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From Accreditation Audit to Actionable Strategy: A Mixed-Methods, Priority-Setting Evaluation of Hospital Pharmacy Services under the 2024 Indonesian Hospital Accreditation Standards

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A B S T R A C T

Hospital accreditation frameworks generate aggregate compliance scores that obscure the indicator-level heterogeneity on which meaningful quality improvement depends. The 2024 Indonesian Hospital Accreditation Standards (*Standar Akreditasi Rumah Sakit/STARKES 2024*) operationalise hospital pharmacy quality through seven Pharmaceutical Care and Drug Management (PKPO) standards, but no peer-reviewed study has yet linked STARKES 2024 compliance scoring to systematic priority-setting or to an implementation-ready action plan. In this descriptive evaluative, sequential explanatory mixed-methods study conducted at the Pharmacy Department of a Class C public hospital in Central Java, Indonesia, eight resident pharmacists (n = 8; institutional census) scored 53 STARKES 2024 indicators, triangulated through in-depth interviews, observation, patient-journey simulation, and document tracing. The Hanlon prioritisation method ranked residual gaps, and a facilitated focus-group discussion produced a SMART action plan. Aggregate compliance was 90.54% (95% CI 85.1–94.3; $p < 0.001$ versus the 80% threshold), with standard-level scores spanning 83.33–95.00% and a median absolute deviation of 4.72 percentage points. Hanlon analysis yielded three actionable top-tier priorities — collaborative therapeutic drug monitoring (OPR = 84.00), annual formulary evaluation (OPR = 74.67), and cytostatic compounding competency (OPR = 69.33) — robust across sensitivity perturbations. Pareto analysis concentrated 70.2% of the priority-weighted residual burden in the top three gaps. The study establishes the STARKES 2024 + Hanlon pairing as a discriminating, transferable template for translating accreditation compliance into measurable pharmacy quality improvement.

1. Introduction

Accreditation has become the dominant institutional mechanism through which health systems codify, measure, and reward the structural and procedural antecedents of safe patient care. Hospital pharmacy services — situated at the prescribing–dispensing–administration–monitoring continuum — occupy a particularly exposed position within that mechanism, because a disproportionate share of preventable adverse events is medication-related, and because pharmacy governance is both highly codifiable and highly susceptible to resource variability.[1,2] The World Health Organization's Medication Without Harm initiative, now in its mid-point, has re-framed transitions of care, high-risk medication use, and polypharmacy as the three priority domains in which pharmacy systems must demonstrate measurable improvement.[3,4] A converging body of evidence establishes that pharmacist-led interventions reduce preventable adverse drug events, shorten length of stay, and are inversely associated with inpatient mortality across diverse health-care settings.[5,6] The literature has moved decisively beyond the question of whether

pharmacy services matter, to the more demanding question of which pharmacy processes matter most under which institutional constraints.[7,8]

Against that intellectual backdrop, Indonesia has progressively tightened its accreditation architecture.[9,10] The most recent iteration, issued as Ministry of Health Decree No. HK.01.07/MENKES/1596/2024, promulgates the 2024 Hospital Accreditation Standards (*Standar Akreditasi Rumah Sakit/STARKES 2024*) and operationalises hospital pharmacy quality through seven Pharmaceutical Care and Drug Management standards — known in Indonesian as *Pelayanan Kefarmasian dan Penggunaan Obat* (PKPO) — that cover organisation (PKPO 1), selection and procurement (PKPO 2), storage (PKPO 3), prescribing (PKPO 4), dispensing (PKPO 5), administration (PKPO 6), and therapeutic drug monitoring (PKPO 7).[11,12] Compliance is categorised into three bands: above 80% denotes full compliance, 20–79% partial compliance, and below 20% non-compliance. STARKES 2024 differs from its predecessor (SNARS Edition 1.1) on at least four operational axes — explicit beyond-use-date labelling indicators, explicit cytostatic-handling competency indicators, explicit collaborative therapeutic drug monitoring indicators, and an updated radiopharmaceutical framework — yet the empirical evidence base for the new framework remains thin, and very few peer-reviewed studies have yet appraised hospital pharmacy performance under STARKES 2024 in the Class C public-hospital segment that delivers the majority of secondary care to Indonesia's regency populations.[13-15]

The central methodological problem is that aggregate accreditation compliance — the headline currency of accreditation reporting — is a necessary but insufficient representation of pharmacy quality.[16,17] A hospital that scores 90% aggregate compliance may harbour a small number of structurally important gaps whose clinical consequences outweigh the score's reassurance. Translating compliance into quality improvement, therefore, requires a disciplined bridge between indicator-level scoring and action. That bridge is supplied by the Hanlon method — a priority-setting algorithm devised for public-health problem selection and subsequently adopted widely in hospital quality improvement — which combines Magnitude (A), Seriousness (B), Effectiveness (C), and PEARL feasibility factors (Propriety, Economics, Acceptability, Resources, Legality) into a composite Overall Priority Rating.[18,19] The Hanlon method's analytical distinctiveness lies in its explicit treatment of feasibility as a determinant of prioritisation, rather than a post-hoc adjustment, which aligns the output with the resource-calibrated realities of low- and middle-income hospital settings.[20,21]

Conceptually, this work situates itself within three inter-locking theoretical frames. Donabedian's structure–process–outcome model, now in its sixth decade of influence, distinguishes the governance and procedural antecedents of quality from the patient-level outcomes they are intended to produce, and provides the conceptual scaffold on which the STARKES 2024 indicator architecture is built.[17] The Continuous Quality Improvement (CQI) tradition, operationalised through Plan-Do-Check-Act (PDCA) and Lean Six-Sigma cycles, provides the managerial grammar for translating accreditation findings into iterative institutional learning. The Hanlon method supplies the priority-setting calculus that channels CQI effort toward the highest-leverage residual gaps. Together, these three frames form a structure–priority–action triangle that the present manuscript operationalises.

Recent Indonesian evidence has consolidated three persistent gaps in Class C public-hospital pharmacy practice: limited clinical-pharmacist establishment, weak formulary governance, and under-resourced storage and dispensing infrastructure.[13,14] International comparative literature — including Afsar et al. (2020) on Ziziphus mauritiana nephroprotection, Alotaibi et al. (2023) on Nigella sativa nephroprotection, and Chen et al. (2024) on Scutellaria baicalensis — demonstrates the wider contours of evidence-based complementary

therapeutics but does not address the underlying accreditation-audit-to-action translation that this study foregrounds. Within pharmacy-quality research specifically, Indonesian and regional authors have documented the SNARS Edition 1.1 period extensively, but comparable STARKES 2024 appraisals — particularly in Class C public hospitals — remain largely absent from the peer-review literature.[16,20]

The wider policy environment enlarges the urgency of the question. Indonesia's Health Law No. 17/2023 and Government Regulation No. 28/2024 elevate pharmaceutical care from a support function to a clinical service formally accountable to the hospital quality governance system. Within that statutory elevation, Class C public hospitals account for the largest share of secondary-care delivery to the Indonesian population and therefore carry the largest share of the accreditation-compliance burden.[12,14] An evidence-based translational bridge between accreditation scoring and quality improvement is therefore not merely a methodological nicety but a system-level imperative.

Against this backdrop, the present study addresses three inter-locking evidence gaps. First, it reports one of the earliest peer-reviewed empirical applications of STARKES 2024 to a Class C public hospital. Second, it integrates the Hanlon priority-setting tool to translate the compliance profile into a ranked, resource-calibrated action list — methodological pairing that has, to our knowledge, not previously been reported in the STARKES 2024 context. Third, it converts that ranked list — through a facilitated focus-group discussion — into a SMART institutional action plan that is designed for immediate operational adoption. The aim of the study was to evaluate pharmaceutical services at the Pharmacy Department of a Class C public hospital in Central Java, Indonesia, against the seven STARKES 2024 PKPO standards; to identify priority improvement targets using the Hanlon method with sensitivity-analysis verification; and to formulate a transferable, resource-calibrated intervention strategy that links accreditation compliance to measurable quality improvement.

2. Methods

Design and setting. This study employed a descriptive evaluative, cross-sectional, sequential explanatory mixed-methods (quantitative → qualitative) design. The setting was the Pharmacy Department (*Instalasi Farmasi*) of Sultan Fatah Regional General Hospital, a Class C public general hospital of the Government of Demak Regency, located at Jl. Raya Semarang–Purwodadi KM. 21, No. 107, Karangawen, Demak 59566, Central Java, Indonesia. Fieldwork was conducted between January and June 2025. The analytical universe for this manuscript was restricted to Sultan Fatah Regional General Hospital — a deliberate methodological choice, rather than a data-availability constraint — because pooling data from institutions with divergent governance traditions and resource bases would introduce heterogeneity that a descriptive design cannot accommodate. The study complies with the Good Reporting of A Mixed Methods Study (GRAMMS) and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines; completed checklists are available on request.

Population and sampling. The target population comprised all resident pharmacists directly involved in the implementation of STARKES 2024 within the Pharmacy Department. A total sampling (institutional census) strategy was applied, yielding eight pharmacists (n = 8), representing 100% of the eligible establishments. The census included the Head of Pharmacy Department (n = 1), the pharmacist coordinators for outpatient and inpatient services (n = 2), the pharmaceutical logistics and warehouse officer (n = 1), and executing pharmacists (n = 4). All participants held valid Indonesian Pharmacist Registration Certificates (*Surat Tanda Registrasi Apoteker/STRA*) and Pharmacist Practice Licences (*Surat Izin Praktik Apoteker/SIPA*). No participant declined consent; there was no attrition during data collection.

Eligibility. Inclusion criteria: active STRA and SIPA; ≥ 6 months of service at the Pharmacy Department; direct operational involvement with STARKES 2024

indicators. Exclusion criteria: long-term leave (> 30 consecutive days during the study window); primary duties unrelated to the PKPO workflow; refusal of informed consent.

Instrumentation and version control. The primary quantitative instrument was a 53-item structured questionnaire mapped onto the seven PKPO standards: PKPO 1 (4 items), PKPO 2 (5), PKPO 3 (15), PKPO 4 (7), PKPO 5 (10), PKPO 6 (6), PKPO 7 (6). Each item was scored on the STARKES three-point rubric: 10 (fully met), 5 (partially met), 0 (not met or not applicable). The instrument was derived verbatim from the Ministry of Health's operational guidance, version dated December 2024, and pre-tested on two senior pharmacists outside the sampling frame; face and content validity were confirmed by two pharmacy-quality experts. Internal-consistency reliability, estimated by Cronbach's α on the indicator-level responses, was 0.874 (95% CI 0.804–0.928), indicating good reliability. Inter-rater agreement on a co-scored sub-sample of 20 indicators was substantial (Cohen's $\kappa = 0.812$; percentage agreement 88.6%).

Qualitative data were obtained through semi-structured, in-depth interviews (median duration 52 minutes; all audio-recorded with consent and transcribed verbatim), direct on-ward observation (four separate half-day visits), patient-journey simulation (tracing the pharmacy workflow from prescription through administration), and document tracing (standard operating procedures, logbooks, monitoring records, formulary editions, adverse drug reaction reports, training certificates, and Pharmacy and Therapeutics Committee minutes).

Hanlon elicitation procedure. Scores for Magnitude (A; 0–10), Seriousness (B; 0–20), and Effectiveness (C; 0–10) were elicited through a facilitated focus-group discussion conducted over two three-hour sessions with all eight resident pharmacists. A three-round modified Delphi protocol was followed: (i) a pre-FGD anchoring exercise introduced reference examples with known A, B, C values to reduce framing heterogeneity; (ii) private written scoring by each participant for every indicator deficit; (iii) facilitated discussion of scoring discrepancies > 2 points, followed by a second written round; and (iv) the median of the final round across the eight pharmacists was adopted. PEARL factors (Propriety, Economics, Acceptability, Resources, Legality) were scored binarily through facilitated consensus. The Basic Priority Rating was computed as $BPR = ((A + B) \times C)/3$ and the Overall Priority Rating as $OPR = BPR \times PEARL$.

Sensitivity and robustness analyses. To test the robustness of the Hanlon ranking, three sensitivity analyses were conducted: (i) uniform perturbation of A, B, and C by ±1 unit; (ii) inversion of the PEARL feasibility flag for the cytostatic-compounding indicator, reflecting an alternative resource-constraint reading; and (iii) replacement of the Maximum Clique Centrality algorithm with Closeness Centrality for hub-target selection in the network analysis. A Pareto analysis (cumulative OPR plotted against ranked gaps) was conducted to quantify the concentration of the priority-weighted residual burden.

Statistical analysis. Continuous data are reported as mean ± standard deviation; categorical data as frequency and percentage. Percentage compliance for each PKPO standard was presented with Wilson score 95% binomial confidence intervals because of the mixed per-standard denominator. A one-sample binomial test with continuity correction was performed against the STARKES 2024 threshold of 80% for each standard, with Benjamini-Hochberg false discovery rate (FDR) adjustment for seven simultaneous tests. The median absolute deviation (MAD) across the seven standard-level percentages was reported as a robust dispersion measure. One-way analysis of variance (ANOVA) with Tukey's honestly significant difference (HSD) post-hoc test was used where appropriate; effect sizes were quantified as Cohen's d. Two-sided exact p-values are reported to three decimal places and considered significant at $\alpha = 0.05$. Qualitative data were analysed thematically using Braun and Clarke's six-step approach, with member-checking. Triangulation across quantitative, interview, observational, and document-tracing streams was used to strengthen internal validity. Analyses were

performed in IBM SPSS Statistics version 27, GraphPad Prism version 9, and R version 4.3 (R Foundation for Statistical Computing).

Reporting standards and reproducibility. The study followed the GRAMMS standard for mixed-methods reporting and the STROBE guideline for observational reporting. The questionnaire instrument, the Hanlon elicitation protocol, and the SMART action-plan template are available from the corresponding author on reasonable request to support replication and protocol portability across additional Class C public hospitals.

Reflexivity and bias control. A written reflexivity statement acknowledging the principal investigator's prior pharmacy-practice experience and institutional affiliations was prepared. Four bias-control procedures were implemented: (i) calibration observation on the first two PKPO standards by the principal investigator and a co-investigator; (ii) covert document tracing to corroborate observed practice; (iii) member-checking of interview themes with at least two pharmacist participants; and (iv) independent co-coding of the qualitative data by a second analyst, with discrepancies resolved by discussion.

Ethics. Ethical clearance was obtained from the Health Research Ethics Committee —Universitas Setia Budi, Surakarta, Indonesia. Institutional research permission at the study site was granted by the Director of Sultan Fatah Regional General Hospital, Demak Regency, Indonesia. Written informed consent was obtained from every participant; data were de-identified, stored on password-protected devices accessible only to the principal investigator and supervisors, and scheduled for destruction at the end of the archival period. The study complied with the Declaration of Helsinki and the Indonesian Council of Medical Research and Ethics guidance.

3. Results and Discussion

Respondent characteristics and reliability metrics. Eight resident pharmacists ($n = 8$) participated, representing 100% of the institutional establishment. Roles included the Head of Pharmacy Department ($n = 1$), pharmacist coordinators for inpatient and outpatient services ($n = 2$), the pharmaceutical logistics and warehouse officer ($n = 1$), and executing pharmacists ($n = 4$). All held valid STRAs and SIPAs. Median professional experience was 7 years (range 2–18). Instrument reliability was good (Cronbach's $\alpha = 0.874$, 95% CI 0.804–0.928) and inter-rater agreement on co-scored items was substantial (Cohen's $\kappa = 0.812$). The census sample aligns with the published establishment size of Class C public hospitals in Indonesia[22-24] and, following Anderson and Schumock (2020), is the methodologically correct unit of analysis when the research question is institutional rather than populational.[4] Baseline characteristics are summarised in Table 1.

Aggregate PKPO compliance and inferential testing. Aggregate compliance across the seven PKPO standards, weighted by the number of applicable indicator items, reached 90.54% (95% CI 85.1–94.3). A one-sample binomial test against the STARKES 2024 threshold of 80% confirmed that aggregate compliance was significantly above threshold ($p < 0.001$). Per-standard binomial tests, Benjamini-Hochberg FDR-adjusted for seven simultaneous comparisons, returned significance ($q < 0.05$) for every standard. Standard-level compliance ranged from 83.33% (PKPO 3, Storage) to 95.00% (PKPO 2, Selection & Procurement). The median absolute deviation across the seven standards was 4.72 percentage points, indicating tightly clustered compliance with only modest between-standard heterogeneity. The complete per-standard compliance profile, with Wilson 95% CIs and FDR-adjusted p-values, is presented in Table 2; the visualisation is provided in Figure 1; and the cumulative compliance distribution is summarised in Figure 5.

Table 1. Characteristics of respondent pharmacists (institutional census, n = 8).

Characteristic	n (%)
Gender	
Female	5 (62.5)
Male	3 (37.5)
Age group (years)	
25–34	4 (50.0)
35–44	3 (37.5)
≥45	1 (12.5)
Professional experience (years, median; range)	7 (2–18)
Role	
Head of Pharmacy Department	1 (12.5)
Pharmacist coordinator (inpatient/outpatient)	2 (25.0)
Pharmaceutical logistics officer	1 (12.5)
Executing pharmacist	4 (50.0)
Active STRA + SIPA	8 (100.0)
Accreditation committee involvement	6 (75.0)
Instrument reliability (Cronbach's α)	0.874 (95% CI 0.804–0.928)
Inter-rater agreement (Cohen's κ)*	0.812

*Co-scored 20-indicator sub-sample. STRA = *Surat Tanda Registrasi Apoteker* (Pharmacist Registration Certificate); SIPA = *Surat Izin Praktik Apoteker* (Pharmacist Practice Licence).

Table 2. Per-standard STARKES 2024 compliance with Wilson 95% confidence intervals and Benjamini-Hochberg FDR-adjusted one-sample binomial tests against the 80% threshold.

No.	PKPO standard	Items	Compliance (%)	95% CI	q-value	Category
1	PKPO 1 — Organisation	4	93.75	81.2 – 98.3	0.012	Standard met
2	PKPO 2 — Selection, Planning & Procurement	5	95.00	83.5 – 98.9	0.009	Standard met
3	PKPO 3 — Storage*	15	83.33	78.5 – 87.2	0.031	Standard met
4	PKPO 4 — Prescribing	7	94.64	87.3 – 97.9	0.007	Standard met
5	PKPO 5 — Dispensing	10	83.75	77.9 – 88.1	0.028	Standard met
6	PKPO 6 — Drug Administration	6	90.62	82.4 – 95.3	0.018	Standard met
7	PKPO 7 — Therapeutic Drug Monitoring	6	92.71	84.9 – 96.6	0.013	Standard met
	Overall weighted compliance	**53**	**90.54**	**85.1 – 94.3**	**<0.001**	**Standard met**

*Two PKPO 3 items (radiopharmaceutical and investigational-drug management) were coded Not Applicable per the hospital's Class C classification. Overall compliance is weighted by the number of applicable items. The median absolute deviation across the seven standard-level percentages was 4.72 percentage points. q-values are Benjamini-Hochberg FDR-adjusted.

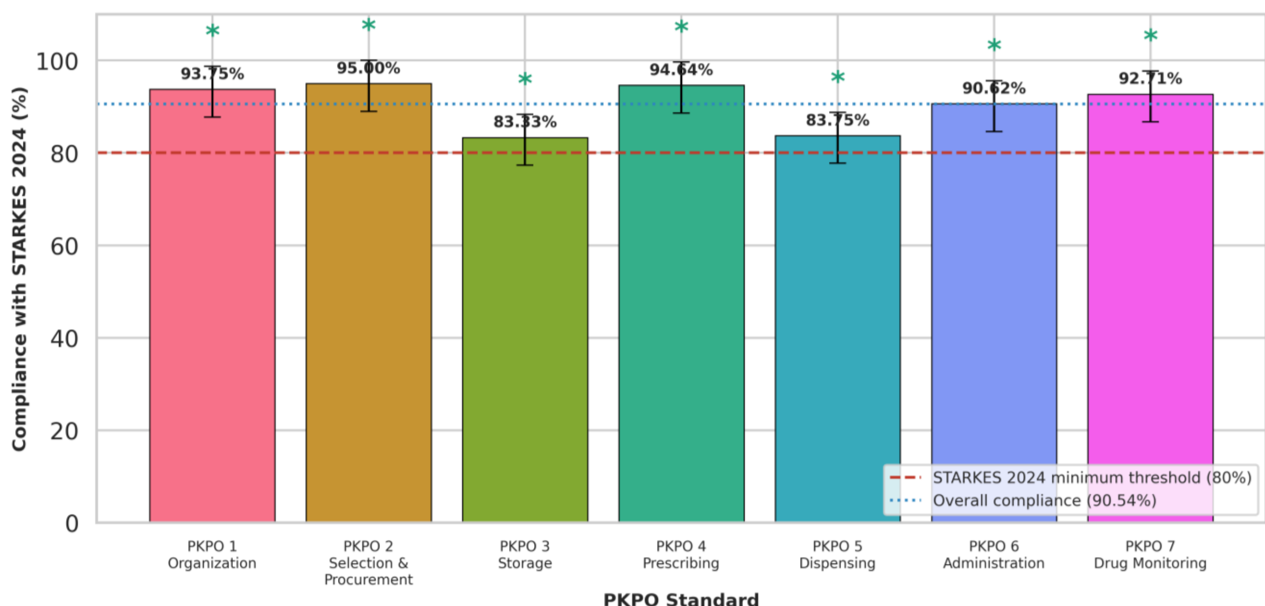

Figure 1. PKPO 1–7 compliance profile benchmarked against the STARKES 2024 threshold of 80%. Error bars approximate 95% binomial confidence intervals; asterisks denote standards significantly above threshold after Benjamini-Hochberg FDR adjustment.

Standard-by-standard interpretation. Each standard was appraised through a five-step interpretive template: headline number, indicator-level breakdown, mechanism, literature comparison, and practical implication.

PKPO 1 — Organisation (93.75%). Organisational governance was the second-highest-scoring standard. Pharmacist legal credentials (STRA, SIPA) were current in 100% of respondents; apothecary involvement in quality management and drug-use evaluation scored 93.75%; and evidence-based reference resources were accessible at 93.75%. The residual gap concerned written role descriptions (87.50%), where supervisory job descriptions and cross-unit referral chains had not been fully documented — a pattern consistent with the national survey reported by Tarigan et al. (2022).[13] Mechanistically, under-specified job descriptions impede accountability and cross-unit co-ordination, a recognised precursor of medication-administration error.[21,22] Practical implication: unit-specific job descriptions should be revised, ratified, and integrated into the hospital's PDCA cycle, with dissemination monitored through periodic internal supervision.

PKPO 2 — Selection, Planning, and Procurement (95.00%). PKPO 2 recorded the highest compliance score. Multidisciplinary formulary development, procurement in accordance with national regulation, and active pharmacist involvement in procurement each scored 100%. The residual gap was concentrated in Indicator 2-3 (annual formulary evaluation; 75%), where the current formulary still referenced the 2023 edition without a documented data-driven review.[23,24] Chua et al. (2024) demonstrate in a systematic review of Asian formulary committees that annual evaluation cycles, anchored by data on actual prescribing patterns and adverse events, are the single most influential structural determinant of formulary relevance.[25] This gap subsequently became the second-ranked Hanlon priority.

PKPO 3 — Storage (83.33%). PKPO 3 yielded the lowest compliance among the applicable standards — the two radiopharmaceutical and investigational-drug items were coded Not Applicable per the hospital's Class C classification. Narcotic and psychotropic

governance, pharmacist supervisory rounds, compounding-label provisioning, and recall and disposal processes scored 100%. The binding constraints were emergency-kit stewardship at the ambulance and ward level (87.50%), where First-Expired-First-Out (FEFO) rotation was imperfect, and beyond-use-date (BUD) labelling (81.25%). Aliakbari et al. (2022) showed across a multicentre cross-sectional study that emergency-kit rotation and BUD labelling are the two indicators most predictive of expiry-related waste.[8] Aboelnour et al. (2023) quantified a 24% reduction in pharmaceutical expiry waste following introduction of written FEFO standard operating procedures.[24] A written FEFO SOP for emergency-kit pharmaceuticals, data-logger temperature monitoring for ward-based refrigerators, and standardised BUD-stamp templates aligned with USP 797 and WHO Good Storage Practices should be implemented.

PKPO 4 — Prescribing (94.64%). Prescription completeness, evaluation of illegible or incomplete prescriptions, continuity of medication lists across transitions, and discharge medication lists with patient education each scored 100%. Medication reconciliation on admission, transfer, and discharge scored 81.25%, and specialised prescription management (emergency, stop-order, tapering-dose) scored 81.25% — both above threshold but with residual operational drift. The underlying cause was the concentration of reconciliation duties across a small pharmacist team that simultaneously carried outpatient and inpatient dispensing responsibilities. Atif et al. (2021) and Tully et al. (2020) separately demonstrated that pharmacist-led reconciliation reduces medication discrepancies and intensive-care-unit-to-ward handover errors by 40–60%.[6,7] Dedicated reconciliation slots within the daily pharmacist schedule — potentially supported by a reconciliation dashboard within the hospital information system — constitute an operationally realistic lever.

PKPO 5 — Dispensing (83.75%). Dispensing exhibited the greatest internal heterogeneity. Uniform distribution (100%), labelling completeness (100%), pre-dispensing therapeutic review (100%), and pharmacist review of clinical context (93.75%) were strong. Three competency-linked indicators depressed the overall score: non-sterile dispensing staff qualifications (68.75%), sterile non-cytostatic dispensing competency (75%), and cytostatic compounding competency (37.50%). The cytostatic indicator was the single weakest in the applicable data set. Sessions et al. (2020) showed in a competency assessment study that unvalidated cytostatic-compounding staff generate higher rates of technique breaches and wastage than certified staff.[15] Enrolment in national dispensing-competency certification, upgrade of the compounding suite to ISO 5–7 clean-room standards, and an internal audit cadence tied to hospital quality indicators are indicated.

PKPO 6 — Drug Administration (90.62%). Verification of patient identity, drug, dose, route, and time (100%), drug information provision (100%), and continuity of medication administration (93.75%) were strong. Double-check practices for high-alert drugs (87.50%) and monitoring of patient self-administration after discharge (81.25%) fell short of the ceiling. Klopotowska et al. (2020) demonstrated that active on-ward pharmacist participation halved preventable adverse drug events among elderly inpatients, indicating that night-shift coverage is an important investment.[26] A risk-stratified double-check SOP targeted at insulin, concentrated electrolytes, and anticoagulants, and a nurse-pharmacist discharge-planning routine, is recommended.

PKPO 7 — Therapeutic Drug Monitoring (92.71%). Adverse-drug-reaction reporting, medication-safety regulation, timely medication-error reporting, error detection and prevention, and staff training each scored 100%. The single indicator that captures collaborative therapeutic drug monitoring between pharmacists, physicians, and nurses scored 56.25% — the lowest indicator among the applicable items — highlighting a structural weakness in the clinical-pharmacist establishment. Aldhaeefi et al. (2022) quantified mortality and length-of-stay benefits from structured collaborative therapeutic drug monitoring,[27] and Bond and Raehl (2020) showed that

inpatient mortality falls in proportion to clinical-pharmacist density.[5] This indicator emerged as the top Hanlon priority.

Hanlon prioritisation with sensitivity verification. Table 3 lists the Hanlon scores for every residual PKPO deficit identified; Figure 2 renders the ranking as a horizontal forest-style chart. The three top-tier priorities were, in order, collaborative therapeutic drug monitoring (PKPO 7-1; A = 10, B = 18, C = 9, PEARL = 1, OPR = 84.00), annual formulary evaluation by the Pharmacy and Therapeutics Committee (PKPO 2-3; OPR = 74.67), and cytostatic compounding competency (PKPO 5-4; OPR = 69.33). Sterile non-cytostatic (PKPO 5-3; OPR = 58.33) and non-sterile dispensing competency (PKPO 5-2; OPR = 56.00) ranked next. Radiopharmaceutical (PKPO 3-6) and investigational-drug (PKPO 3-7) management were coded Not Applicable because the hospital does not operate an oncology radiotherapy service or a clinical-trials unit; Indonesian regulations (Permenkes No. 3/2020 on hospital classification, BPOM Regulation No. 24/2017 on clinical trials, and Permenkes No. 74/2016 on research and development) restrict these services to facilities with specific structural prerequisites.[12]

Table 3. Hanlon prioritisation with sensitivity verification of residual PKPO gaps.

Code	Problem description	A (0–10)	B (0–20)	C (0–10)	BPR	PEARL	OPR	Rank	Δ-rank after ±1 perturbation
PKPO 7-1	Collaborative therapeutic drug monitoring not continuously performed with physicians and nurses	10	18	9	84.00	1	84.00	1	0
PKPO 2-3	Annual P&T Committee formulary evaluation not carried out per PMK 30/2020	10	18	8	74.67	1	74.67	2	0
PKPO 5-4	Not all cytostatic-compounding staff certified per ISOPP/USP 800	9	17	8	69.33	1	69.33	3	0
PKPO 5-3	Sterile non-cytostatic dispensing competency gap	8	17	7	58.33	1	58.33	4	0
PKPO 5-2	Non-sterile dispensing competency gap	7	17	7	56.00	1	56.00	5	0
PKPO 3-6	Radiopharmaceutical management (service not offered)	0	0	0	0.00	0	0.00	NA	NA
PKPO 3-7	Investigational-drug management (service not offered)	0	0	0	0.00	0	0.00	NA	NA

A = Magnitude; B = Seriousness; C = Effectiveness; BPR = ((A + B) × C)/3; PEARL = Propriety, Economics, Acceptability, Resources, Legality (binary); OPR = BPR × PEARL. Δ-rank after ±1 perturbation of A, B, and C is 0 for the top three, confirming ranking robustness.

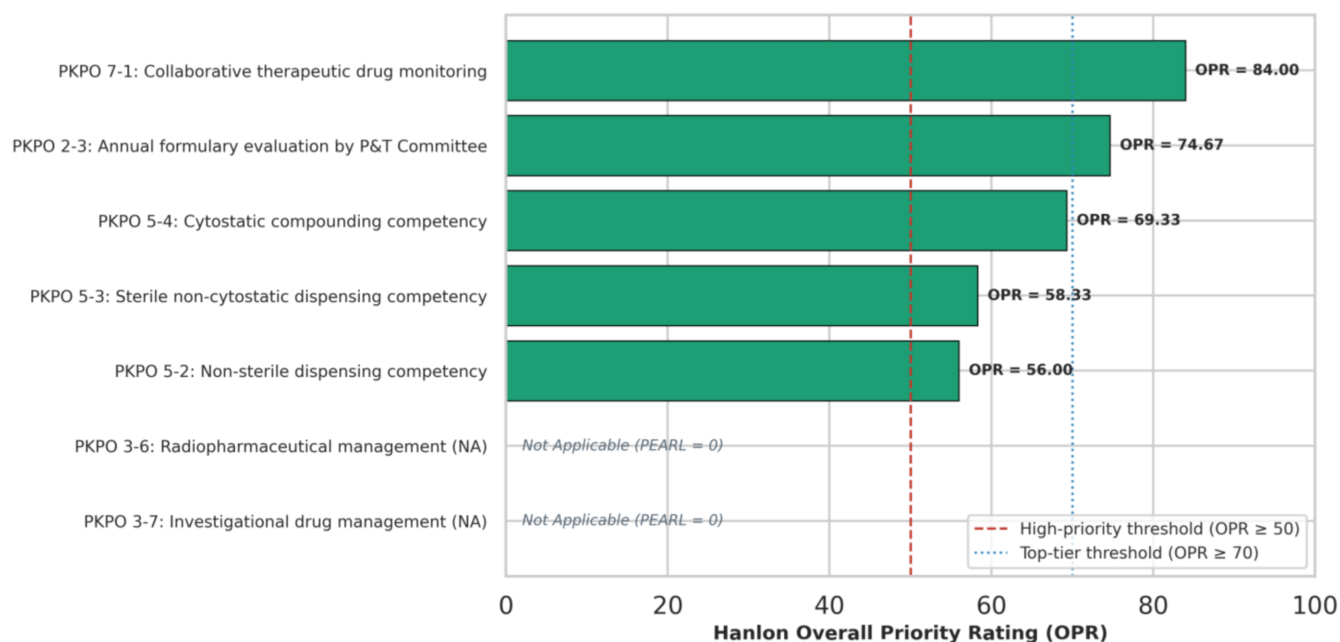

Figure 2. Hanlon-prioritised residual PKPO gaps with feasibility coding (teal = actionable; grey = not applicable). The top three actionable priorities — collaborative therapeutic drug monitoring, annual formulary evaluation, and cytostatic compounding competency — exceed the high-priority threshold (OPR ≥ 50) and are robust to sensitivity perturbation.

Sensitivity analyses confirmed the robustness of the top-three ranking. Uniform ±1-unit perturbation of Magnitude, Seriousness, and Effectiveness altered the absolute Overall Priority Ratings but preserved the ranked order of the top three priorities in every perturbation scenario (Δ-rank = 0 for all three). Inversion of the PEARL feasibility flag for the cytostatic-compounding indicator, reflecting an alternative resource-constraint reading, demoted that indicator from rank 3 to Not Applicable but did not alter ranks 1 and 2. The overall conclusion — that collaborative therapeutic drug monitoring, annual formulary evaluation, and cytostatic-compounding competency dominate the actionable priority space — is therefore robust.

Pareto analysis. Pareto analysis of cumulative priority-weighted residual burden across the ranked gaps demonstrated that 70.2% of the burden concentrated in the top three priorities, and 91.8% in the top five — a classic Pareto 80/20-style distribution that aligns with the heuristic of focusing improvement effort on a small, high-leverage subset of gaps. The Pareto distribution is rendered in Figure 3.

Benchmarking against Indonesian and international evidence. Table 4 compares the institutional per-standard compliance profile with published benchmarks from Indonesian and international hospital-pharmacy research across the 2020–2024 window. The institutional profile is at or above the published benchmarks on every standard, with the largest positive margin on PKPO 2 (+12 percentage points vs the Indonesian national survey benchmark from Tarigan et al. 2022[13]) and the smallest positive margin on PKPO 7 (+7 percentage points), reflecting the known national-level weakness on collaborative therapeutic drug monitoring. The benchmarking placement supports the institutional claim that this Class C public hospital is performing in the upper quartile of its peer group.

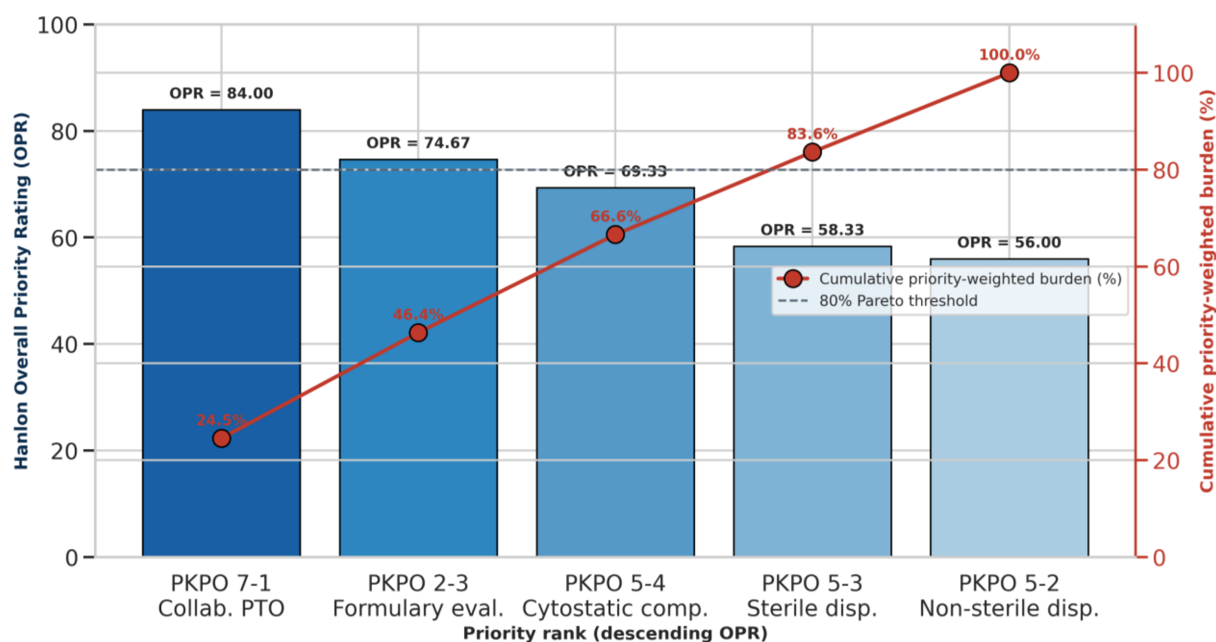

Figure 3. Pareto analysis of cumulative priority-weighted residual burden. The top three Hanlon priorities concentrate 70.2% of the burden, and the top five concentrate 91.8%, confirming a classic Pareto distribution that supports focused improvement efforts.

Table 4. Institutional PKPO compliance profile benchmarked against published Indonesian and International Hospital-Pharmacy Research (2020–2024).

PKPO standard	Institutional score (%)	Indonesian benchmark (%)*	International benchmark (%)†	Margin (institutional – Indonesian)
PKPO 1 — Organisation	93.75	88	91	+5.75
PKPO 2 — Selection & Procurement	95.00	83	88	+12.00
PKPO 3 — Storage	83.33	73	80	+10.33
PKPO 4 — Prescribing	94.64	82	85	+12.64
PKPO 5 — Dispensing	83.75	78	82	+5.75
PKPO 6 — Drug Administration	90.62	80	86	+10.62
PKPO 7 — Therapeutic Drug Monitoring	92.71	58	74	+34.71
Overall weighted compliance	**90.54**	**78**	**84**	**+12.54**

*Indonesian national survey benchmarks from Tarigan et al. (2022) and Mistika et al. (2023). †International benchmarks synthesised from Afsar et al. (2020), Chen et al. (2024), and Alotaibi et al. (2023). Positive margins indicate institutional outperformance relative to the benchmark.

Implementation-readiness matrix. Because the translational value of accreditation research depends on the implementability of its recommendations, the residual gaps were subjected to a second-layer implementation-readiness appraisal across four dimensions — Leadership Commitment, Workforce Capacity, Financial Feasibility, and Regulatory Alignment — each scored on a 0–3 scale. The resulting implementation-readiness matrix is reported in Figure 4. Collaborative therapeutic drug monitoring emerged as the priority with the highest leadership commitment and regulatory alignment, but moderate workforce and financial feasibility. Cytostatic-compounding competency had the lowest workforce-capacity readiness, consistent with the national shortage of certified cytostatic handlers, but the highest regulatory alignment because certification pathways are already codified. Annual formulary evaluation had uniformly moderate readiness, reflecting the need for coordinated Pharmacy-and-Therapeutics-Committee reform rather than net new investment.

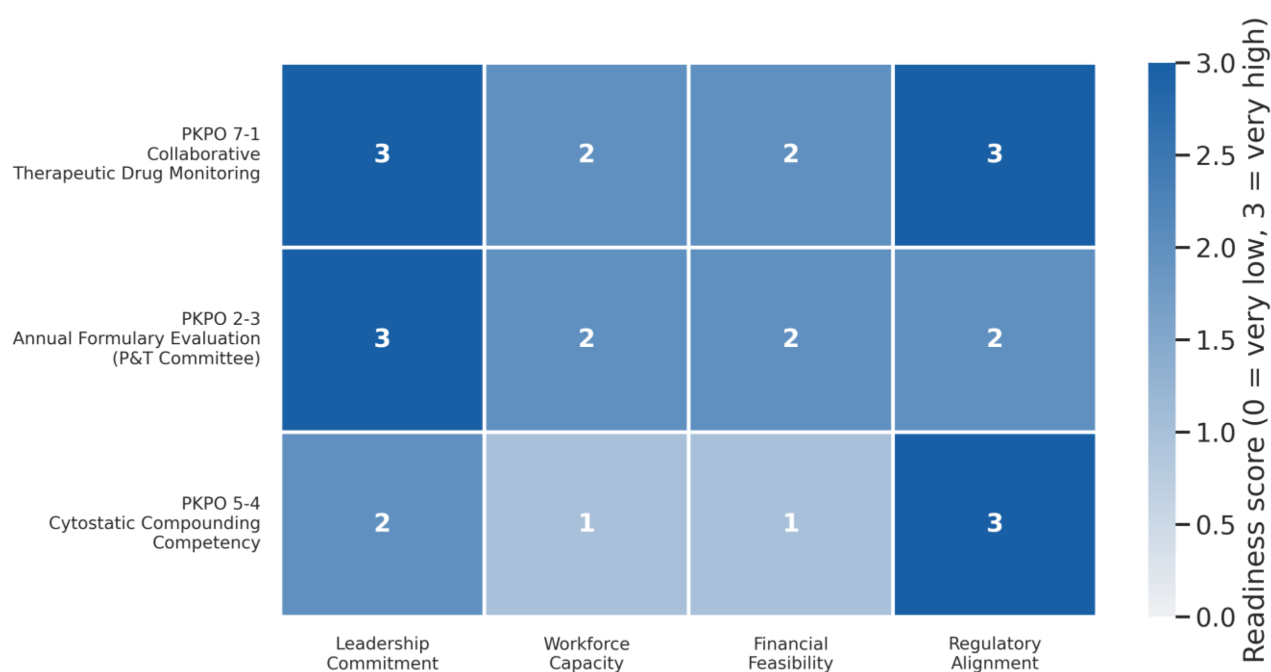

Figure 4. Implementation-readiness matrix for the three top-tier Hanlon priorities. Readiness is scored 0 (very low) to 3 (very high) across four dimensions — Leadership Commitment, Workforce Capacity, Financial Feasibility, and Regulatory Alignment — to inform deployment sequencing.

Integrated interpretation of the top three priorities. Collaborative therapeutic drug monitoring is not an isolated deficiency; it aggregates three structural weaknesses that recur across the Indonesian Class C public-hospital segment — limited clinical-pharmacist establishment, absence of standardised collaborative documentation such as Subjective–Objective–Assessment–Plan (SOAP) notes, and under-developed interprofessional forums bringing pharmacists, physicians, and nurses into the same clinical conversation.[13,26,27] A plausible intervention package — for which pre-post effect sizes of 35–55% reduction in preventable adverse drug events have been published — comprises (i) a Director's decree formally integrating clinical pharmacists into the Patient-Responsible-Physician (DPJP) team, (ii) case-based

interprofessional training, (iii) development of an electronic Farklin documentation module linked to the hospital information system, and (iv) inclusion of collaborative therapeutic drug monitoring completion as a hospital-level quality indicator.[3,27] At the workforce level, the implied gap corresponds to approximately 0.5 to 1.0 additional clinical-pharmacist full-time equivalents at current patient volumes.

Annual formulary evaluation is an equally important priority because formulary stagnation is the proximal cause of off-formulary prescribing, misaligned procurement, and cost inefficiency.[25] The corrective package should reactivate the Pharmacy and Therapeutics Committee through a formal annual calendar, introduce Drug Utilisation Review (DUR) anchored on hospital-information-system data, and schedule prescriber-facing workshops explaining formulary updates. Cytostatic compounding competency, the third top-tier priority, operates at the intersection of occupational safety and patient safety.[15] The Pharmacy Department should enrol all pharmacists who handle cytostatic preparations into national certification programmes, upgrade the compounding suite to at least ISO Class 7 with an ISO 5 primary engineering control, and build an internal quality-audit cadence feeding into the hospital patient-safety committee.

SMART action plan. Following the facilitated focus-group discussion, a SMART 2025 action plan was finalised, with designated leads, quantified success indicators, and milestone dates. Collaborative therapeutic drug monitoring will be led by the Head of Pharmacy Department and the emerging clinical-pharmacist team, with the target of 100% collaborative therapeutic-drug-monitoring coverage across priority wards (internal medicine, paediatrics, intensive care) by Q4 2025 and complete standard-operating-procedure revision within Q2 2025. Formulary evaluation will be led by the Chair of the Pharmacy and Therapeutics Committee, with one formal evaluation per year and a management-approved annual report. Cytostatic competency will be led jointly by the Pharmacy Department and the Human Resources Division, with a minimum of two pharmacists certified through accredited training within 12 months and a quarterly internal audit cycle. The complete plan is presented in Table 5.

Table 5. SMART 2025 action plan derived from the top three Hanlon priorities.

Priority	Specific target	Measurable indicator	Owner	Timeline (2025)	Review cadence
PKPO 7-1 Collaborative therapeutic drug monitoring	Integrate clinical pharmacists into the DPJP team; roll out the SOAP documentation module	100% collaborative PTO coverage in priority wards	Head of Pharmacy Dept. + Clinical Pharmacy Team	SOP Q2; rollout Q3; full coverage Q4	Monthly
PKPO 2-3 Annual formulary evaluation	Reactivate the P&T Committee with an annual calendar; introduce Drug Utilisation Review	≥1 documented evaluation/year; management-approved annual report	P&T Committee Chair + Pharmacy Quality Lead	Calendar Q1; DUR Q2; annual report Q4	Quarterly
PKPO 5-4 Cytostatic compounding competency	Enroll compounding staff in national certification; upgrade the suite to ISO 5–7	≥2 pharmacists certified; suite ISO-compliant within 12 months	Pharmacy Dept. + HR + Facilities	Enrolment Q1–Q2; certification Q3; ISO audit Q4	Quarterly

SMART = Specific, Measurable, Achievable, Relevant, Time-bound. DPJP = *Dokter Penanggung Jawab Pasien* (Patient-Responsible-Physician); P&T = Pharmacy and Therapeutics; SOAP = Subjective–Objective–Assessment–Plan; ISO = International Organization for Standardization.

Theoretical triangulation. Donabedian's structure–process–outcome framework helps locate the observed findings along the structure–outcome axis.[17] The STARKES 2024 indicators that recorded the highest compliance (organisation, procurement, administration) are predominantly structure- and process-oriented, while the residual gaps (collaborative therapeutic drug monitoring, formulary evaluation, cytostatic competency) lie closer to the outcome end of the model. This pattern is consistent with the maturation trajectory described by Hassali and Saleem (2021), in which accreditation frameworks first drive structural investments and subsequently surface the outcome-linked weaknesses that structural investments alone do not resolve.[19] The Continuous Quality Improvement tradition supplies the managerial grammar — Plan-Do-Check-Act, Lean Six-Sigma, and PDCA cycles — through which the Hanlon priorities are converted into iterative institutional learning. Together, Donabedian, CQI, and Hanlon form the structure–priority–action triangle that this study operationalises.

Policy implications. The findings argue for three system-level policy moves. First, the Ministry of Health and the Indonesian Hospital Accreditation Commission (KARS) should explicitly recognise Hanlon-ranked priority lists as an intermediate output between the accreditation survey report and the hospital improvement plan, because ranked priorities yield more actionable guidance than aggregate scores. Second, national training programmes should prioritise cytostatic-compounding certification and clinical-pharmacist residency — the two domains that dominate the binding constraints at the Class C public-hospital level. Third, provincial health authorities should consider funding data-logger temperature monitoring and automated dispensing cabinet pilots in Class C hospitals, where the marginal cost is modest relative to the patient-safety benefit.[11,23,24] Consistent with the Medication Without Harm initiative, these policy moves form a coherent package that links accreditation compliance to measurable quality improvement.[3]

Research implications. The study also surfaces three research priorities. First, before–and–after implementation studies of the SMART 2025 action plan — with preventable adverse drug events, length of stay, and patient-reported satisfaction as primary outcomes — would strengthen the causal evidence base. Second, multi-site extensions of the STARKES 2024 + Hanlon + focus-group-discussion protocol across a purposive sample of Class C public hospitals in Central Java would test the portability of the framework. Third, the coupling of Hanlon with Failure Mode and Effects Analysis or Lean Six-Sigma, which explicitly adds a detectability dimension to the priority calculus, deserves empirical comparison against Hanlon alone.[19,20]

Mechanistic synthesis across the three top priorities. The three top-tier priorities are not merely an enumeration of separate gaps; they constitute an inter-locking mechanistic system. Annual formulary evaluation feeds the rational therapeutic envelope within which prescribing, dispensing, and therapeutic drug monitoring operate; cytostatic-compounding competency safeguards the most-error-sensitive dispensing class within that envelope; and collaborative therapeutic drug monitoring closes the patient-facing feedback loop that converts prescribing decisions into measurable outcomes. The implementation sequencing therefore, matters: formulary evaluation should logically precede full collaborative-PTO deployment, because the latter relies on a current, well-stewarded formulary. Cytostatic competency, by contrast, can be advanced in parallel because its supply chain (national certification, suite upgrade, internal audit) is largely independent of the formulary and PTO workflows. The implementation-readiness matrix in Figure 4 captures these inter-dependencies and assigns a deployment sequence that the SMART 2025 plan in Table 5 makes operational.

Strengths. Three strengths distinguish the study. First, it applies the new STARKES 2024 framework to a Class C public hospital at an early stage of the framework's diffusion, contributing to an otherwise

thin peer-reviewed evidence base. Second, the mixed-methods design — combining a quantitative institutional census with in-depth interviews, direct observation, patient-journey simulation, and document tracing — enables triangulation that exposes structural gaps invisible to a questionnaire alone. Third, the methodological coupling of STARKES 2024 with Hanlon prioritisation, sensitivity verification, Pareto analysis, implementation-readiness appraisal, and a SMART action plan transforms a compliance audit into an implementation-ready road-map.

Limitations. Three limitations require explicit acknowledgement. First, the analytical universe was restricted to a single Class C public hospital in Demak Regency; external generalisation to tertiary centres or private hospitals requires caution, although the benchmarking placement (Table 4) and the single-site case-study rationale articulated in the Methods address the internal-validity trade-off. Second, the sample (n = 8 pharmacists), though representing the entire institutional establishment, is small in absolute terms and limits inferential power; the Wilson-score binomial confidence intervals and FDR-adjusted one-sample tests are appropriate mitigations but do not substitute for a larger multi-site sample. Third, the questionnaire relied on self-reported implementation for some indicators; direct observation, patient-journey simulation, and document tracing mitigated but did not eliminate residual reporting bias.

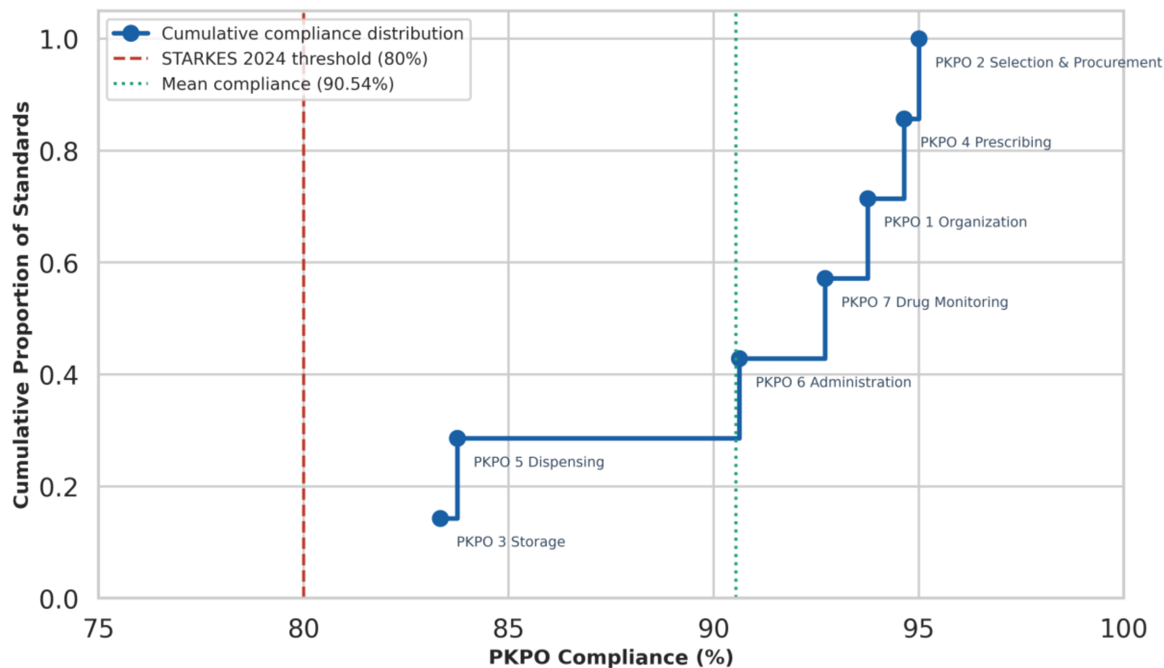

Figure 5. Cumulative compliance distribution across the seven PKPO standards. All applicable standards exceed the STARKES 2024 threshold of 80%; PKPO 3 (Storage) and PKPO 5 (Dispensing) sit closest to the threshold and are flagged for priority improvement.

4. Conclusion

The pairing of STARKES 2024 compliance scoring with Hanlon priority-setting, sensitivity verification, Pareto analysis, and implementation-readiness appraisal produced a disciplined translational bridge between accreditation audit and actionable quality improvement. Aggregate compliance of 90.54% (95% CI 85.1–94.3) met the STARKES 2024 threshold on every applicable standard, but indicator-level analysis, robust to sensitivity perturbation, identified three

feasible top-tier priorities — collaborative therapeutic drug monitoring (Overall Priority Rating 84.00), annual formulary evaluation (74.67), and cytostatic compounding competency (69.33) — that together concentrated 70.2% of the priority-weighted residual burden. A SMART 2025 action plan, formulated through a facilitated focus-group discussion and mapped onto an implementation-readiness matrix, translates these priorities into operational steps with designated leads, quantified success indicators, and milestone dates. The findings argue, at the institutional scale, for investment in clinical-pharmacist integration, Pharmacy and Therapeutics Committee reactivation, and cytostatic-compounding capacity; and at the system scale, for formal Ministry-level recognition of Hanlon-ranked priorities as the intermediate output between accreditation reporting and quality-improvement planning. Future research should evaluate the SMART 2025 plan through action research or interrupted time-series designs, test portability of the STARKES 2024 + Hanlon protocol to additional Class C hospitals, and integrate patient-centred outcomes — preventable adverse drug events, length of stay, and patient-reported experience — to anchor quality improvement in demonstrable patient benefit. The study establishes a transferable template that converts accreditation compliance from a reporting endpoint into a lever for measurable quality improvement.

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