

Medication Errors Among Health Professionals in a Nigerian Tertiary Paediatric Department: Stages, Types, and Associated Occupational Factors

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ABSTRACT

Background: Children remain disproportionately vulnerable to medication errors because of weight-based dosing, limited ability to communicate adverse effects, and the frequent use of formulations designed primarily for adults. Data describing where in the medication-use process these errors originate, and which occupational factors are associated with them, remain scarce in Nigerian tertiary hospitals.

Objective: To evaluate the stages of the medication-use process and the types of medication error reported by physicians, nurses and pharmacists in a paediatric department, and to examine associations with occupational characteristics.

Methods: A descriptive cross-sectional survey was conducted in 2020 among 89 health professionals (physicians, nurses and pharmacists) in the paediatric department of a Federal Medical Centre in South-South Nigeria, using a structured, self-administered questionnaire. Descriptive statistics summarised frequencies and percentages, and the Pearson chi-square test assessed associations between professional cadre and error stage or type, with $p < 0.05$ taken as significant.

Results: Because the survey captured respondent-reported, ever-observed exposure rather than errors per prescription or medication opportunity, the percentages below describe how many professionals reported ever encountering each error, not incidence rates, and should be interpreted accordingly. Transcribing (92.2%) and drug administration (92.1%) were the stages most frequently reported as sites of medication error, followed by dispensing (82.0%); the association between professional cadre and error stage was statistically significant for transcribing, dispensing and administration ($p < 0.05$). Wrong dose was reported by all respondents (100.0%), and dose error was the single most common predominant error type (40.5%), driven mainly by overdose (51.7%). Route errors (23.6%), dominated by inappropriate route (49.5%), and frequency errors (17.9%) followed. Nurses and physicians accounted for the bulk of reported dose and route errors, with pharmacists more concentrated in dispensing-related error.

Conclusion: Medication error in this paediatric department clusters at the transcribing and administration stages and is dominated by dosing error, implicating both systemic (paper-based, multi-step transcription) and human factors (workload, cadre-specific task exposure). These cross-sectional findings suggest that targeting these two stages, rather than relying on uniform hospital-wide measures, may be a reasonable priority for

intervention; prospective studies with direct observation are needed to confirm actual impact on error reduction.

Keywords: medication error; paediatric patients; health professionals; patient safety; Nigeria; nurses; physicians; pharmacists

INTRODUCTION

Medication use in children carries a narrower margin for error than in adults. Because most drugs are formulated and dosed for adult physiology, paediatric prescribing and administration typically require a weight-based calculation step that adult care does not, and a single miscalculation or omitted step can translate into a dose several times higher than intended; a recent systematic review and meta-analysis found paediatric inpatient medication error rates that remain substantial across settings worldwide, with dosing errors consistently the largest single category (Gates et al., 2019). This concern sits within a wider global patient-safety agenda: in 2017 the World Health Organization launched its Third Global Patient Safety Challenge, Medication Without Harm, aiming to reduce severe avoidable medication-related harm by half within five years, in explicit recognition that unsafe medication practices remain a leading, preventable cause of injury in health systems worldwide (World Health Organization, 2017; Donaldson et al., 2017). Children are also less able to report early signs of an adverse reaction, which removes one of the safety checks that adult patients provide for themselves. A parallel systematic review focused on paediatric and neonatal intensive care settings similarly found that preventable adverse drug events remain common despite decades of patient-safety attention (Alghamdi et al., 2019). It is against this backdrop that medication error in paediatric care has attracted sustained research attention in high-income settings, while remaining comparatively under-documented in sub-Saharan African tertiary hospitals, where medication systems are still largely paper-based and pharmacy staffing is often stretched thin.

The medication-use process is conventionally described as a chain of discrete stages — prescribing, transcribing, dispensing, preparing, administering and monitoring — each performed by a different cadre of health professional and each carrying its own characteristic error profile (Motta Robayo et al., 2026). A prescribing error made by a physician can be intercepted at the transcribing or dispensing stage; equally, a correctly prescribed medication can still reach a child incorrectly if it is transcribed, dispensed or administered in error. Understanding which stage is most error-prone, and which cadre is most exposed at that stage, is therefore a precondition for designing an intervention that targets the actual point of failure rather than the department as a whole.

Prior hospital-based studies from Ethiopia have identified administration as a particularly error-prone stage in sub-Saharan African paediatric settings comparable to the present one: a prospective study at Jimma University Medical Center found a substantial burden of medication error among paediatric inpatients with infectious diseases (Feyissa et al., 2020), and a study across Amhara Region referral hospitals found a similarly high magnitude of nurse-associated administration error, with workload and interruption identified as contributing factors (Mekonen et al., 2020). A recent scoping review of factors associated with paediatric medication administration error likewise concluded that error rates vary substantially by ward type and that the multi-step, sequential nature of weight-based paediatric dosing creates repeated, independent opportunities for the same type of mistake to recur (Motta Robayo et al., 2026). Comparable Nigerian data describing this stage-by-stage breakdown, disaggregated by professional cadre, remain limited; a recent Nigerian survey of error reporting behaviour among doctors and nurses found marked inter-professional differences in willingness to report errors, underscoring that cadre-level differences in this setting are not confined to error type alone but extend to how errors are handled once they occur (Afolalu, Jordan & Kyriacos, 2021). This paper addresses the stage-and-cadre data gap using information collected from physicians, nurses and pharmacists working in the paediatric department of a Federal Medical Centre in South-South Nigeria.

The specific objectives of this paper were: (i) to determine the stage of the medication-use process at which health professionals most frequently reported medication error; (ii) to characterize the types of medication error reported, including the specific subtype of dose and route error; and (iii) to examine whether professional

cadre was associated with the stage and type of error reported, and to describe occupational-exposure characteristics of the sample (working across multiple hospitals, shift pattern)

METHODS

Design and setting

This was a descriptive cross-sectional survey conducted in the paediatric department of a Federal Medical Centre (FMC) in South-South Nigeria. The department comprises the children's emergency ward, in-patient wards, a special care baby unit, a children's out-patient clinic, a paediatric surgery unit and a paediatric pharmacy, staffed by physicians (consultants, senior residents, junior residents and house officers), nurses and pharmacists.

Study population and sampling

The target population comprised health professionals working within the paediatric department. A convenience sampling technique was used over a three-month period (February to April 2020). Of an estimated eligible population, 89 health professionals were recruited and completed the survey in full, giving a professional-cadre composition of 43.8% physicians (consultants 7.9%, senior residents 13.5%, junior residents 17.9%, house officers 4.5%), 38.2% nurses and 18.0% pharmacists.

Instrument and data collection

Data were collected using a structured, self-administered questionnaire developed for this study and pretested prior to use, comprising a demographic section and a 19-item section addressing the stage and type of medication error respondents had observed or been involved in. Respondents were asked whether they had ever observed or been involved in each error type, rather than to report a count of errors against a specific number of prescriptions, doses administered, or other medication-use opportunities; the resulting measure is therefore a respondent-reported, ever-observed exposure (a career/practice-period prevalence), not an incidence rate, and no incidence denominator (e.g., errors per prescription or per medication-administration opportunity) was captured. This distinction is maintained throughout the Results and Discussion. Questionnaires were self-administered, with a 100% response rate among enrolled participants.

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 25. Descriptive statistics (frequencies and percentages) summarized demographic and error-related variables. The Pearson chi-square test was used to test the association between professional cadre and stage or type of medication error; a p-value below 0.05 was considered statistically significant.

Ethical consideration

Ethical approval was obtained from the Research and Ethics Committee of the Federal Medical Centre. Participants were informed of the purpose of the study and their role in it, and informed consent was obtained before administration of the questionnaire.

RESULTS

Respondent characteristics

Of the 89 health professionals surveyed, 65.2% were female. Most respondents (77.5%) worked in more than one hospital, and 67.4% were on a rotational shift pattern. Working experience was concentrated in the earlier career years, with 29.2% reporting 1–3 years and only 9.0% reporting more than 15 years. Respondents were drawn most heavily from the children's emergency ward (27.0%) and least from paediatric surgery (1.1%).

Stage of the medication-use process

As noted in the Methods, the figures below represent the proportion of respondents who reported ever observing or being involved in error at each stage, not a per-opportunity incidence rate. Transcribing (92.2%) and drug administration (92.1%) were the stages most frequently identified as sites of medication error, followed closely by dispensing (82.0%) and patient monitoring (82.0%). Hospital pharmacy service was implicated least often (69.7%). The association between professional cadre and reported error was statistically significant at the transcribing, dispensing and administration stages ($p < 0.05$ for each), but not at the prescribing, monitoring or hospital-pharmacy-service stages, indicating that cadre-specific exposure becomes more pronounced once a prescription has left the prescriber's hands.

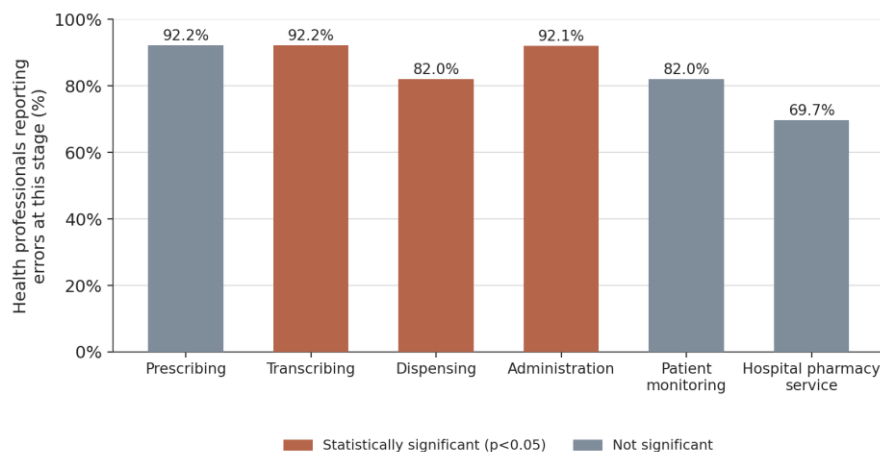


Figure 1. Proportion of health professionals ($n=89$) reporting medication error at each stage of the medication-use process. Stages shaded in a darker tone reached statistical significance in the chi-square test of association with professional cadre ($p < 0.05$).

Types of medication error

Wrong dose was reported by all 89 respondents (100.0%), making it the most universally recognized error type in this sample. Wrong medicine and wrong duration were each reported by 94.3% of respondents, wrong dosage form by 93.3%, wrong patient and wrong rate by 93.2% each, wrong route and wrong time by 92.2% each, and dose omission by 84.2%. Deteriorated medicine, at 70.8%, was the least frequently reported type, though still substantial.

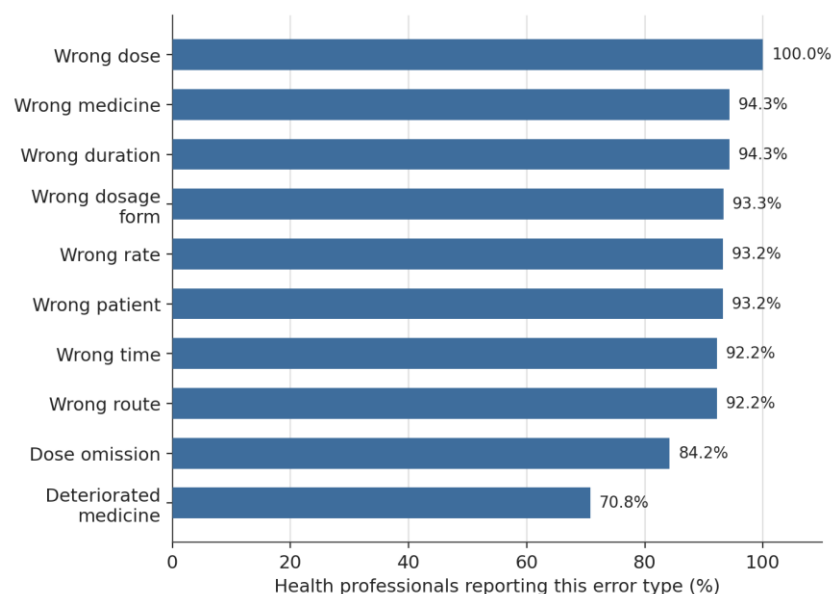


Figure 2. Frequency with which each type of medication error was reported by health professionals ($n=89$).

Predominant error type and cadre-specific subtypes

When respondents were asked to identify the single predominant type of error encountered, dose error was the most common (40.5%), followed by route error (23.6%) and frequency error (17.9%). Incompatibility (7.9%), duplicate therapy (6.7%) and wrong drug selection (3.3%) were reported less often. This association between professional cadre and predominant error type was statistically significant ($p=0.003$).

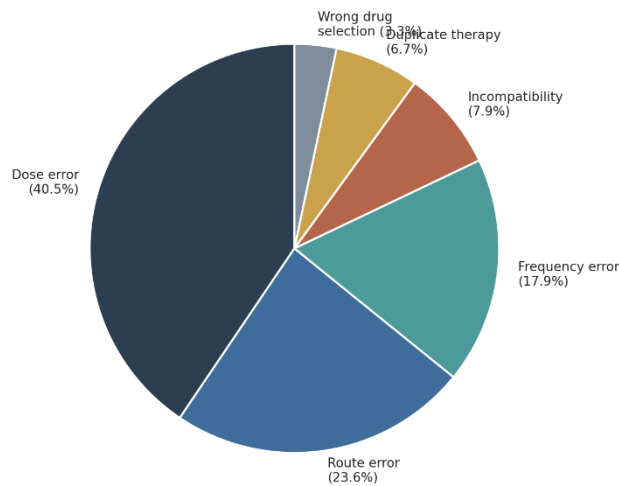


Figure 3. Predominant single type of medication error identified by health professionals (n=89).

Within dose errors, overdose was the leading subtype (51.7%), followed by missed dose (25.8%), undecided dose (19.1%) and under-dose (3.5%) ($p=0.01$). Within route errors, inappropriate route was leading (49.5%), followed by undecided route (30.3%) and missed route (20.3%) ($p=0.03$). Physicians and nurses contributed comparably to both subtypes, with pharmacists contributing a smaller but non-trivial share, particularly to overdose (14.6%).

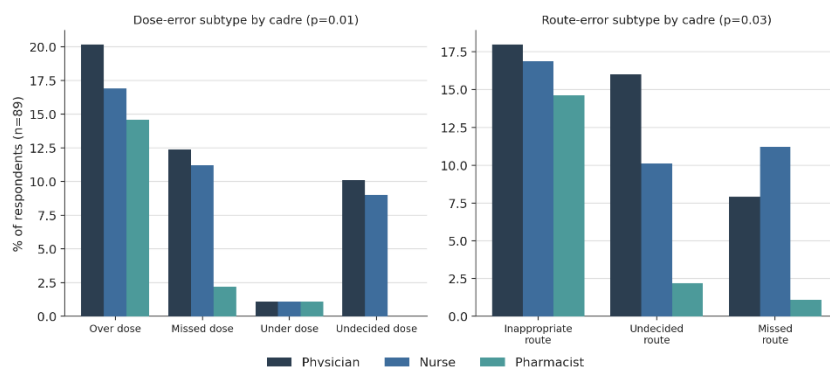


Figure 4. Dose-error and route-error subtypes by professional cadre. Left: dose-error subtype ($p=0.01$); right: route-error subtype ($p=0.03$).

Table 1. Stages of the medication-use process implicated in medication error, by professional cadre (n=89).

Stage	Physician n(%)	Nurse n(%)	Pharmacist n(%)	Sub-total n(%)	95% CI	p-value
Prescribing	33 (37.1)	33 (37.1)	16 (18.0)	82 (92.2)	84.6–96.1	0.30

Transcribing	34 (38.2)	33 (37.1)	15 (16.9)	82 (92.2)	84.6–96.1	0.00*
Dispensing	35 (39.3)	31 (34.8)	7 (7.9)	73 (82.0)	72.8–88.6	0.01*
Administration	39 (43.8)	31 (34.8)	12 (13.5)	82 (92.1)	84.6–96.1	0.02*
Patient monitoring	31 (34.8)	30 (33.7)	12 (13.5)	73 (82.0)	72.8–88.6	0.30
Hospital pharmacy service	32 (36.0)	24 (27.0)	6 (6.7)	62 (69.7)	59.5–78.2	0.07

* $p < 0.05$, considered statistically significant. 95% CI = Wilson score confidence interval for the sub-total proportion reporting error at that stage, out of $n = 89$.

DISCUSSION

The transcribing and administration stages emerged as the two points in the medication-use process most consistently implicated in error, a pattern that fits within recent literature describing paper-based transcription as a particularly fragile step because it sits at the junction of two independent record systems — the prescriber's order and the ward or pharmacy transcript — with no automated cross-check between them. A recent scoping review of factors associated with paediatric medication administration error concluded that clinical decision support and computerized order entry chiefly reduce upstream prescribing and transcribing errors, with only indirect downstream effects on administration itself (Motta Robayo et al., 2026), which is consistent with the pattern observed here: a setting that, like the present one, relies on handwritten inpatient sheets rather than computerized prescriber order entry leaves the transcribing step without an independent check against the original order. The proportion of professionals in the present study who identified transcribing as an error-prone stage (92.2%) should be read as a respondent-reported, career-prevalence figure rather than an incidence rate per opportunity, which limits direct numerical comparison with observational studies, but the underlying mechanism — a manually re-copied order having no automated safeguard — is the same one described in this recent literature.

The administration-stage finding (92.1%) is broadly consistent with the high administration-error burden reported in comparable Sub-Saharan African paediatric settings: a prospective study at Jimma University Medical Center in Ethiopia found a substantial proportion of paediatric inpatients affected by medication error, with administration among the leading contributing stages (Feyissa et al., 2020), and a study across Amhara Region referral hospitals in Ethiopia similarly found a high magnitude of nurse-associated administration error linked to workload (Mekonen et al., 2020). Administration is, by definition, the last opportunity for interception before a medication reaches the child, and nurses — who typically spend a substantial proportion of their working time on medication administration — were correspondingly well represented at this stage in the present sample; a recent Japanese administrative-data analysis similarly found that ward-level nursing time and busyness were measurably associated with medication error rates, even after adjusting for staffing (Moriwaki et al., 2025). This is not evidence that nurses are more error-prone as individuals; it more plausibly reflects that administration is the stage at which the largest number of discrete medication-handling actions occur, and therefore the stage offering the greatest cumulative opportunity for something to go wrong.

Dispensing errors (82.0%) were also common. A recent global systematic review and meta-analysis of 62 studies found a pooled dispensing-error prevalence of 1.6% across community, hospital and other pharmacy settings, with rates ranging as high as 33.3% depending on setting, denominator and detection method, and identified workload, staffing and the absence of an independent verification step as recurring contributory factors (Um, Clough & Tan, 2024). The considerably higher proportion of professionals reporting dispensing-related error in the present sample (82.0%) again reflects a respondent-reported, ever-observed measure rather than a per-prescription incidence rate, but the department's reliance on unit-dose dispensing without a formal

independent pharmacist check is consistent with the workload- and verification-related mechanisms this recent meta-analysis describes.

Dose error was the dominant single error type in this sample (40.5%), driven chiefly by overdose (51.7%), a pattern broadly consistent with recent international evidence identifying dosing error as the most frequent category of paediatric medication error (Gates et al., 2019). The 40.5% figure is higher than the 16.2% reported by Kishore et al. (2017) in an Indian paediatric inpatient department, again illustrating the gap between a per-prescription incidence measure and a respondent-reported predominant-error measure; future studies in this setting would benefit from capturing incidence denominators (opportunities for error) rather than respondent-reported prevalence alone, which would allow more direct comparison with the international literature cited here.

Route error, led by inappropriate route (49.5%), was the second most common predominant type (23.6%), a finding of particular concern given that the intravenous and intramuscular routes carry the least room for error correction once a medication has been administered. This is in keeping with the broader observation in this department that the drugs most frequently implicated in error — principally injectable antibiotics such as cefuroxime and gentamicin — are agents with a comparatively narrow therapeutic margin, and route or dose error involving them carries a correspondingly higher risk of harm, consistent with recent evidence that neonatal and paediatric intensive-care populations remain at elevated risk of preventable, potentially harmful drug events (Alghamdi et al., 2019).

Taken together, these findings point toward two priority targets for intervention rather than a diffuse, department-wide response: the transcribing step, where introducing even a simple independent second-check (rather than a full electronic prescribing system, which may not be immediately feasible in this setting) could plausibly reduce error; and the administration step, where a Dutch before-and-after study found that introducing centralised automated unit-dose dispensing combined with barcode-assisted administration was associated with a fall in both omission errors (from 4.6% to 2.0%) and wrong-dose errors (from 3.8% to 2.1%) (Jessurun et al., 2021). Where electronic systems are feasible, a Swiss retrospective study similarly found that introducing computerised physician order entry with limited clinical decision support significantly reduced potentially harmful prescribing errors on paediatric general wards (Satir et al., 2023), lending further, more recent support to the systemic (rather than individual-blame) approach to paediatric medication safety recommended by the American Academy of Pediatrics (Mueller, Neuspiel & Fisher, 2019). While full barcode-assisted administration or computerised prescribing may not be immediately feasible in this setting, the underlying principle — an independent check at the point of administration, standardised measuring devices, and protected time for medication rounds free of interruption — is transferable even without the same technology.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the convenience sampling strategy and single-centre design limit generalisability: the department studied is a Federal Medical Centre paediatric department in South-South Nigeria with a paper-based (non-computerised) prescribing and transcription system, staffed by physicians, nurses and pharmacists across a children's emergency ward, in-patient wards, a special care baby unit, an out-patient clinic and a paediatric surgery unit; readers should weigh transferability against how closely their own setting matches this staffing mix, documentation system and case mix, since tertiary hospitals with electronic prescribing, different staffing ratios, or a different patient population may show a different stage-and-type error profile. Second, data were self-reported rather than derived from direct observation or chart review, and no incidence denominator (errors per prescription, dose administered, or other medication-use opportunity) was captured; the percentages reported throughout are respondent-reported, ever-observed exposure rather than incidence, introduce the possibility of recall and social-desirability bias, and should not be compared numerically with observational incidence studies. Third, while professional cadre was formally tested for association with error stage and type, the other occupational-exposure variables described in the sample (working across multiple hospitals, rotational shift pattern, years of experience) were characterised descriptively but not formally tested for

association with error stage or type in this analysis; the third study objective is accordingly only partially addressed, and this association should be examined explicitly in future analyses of this or a similar dataset.

Fourth, 95% confidence intervals (Wilson score method) have been added in Table 1 for the proportion of respondents reporting error at each stage; however, effect sizes for the cadre associations themselves (e.g., Cramér's V) could not be calculated from the published cell counts, since attempts to reconstruct the full contingency tables from the reported summary figures did not reproduce the exact p-values shown, indicating the underlying test structure cannot be fully recovered without the original dataset or crosstab output. Confidence intervals for the predominant error-type and dose/route-subtype percentages (Figures 3 and 4) were likewise not added, as only rounded percentages rather than exact counts were reported for these breakdowns. Future reporting from this or comparable datasets should include exact cell counts, measures of association strength, and confidence intervals throughout to allow a fuller appraisal of practical, and not only statistical, significance.

Contribution to Knowledge

This study adds to the paediatric medication-safety literature in the following specific ways:

- It provides dual-cadre, stage-disaggregated data on where in the medication-use process error concentrates within a Nigerian tertiary paediatric department, a level of granularity (physician/nurse/pharmacist breakdown by stage) not previously reported for this setting.
- It identifies transcribing and administration, rather than prescribing, as the statistically significant loci of cadre-associated error in a paper-based (non-computerised) documentation system, offering an evidence base for where a resource-limited department should target intervention first.
- It quantifies, for the first time in this setting, the specific subtypes underlying dose error (overdose, missed dose, under-dose, undecided dose) and route error (inappropriate, undecided, missed route) by professional cadre, moving beyond the broad “dose error” category reported in most prior Nigerian studies.
- It links these findings to two named high-risk drugs (cefuroxime and gentamicin) administered via high-risk routes (intravenous/intramuscular), giving department pharmacy-and-therapeutics committees a concrete, drug-specific starting point for a targeted safety intervention rather than a generic one.

CONCLUSION

In this Nigerian tertiary paediatric department, medication error clustered most heavily at the transcribing and administration stages of the medication-use process, and was dominated by dosing error, chiefly overdose, followed by inappropriate-route error. These findings suggest that transcription accuracy and the point of administration are reasonable priorities for intervention — rather than uniform, hospital-wide safety messaging — though this cross-sectional, respondent-reported design cannot itself demonstrate that targeting these stages will reduce medication error risk to paediatric patients in this or comparable settings. Larger, multi-centre, prospective studies incorporating direct observation would strengthen the evidence base for these priorities.

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