed events).
Badi S *et al.*, 2025 [108], Sudan	Diabetes clinic (secondary hospital) (outpatient)	Non-randomised, quasi-experimental before-and-after study without a control group; 12 months (January 2021-January 2022); 110 patients, none lost to follow-up	Therapeutic education	- HbA1c −1.9% at 12 months ($p < 0.001$); - Fasting blood glucose −41.9 mg/dL; - Improved self-care practices.
Elreyani NE and Anbia SA, 2025 [109], Libya	Paediatric respiratory clinic (outpatient)	Non-randomised, prospective interventional study with a non-randomised control group; 6 months' follow-up (July 2019-June 2020); 36 children (21/15)	Therapeutic education	- Fewer visits to A&E in the intervention group ($p = 0.01$); - Adherence associated with better control ($p = 0.02$).
Endalifer BL *et al.*, 2025 [110], Ethiopia	Medicine (Hakim Gizaw Hospital)	Prospective, single-arm descriptive study; 4 months; 183 patients	- Pharmaceutical analysis - Attendance at follow-up visits	- MRP in 27.3% of patients; 143 PIs; acceptance rate 74.1%; - CLEO impact: major 8.4%, negative 4.9%; 48.2% of PIs reduce costs.
Moges TA *et al.*, 2025 [111], Ethiopia	Paediatrics (infectious diseases), 5 hospitals	Multicentre cross-sectional study; 3 months; 389 children	Pharmaceutical analysis	- MRP in 56.6 per cent of children; - 250 MRPs; 370 PIs; acceptance rate 84.0% (overall 74.3%).
Ouédraogo M *et al.*, 2025 [14], Burkina Faso	Paediatric A&E	Cross-sectional descriptive study; 6 weeks; 135 patients	Medication reconciliation	- 71 unintentional discrepancies (34.8% of patients); - 49/71 corrected following medication reconciliation (69%); relevance assessed by doctors: 88.2%; - CLEO impact mainly minor; - Reconciliation within <24 hours: 71.9%; 53.7 minutes per patient.
Ouédraogo M *et al.*, 2025 [13], Burkina Faso	Neonatology	Cross-sectional descriptive study; 5 days; 30 newborns	- Pharmaceutical analysis - Ensuring safe administration	- 109 PIs (27 following analysis, 82 following observation); - Acceptance rate: 92.6% (doctors) and 93.9% (nurses).

3.3. Classification of Clinical Pharmacy Activities

Ten types of activities were identified, totalling 124 occurrences; 36 studies reported more than one activity (Table 3).

Table 3. Types of clinical pharmacy activities.

Type of activity	Occurrence (n)	Percentage (%)
Pharmaceutical analysis and review of pharmacotherapy (inpatient care)	34	40
Patient therapeutic education	29	34.1
Pharmaceutical care and management of chronic conditions	22	25.9
Pharmaceutical analysis during consultations or in hospital dispensing services	8	9.4
Appropriate use of antimicrobials (Stewardship)	8	9.4
Training and interventions on healthcare professionals' practices	8	9.4
Participation in rounds/integration into the team	6	7.1
Medication management	6	7.1
Ensuring the safety of preparation and administration	2	2.4
Pharmacovigilance	1	1.2
Total	124	100

3.3.1. Pharmaceutical Analysis and Review of Pharmacotherapy

A total of 42 studies, or 49.4 per cent, reported on this activity, including 8 in outpatient consultations or at the point of dispensing; 36 were descriptive. It covered internal medicine [28] [50] [81] [83] [91] [110], geriatrics [65], paediatrics and neonatology [13] [38] [53] [98] [111], oncology [70] [79], A&E [62], intensive care [85] [95] [103], and surgery [42] [68]. It also covered specific contexts such as outpatients or inpatients with HIV infection [30] [35] [39] [77] [94] [100] or COVID-19 [88] [92] [104]. Various methods of analysis were employed, ranging from centralised analysis of prescriptions [42] [49] [53] [87] to daily monitoring at the patient's bedside, including participation in ward rounds [28] [50] [65] [91] [110], often carried out by supervised interns or residents [38] [50] [62] [77] [95]. With regard to pharmaceutical interventions (PIs), the numbers ranged from 1019 PIs over three years in a university hospital in Ghana [40] to 2149 PIs over four months in a neonatal intensive care unit in an Egyptian hospital, with an acceptance rate of 98.8% [98]. The most common medication-related problems (MRPs) were dosing errors, untreated indications, off-label use of medicines, drug interactions and inappropriate routes of administration, whilst pharmaceutical interventions mainly involved dose adjustments, discontinuation or the addition of medicines. In some studies, an effect was observed beyond the acceptance of the interventions: in intensive care, the pharmaceutical validation protocol reduced inappropriate albumin prescriptions from 83.6 per cent to 16 per cent [85]; in patients with COVID-

19, prescription errors fell from 14.7 to 2.56 errors per 1000 patient-days following training of prescribers [92]; in HIV clinics, the proportion of patients with a viral load below 400 copies/ml rose from 29.4 per cent to 67.1 per cent following the intervention [30]. Endalifer *et al.* [110] were the only authors to use the CLEO tool for this activity, whilst Alsetohy *et al.* [107] estimated, through modelling, that costs of USD 8.6 million were avoided over six years in four private hospitals in Egypt.

3.3.2. Appropriate Use of Antimicrobials (Stewardship)

Eight studies, all of which were non-randomised, described programmes on the appropriate use of antimicrobials led by pharmacists, combining prospective audits with feedback, protocols and training [34] [43] [47] [52] [57] [63] [69] [104]. In South Africa, three publications successively reported an 18.1 per cent reduction in antibiotic consumption across 47 hospitals [43], an improvement in adherence to administration timings from 42.1 per cent to 78.4 per cent [34], and modest gains in compliance in the management of community-acquired pneumonia [69]. Also in South Africa, another programme targeting surgical antibiotic prophylaxis in 34 hospitals increased compliance from 66.8 per cent to 83.3 per cent and reduced surgical site infections by 19.7 per cent [47]. In Nigeria, the administration of antibiotic prophylaxis prior to incision rose from 14.2 per cent to 43.3 per cent, with no change in surgical site infections [57]. In Egypt, adherence to antibiotic stewardship programmes in intensive care units rose from 33.9 per cent to 67.3 per cent following training for doctors [52], and the work of a medicines committee during the COVID-19 pandemic was accompanied by a 66.3 per cent reduction in expenditure [104]. Finally, in Ethiopia, following the discontinuation of a programme promoting the appropriate use of antimicrobials, the duration of antibiotic treatment, length of stay and mortality rates all increased [63].

3.3.3. Therapeutic Education and Pharmaceutical Care in Outpatient Settings

Thirty-four studies focused on therapeutic education or pharmaceutical care, 32 of which involved patients receiving outpatient care. These interventions mainly concerned chronic conditions such as diabetes [22] [25] [33] [48] [73] [74] [80] [82] [84] [108] [112], high blood pressure [31] [58] [67] [75] [78] [89] [101], heart failure [71] [93] [106], thromboembolic diseases [24] [45] [105], asthma and chronic obstructive pulmonary disease [21] [72] [97] [109], HIV infection [29] [46] [75], and chronic kidney disease, including in children [32] [89]. These studies encompassed the 15 RCTs in our review and most of the clinical outcomes measured. In the management of diabetes, a greater reduction in glycated haemoglobin was observed in the intervention groups (−0.75 versus +0.15 points [73]; −1.6 versus −0.3 points [84]) and the proportion of patients with HbA1c below 7 per cent rose from 10.5 per cent to 52 per cent after six months' follow-up [33]. Among patients with high blood pressure, blood pressure control reached 53.4 per cent

compared with 25.2 per cent in the control group [75], and systolic blood pressure fell by 7 - 8 mmHg more than in the control group [31] [89]. Treatment adherence improved in most of the trials; in Ethiopia, the intervention also halved hospital admissions among diabetic patients [48]. In patients treated with an anticoagulant (warfarin), consultations during which the pharmacist monitored the INR and adjusted the dose themselves enabled the INR to be maintained within the therapeutic range in 60.9% to 64.6% of cases [24] [105], which was higher than in patients monitored solely by the doctor in the comparative study [105]. Several studies reported an improvement in quality of life [25] [46] [59] [76]. Finally, in Nigeria, a cost-effectiveness analysis showed that pharmaceutical care for diabetic patients cost approximately USD 571 per healthy life-year gained, making it cost-effective [26].

3.3.4. Medication Reconciliation, Training of Healthcare Professionals, Ensuring the Safe Preparation and Administration of Medicines, and Pharmacovigilance

Medication reconciliation was evaluated in six studies [14] [54] [86] [96] [100] [102]. In A&E, medication reconciliation carried out by a pharmacist reduced the proportion of patients with at least one unintended discrepancy from 59 per cent to 10.5 per cent [54], and pharmacists obtained a complete medication history more often than A&E doctors (75.2 per cent versus 50.3 per cent) [96]. In an Ethiopian cross-sectional study conducted in internal medicine, an unintended discrepancy was found in 39.1 per cent of patients [86]. In a Sudanese non-randomised controlled trial, pharmacists detected three times as many discrepancies as doctors (39 per cent versus 12 per cent of medicines) [102]. In Burkina Faso, medication reconciliation carried out in paediatric A&E by pharmacists detected an unintended discrepancy in 34.8 per cent of children and took an average of 53.7 minutes per patient [14]. Eight studies involved training initiatives led by pharmacists [23] [43] [52] [56] [57] [66] [92] [104]. In paediatric intensive care, these training sessions reduced the number of prescriptions containing errors from 78.1% to 35.2% [23], whilst in A&E, administration errors fell from 34.2% to 15.3% [66]. In neonatology, the observation of medicine preparation and administration resulted in 82 intervention protocols being issued to nurses, 93.9 per cent of which were accepted [13]. In South Africa, a pharmacovigilance system led by a pharmacist increased the proportion of healthcare staff reporting an adverse event from 12.1 per cent to 33.8 per cent [56].

3.3.5. Participation in Rounds and Integration into the Multidisciplinary Team

The pharmacist's participation in ward rounds or healthcare team meetings was described in six descriptive studies conducted in Ethiopia [28] [51] [65] [91] [110] and Benin [50] respectively. Depending on the context, the pharmacist, a pharmacy trainee [50] or final-year students [51] would accompany the medical team during ward rounds, review treatments at the patient's bedside and discuss their recommendations directly with the doctors. In Benin, the pharmacy intern was present

for five half-days a week [50]; in Ethiopia, interventions that were refused were discussed again with a senior doctor [65] or within a multidisciplinary team [110]. At least one MRP was identified in 27.3% to 83% of patients [51] [65] [91] [110]. As regards pharmaceutical interventions, these were accepted by doctors in 68.4% to 93% of cases [28] [50] [65] [91] [110]; one study documented none at all [51]. The impact of these interventions was assessed in two studies. In the study by Mekonnen *et al.*, a panel of experts judged the impact to be major for 48.9 per cent of the interventions and extreme for 5.3 per cent [28]. In the study by Endalifer *et al.*, which used the CLEO scale for assessment, 8.4 per cent of the interventions had a major clinical impact, 4.9 per cent had a negative impact and 48.2 per cent reduced costs [110].

3.4. Indicators and Acceptance of Pharmaceutical Interventions

The acceptance rate for pharmaceutical interventions was reported in 36 studies (**Figure 4**), with a median of 91.1 per cent (interquartile range 79.65 per cent - 95.15 per cent) and a range of 58.1 per cent - 100 per cent; 26 studies reported an acceptance rate exceeding 80 per cent. Some studies measured the implementation of interventions through the proportion of errors actually corrected in the prescription (73.8 per cent) [100], the proportion of medication errors resolved (72.1 per cent to 92 per cent) [91] [98], or the proportion of pharmaceutical interventions actually applied to the patient's treatment (86 per cent to 93 per cent) [98] [102].

4. Discussion

Our scoping review included 85 studies conducted in Africa, the full texts of which were reviewed. It reveals a hospital-based clinical pharmacy practice centred on pharmaceutical analysis with pharmaceutical intervention directed at the prescriber, supplemented by therapeutic education and pharmaceutical care in outpatient consultations, the appropriate use of antimicrobials, medication reconciliation and training for healthcare professionals. Clinical pharmacy interventions were generally well accepted; clinical outcomes were primarily documented by randomised trials in outpatient chronic disease settings, whilst studies conducted in hospital settings were mainly descriptive.

The predominance of Ethiopia, Nigeria and Egypt reflects structured clinical pharmacy training programmes and supportive university policies [113] [114]. In Nigeria, most of the trials were conducted by teams linked to the same university department of clinical pharmacy [25] [29] [59] [72] [75]. In French-speaking West Africa, teams from Côte d'Ivoire, Benin and Burkina Faso produced a series of studies based on the SFPC tools [13] [14] [36]-[39] [50] [77], several of which were only identified through targeted supplementary research. The absence of studies from Central Africa likely reflects under-publication rather than a lack of activity; it may also be due to our language restriction and the full texts that could not be obtained (see limitations), so it should be interpreted with caution.

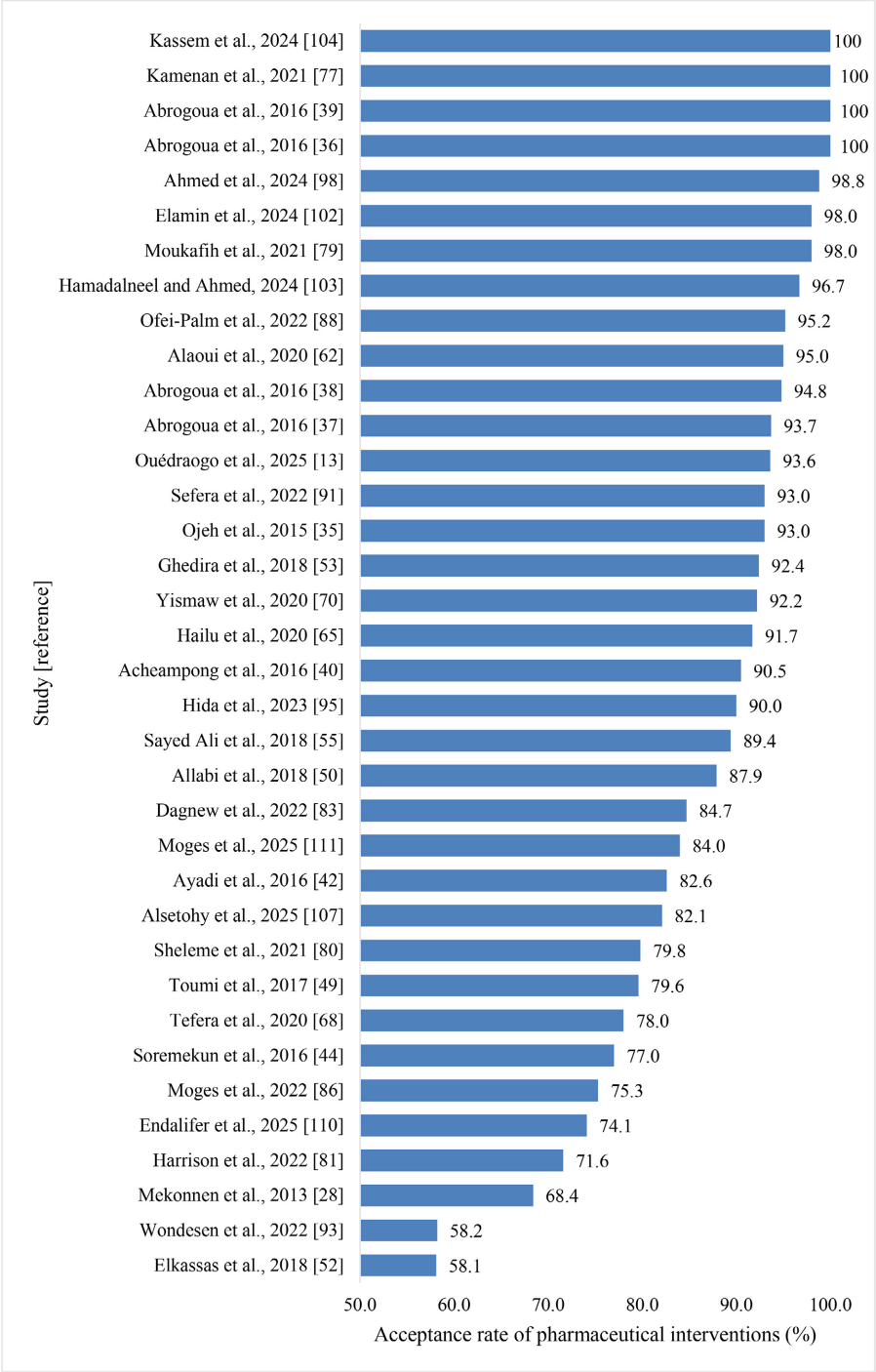


Figure 4. Acceptance rates for pharmaceutical interventions (%) across the 36 studies.

The median acceptance rate of 91.1% is close to the figures reported in surgery (70% to 98%) [115] and in paediatrics (approximately 95%) [116]. Oral and direct communication to the prescriber, which was common in the included studies, is associated with higher rates than written communication [117]. This rate remains a process indicator, often measured by the practitioner themselves. The lowest rates occur at the start of an initiative or during consultations, and increase following

training of prescribers [52] [93], which highlights the importance of the working relationship between pharmacists and doctors and the organisational barriers described in Ghana [41]. Assessments of the impact of pharmacy-led programmes remain varied; the CLEO tool [118], used in two of the recent studies [14] [110], also enables the documentation of economic and organisational impacts. Antimicrobial stewardship programmes led by pharmacists are feasible in resource-limited settings [57] [63]. Large-scale studies from South Africa report a reduction in antibiotic consumption [43] and, in the case of antibiotic prophylaxis, a reduction in surgical site infections [47]. Data from Ethiopia suggest that a discontinued programme loses its benefits [63].

The 15 randomised trials, all conducted in outpatient settings, mostly report improvements in glycated haemoglobin, blood pressure, adherence and, in some cases, quality of life. However, these results were not uniform: quality of life did not differ from the control group in patients with type 2 diabetes in Sudan [99], viral load was unchanged in HIV-positive patients with hypertension [75], blood pressure control at 12 months was not significantly better in patients with chronic kidney disease [89], and the education delivered through caregivers did not improve asthma control [72]. Positive results should therefore be read outcome by outcome. Among hospitalised patients, the impact of clinical pharmacists on mortality, length of stay or readmissions—documented elsewhere [119] [120]—remains understudied in Africa. Comparative studies in hospital settings, incorporating clinical and economic indicators, are needed; a systematic review with a meta-analysis of trials conducted in outpatient settings could also quantify their impact.

5. Strengths and Limitations

Our review has a number of strengths, including the application of the JBI framework and PRISMA-ScR, a search strategy combining controlled descriptors and the names of the 54 African countries, and the verification of data against the full text. Its main limitations are the absence of an assessment of study quality, although this is not required by the scoping review methodology; consequently, the reported results should be interpreted with caution. Furthermore, Google Scholar was examined only for the first 300 results per query, and AJOL was searched exclusively via Google Scholar. In addition, only studies published in French or English were included, and 19 full texts could not be obtained. Studies published in other languages, such as Portuguese or Arabic, or in journals not indexed in the databases searched, may therefore have been missed. These limits reduce the geographic coverage of the review and may partly explain why no study from Central Africa was included.

6. Conclusion

Clinical pharmacy in African hospitals is developing. Its practice remains dominated by pharmaceutical analysis, involving the formulation of pharmaceutical

interventions for prescribers, which is well accepted by medical teams. Therapeutic education and pharmaceutical care, the appropriate use of antimicrobials, medication reconciliation and the training of healthcare staff are also reported as part of the pharmacist's role in the hospital. Clinical outcomes are mainly documented in consultations for chronic conditions, with mostly favourable but not uniform results; comparative studies are needed among hospitalised patients.

Author Contributions

Geoffroy Wendoumba Dibri: Study design, development of the methodology, data analysis, interpretation of results, drafting of the first version of the manuscript and coordination of the revision. **Souleymane Fofana**: Contribution to study design, general supervision, scientific validation and approval of the final version of the manuscript. **Ada Yamine Kagone**: Contribution to study design, validation of the methodology, interpretation of results, critical review and revision of the manuscript. **Adama Guembre**: Contributed to the study design, validated the methodology, interpreted the results, and undertook critical review and revision of the manuscript. **Ezéchiel P. B. Noali**: Contributed to the study design, validated the methodology, interpreted the results, and undertook critical review and revision of the manuscript. **La Ibrahim Ouattara**: Contributed to the critical review and revision of the manuscript. **Moussa Ouedraogo**: General supervision, scientific validation and approval of the final version of the manuscript. **Estelle N. H. Youl**: General supervision, scientific validation and approval of the final version of the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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