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Feasibility and Determinants of Medication Reconciliation at Hospital Admission in a Resource-Limited Setting: Evidence from Burkina Faso

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Abstract

Background: Medication errors during transitions of care are a major patient safety concern, particularly in low- and middle-income countries where medication reconciliation remains poorly implemented. This study assessed the feasibility of pharmacist-led medication reconciliation at hospital admission in Burkina Faso and characterized medication discrepancies and associated factors. **Methods:** A six-week prospective implementation study was conducted from May to June 2018 among 52 consecutively admitted patients in the medical department of Tengandogo University Teaching Hospital. A trained clinical pharmacist performed medication reconciliation after admission, prescribing, following the WHO High 5s standards. Feasibility was assessed through completion, timeliness, and workload. Discrepancies and associated factors were analyzed using appropriate bivariate tests and an exploratory multivariable logistic regression limited to two prespecified predictors because of the small number of outcome events. **Results:** Complete medication reconciliation was achieved in 46/52 patients (88.5%). Mean active pharmacist time was 4.0 hours

± 1.8 hours per patient, while reconciliation was completed within 24 hours in 31/46 patients (67.4%). Overall, 109 discrepancies were identified in 35 patients (76.1%), corresponding to a mean of 2.4 discrepancies per patient. Twenty-three discrepancies (21.1%) were unintentional medication errors, affecting 14 patients (30.4%); omissions accounted for 69.6% of errors. Patients aged ≥ 65 years showed a non-significant trend toward more discrepancies (90.0% vs. 65.4%; p = 0.08). Polypharmacy (≥5 medications) showed the strongest bivariate association with medication errors: all patients with errors had polypharmacy (p = 0.08). Because of perfect separation, polypharmacy was not included in the multivariable model. Neither age nor chronic disease was significantly associated with medication errors after adjustment. Corrective action was documented in 7/14 affected patients (50.0%). Only 1/49 healthcare staff members (2.0%) reported familiarity with medication reconciliation. **Conclusion:** Pharmacist-led medication reconciliation appears feasible in a resource-constrained African hospital and identifies a substantial burden of medication discrepancies. Polypharmacy may be a useful criterion for targeted screening, although larger studies are needed to confirm this association. Scaling up medication reconciliation should include staff training and integration of pharmacists into hospital care. Findings should be interpreted cautiously because error severity and clinical outcomes were not assessed.

Keywords

Clinical Pharmacy, Medication Errors, Medication Reconciliation, Patient Safety, Sub-Saharan Africa, Implementation Study

1. Introduction

Patient safety represents a fundamental challenge in healthcare systems worldwide. The World Health Organization has identified medication-related harm as a priority, launching the "Medication Without Harm" Global Patient Safety Challenge to reduce severe preventable harm by 50% globally [1] [2]. Care transitions, particularly during hospital admissions, constitute critical vulnerability points where medication error risk escalates due to breakdowns in information transmission [3] [4]. Medication history errors at hospital admission are frequent, with systematic reviews reporting error rates of 10% - 67% depending on detection methods, and up to 60% of these errors have potential clinical significance [5] [6].

Medication reconciliation (MR), advocated by WHO through its "High 5s" initiative, represents a formalized multiprofessional process aimed at establishing comprehensive medication lists to compare with prescriptions and resolve discrepancies [7]. The process has demonstrated effectiveness in reducing unintentional discrepancies at hospital admission, with studies showing that up to 46% of patients have at least one unintentional discrepancy without reconciliation [8]. Systematic reviews and meta-analyses confirm that pharmacist-led reconciliation

significantly reduces medication errors and improves clinical outcomes at hospital transitions [3] [9] [10]. Studies from high-income countries consistently demonstrate this approach's effectiveness in reducing errors, preventing adverse drug events, and enhancing care continuity [11] [12].

However, the burden of medication errors and prevention strategies in low- and middle-income countries (LMICs), particularly sub-Saharan Africa, remains largely undocumented. Recent systematic reviews reveal a medication error prevalence of 48.0% among hospitalized LMIC patients, with 30.7% being clinically significant [13]. Evidence from Jordan and other middle-income settings demonstrates that medication discrepancies at hospital admission are common in low-resource settings, with prevalence rates of 45% - 65% and polypharmacy identified as a significant predictor [14] [15]. These findings suggest that pharmacist-led reconciliation can significantly reduce discrepancies even in resource-constrained environments.

Structural challenges in LMICs, including limited computerization, absence of unified patient records, and healthcare system fragmentation between community and hospital settings, may limit intervention feasibility and impact [16]. In Burkina Faso, data are scarce, but isolated studies suggest that prescription errors related to insufficient communication are frequent and preventable [17] [18]. The healthcare system faces additional sub-Saharan African challenges: limited pharmaceutical human resources, inadequate health information infrastructure, and significant gaps in essential medicine access [19]. Appropriate prescribing in elderly people, particularly those with polypharmacy, remains a significant challenge that medication reconciliation can help address [20].

No previous study has examined medication reconciliation implementation in Burkina Faso hospitals. This prospective implementation study introduced reconciliation at Tengandogo University Teaching Hospital with the following prespecified objectives: 1) evaluate the feasibility of implementation in a resource-limited setting, using explicit criteria for completion, timeliness, and workload; 2) document the prevalence and nature of medication discrepancies; and 3) explore factors associated with medication errors through bivariate analysis and, given the limited number of outcome events, a parsimonious exploratory multivariable model rather than a fully adjusted multi-predictor model. Understanding these dynamics is essential, as the global community increasingly acknowledges that sustainable medication access must be supported by equity and appropriate use principles, particularly where medication safety infrastructure remains underdeveloped [21].

2. Materials and Methods

2.1. Study Setting and Design

A prospective implementation study with analytical components was conducted from May 21 to June 30, 2018, at Tengandogo University Teaching Hospital's medical department in Ouagadougou, Burkina Faso. The department includes cardi-

ology, neurology, gastroenterology, and internal medicine specialties, selected due to the high prevalence of older adults and multimorbid patients at elevated medication error risk [8]. The study design focused on implementing medication reconciliation as a quality improvement intervention while prospectively collecting data on feasibility, discrepancy patterns, and associated factors.

2.2. Feasibility Outcome Definitions

Feasibility was operationalized a priori across three dimensions, consistent with implementation-science conventions.

1) Completion was defined as the proportion of admitted patients for whom all four reconciliation stages (below) were fully completed among those not meeting exclusion criteria. 2) Timeliness was assessed using two distinct, non-interchangeable metrics: a) elapsed time, the calendar time from hospital admission to reconciliation completion, which could span interruptions (e.g., nights, weekends, patient unavailability); and b) active pharmacist time, the cumulative hands-on duration the pharmacist spent on interviews, record review, cross-checking sources, and prescriber discussion for a given patient (*i.e.*, workload), which is not equivalent to elapsed time.

3) Workload was defined as active pharmacist time per patient and the number of patients a single pharmacist could reconcile within the study period, which was used to inform staffing estimates for scale-up.

2.3. Reconciliation Staffing, Training, and Supervision

Medication reconciliation was performed by a single clinical pharmacist trained in hospital pharmacy practice. Before study initiation, the pharmacist completed a structured orientation to the WHO High 5s Standard Operating Protocol, including a review of the protocol documentation and supervised pilot practice on a small number of cases that were not included in the analytic sample. Pharmacy trainees (students) assisted with information-gathering tasks (patient interviews, record review) under the direct supervision of the lead pharmacist. The students were in their fourth year of a pharmacy degree program. There were three of them.

The senior pharmacist is responsible for overseeing the student's practical training. He or she imparts the necessary skills, supervises the student's actions to ensure patient safety, and integrates the student into a culture of collaboration, which is essential to the success of medication reconciliation. However, synthesis of the Best Possible Medication History, discrepancy classification, and all final determinations were performed or verified by the lead pharmacist alone, consistent with the pharmacist-validation principle emphasized in the HAS Med'Rec framework [22].

2.4. Population and Recruitment

All patients admitted during the study period were consecutively enrolled without

exclusion criteria based on age, diagnosis, or admission modality to assess feasibility across diverse populations. Informed oral consent was obtained from patients or accompanying persons after explaining the study objectives. Patients were excluded from analysis only if they died within 24 hours of admission (n = 2) or were discharged before reconciliation completion (n = 4).

2.5. Medication Reconciliation Process

Medication reconciliation was conducted after the admission prescription, adhering to WHO High 5s standardized protocols [7] and French High Authority for Health guidelines [22], systematically applying four key stages to each participant:

Stage 1: Active collection of medical histories. The usual medication regimen was defined as all medications the patient reported taking on a regular basis during the 4 weeks preceding admission, including any changes documented in the most recently available prescription. Usual medication lists, including prescribed medications, self-medication, and herbal remedies, were established by cross-referencing at least three sources: patient and accompanying person interviews, physical and computerized medical record consultation, and daily treatment sheet analyses. When information from different sources conflicted, a predefined hierarchy was applied: 1) direct physical inspection of medication packaging brought by the patient, considered most reliable; 2) the most temporally recent prescription or discharge summary from a healthcare provider; 3) patient/caregiver report, cross-checked against at least one additional source where possible. Unresolved conflicts were documented, with the source of each retained item noted and flagged for discussion during the prescriber interview (Stage 4). This approach aligns with best practices for obtaining the Best Possible Medication History [23] [24].

Stage 2: Best Possible Medication History establishment. Collected information was synthesized into exhaustive, validated usual treatment lists serving as references for comparison. Self-medication and herbal remedies were recorded in the BPMH for clinical safety purposes; however, only prescribed medications were included in the discrepancy count, because verifying an authoritative intended dose or indication for non-prescribed products was not feasible with the available sources. This scope restriction is stated explicitly to aid interpretation and comparison with other studies.

Stage 3: Comparison and discrepancy identification. The Best Possible Medication History was compared line-by-line with Admission Medical Orders. Undocumented differences were noted as discrepancies [5] [8].

Stage 4: Analysis and resolution of discrepancies. Each discrepancy was collaboratively classified with prescribing physicians as either an Intentional Discrepancy (deliberate undocumented treatment modification) or an Unintentional Discrepancy (omission, incorrect dosage, or unjustified medication representing medication errors) [5] [6] [8].

2.6. Staff Knowledge Survey

A supplementary cross-sectional survey assessed baseline familiarity with medication reconciliation among medical, nursing, and pharmacy staff of the department. We conducted a comprehensive survey of 49 staff members. The survey used a single closed-ended item ("Have you previously heard of medication reconciliation as a formal clinical practice? Yes/No"), administered by paper questionnaire to staff present in the department during the study period.

2.7. Variables and Data Analysis

Data were collected using standardized forms and analyzed using Epi Info version 7 software. Primary variables included patient characteristics, reconciled patient numbers and proportions, reconciliation completion time, discrepancy numbers and types per patient, frequency of information sources, and reconciliation performance indicators.

Continuous variables are expressed as mean ± standard deviation or median with interquartile range, contingent upon normality assessment via the Shapiro-Wilk test. Categorical variables are presented as frequencies with percentages, consistently reporting sample size before percentage as n (%). Bivariate analyses employed the Chi-square test (used only when all expected cell counts were ≥5) or Fisher's exact test (used when any expected cell count was <5) for categorical variables, and Student's t-test or Mann-Whitney U test for continuous variables, depending on normality.

With only 14 medication-error events, standard guidance (≥10 events per variable, EPV) supports at most 1 - 2 candidate predictors in a multivariable model. We adopted a more parsimonious, prespecified approach: age (≥65 years) and presence of chronic disease. Those two covariates identified a priori as clinically relevant were entered into a single exploratory multivariable logistic regression model (14 events/2 predictors ≈ 7.0 EPV), still below the conventional 10-EPV threshold and therefore explicitly labeled exploratory/hypothesis-generating rather than confirmatory. Polypharmacy (≥5 medications) could not be included in this model because it produced complete separation (all 14 error cases had polypharmacy; zero non-polypharmacy patients had errors), precluding standard maximum-likelihood estimation of an adjusted odds ratio. The association between polypharmacy and medication errors is therefore reported only as a bivariate Fisher's exact result, not as an adjusted multivariable/independent-predictor estimate. Crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) are reported for the two-predictor exploratory model only. p-values < 0.05 were deemed statistically significant with two-tailed tests.

2.8. Ethical Considerations

This study was approved by the Directorate of Tengandogo University Teaching Hospital. Strict adherence to medical confidentiality and patient anonymity was maintained throughout the study.

3. Results

3.1. Study Population Characteristics

Of 52 patients admitted, 46 (88.5%) underwent complete medication reconciliation. Six patients were excluded: two due to early mortality within 24 hours (3.8%) and four due to premature discharge before reconciliation completion (7.7%). The mean age was 51.8 years ± 16.3 years, with a male-to-female ratio of 1.16. Thirty patients (65.2%) were from Ouagadougou, and 43 (93.5%) were admitted emergently. The mean number of medications on Admission Medical Order was 7.0 ± 2.8, with 38 patients (82.6%) experiencing polypharmacy (≥5 medications). This high polypharmacy rate is consistent with findings from other settings, where polypharmacy is a known risk factor for medication discrepancies. Chronic diseases were present in 23 patients (50.0%), including hypertension (34.8%), diabetes mellitus (26.1%), HIV infection (10.9%), cancer (8.7%), chronic kidney disease (6.5%), heart failure (6.5%), and chronic respiratory disease (4.3%). Table 1 summarizes demographic and clinical characteristics.

Table 1. Characteristics of the reconciled population (n = 46).

Characteristic	Frequency n (%)
Age categories	
18 - 44 years	14 (30.4)
45 - 64 years	12 (26.1)
≥65 years	20 (43.5)
Male sex	25 (54.3)
Patients with chronic diseases	23 (50.0)
Ouagadougou residence	30 (65.2)
Emergency admission	43 (93.5)
Polypharmacy (≥5 medications)	38 (82.6)
Mean number of medications ± SD	7.0 ± 2.8

SD: Standard Deviation.

3.2. Feasibility and Process Implementation

Using the feasibility definitions above, two distinct timeliness metrics are reported. Elapsed time (calendar time from admission to reconciliation completion) was within 24 hours for 31 of 46 reconciled patients (67.4%); the remaining 15 patients (32.6%) had elapsed completion times exceeding 24 hours, up to a maximum of 72 hours, reflecting workflow interruptions (e.g., absence of weekend/night pharmacist coverage, temporary patient unavailability) rather than continuous active work. Separately, active pharmacist time (workload, *i.e.*, cumulative hands-on time actually spent by the pharmacist on interviews, record review, and cross-checking) averaged 4.0 hours ± 1.8 hours per patient (median 3.5 hours, range 0.5

- 8.0 hours). This workload metric is distinct from elapsed calendar time and reflects the real hands-on burden per patient, consistent with challenges of paper-based systems and limited information-sharing infrastructure. Analysis of Best Possible Medication History information sources revealed strong reliance on internal hospital documentation, with a mean of 3.2 sources ± 0.8 sources (range 2 - 5) consulted per patient, which is consistent with recommended best practices.

Patient or accompanying person interviews were universally utilized (46 cases, 100.0%), underscoring the fundamental importance of direct patient engagement despite variable quality based on cognitive status and medication knowledge. Hospital medical records (physical and electronic) were consulted in 44 cases (95.7%), representing the second most common source, though documentation was often incomplete or fragmented. Daily treatment sheets documenting current/recent hospitalization medications were examined in 43 reconciliations (93.5%).

Physical medication examination, direct inspection of containers brought from home, was feasible in 24 instances (52.2%), offering highly reliable verification when available, but was limited by many patients not bringing medications. Previous hospitalization discharge summaries were available in 21 instances (45.7%), though often outdated. Outpatient physician contact attempts succeeded in only 4 cases (8.7%), attributed to identification difficulties, lack of contact information, and unavailability. Community pharmacy records were completely absent (0 cases, 0.0%), representing a significant gap despite WHO endorsement and evidence that pharmacy records can be valuable sources for medication histories. Table 2 summarizes information source utilization.

Table 2. Information source frequency for the best possible medication history (n = 46).

Information Source	Frequency n (%)
Patient/accompanying person interview	46 (100)
Hospital medical records	44 (95.7)
Daily treatment sheets	43 (93.5)
Physical medication examination	24 (52.2)
Previous discharge summaries	21 (45.7)
Outpatient physician contact	4 (8.7)
Community pharmacy records	0 (0)

3.3. Staff Knowledge Survey Results

Among staff members surveyed (N = 49), only 1 (2.0%) reported prior familiarity with medication reconciliation as a defined clinical practice, while 48 (98.0%) reported no prior familiarity.

3.4. Prevalence and Nature of Medication Discrepancies

Among 46 reconciled patients, 35 (76.1%) exhibited at least one discrepancy be-

tween usual treatment and Admission Medical Orders, with 109 total discrepancies identified (mean 2.4 ± 2.3 per patient, 3.1 ± 2.1 among affected patients). This discrepancy rate is substantially higher than the 27% - 54% typically reported in high-income countries but is consistent with rates of 45% - 65% observed in other low-resource settings. Of these, 86 discrepancies (78.9%) were classified as Intentional Discrepancies, deliberate undocumented modifications averaging 1.9 ± 2.1 per patient and affecting 35 patients (76.1%). The remaining 23 discrepancies (21.1%) represented Unintentional Discrepancies (medication errors), averaging 0.5 ± 0.9 per patient and affecting 14 patients (30.4%). Table 3 summarizes discrepancy prevalence and characteristics.

Table 3. Medication discrepancy prevalence and characteristics.

Discrepancy Type	Total Number	Percentage (%)	Mean per Patient	Patients Affected, n (%)
Intentional Discrepancy	86	78.9	1.9 ± 2.1	35 (76.1)
Unintentional Discrepancy (Medication Error)	23	21.1	0.5 ± 0.9	14 (30.4)
Total	**109**	**100**	**2.4 ± 2.3**	**35 (76.1)**

Among 23 medication errors, omissions of routine medications constituted the predominant error type, accounting for 16 cases (69.6% of all errors) affecting 11 patients. This finding aligns with literature showing that omissions are the most common type of medication error at hospital admission, representing 42% - 59% of all unintentional discrepancies. These omissions were concentrated in critical chronic disease management areas: cardiovascular medications (6 errors, 26.1% of all errors), endocrine medications including oral hypoglycemics (4 errors, 17.4%), gastrointestinal medications including proton pump inhibitors (3 errors, 13.0%), and other therapeutic classes (3 errors, 13.0%).

Incorrect dosages represented the second error type, with 4 instances (17.4% of all errors) affecting 4 patients, equally divided between excessive doses (2 cases, 8.7%) that risk toxicity and insufficient doses (2 cases, 8.7%) that risk therapeutic failure. Dosing errors have been reported in 10% - 40% of medication discrepancies and can have significant clinical implications. Inappropriate medication continuation occurred in 2 instances (8.7% of all errors) affecting 2 patients; medications that should have been discontinued were inadvertently continued. Therapeutic duplication occurred in 1 instance (4.3% of all errors) affecting 1 patient. The concentration of omissions in cardiovascular and endocrine medications (10 of 16 omissions, 62.5%) underscores that errors predominantly impact chronic non-communicable disease management, consistent with patterns observed in elderly patients with polypharmacy.

3.5. Factors Associated with Medication Discrepancies and Errors

Bivariate analyses comparing patients with versus without discrepancies showed

that elderly patients (≥65 years) had a non-significant trend toward higher discrepancy rates: 18 of 20 elderly patients (90.0%) versus 17 of 26 younger patients (65.4%; Fisher's exact test, p = 0.08). The mean medication number was significantly greater among patients with discrepancies (7.5 ± 2.6) versus those without (5.3 ± 2.9, Student's t = 2.38, p = 0.02). Polypharmacy showed a non-significant trend (88.6% vs. 63.6%; Fisher's exact test, p = 0.08). Table 4 presents factors associated with discrepancies.

Table 4. Factors associated with medication discrepancies. bivariate analysis (n = 46).

Characteristic	Discrepancies		Test Statistic	p-Value
	Yes (n = 35)	No (n = 11)		
Age ≥ 65 years, n (%)	18 (51.4)	2 (18.2)	Fisher's exact	0.08
Male sex, n (%)	20 (57.1)	5 (45.5)	$\chi^2 = 0.46$	0.50
Chronic diseases, n (%)	19 (54.3)	4 (36.4)	$\chi^2 = 1.08$	0.30
Polypharmacy, n (%)	31 (88.6)	7 (63.6)	Fisher's exact	0.08
Emergency admission, n (%)	33 (94.3)	10 (90.9)	Fisher's exact	1.00
Mean medications ± SD	7.5 ± 2.6	5.3 ± 2.9	t = 2.38	0.02*

*Statistically significant ($p < 0.05$); χ^2 = Pearson Chi-square (used only where all expected cell counts ≥ 5); t = Student's t-test (pooled variance); SD = Standard Deviation. Fisher's exact test was used because at least one expected cell count was <5.

For medication errors specifically, polypharmacy showed a perfect (complete-separation) association: all 14 patients with errors (100%) had ≥5 medications versus 24 of 32 without errors (75.0%); Fisher's exact test, p = 0.08. Because of complete separation, this association is reported here as a bivariate finding only and is not carried forward as an adjusted/independent predictor. Patients with chronic diseases exhibited higher error rates: 10 of 14 with errors (71.4%) versus 13 of 32 without errors (40.6%, $\chi^2 = 3.70$, p = 0.054). Mean medication number was significantly greater among those with errors (8.6 ± 2.3) versus those without errors (6.3 ± 2.7), p = 0.008. Advanced age showed a trend: 9 of 14 with errors (64.3%) versus 11 of 32 without errors (34.4%), p = 0.06. Emergency admission (Fisher's exact, p = 0.54) and sex were not significantly associated. Table 5 presents detailed factors associated with medication errors.

3.6. Exploratory Multivariable Analysis

In the multivariate analysis, we included two predictors: age ≥ 65 years and the presence of a chronic disease. In this exploratory model with two predictors (14 events/2 predictors ≈ 7.0 EPV, which remains below the conventional threshold of 10 EPV), neither age (adjusted OR 2.8, 95% CI: 0.68 - 11.5, p = 0.15) nor chronic disease (adjusted OR: 3.2, 95% CI: 0.74 - 13.8, p = 0.12) reached the threshold for statistical significance after mutual adjustment, although both had clinically significant point estimates. Table 6 summarizes the exploratory multivariable model.

Table 5. Factors associated with medication errors—Bivariate analysis (n = 46).

Characteristic	Errors		Test Statistic	p-Value
	Yes (n = 14)	No (n = 32)		
Age ≥ 65 years, n (%)	9 (64.3)	11 (34.4)	$\chi^2 = 3.55$	0.06
Male sex, n (%)	9 (64.3)	16 (50.0)	$\chi^2 = 0.80$	0.37
Chronic diseases, n (%)	10 (71.4)	13 (40.6)	$\chi^2 = 3.70$	0.054
Polypharmacy, n (%)	14 (100)	24 (75.0)	Fisher's exact	0.08
Emergency admission, n (%)	14 (100)	29 (90.6)	Fisher's exact	0.54
Mean medications ± SD	8.6 ± 2.3	6.3 ± 2.7	t = 2.77	0.008**

*Significant ($p < 0.05$); **Highly significant ($p < 0.01$); χ^2 = Pearson Chi-square; t = Student's t-test. Fisher's exact test was used because at least one expected cell count was <5.

Table 6. Exploratory multivariable logistic regression.

Variable	Crude OR	95% CI	p (Bivariate)	Adjusted OR*	95% CI	p (Multivariate)
Age ≥ 65 years	3.4	0.93 - 12.6	0.06	2.8	0.68 - 11.5	0.15
Chronic diseases	3.7	0.96 - 14.2	0.054	3.2	0.74 - 13.8	0.12

OR: Odds Ratio; CI: Confidence Interval. *Adjusted for the other covariate in this two-predictor exploratory model only.

3.7. Intervention Outcomes

With regard to patients, corrective measures were implemented for at least one identified error in 7 of the 14 patients with errors (50.0%); for the remaining 7 patients (50.0%), no errors had been corrected by the time of discharge from the hospital.

However, for prescribers, the 23 errors that were acknowledged and corrected by the prescriber, as opposed to those that were not, as well as the specific reasons why the errors were not corrected (e.g., no response from the prescriber, clinical contraindication to reintroducing the medication, patient discharge before the problem was resolved), were not systematically coded during data collection. At the patient level, corrective action was implemented for at least one identified error in 7 of the 14 patients with errors (50.0%); the remaining 7 patients (50.0%) had no error corrected by the time of hospital discharge.

Because error severity (e.g., using a validated scale such as the NCC MERP index) and downstream clinical outcomes (adverse drug events, length of stay, readmission) were not assessed in this study, findings regarding intervention impact are limited to error identification and partial resolution at the patient level, rather than to a demonstrated reduction in clinical harm.

4. Discussion

This prospective implementation study constitutes the inaugural evaluation of pharmacist-led medication reconciliation upon hospital admission in Burkina Faso. The findings revealed significant insights into the feasibility of practice deployment in resource-constrained African settings, the critical magnitude of previously undetected medication discrepancies, and polypharmacy as the strongest bivariate correlate of medication errors, alongside an exploratory multivariable analysis of age and chronic disease.

4.1. High Discrepancy Prevalence Revealing Systemic Vulnerabilities

The principal finding was that 35 of 46 patients (76.1%) exhibited at least one undocumented discrepancy between usual treatment and admission orders, averaging 2.4 ± 2.3 discrepancies per patient. This rate significantly surpasses the 27% - 54% typically reported in high-income countries [3] [8] [9] [11] but aligns with rates of 45% - 65% observed in other low-resource settings [14] [15]. This disparity is likely attributable to structural challenges, including the absence of computerized prescribing, lack of shared information systems, and absence of formalized community medicine or pharmacy links, creating fertile ground for information breakdown [16]. These results align with systematic reviews highlighting particularly high medication error prevalence in low- and middle-income countries [13].

Notably, 14 of 46 patients (30.4%) encountered at least one medication error, averaging 0.5 ± 0.9 unintentional discrepancies per patient. While this rate is within the range reported in other studies (10% - 67% depending on detection methods) [5] [6] [8], it remains concerning as nearly one in three admitted patients received prescriptions containing omissions, incorrect dosages, or unjustified medications. Omission predominance in 16 of 23 errors (69.6%) is consistent with literature showing omissions as the most common error type at hospital admission [5] [6] [8]. This finding corroborates previous Burkina Faso studies identifying poor prescriber-patient communication as an inappropriate prescription risk factor [17] [18].

4.2. Statistical Power and Sample Size Considerations

The small sample size (46 patients, 14 medication-error events) substantially constrained the statistical power of this study and required revising the original analytic plan (see Methods). With only 14 events, the study had limited power (approximately 30% - 40% by post-hoc estimation) to detect moderate effect sizes (OR 2.5 - 3.5) as statistically significant at the conventional $\alpha = 0.05$ threshold in a multi-predictor model. This under-powering likely explains why age (adjusted OR 2.8) and chronic disease (adjusted OR 3.2) did not reach significance in the exploratory two-predictor model despite clinically meaningful point estimates, and why several bivariate comparisons that showed sizeable effect estimates (e.g., age and polypharmacy in Table IV, both re-analyzed with Fisher's exact test at p

= 0.08) did not cross the $p < 0.05$ threshold once the appropriate exact test was applied. To achieve 80% power to detect odds ratios in the 2.8 - 3.5 range in a two- or three-predictor model, approximately 150 - 200 patients with a proportionally larger number of error events would be required. The wide 95% confidence intervals observed throughout (e.g., 0.68 - 11.5 for age; 0.74 - 13.8 for chronic disease) reflect this statistical uncertainty and should temper causal interpretation of any single estimate. Nevertheless, the complete separation observed for polypharmacy, wherein all 14 patients with errors had ≥5 medications and no patients with <5 medications had errors, constitutes strong, if statistically unconventional, evidence of this variable's practical importance as a risk-stratification criterion, independent of the formal significance threshold.

4.3. Polypharmacy as the Strongest Bivariate Correlate of Medication Errors

Polypharmacy showed the strongest and most consistent association with medication errors of any variable examined, though, consistent with reviewer guidance, we no longer describe it as an "independent predictor," since complete separation precluded a standard adjusted multivariable estimate. The bivariate association was a perfect separation (Fisher's exact, $p = 0.08$): all 14 patients with errors had ≥5 medications, while none of the 8 patients with <5 medications had an error. This finding is directionally consistent with international literature identifying polypharmacy as a major risk factor for medication discrepancies and errors [14] [20], although, as noted above, the point estimate here could not be formally adjusted for other covariates with the available data and statistical method.

Clinical implications remain noteworthy despite these statistical caveats. In resource-constrained environments where universal medication reconciliation is unfeasible due to limited pharmacist availability, focusing on patients with ≥5 medications would, in this sample, have identified all 14 error-risk patients while excluding 8 of 46 (17.4%) low-risk patients from reconciliation workload, an efficiency gain that warrants prospective confirmation rather than being treated as an established, adjusted effect. This approach offers efficient risk stratification, balancing patient safety priorities with resource limitations. In our sample, this strategy would reduce reconciliation workload by 17% (from 46 to 38 patients) while maintaining complete sensitivity for error detection in this dataset; external validation in larger, independently sampled cohorts is needed before this threshold is adopted as a screening rule.

Although advanced age and chronic diseases did not achieve statistical significance in the exploratory multivariable analysis, they exhibited clinically meaningful effect sizes with adjusted odds ratios of 2.8 and 3.2, respectively. Lack of statistical significance likely reflects limited statistical power from a small sample size rather than a true absence of association. These findings align with international literature identifying older adults and individuals with multimorbidity as high-risk groups for medication-related problems [20], attributed to age-related phar-

macokinetic changes, the necessity of complex medication regimens due to multiple comorbidities, and increased susceptibility to adverse drug events.

4.4. Feasibility and Operational Challenges in Resource-Limited Settings

Our study demonstrates that structured reconciliation is achievable despite significant constraints. Reconciliation was completed for 46 of 52 patients (88.5%), with elapsed time from admission to completion within 24 hours achieved for 31 of 46 reconciled patients (67.4%). These figures are encouraging and comparable to initial deployments in other contexts [22] [25]. Separately, active pharmacist time (workload) averaged 4.0 hours ± 1.8 hours per patient. This is a hands-on-time metric and is not directly comparable to the 15 - 51 minutes of elapsed/staff time reported in some computerized environments [24] [25], since published comparators often do not specify whether they measure elapsed calendar time or active staff time; readers should therefore treat cross-study time comparisons with caution (see Methods for our operational definitions). This substantial time investment reflects real-world challenges in paper-based systems: labor-intensive searching through partially completed records, temporary patient or physician unavailability, and the absence of prior systematic pharmaceutical validation.

Inability to contact community pharmacies in all 46 cases (0.0%), despite WHO identification as a priority source [7] and evidence of their value in medication history collection [24], constituted a major limitation in achieving a complete Best Possible Medication History. This gap is particularly problematic in sub-Saharan Africa, where the formal health information infrastructure remains underdeveloped [16]. Near-universal absence of medication reconciliation knowledge among 48 of 49 personnel (98.0%) represents a substantial cultural and organizational impediment, underscoring institutional advocacy and the necessity of targeted training as prerequisites [22].

4.5. Implications for Practice and Patient Safety

Error identification occurred in all 14 affected patients, with corrective action implemented for at least one error in 7 of 14 (50.0%); our study is broadly consistent with existing evidence on medication reconciliation effectiveness in enhancing patient safety upon admission [3] [9]-[12]. However, because error severity and downstream clinical outcomes were not measured here (see Limitations), we stop short of claiming a demonstrated reduction in clinical harm; systematic reviews and meta-analyses in other settings do report that pharmacist-led reconciliation reduces medication errors and improves clinical outcomes at hospital transitions [3] [9] [10], and confirmatory outcome-focused research in this setting is an important next step.

Given the statistical caveats above, we present risk-stratification as a hypothesis to test rather than an established finding: A practical three-tier approach could be piloted and evaluated in future work: Tier 1 prioritizes patients aged ≥ 65 years

with chronic diseases prescribed ≥ 5 medications; Tier 2 prioritizes all other patients prescribed ≥ 5 medications; Tier 3 assigns standard priority to patients prescribed < 5 medications. This strategy aims to maximize patient safety impact while optimizing limited pharmacist resource utilization, pending confirmation in adequately powered, ideally multicenter, studies.

Medication reconciliation integration into routine practice necessitates coordinated multi-level actions. Healthcare facilities should formally incorporate reconciliation into medical projects and quality plans [22], allocating dedicated human resources. Efficient models could involve coordinating pharmacists supervising pharmacy technicians or trained students for initial medication history collection [23] [24]. Information system enhancement is essential for sustainable hospital reconciliation, with priorities including effective computerized prescribing implementation and electronic patient record completion [25].

5. Study Limitations

This study had several limitations requiring consideration. First, the single-center design and limited sample size constrain the generalizability of the findings and reduce statistical power. With only 14 medication error events, the study lacked the capacity to identify moderate effect sizes as statistically significant.

Second, complete separation in the polypharmacy variable, while providing strong clinical evidence of a threshold effect, prevented standard maximum-likelihood estimation of an adjusted odds ratio. We therefore report this association as bivariate only and no longer describe polypharmacy as an "independent predictor" in this manuscript. Future analyses of the original patient-level dataset should apply Firth's penalized (bias-reduced) logistic regression or exact logistic regression, both of which are designed to handle complete or quasi-complete separation and can yield a finite, appropriately adjusted effect estimate with a confidence interval.

Third, we did not assess the clinical severity of identified medication errors using a validated classification system such as the NCC MERP (National Coordinating Council for Medication Error Reporting and Prevention) index. While we identified 23 unintentional discrepancies affecting 14 patients, their potential clinical severity, ranging from minimal to severe, remains unknown, which limits our ability to prioritize error types by urgency or to estimate the true patient safety impact of reconciliation in this setting.

Fourth, this study did not measure downstream clinical outcomes such as adverse drug events, hospital length of stay, readmission rates, or mortality. We therefore cannot quantify the clinical benefit of reconciliation beyond error identification and partial correction; conclusions are accordingly limited.

Fifth, intervention outcomes were captured only at the patient level (7 of 14 patients with ≥1 error corrected); error-level correction outcomes for all 23 errors, and the specific reasons individual errors were or were not corrected, were not systematically recorded during data collection.

This study also precluded measuring "proactive" reconciliation error prevention impact, since only errors that reached the admission prescription were captured; errors averted before reaching the prescription would not have been observed.

Sixth, the single-operator design (one trained pharmacist performing all reconciliations, assisted by supervised trainees for information-gathering only) ensured internal consistency but limits assessment of inter-rater reliability and may not reflect time requirements when reconciliation is performed by multiple staff in routine practice.

Finally, the reported active-pharmacist-time metric (4.0 hours ± 1.8 hours per patient), while distinguished in this revision from elapsed calendar time, may still not be directly comparable across studies that do not report which time concept they used; readers should interpret cross-study time comparisons with this caveat in mind. Despite these limitations, this study provides the first implementation evidence for medication reconciliation in Burkina Faso and identifies polypharmacy as a practical, low-cost bivariate criterion for risk stratification that merits confirmation with bias-reduced regression methods and outcome data in future, adequately powered studies.

6. Conclusion

Pharmacist-led medication reconciliation at hospital admission is feasible in resource-limited African hospital settings and can identify a substantial burden of medication discrepancies and errors. Polypharmacy appears to be a simple and potentially useful criterion for identifying patients at higher risk, although this association needs to be confirmed in larger studies. Despite a considerable workload, the intervention enabled partial correction of identified medication errors. The low level of staff knowledge highlights the need for training and better integration of pharmacists into healthcare teams. Future multicenter studies should assess error severity, correction rates, and the impact of medication reconciliation on adverse drug events and other clinical outcomes.

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Author Contributions

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Ethical Approval Statement

This study was approved by the Directorate of the Tengandogo University Teaching Hospital (CHU-T), Ouagadougou, Burkina Faso. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and complied with local institutional guidelines for clinical research. The principles of respect for persons, beneficence, and justice were upheld throughout the study.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Due to patient confidentiality considerations and local institutional regulations, the raw data are not publicly available. Aggregated data supporting the findings of this study are included in the manuscript.

Patient Consent Statement

Informed oral consent was obtained from all participants or their legally authorized representatives prior to inclusion in the study. Participants were adequately informed about the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without affecting their medical care. The use of oral consent was deemed appropriate given the observational nature of the study and was approved by the hospital administration. All patient data were anonymized to ensure confidentiality.

Conflicts of Interest

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

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