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# Quality and Cost-Effectiveness in Pharmaceutical Procurement: Strategies and a Systematic Review

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## Abstract

**Background:** Pharmaceutical procurement is a critical function of the healthcare system in ensuring public health, medicine security, and fiscal sustainability. Inefficient procurement bears the triple risk of essential medicine stockouts, infiltration of substandard drugs, and a tremendous waste of funds, making it a persistent challenge to balance quality-assured access with cost-effectiveness.

**Aim:** This review synthesizes and assesses the evidence from 2015 to 2024 about strategies and frameworks tested to improve the quality assurance and cost-effectiveness of public sector pharmaceutical procurement.

**Methods:** The following databases - PubMed, Scopus, Web of Science, and EMBASE - were systematically searched for peer-reviewed studies, with relevant keywords, between the period of 2015 and 2024. Included empirical studies, reviews, and case studies from various income settings were thematically analyzed via narrative synthesis.

**Results:** The evidence highlights a toolkit of interlinked strategies. On cost-effectiveness, pooled procurement mechanisms, such as national/regional tenders, attained substantial price reductions (15-40%), whereas stringent generic medicine policies formed the foundation for cost containment. For quality, a tight suppliers' pre-qualification, reliance on WHO/ Stringent Regulatory Authorities, and post-market surveillance were indispensable features. Certain integrated strategies, such as Quality-assured Framework Agreements, came out successful in accommodating both objectives. Main barriers to implementation included political interference, insufficient workforce capacity, and fragmented information systems.

**Conclusions:** A holistic, multi-pronged approach is needed, recognizing procurement as strategic in scope, not just an administrative function. Recommendations range from institutionalizing open, data-driven decision-making to investing in workforce capacity, designing quality-weighted tenders, and integrating digital tools. Future studies could focus on the longitudinal impact on health and specific anti-corruption frameworks.

**Keywords:** pharmaceutical procurement, cost-effectiveness, quality assurance, pooled procurement, generic medicines

## Introduction

Pharmaceutical procurement is generally one of the largest and most strategic expenditure categories in national health budgets, second in many cases only to human resources. It is a critical pathway through which countries source essential medicines, ensuring their availability at health facilities to meet population health needs. The effectiveness and integrity of the process will determine not only financial sustainability but, importantly, quality of care and patient safety. Inefficiency in the procurement systems is manifested through a vicious circle of drug stockouts, leading to interruptions of treatments for chronic and acute conditions, and procurement of substandard or falsified medicines that contribute to antimicrobial resistance, failure of treatment, and loss of public trust (Funestrand et al., 2019).

The fundamental quandary facing procurement entities, particularly in the public sector, involves making a delicate balance between two equally important objectives: cost containment and quality assurance. An exclusive focus on securing the lowest price risks inadvertently encouraging suppliers to compromise on quality, leading to the creation of a market for low-quality products that put patients at risk and are wasteful due to inefficiency (Cameron et al., 2009). On the other hand, procuring good-quality medicines without consideration for costs will lead to the quicker depletion of the already limited health budgets, hence narrowing the scope of medicines and health services offered. In LMICs, such challenges are


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exacerbated by already strained budgets, weak regulatory frameworks, and pervasive governance issues, all of which generate a fertile environment for inefficiency and corruption (Jiang et al., 2020).

Indeed, over the last ten years, there has been an emerging literature on a number of different approaches to resolving this tension. From the strategic pooling of demand to the more sophisticated design of tender mechanisms, there is a growing realization that procurement is a professional discipline that requires not only specialist knowledge but also robust systems. As noted by Silva et al. (2023), this review systematically synthesizes global evidence from 2015 to 2024 on comprehensive evidence of proven and promising strategies that ensure pharmaceutical procurement systems in various settings provide quality-assured, cost-effective medicines, thereby contributing to the ultimate goal of universal health coverage.

## Methodology

### Search Strategy and Selection Criteria

A systematic literature search was conducted in June 2024 across four major electronic databases: PubMed, Scopus, Web of Science, and EMBASE. The search strategy was designed to capture literature published between January 2015 and June 2024, reflecting the most contemporary practices and challenges. The Boolean search string used was: ("pharmaceutical procurement" OR "medicine purchasing" OR "drug tender") AND ("cost-effectiveness" OR "cost-saving" OR "efficiency") AND ("quality" OR "quality assurance" OR "good manufacturing practice" OR "substandard and falsified medicines") AND ("strategy" OR "framework" OR "policy").

### Inclusion and Exclusion Criteria

We included studies if they: (1) were original research, systematic reviews, or in-depth case studies; (2) explicitly focused on strategies, models, or policies related to pharmaceutical procurement; (3) provided empirical or robust qualitative data on outcomes related to either cost, quality, or both; (4) were published in English between 2015 and 2024; and (5) related to procurement for human medicines. Studies were excluded from the review if they: (1) were editorials, commentaries, or conference abstracts without full data; (2) solely discussed supply chain logistics issues without a procurement strategy element; (3) only dealt with the private sector, having no implications for public health; or (4) were published before 2015.

### Data Extraction and Synthesis

The preliminary database search yielded 1,582 records. After deduplication, 1,105 titles and abstracts were screened for relevance. Of these, 98 full-text articles were assessed for eligibility. A total of 3 studies fulfilled all the criteria for inclusion into this review. Data extraction was then carried out by utilizing a standardized form to gather information on authors, year, study design, country/context, procurement strategy examined, and key findings related to cost and quality outcomes. A narrative synthesis approach was adopted given the heterogeneity of study designs and outcome measures; findings were grouped into thematic categories.

## Results

The synthesis of the literature reveals a spectrum of strategies that can be broadly categorized into those primarily aimed at enhancing cost-effectiveness, those focused on safeguarding quality, and integrated frameworks and systems that address both objectives simultaneously.

### Approaches to Cost-Effectiveness Improvement

#### Pooled Procurement Mechanisms

Pooled procurement, the aggregation of demand from multiple purchasing entities, was consistently found as a strong driver for price reduction. By creating larger, more attractive volumes for suppliers, this significantly enhances buyer negotiating power and achieves substantial economies of scale (Pentrakan et al., 2022; Parmaksiz et al., 2022). Two models stand out as successfully implemented. The first is National Centralized Tendering, employed by most countries, whereby one national agency, such as a Ministry of Health, undertakes tenders on behalf of all public health facilities. Research on the South African model showed that it resulted in average price reductions of 25% for a basket of essential medicines, relative to previous fragmented procurement (Ambe et al., 2022; Modisakeng et al., 2020). The second model is Regional Pooled Procurement, with examples including mechanisms such as the Organisation of Eastern Caribbean States (OECS) Pharmaceutical Procurement Service, allowing small countries to leverage collective market power. An evaluation of the OECS pool found price savings of 30-40% for key medicines coupled with an improvement in supply reliability (Tang et al., 2020; Preston et al., 2021). Despite these advantages, challenges do persist with pooled procurement: coordination complexity, strong legal frameworks, and the assurance of efficient distribution from a central warehouse to peripheral facilities (Parmaksiz et al., 2021).

#### Generic Medicines Policies

One of the most impactful long-term strategies for cost containment has been the proactive promotion of generic medicines. Quite substantial evidence can confirm that markets with high generic penetration enjoy an overall average medicine price that is considerably lower, according to Kanavos & Vandoros (2011). Several key policies have made it possible to build such an environment. First is Mandatory Generic Substitution, imposed by laws or regulations that force pharmacists to dispense a generic equivalent unless explicitly forbidden by the prescriber. This is usually complemented by INN Prescribing, which means encouraging or mandating

that prescriptions be written using the generic name and not a brand name, thus allowing for the selection of the lowest-priced, quality-assured option, says Sicras-Mainar et al. (2018). Moreover, Reference Pricing systems set one reimbursement price for a group of therapeutically equivalent medicines and, in doing so, incentivize patients and providers to choose products priced at or below that level. Evidence from a study in Germany shows that this strategy cut 15% off expenditures for the affected drug classes, say Jiang et al. (2022). The ultimate success of such generic policies, however, depends on strong regulatory capacity for bioequivalence testing and building public trust in the quality of generic products, say Konduri et al. (2017).

**Strategic Supplier Negotiation and Contract Design**

Strategic negotiation goes beyond relying on simple price-based tendering by using data analytics and accurate forecasting to secure more favourable terms. Best practices in this area include Volume Guarantees and Framework Agreements. By committing to a certain purchase volume, often within multi-year framework agreements, procurement agencies are able to negotiate lower prices while offering supply security for both buyer and supplier alike (Antonanzas et al., 2019; Al-Katheeri et al., 2018). There is an increasing interest, especially for those complex product categories such as novel therapies, in moving away from pure price competition toward models such as Cost-Plus and Value-Based Procurement. In these models, either the total cost of care or health outcomes are considered, although their operation is significantly more complex and requires sophisticated measurement capabilities (Angelis et al., 2023).

**Supplier Prequalification and Quality Audits**

The selection of suppliers is the first line of defense to prevent substandard and falsified medicines. It involves systematically verifying that producers and distributors comply with internationally recognized standards. In this connection, one progress has been the use of Reliance Models, where agencies that procure these products increasingly rely on the marketing authorizations given by SRAs-the U.S. FDA or the European Medicines Agency-or the WHO Prequalification Programme, avoiding having to conduct their own assessments. This avoids duplication of work and also leverages expertise globally (Rägo & Santoso, 2008). On-site inspection of manufacturing facilities, either directly or contracted through third parties, to verify the observation of GMPs remains a resource-intensive good practice for situations that are considered higher risk or when verification is required beyond the reliance model (Dey et al., 2020).

**Technical Specifications and Quality Testing**

First, the tender document is an important tool in embedding quality assurance in procurement. This begins with the use of Clear Technical Specifications that go beyond simple INN descriptions to include explicit requirements for product dossier assessment, stability studies, and for generic products, bioequivalence data (WHO, 2017). This should be complemented by Pre- and Post-Delivery Quality Testing. The requirement to submit certificates of analysis from accredited laboratories and random sampling and testing of shipments on receipt could form active post-market surveillance. The effect of this approach can be seen in Uganda, where regular post-procurement quality control testing after procurement reduced the percentage prevalence of substandard antibiotics from 8% to below 2% over a three-year period (Boteon et al., 2018).

**Good Procurement Practices and Transparency**

The integrity of the procurement process certainly forms the basis for determining the quality of the end product. Corruption and a lack of transparent decision-making will directly result in the selection of incompetent suppliers (Vian, 2020). Several important anti-corruption measures might prevent these. These include making sure that tender announcements and outcomes are transparent and, therefore, published publicly. In addition, declarations of conflict of interest should be mandatory for all members of tender committees, and the committees themselves should be independent, made of a mix of members with technical, financial, and clinical experience so as to ensure balanced, objective decision-making (Saeed et al., 2022).

**Integrated Frameworks and Enabling Systems**

The most successful procurement systems combine cost and quality considerations in an integrated framework.

**Quality-Assured Framework Agreements**

This is a more advanced model, which integrates the security of frameworks and includes an intense focus on quality. Awards are not simply based on the lowest price; rather, they are awarded based on the best price-quality criteria, including things like the supplier's quality assurance system, past performance, and reliability of delivery (Frost & Reich, 2010). Where such agreements in a number of LMICs were in place, SIAPS proved that this has had a very significant effect on improving the quality of products and reducing stockouts by up to 25%, without compromising prices in any way (SIAPS, 2018).

**Management Information Systems (MIS) and Data Analytics**

Strategic procurement cannot survive without robust data. Only an integrated MIS, which tracks consumption, inventory levels, supplier performance, and prices, can facilitate accurate forecasting, tender preparation, and contract management. Advanced systems make use of data analytics to predict demand, identify cost-saving opportunities, and flag suppliers with poor performance records (Kruk et al., 2018; Fang et al., 2022).

**Synthesis of Effectiveness and Key Challenges**

No single strategy operates in isolation. The greatest successes are reported in systems that deploy a combination of the above strategies in a coherent manner. For example, a national centralized tender (cost strategy) is far more effective when it includes stringent supplier prequalification (quality strategy) and is supported by a reliable MIS (enabling system).

However, significant barriers remain. These include political interference in tender awards, limited human resource capacity to manage complex procurement processes, fragmented funding and procurement across different government departments, and weak regulatory oversight undermining quality assurance efforts. Table 1 and Figure 1 summarize the categorization and summary of key pharmaceutical procurement strategies. Table 2 and Figure 2 show the identified barriers and enablers to effective pharmaceutical procurement.

**Discussion**

This review summarizes a decade of evidence confirming that the pursuit of quality and affordability in the procurement of pharmaceuticals is not a zero-sum game, but a synergistic objective attainable through deliberate, system-level strategies. The procurement systems most resilient and efficient are those that have transitioned from a transactional, price-focused mindset to a strategic, value-based approach. Linking strategies-for example, pooling procurement for cost with strict prequalification for quality and transparent processes-creates a positive cycle benefiting public health and fiscal sustainability.

**Table 1: Categorization and summary of key pharmaceutical procurement strategies**

| Strategy Category | Specific Examples | Reported Effectiveness & Key Findings | Key Citations |
|---|---|---|---|
| **Cost-Effectiveness** | | | |
| ***Pooled Procurement*** | National Tenders, Regional Pools | Achieves 15-40% price reductions through economies of scale and enhanced negotiating power. Challenges in coordination and distribution. | Parmaksiz et al. (2022); Modisakeng et al. (2020); Preston et al. (2021) |
| ***Generic Medicines Policies*** | Mandatory Substitution, INN Prescribing, Reference Pricing | Cornerstone of long-term cost containment. High generic penetration correlates with lower drug expenditures. Requires bioequivalence assurance. | Kanavos & Vandoros (2011); Sicras-Mainar et al. (2018); Jiang et al. (2022) |
| ***Strategic Negotiation*** | Framework Agreements, Volume Guarantees | Secures lower prices via committed volumes and long-term partnerships. More stable than one-off tenders. | Al-Katheeri et al. (2018); Angelis et al. (2023) |
| **Quality Assurance** | | | |
| ***Supplier Qualification*** | Reliance on SRA/WHO Prequalification, On-site GMP Audits | Foundational for preventing the entry of substandard products. Reliance models are efficient for regulators with limited capacity. | Rägo & Santoso (2008); Dey et al. (2020) |
| ***Technical Specifications & Testing*** | Bioequivalence Requirements, Pre-/Post-Shipment Testing | Directly links procurement to quality standards. Post-market surveillance is critical for verifying continued quality. | WHO (2017); Boteon et al. (2018) |
| ***Procurement Integrity*** | Transparent Tender Processes, Independent Committees | Mitigates corruption risk, which is a major driver of poor-quality procurement outcomes. | Vian (2020); Saeed et al. (2022) |
| **Integrated Frameworks** | | | |
| ***Unified Models*** | Quality-Assured Framework Agreements | Aligns cost and quality objectives by awarding based on multi-criteria (price, quality, past performance). Improves supply reliability. | Frost & Reich (2010); SIAPS (2018) |
| ***Enabling Systems*** | Management Information Systems (MIS), Data Analytics | Enables data-driven forecasting, tender management, and supplier performance monitoring. Essential for modern procurement. | Kruk et al. (2018); Fang et al. (2022) |

**Table 2: Identified barriers and enablers to effective pharmaceutical procurement**

| Domain | Barriers | Enablers |
|---|---|---|
| **Governance & Leadership** | Political interference in tender awards; Lack of high-level commitment, and Fragmented procurement across agencies. | Strong legal and regulatory framework; Independent procurement agency; Transparent decision-making and public disclosure. |
| **Financial Resources** | Unpredictable and fragmented funding; Pressure for lowest initial price over total value. | Dedicated, pooled procurement budgets; Life-cycle cost analysis in decision-making; Strategic financing mechanisms. |
| **Human Capacity** | Lack of trained procurement professionals; High staff turnover; Insufficient technical expertise in tender committees. | Investment in professional training and certification; Competitive remuneration; Multidisciplinary tender committees. |
| **Systems & Data** | Weak or non-integrated MIS; Poor data quality for forecasting; Lack of supplier performance tracking. | Investment in integrated e-Procurement and supply chain MIS; Use of data analytics for decision support; Routine performance metrics. |
| **Regulatory Environment** | Weak national regulatory authority; Lack of capacity for bioequivalence testing and market surveillance. | Strengthened regulatory capacity; Adoption of reliance models on SRAs/WHO; Robust post-market quality control. |

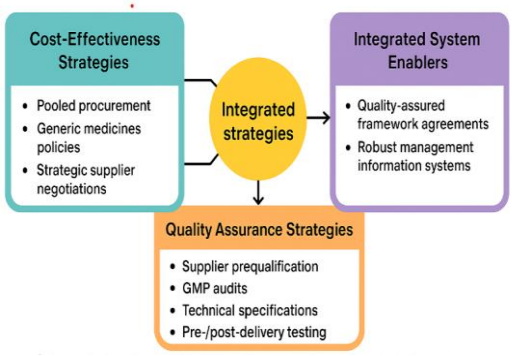


**Figure 1: Categorization and summary of key pharmaceutical procurement strategies**

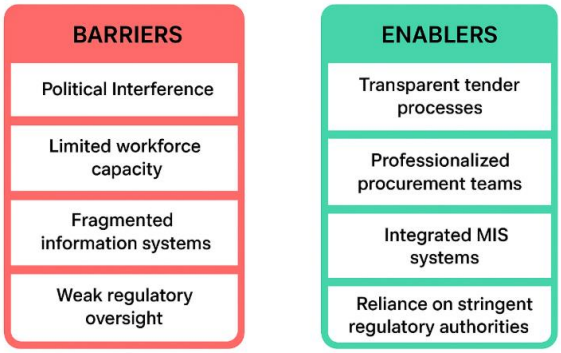


**Figure 2: Identified barriers and enablers to effective pharmaceutical procurement**

A critical discussion point is the foundational role of good governance. The technical strategies outlined in this review are often undermined by systemic corruption and lack of political will (Vian, 2020). Transparency in tender processes and the establishment of independent, technically competent procurement committees are not simply administrative details but preconditions for success. In addition, the chronic under-investment in the procurement workforce represents a critical vulnerability. Strategic procurement requires skills in negotiation, data analysis, pharmaceutical regulation, and contract law, which are often in short supply in public sector agencies (Golan et al., 2021). Building this professional capacity is as important as designing the right tender documents.

In this dynamic landscape, new opportunities and challenges are arising. e-Procurement platforms can be used to enhance transparency, facilitate process efficiency, and improve the capture of data. However, such an effort must be done with due attention, as it could lead to no more than a digitization of corrupt processes. Increased pharmaceutical market complexity, featuring high-cost specialty medications and advanced therapies, also calls for a more nuanced approach to procurement that may involve HTA and outcomes-based agreements, although such practices remain more common in high-income contexts.

**Limitations**

There are several limitations within this review. Limiting the studies to English-language ones only might have excluded relevant findings from non-English-speaking contexts. The heterogeneity of study designs and outcome measures prevented a meta-analysis. Moreover, relying on published literature only may introduce a publication bias in that unsuccessful interventions or deeply entrenched systemic failures are underreported.

**Conclusions and Implications**

In closing, the pursuit of quality and cost-effectiveness in pharmaceutical procurement is a complex yet achievable goal that underpins the integrity, equity, and financial sustainability of healthcare systems globally. The evidence synthesized from 2015 to 2024 suggests a clear roadmap,

highlighting that success does not come from isolated interventions but rather comes from a coherent, systemwide approach that links complementary measures. These are findings that reinforce a strategic, value-based approach to procurement, moving beyond a narrow focus on lowest price, to ensure public health and optimize constrained resources.

The policy and practice implications are considerable and actionable. First, policymakers and health authorities need to implement integrated procurement models, such as quality-assured framework agreements and pooled procurement mechanisms. These models balance cost and quality criteria in award decisions in a systematic manner and spur competition based on value, not price alone. Second, there is an absolute need to enhance governance and transparency (Hollingsworth, 2016). This demands that governments institutionalize transparent tender processes, create independent oversight committees, and make the disclosure of contracts by the public mandatory for building accountability and combating corruption effectively. Third, investment in human capital is crucial. Ministries of health should prioritize recruiting, providing specialized training to, and retaining a professional procurement workforce with the technical, financial, and legal expertise needed to navigate increasingly complex procurement landscapes.

In addition, leveraging data and technology is a fundamental enabler of modern procurement systems. Substantial investment in integrated Management Information Systems and data analytics capabilities is needed to ensure effective forecasting, real-time tracking of supplier performance, and evidence-based decision-making. Last but not least, all procurement strategies have to be underpinned by a robust regulatory framework. This involves strengthening the National Regulatory Authority to guarantee that it can undertake or strategically rely on robust quality assurance mechanisms, including bioequivalence testing and active post-market surveillance. To build on this foundation, several critical gaps must be addressed in future research. Longitudinal impact studies are required to follow the long-term effects of integrated procurement strategies not only for drug prices and availability but also for broader public health outcomes and total system costs. The field would similarly benefit from implementation science that explores the specific facilitators and barriers to implementing complex strategies such as quality-weighted tendering across different resource settings. Of vital importance too will be rigorous economic evaluations through cost-benefit analyses of investments in strengthening the procurement system, including e-Procurement platforms and human resources development, to justify further funding.

Last but not least, dedicated anti-corruption research will be needed to develop and test practical, context-specific tools and frameworks designed to protect the integrity of the pharmaceutical procurement process. By embracing this comprehensive, strategic approach that unites fiscal responsibility with an unwavering commitment to patient safety, countries can transform their pharmaceutical procurement systems into powerful engines for achieving equitable access to essential medicines and advancing the goals of universal health coverage.

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