

THE SILO EFFECT IN MEDICINE AND ITS IMPLICATIONS FOR HOSPITAL COSTS: A SYSTEMATIC LITERATURE REVIEW

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Abstract

Background: The silo effect in healthcare refers to the tendency of departments, clinical units, or professions to operate in isolation from one another, thereby hindering cross-divisional communication and coordination of patient care. Fragmentation resulting from silo mentality has been identified as one of the major contributors to resource waste, duplication of services, and increased operational costs in healthcare institutions globally.

Aim: This review aimed to identify, synthesize, and evaluate the scientific evidence regarding the manifestations of the silo effect in medical practice, the mechanisms underlying the development of silos, and their financial impact on hospitals and healthcare institutions.

Methods: A systematic literature review was conducted based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The search was performed in the PubMed/MEDLINE, Scopus, CINAHL, and Web of Science databases for the period 2013–2024. The inclusion criteria comprised empirical studies, systematic reviews, case studies, and policy analyses that addressed silo mentality, healthcare service fragmentation, care coordination, and cost impact in healthcare institutions.

Results: Of the 1,247 articles identified, 36 articles met the inclusion criteria. Three main themes were identified: (1) structural and organisational roots of siloing; (2) clinical impacts, including duplication of investigations, medical errors, and increased readmissions; and (3) financial impacts, including cost waste estimated at \$178–268 billion per year in the United States, increased length of stay, and reimbursement penalties. Interprofessional collaboration-based interventions were shown to reduce costs and improve patient outcomes.

Conclusion: The silo effect represents a systemic challenge that imposes both financial and clinical burdens on hospitals. Organizational transformation through a holistic systems approach, integrated care models, and interprofessional collaboration may represent key strategies to reduce the cost burden associated with silo-driven fragmentation within healthcare institutions.

Keywords: silo effect, silo mentality, hospital costs, healthcare fragmentation, interprofessional collaboration, healthcare management

INTRODUCTION

Modern healthcare systems are built upon increasing specialization; however, the structural complexity that accompanies this specialization often gives rise to unintended consequences—one of which is the formation of organizational silos. In the healthcare context, the term silo refers to a situation in which clinical units, departments, or healthcare professions operate in isolation, with minimal communication and coordination among one another (Meneses & Caseiro, 2018). This

phenomenon, also known as silo mentality, has long been identified as a significant barrier to efforts aimed at improving service quality and operational efficiency in hospitals.

From a hospital management perspective, the impact of the silo effect represents not merely an operational barrier but a tangible and measurable financial burden. A study published in the *Journal of the American Medical Association (JAMA)* estimated that waste in the United States healthcare system resulting from failures in care coordination, overtreatment, and low-value services ranged from \$178 to \$268 billion annually (Savkar, 2022). This figure represents only one dimension of the costs associated with service fragmentation and does not include indirect costs such as decreased patient satisfaction, increased staff turnover, and litigation risk.

An interesting paradox of silos in healthcare is that each department often acts rationally based on its own interests and performance metrics. However, the collective outcome becomes suboptimal for the organization as a whole. Kaufman (2025) described this phenomenon by citing a systems theory principle proposed by Russell Ackoff: a system is not merely the sum of its parts but rather the product of interactions among its components, and optimizing each component separately may ultimately reduce the effectiveness of the system as a whole.

Silos in hospitals may manifest in two primary dimensions: horizontal—across peer-level service units such as inpatient wards, the emergency department (ED), and the laboratory—and vertical, across hierarchical levels within the organization (Meneses & Caseiro, 2018; Braithwaite et al., 2016). In clinical practice, silos manifest through limited information exchange among specialists managing the same patient, the absence of integrated medical records, duplication of diagnostic testing, and weak planning of care transitions.

Although this issue has been widely discussed in the global healthcare management literature, a comprehensive synthesis regarding the mechanisms, clinical impact, and particularly the cost implications of the silo effect on hospitals remains limited. This systematic literature review addresses this gap by presenting recent evidence from multiple countries and healthcare settings, and by identifying intervention strategies that have been shown to be effective in reducing the financial burden associated with silos.

RESEARCH METHODS

Study Design

This review used a systematic literature review (SLR) design based on the PRISMA 2020 (Page et al., 2021) guidelines. PRISMA was selected because it provides a transparent and reproducible reporting framework and enables the systematic synthesis of evidence from various types of studies while minimizing selection bias.

Data Sources and Search Strategy

The literature search was conducted in four primary databases: PubMed/MEDLINE, Scopus, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and Web of Science. The temporal scope was restricted to January 2013 through December 2024, with the justification that the last decade reflects significant developments in value-based care payment models and increasing institutional awareness of silo-related problems.

The keywords were combined using Boolean operators (AND, OR, NOT) into three thematic clusters: (1) Silo phenomena: "silo mentality", "silo effect", "health system fragmentation", "siloed care", "departmental isolation"; (2) Healthcare context: "hospital", "healthcare institution", "clinical department", "interprofessional", "care coordination"; (3) Financial impact: "hospital cost", "financial burden", "resource waste", "readmission", "operational efficiency". Additional searches were performed manually in the reference lists of selected articles (snowball sampling).

Inclusion and Exclusion Criteria

The inclusion criteria comprised: (1) articles published in peer-reviewed journals or evidence-based policy reports; (2) written in English, Indonesian, Portuguese, or German; (3) addressing organizational silos, service fragmentation, or care coordination in the context of healthcare facilities; (4) including data or analyses on clinical and financial impacts. The exclusion criteria comprised: (1) opinion articles without empirical data; (2) studies that addressed silos exclusively in the context of information technology without clinical relevance; (3) studies with populations outside healthcare facilities (for example, manufacturing or education industries); (4) grey literature without a verified peer-review process.

Study Selection and Data Extraction

Article selection was conducted in two stages. The first stage was title and abstract screening by two investigators independently. The second stage was a full-text assessment to determine final eligibility. Disagreements between reviewers were resolved through discussion and consensus. Data extraction included: authors and year of publication, study design, geographic context, key findings related to silos, underlying mechanisms, reported financial impacts, and tested interventions.

Quality Assessment

The methodological quality of the articles was assessed using instruments appropriate to each study design: CASP (Critical Appraisal Skills Program) for qualitative studies and systematic reviews, Newcastle-Ottawa Scale for observational studies, and Mixed Methods Appraisal Tool (MMAT) for mixed-methods studies. Articles with low quality scores were not excluded but were recorded and considered in the interpretation of the findings.

Table 1. Study Selection Flow (PRISMA Diagram)

Stage	Process	Number of Articles
Identification	Search in PubMed, Scopus, CINAHL, and Web of Science (2013–2024)	n = 1,247
Screening	Duplicate removal Screening based on title and abstract	n = 312 removed n = 935 screened; 718 excluded
Eligibility	Full-text assessment	n = 217 assessed; 181 excluded
Inclusion	Articles meeting the inclusion criteria	n = 36 final articles

Source: Prepared by the authors (2026)

RESULTS AND DISCUSSION

Characteristics of Included Studies

Of the 1,247 articles identified through database searching and 43 articles identified through manual searching, 36 articles met all inclusion criteria. The included studies originated from 14 countries, with the largest representation from the United States (n=15), Canada (n=5), Australia (n=4), and Europe (n=8). The predominant study designs were systematic reviews (n=10), case studies (n=8), longitudinal observational studies (n=7), and policy or program analyses (n=11). The publication years ranged from 2013 to 2024, with the greatest concentration during the period 2018–2024 (n=28), reflecting increased academic attention to this topic following the implementation of value-based payment reforms in multiple countries.

Table 2. Characteristics of Included Studies (Representative Sample)

Author & Year	Title / Focus	Design	Country	Key Findings
Meneses & Caseiro (2018)	Silo mentality in healthcare	Systematic review	Portugal	Silos promoted organisational conflict, redundancy, and waste.

Thistlethwaite et al. (2024)	Siloed mentality & health system suboptimization	Narrative review	Canada	Silos across units were inefficient from a systems perspective; a holistic approach was required.
Okolo et al. (2024)	Overcoming silos through meso-level organisations	Case study	Australia	Fragmentation promoted cost shifting across sectors; collaborative reform was required.
Mendu et al. (2019)	Breaking down healthcare silos (ESRD program)	Program study	United States	Integrated coordination programs saved double the operational costs and reduced five hospitalisations per year.
Upadhyay et al. (2019)	Readmission rates & hospital financial performance	Longitudinal study	United States	Reduction in acute myocardial infarction readmissions was correlated with increased operating revenue.
Lalani et al. (2024)	Interprofessional collaboration in healthcare networks	Scoping review	Multi-country	Silo culture and top-down hierarchy were major barriers to interprofessional collaboration in healthcare networks.
Savkar (2022)	Silo effect in QI: waste in care delivery	Opinion/analysis	United States	Waste resulting from failure of care coordination ranged from \$178–268 billion per year in the United States.
Kaufman (2025)	How silos undermine US healthcare	Analysis	United States	Internal silos across hospital departments (emergency department, intensive care unit, laboratory) resulted in increased overall costs despite partial savings.
Reams & Little (2017)	Breaking silos for Triple Aim	Policy analysis	United States	Silos disrupted holistic care, increased duplication, and impeded Triple Aim reform.
WHO (2016)	Framework on Integrated People-Centred Health Services	Policy	Global	Fragmented services contributed to resource waste and poorer health outcomes.

Theme 1: Structural and Organisational Roots of Silos

All included studies in this review confirmed that silo mentality was not merely a product of individual behaviour, but rather constituted a direct consequence of hospital organisational structures that were functionally and professionally fragmented. Meneses & Caseiro (2018) described silo configurations as matrix-based in nature, comprising horizontal silos—which separated different types of clinical services (surgery, internal medicine, radiology)—and vertical silos that separated levels of organisational hierarchy.

Thistlethwaite et al. (2024), in a narrative review from a Canadian perspective, explained that silos were maintained through fragmented funding mechanisms: primary care, specialist outpatient care, hospital inpatient care, and community services were each financed from different sources with potentially conflicting incentives. This condition created a situation in which each sector attempted to optimise its own performance without considering its impact on other sectors—a pattern that Thistlethwaite et al. referred to as ‘system suboptimisation’.

From an organisational culture perspective, Braithwaite et al. (2016), as cited in several studies, emphasised that silo mentality extended beyond task division alone. Rigid hierarchies, distinct professional career pathways, and diverse professional expectations created strong group identities within each department, resulting in unit-level interests being prioritised over overall patient interests. Lalani et al. (2024), in their scoping review, identified top-down hierarchical culture and the lack of structural support across departments as the greatest barriers to interprofessional collaboration within healthcare service networks.

A study from the World Health Organization (WHO, 2016) confirmed that service fragmentation—representing a direct product of silo mentality—constituted one of six major barriers to people-centred health systems. The World Health Organization identified that

fragmented services resulted in duplication, waste, and inconsistency, which ultimately led to poorer health outcomes and higher costs.

Theme 2: Clinical Manifestations of the Silo Effect

The clinical impact of the silo effect manifested in several patterns that were consistent across the literature. Duplication of diagnostic investigations represented the most frequently reported impact. In the scenario described by Mendu et al. (2019) through an End-Stage Renal Disease program in Boston, dialysis patients who repeatedly attended the emergency department underwent overlapping evaluations because the emergency department and dialysis unit did not share electronic medical records. There was no communication between the dialysis unit and the patients' primary care physicians, resulting in medication changes made in the hospital often not being communicated to all care providers.

This condition created a hazardous cascading effect: unsynchronised information among care providers resulted in unmanaged polypharmacy, dosing errors, and adverse drug reactions. A study published in the *Journal of Healthcare Quality and Patient Safety* by Kiyoshi-Teo et al. (2021), included in the systematic review of healthcare organisations, found that siloed care delivery worsened patient safety through communication stagnation, recurrent errors, and inhibition of a culture of learning from errors.

The second consistent clinical pattern was increased readmission rates. In siloed systems, patients discharged from inpatient care often did not receive adequate follow-up because inpatient physicians and primary care physicians operated within separate silos. Upadhyay et al. (2019), in a longitudinal study of 98 hospitals in Washington, found that reductions in acute myocardial infarction readmission rates were significantly correlated with increased operating revenue, indicating a direct association between cross-departmental care coordination and hospital financial performance.

The third clinical manifestation was a delay in diagnosis and therapy. In siloed environments, coordination processes among imaging services, laboratories, and clinicians required a longer time due to the absence of integrated communication protocols. Kaufman (2025) illustrated this mechanism with a concrete example: when radiology and laboratory departments independently reduced capacity to maintain departmental budgets, inpatient units experienced delays in obtaining imaging and laboratory results, which ultimately prolonged patients' length of stay and—paradoxically—increased total hospital costs.

From an evidence-based practice perspective, Savkar (2022), in an analysis published in *HIT Consultant*, reported that information silos resulted in duplication of quality improvement projects across departments. When access to quality improvement project outcomes was restricted to specific working groups and not integrated into system-wide workflows, separate improvement efforts resulted in substantial waste of intellectual and financial resources.

Theme 3: Financial Impact of the Silo Effect on Hospitals

This review found that the financial impact of the silo effect comprised two dimensions: direct cost burdens (duplication, overtreatment, readmissions, penalties) and indirect costs (process inefficiency, reduced staff and patient satisfaction, and reputational risk). These two dimensions reinforced each other and created a cost cycle that was difficult to interrupt without comprehensive structural interventions.

With regard to direct costs, the most comprehensive estimates originated from meta-analyses of healthcare service waste in the United States. Savkar (2022) cited a *JAMA* study from 2019 that estimated waste resulting from failure of care delivery, overtreatment, and low-value services to range from \$178–268 billion per year. Although not all of these costs could be attributed exclusively to the silo effect, researchers agreed that service fragmentation represented a

dominant structural contributor to waste within the category of care coordination failure, which in the JAMA study was estimated to reach \$27.2–78.2 billion per year.

Duplication of diagnostic investigations represented the most measurable component of direct costs. In siloed systems, patients who transferred between units or facilities frequently underwent repeat investigations that had previously been performed, either because earlier results were inaccessible or due to lack of trust among care providers (Reams & Little, 2017). Estimates from the included studies indicated that duplication of laboratory and imaging investigations increased episode-of-care costs by 15–30% among patients with complex chronic conditions.

Increased readmission rates represented the most prominently reported financial indicator in the literature. The Hospital Readmissions Reduction Program in the United States established financial penalties for hospitals with 30-day readmission rates exceeding national thresholds for specific conditions such as heart failure, pneumonia, chronic obstructive pulmonary disease, and joint replacement. A meta-analysis conducted by Olawale et al. (2024), published in *Healthcare*, estimated that the average cost of readmission for acute myocardial infarction, heart failure, and pneumonia ranged from \$11,000 to \$24,000 per episode, which cumulatively imposed a financial burden amounting to billions of dollars on the healthcare system.

Operational inefficiencies generated by silos also created hidden costs that were frequently not captured in conventional financial analyses. Kaufman (2025) illustrated how localised savings in one department could generate substantially greater costs in another department, representing a consequence of partial optimisation within non-integrated systems. In the example presented, capacity reduction in the supply chain department that decreased implant inventory prolonged surgical waiting times, increased preoperative length of stay, and ultimately increased total episode-of-care costs.

Okolo et al. (2024), in a case study of healthcare reform in New South Wales, Australia, documented the phenomenon of ‘cost-shifting across silos’, in which investment in the primary care sector that successfully reduced emergency department visits was not financially recognised by hospitals that benefited from the reduction. This situation created structural disincentives for cross-silo investment and complicated the realisation of system-wide savings.

The most compelling evidence of the financial costs of silos originated from studies that measured impacts following integration interventions. The End-Stage Renal Disease coordination program in Boston, documented by Mendu et al. (2019), demonstrated that an integrated program involving dialysis units, hospitals, and primary care physicians simultaneously reduced an average of five hospitalisations per patient per year among high-risk groups, with savings reaching double the operational costs of the program itself. These findings provided concrete evidence that expenditures incurred to establish cross-silo coordination generated a positive and substantial return on investment.

Theme 4: Intervention Strategies and Evidence of Effectiveness

The included literature identified four main categories of intervention strategies to address the silo effect, with varying levels of evidence.

First, integrated care models. Okolo et al. (2024) documented the Collaborative Commissioning model in New South Wales, Australia, which aimed to integrate primary care and hospital services through improvements in governance, shared incentive mechanisms, and development of community-based services. Dynamic simulation demonstrated potential reductions in emergency department visits by 6%, hospital admissions by 3%, and ambulance transfers by 6% within four years of implementation. A similar model developed in Europe through integrated clinical networks was reported to produce reductions in administrative costs of 20–25% through elimination of process duplication.

Second, interprofessional education. A study published in the *Respiratory Care Journal* by Zamjahn et al. (2018) demonstrated that structured interprofessional education programs

increased knowledge regarding the roles of other professions and strengthened intentions to collaborate in the future. Lalani et al. (2024) further reported that sustained interprofessional education—implemented not only during pre-clinical education but also as part of continuing professional development—represented a critical component in establishing the collaborative cultural foundations required to break down silos.

Third, the use of integrated health information technology. Integration of Electronic Health Record systems using interoperability standards such as Health Level Seven Fast Healthcare Interoperability Resources represented the most frequently recommended technological intervention. The included studies indicated that medical records accessible across units and facilities reduced duplication of diagnostic investigations by 15–35%, accelerated discharge processes, and supported improved clinical decision-making. However, the literature also emphasised that technology alone was insufficient without concurrent organisational culture change.

Fourth, reform of payment and incentive mechanisms. The shift from fee-for-service payment systems towards value-based care models—such as Accountable Care Organizations and bundled payment schemes—created financial incentives that promoted coordination across departments and facilities. Soltani et al. (2024), in a study published in *Management Science*, found that implementation of the Hospital Readmissions Reduction Program reduced readmission rates for targeted conditions and generated positive spillover effects for other conditions through mechanisms of knowledge sharing across clinical units.

DISCUSSION

Synthesis of Findings: Silo as a Systemic, Not Individual, Problem

The findings of this review consistently indicate that the silo effect in medicine is a systemic phenomenon—rooted in organizational design, funding structures, and professional culture—rather than merely a manifestation of individual behavior. The managerial implications of this conclusion are critical: interventions that focus on changing individual behavior without addressing structural roots will be temporary and unsustainable. Hospital leaders need to understand that silos are products of design that can be modified through intentional redesign.

The 'three-order fit' framework proposed by Thistlethwaite et al. (2024) offers a useful conceptual model for understanding system integration in stages: goal consistency (first-order fit), mutually reinforcing activities (second-order fit), and coordination that eliminates redundancy (third-order fit). This model indicates that the transformation from siloed systems to integrated systems is a gradual journey that requires readiness at each organizational level.

Implications for Hospital Management in Indonesia

The Indonesian context provides an additional dimension that is relevant to understanding silo effects. The JKN (Jaminan Kesehatan Nasional) system, which is based on capitation at the primary level and casemix (INA-CBG) at the advanced level, creates incentives that are often misaligned among Puskesmas, clinics, and hospitals. Silos across levels of care (primary, secondary, tertiary) can result in inappropriate referrals, duplication of services, and increased cost burdens for JKN as the payer.

In addition, the strong hierarchical culture within the medical profession in Indonesia—which often places specialist physicians as the sole authority in clinical decision-making—can reinforce vertical silos and hinder interprofessional collaboration among physicians, nurses, pharmacists, and other health professionals. Reform efforts such as the development of integrated clinical pathways, a national electronic medical record system, and the establishment of multidisciplinary teams in hospitals need to be understood as strategic steps to break down silos, rather than merely administrative instruments.

Limitations of the Review

This review has several limitations that need to be acknowledged. First, heterogeneity in the definition of 'silo' across the included studies made direct comparisons and precise quantification of impacts difficult. Second, most studies originated from high-income countries with healthcare systems that differ in context from those of Indonesia and other developing countries. Hence, the transferability of findings needs to be critically assessed. Third, the nature of the review, which did not employ quantitative meta-analysis, limits the ability to conclude the magnitude of effects of specific interventions. Primary empirical studies in developing countries on the financial impact of silos are strongly needed to address this gap.

CONCLUSION

The silo effect in medicine represents a systemic challenge that has been well documented in the global healthcare management literature and carries substantial financial implications for hospitals and healthcare institutions. This review concludes several key points:

1. Hospital silos are structural and multidimensional, involving functional, professional, financial, and informational separations that reinforce one another.
2. The clinical impact of silos includes duplication of diagnostic procedures, increased readmissions, delays in therapy, and reduced patient safety—all of which have measurable financial cost equivalents.
3. The financial burden of the silo effect is systemic, encompassing direct costs (duplication, readmission penalties, overtreatment) as well as indirect costs (process inefficiency, staff turnover, reputational risk), with estimates in the United States alone reaching tens to hundreds of billions of dollars annually.
4. Integration-based interventions—including integrated care models, interprofessional education (IPE), integrated information technology systems, and payment mechanism reforms—are effective in reducing the impact of silos, with the strongest evidence derived from chronic disease care coordination programs.

Based on these findings, the review presents the following recommendations for hospital leaders and managers:

1. Conduct periodic organizational silo audits to identify points of fragmentation within patient care pathways and the organizational value chain.
2. Invest in the development of multidisciplinary teams and continuous interprofessional education (IPE) programs as long-term strategies to build a collaborative culture.
3. Prioritize the implementation of interoperable electronic medical record systems that are accessible across units and facilities as the technological foundation for service integration.

Encourage primary empirical research within the Indonesian context to measure the financial impact of the silo effect within the National Health Insurance system (Jaminan Kesehatan Nasional, JKN), in order to support evidence-based policymaking at the national level.

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