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Single-Use vs Reuse: Unit Cost Analysis of Hemodialysis with Activity-Based Costing and Double Distribution

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Abstract:
Hemodialysis is a vital therapy for chronic kidney failure patients, yet accurate unit cost calculation remains a challenge for hospitals under the National Health Insurance (*JKN*) system. This study aims to analyze the unit cost calculation of outpatient hemodialysis procedures at a private hospital in Indonesia using Activity-Based Costing (ABC) and Double Distribution (DD) methods, and to compare them with *INA-CBGs* tariffs to evaluate potential financial losses and formulate efficiency strategies. This descriptive observational study with a quantitative approach used 350 samples of *BPJS* hemodialysis procedures from January-March 2023. Data were obtained through service flow observations, clinical and financial documentation, and interviews with relevant stakeholders, validated by the hospital's finance department. Results show that ABC method unit costs (*Rp*1,102,848 for reuse and *Rp*1,197,184 for single-use) are higher than DD (*Rp*948,756 for reuse and *Rp*1,043,092 for single-use), with ABC considered more accurate as it reflects real resource consumption. Both methods show unit costs exceeding *INA-CBGs* tariffs (*Rp*800,360 for reuse and *Rp*941,600 for single-use), indicating potential annual financial losses of *Rp*142-423 million. Clinical pathway-based efficiency strategies are needed to achieve cost control while maintaining care quality, with recommendations to adopt single-use dialyzers as operational standards to improve patient safety and reduce long-term financial risks.

Keywords: Hemodialysis, Unit Cost, Activity-Based Costing, Double Distribution, INA-CBGs, Cost Efficiency

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INTRODUCTION

The Indonesian government, through *BPJS Kesehatan*, is implementing the National Health Insurance program to achieve Universal Health Coverage (UHC). Hemodialysis is a vital therapy for chronic kidney failure, with increasing outpatient service demand at a private hospital in Bekasi, from 477 procedures in January 2022 to 757 in March 2023. However, the hospital has not systematically calculated the unit cost for outpatient hemodialysis, creating challenges in cost control and tariff accuracy under the *INA-CBGs* scheme (HASANAH & Inayah, 2017; Lusiana et al., 2019; Paulina & Medica, 2022; Suhartoyo, 2018; Sundoro, 2023).

A significant tariff gap exists: hospital rates are *Rp*1,294,220 per procedure, while *INA-CBGs* reimburses *Rp*941,600 (single-use) or *Rp*800,360 (reuse), leading to a potential deficit of *Rp*352,620–*Rp*493,860 per procedure. This may cause annual losses of *Rp*3.2–4.48 billion, threatening service sustainability. Without accurate unit cost data, inefficiencies and resource waste cannot be objectively identified.

This study applies Activity-Based Costing (ABC) and Double Distribution (DD) methods to calculate unit costs, compare results, and provide a managerial basis for strategic decisions on cost control, tariff setting, and efficiency improvement, ensuring service

sustainability within the *JKN* framework (Kusumawardhani & ..., 2020; MPH, 2021; Roza et al., 2022; Sanjaya et al., 2019; Setiawan et al., 2021; Wahidah & Yusuf, 2022).

The primary research problem lies in the absence of a standardized unit cost calculation system for hemodialysis services at the hospital, which creates several critical issues. First, the hospital cannot accurately assess the true cost of providing hemodialysis services, making it difficult to identify areas of inefficiency or resource waste. Second, the significant gap between current hospital charges and *INA-CBGs* reimbursement rates suggests potential financial unsustainability, but without proper cost analysis, the actual magnitude of losses cannot be determined. Third, the hospital lacks evidence-based data to support strategic decisions regarding dialyzer selection (single-use versus reuse), operational efficiency improvements, or tariff negotiations with insurance providers.

This research is urgently needed due to several critical factors. The growing volume of hemodialysis procedures (59% increase from January 2022 to March 2023) amplifies the financial impact of any cost-tariff misalignment. The current potential annual losses of *Rp*3.2-4.48 billion threaten the long-term sustainability of hemodialysis services, which are essential for patient survival. Furthermore, without accurate cost data, the hospital cannot make informed decisions about resource allocation, quality improvement initiatives, or strategic planning for hemodialysis services expansion.

Several studies have addressed hemodialysis costing in various healthcare settings. Fuad et al. (2021) at Harapan Keluarga Mataram Hospital identified similar gaps between unit costs and *INA-CBGs* tariffs, highlighting widespread challenges in Indonesian healthcare. International studies by Hansen, Mowen, & Guan (2021) and Taschner & Charifzadeh (2020) demonstrated that unit costs often exceed externally imposed tariffs due to bundled payment mechanism limitations. However, most previous research focused on traditional costing methods without comparing ABC and DD approaches specifically for hemodialysis services.

Despite existing literature on healthcare costing, there remains a significant gap in comparative analysis between ABC and DD methods specifically for hemodialysis services in Indonesian private hospitals. Most studies either used single costing methods or focused on different healthcare contexts. Additionally, limited research has examined the practical implications of dialyzer selection (single-use versus reuse) from both cost and clinical perspectives within the Indonesian healthcare financing system.

This study contributes several novel elements to the literature. First, it provides a comprehensive comparison between ABC and DD methods specifically applied to hemodialysis costing in an Indonesian private hospital setting. Second, it integrates clinical pathway analysis with cost calculation to provide more accurate resource consumption mapping. Third, it offers practical insights into the financial implications of dialyzer selection decisions within the *INA-CBGs* reimbursement framework. Fourth, the study validates cost calculations through hospital finance department verification, ensuring reliability and practical applicability.

The primary objective is to calculate and compare unit costs of outpatient hemodialysis using ABC and DD methods, evaluate the gap with *INA-CBGs* tariffs, and provide strategic recommendations for efficiency improvement. Specific objectives include: (1) mapping the hemodialysis service flow and identifying cost components; (2) calculating unit costs using

both ABC and DD methods; (3) comparing costs between single-use and reuse dialyzer approaches; (4) analyzing the financial gap with *INA-CBGs* tariffs; and (5) formulating evidence-based efficiency strategies. The benefits include providing hospital management with accurate cost data for strategic decision-making, contributing to healthcare costing methodology literature in Indonesia, and supporting policy discussions on tariff adequacy in the national health insurance system.

RESEARCH METHODS

This descriptive observational study with a quantitative approach aimed to analyze the unit cost of outpatient hemodialysis at a private hospital in Bekasi using Activity-Based Costing (ABC) and Double Distribution (DD) methods. The study population comprised 1,998 *BPJS*-covered hemodialysis procedures from January–March 2023. Using Slovin's formula, 350 procedures were sampled.

Primary data were collected through interviews and observation, while secondary data included financial reports, patient bills, clinical pathways, and medical records. Direct costs were traced to staff and materials[A1], while indirect costs from supporting units were allocated proportionally. Data were processed using ABC and DD methods, then compared to *INA-CBGs* tariffs per Minister of Health Regulation No. 3/2023.

Statistical analysis used IBM SPSS 26, with Wilcoxon Signed Rank Test to compare unit costs with *INA-CBGs* and between methods, and Friedman Test to assess differences among three cost groups. Results were presented descriptively to identify cost gaps and efficiency opportunities in outpatient hemodialysis services.

RESULTS AND DISCUSSION

Unit Cost Activity-Based Costing (ABC) Method

Table 1. Result of unit cost ABC

Unit Cost	Reuse	Single Use
Direct material and labor	627,048	721,384
Overhead		
Direct Overhead	Total	
Operational Cost	43,022,291	
Maintenance Cost	9,640,924	
Building depretiation cost	6,375,589	
Medical equipment depretiation cost	2,567,449	
Non-medical equipment depretiation cost	1,413,776	
Indirect Overhead		
Operational Cost	72,260,120	
Maintenance Cost	10,583,509	
Building, Medical equipment, and Non-medical equipment depretiation cost	20,666,251	
Total Overhead	166.529.910	
Service total	350	

Unit Cost	Reuse	Single Use
Overhead costs per service	475,800	475,800
Unit Cost Results of ABC Method	**1,102,848**	**1,197,184**
INACBGs Rates Outpatient hemodialysis for Class B Regional 1 Hospital (according to the location of this hospital)	**800,360**	**941,600**
Unit Cost Results of ABC Method	**302,488**	**255,584**

Activity-Based Costing (ABC) analysis for outpatient hemodialysis at this hospital revealed unit costs of Rp1,102,848 (reuse) and Rp1,197,184 (single-use), exceeding INA-CBGs rates by 27–37%. This gap results in potential annual losses of Rp357.8–423.5 million. ABC identified management and administration as the largest cost contributors.

Unit Cost Double Distribution (DD) Method

Calculation unit cost with the DD method, it is the result of adding the costs of consumable materials and medical services with overhead costs resulting from distribution from support units to services, which is then the cost of the service unit divided by the number of patients.

Table 2. Results of Unit Cost Double Distribution

Unit Cost	Reuse	Single Use
Direct material and labor	627,048	721,384
Service Unit		
Hemodialysis Unit	139,312	
Laboratory Installation	19,427	
Pharmacy Unit	85,247	
Radiology Unit	77,720	
Total Unit Cost of Service	321,708	321,708
Unit Cost Results of DD Method	**948,756**	**1,043,092**
INACBGs Rates Outpatient hemodialysis for Class B Regional 1 Hospital (according to the location of this hospital)	**800,360**	**941,600**
Tariff gap	**148,396**	**101,492**

The Double Distribution (DD) method calculation resulted in a unit cost of IDR 948,756 (reuse) and IDR 1,043,092 (single use), which is 10.7–18.5% higher than the INA-CBGs rates (IDR 800,360 and IDR 941,600). The cost gap of IDR 101,492–148,396 per patient may lead to an annual loss of IDR 142,088,800–207,754,400 for 350 patients.

Comparison of Unit Cost Calculations for Single-Use and Reuse Dialyzers

If we compare the processes and calculation results of these two methods, we can see several similarities and differences, as shown in the following table:

Table 3. Comparison of Unit Cost Calculations for Single-Use and Reuse Dialyzers

Categories	Reuse	Single Use	Difference between Single Use vs Reuse
ABC method	1,102,848	1,197,184	94,336
DD Method	948,756	1,043,092	94,336

From the calculation results above, it can be seen that unit cost in the single use dialyzer method, it is relatively higher compared to the reuse dialyzer method. From the details of direct costs, it can be seen that the consumables used in the single use method are more expensive because the Hospital is required to purchase a new dialyzer for Rp182,817 each time a hemodialysis procedure is performed, in contrast to the reuse method where the dialyzer can be reused in subsequent hemodialysis procedures so that if allocated only Rp45,704 is charged. However, in the reuse method there is also a cost of Rp42,777 used for consumables used for re-washing the dialyzer.

The use of single-use dialyzers and reuse dialyzers (which are washed again) each have advantages and disadvantages that need to be considered based on clinical, operational, and economic aspects.

Advantages of Single Use Dialyzer:
- Better Patient Safety: Avoids the risk of cross-contamination and infection because each patient uses a new dialyzer (Chazan et al., 2019).
- Optimal Filtration Quality: Clearance of uremic substances is better because the membrane does not experience degradation due to repeated use (Maduell et al., 2020).
- Reduced Risk of Biological Reactions: Lower risk of inflammatory and pyrogenic reactions because the membrane has not been contaminated with proteins or endotoxins.
- According to International Standards: Many countries in Europe and America have restricted or banned reuse due to patient safety concerns.
- Operational Efficiency: No reprocessing, machine reuse, or additional labor required, reducing the potential for human error.

Disadvantages of Single Use Dialyzers:
- Higher Costs: Operating costs per hemodialysis treatment increase as each patient uses a new dialyzer.
- Medical Waste Volume Increases: Solid medical waste production is greater than reuse.

Advantages of Dialyzer Reuse:
- Cost Efficiency: The cost of the dialyzer per procedure is lower because it can be reused up to 10–20 times, depending on the protocol.
- Reduced Use of New Materials: Suitable for hospitals with limited budgets and high surgical loads.

Disadvantages of Reuse Dialyzer:
- Risk of Contamination and Infection: Reprocessing is not always 100% effective even when following strict protocols.

- Efficiency Decreased: Membrane function decreases with reuse, impacting the quality of therapy.
- Additional Human Resources and Equipment Requirements: Staff training, reprocessing machines, and regular quality control are required.

Therefore, the choice of method must consider the balance between cost efficiency and patient safety. The problem lies in the high cost of procurement compared to reuse, so hospitals need to conduct a cost-benefit analysis based on the volume of procedures and patient profiles.

Comparison of Unit Cost Calculations Using the ABC Method and the DD Method

If we compare the processes and calculation results of these two methods, we can see several similarities and differences, as shown in the following table:

Table 4. Comparison of ABC and DD Methods

Categories	ABC method	DD Method	Difference between ABC and DD
Unit Cost Reuse	1,102,848	948,756	**154,092**
Unit Cost Single Use	1,197,184	1,043,092	**154,092**

The Activity-Based Costing (ABC) method produced higher unit costs than the Double Distribution (DD) method, as overhead was allocated based on actual activities. In ABC, the highest costs came from the hemodialysis, radiology, and laboratory units, with consumables accounting for 69–73% of total direct costs. The DD method allocates overhead proportionally to staff numbers, making it simpler but less precise in tracking resource consumption. The comparison shows that ABC is more effective in identifying efficiency gaps and tariff discrepancies than DD. These differences have strategic implications for tariff setting and cost control in hemodialysis services. Similarly, Rohde, Wald, and Wiese (2018) argue that ABC helps identify value-added versus non-value-added activities, making it suitable for complex hospital services such as hemodialysis.

Wilcoxon Signed Rank Test Results between Unit Cost ABC and Unit Cost DD

Based on data collection, there were 350 samples that met the inclusion and exclusion criteria, as presented in the following table:

Table 5. Sample Outpatient Hemodialysis Data January – March 2023

No	Hemodialysis Method	Number of Samples
1	Reuse	215
2	Single Use	135

The Wilcoxon Signed Rank Test is used to determine whether there is a significant difference between outpatient hemodialysis unit costs ABC method and DD method. This test was chosen because the data is paired and not normally distributed.

Table 6. Results of Rank Statistical Test of Unit Cost ABC and Unit Cost DD

		N	Mean Rank	Sum of Ranks
Unit Cost ABC – Unit Cost DD	Negative Ranks	0a	.00	.00
	Positive Ranks	350b	175.50	61425.00
	Ties	0c		
	Total	350		

a. UnitCostABC < UnitCostDD
b. UnitCostABC > UnitCostDD
c. UnitCostABC = UnitCostDD

Table 7. Results of the Wilcoxon Signed Rank Test between Unit Cost ABC and Unit Cost DD

	Unit Cost ABC – Unit Cost DD
Z	-10.218a
Asymp. Sig. (2-tailed)	.000

a. Based on negative ranks
b. Wilcoxon Signed Ranks Test

The significance value of p = 0.000 (<0.05) indicates that there is a statistically significant difference between the two calculation methods. Therefore, the null hypothesis (H_0) which states that there is no difference in unit cost between the DD and ABC methods is rejected, and the alternative hypothesis (H_1) is accepted.

Comparison of Unit Cost Results of ABC, DD and INA-CBGs Tariff Methods

Comparison between results *unit cost* calculated using the ABC method and the unit cost results calculated using the DD method with the INA-CBGS rates for outpatient hemodialysis services applicable at a private hospital in Bekasi are as follows:

Table 8. Comparison of Unit Cost Results of ABC, DD, and INA-CBGs Tariff Methods

Categories	Reuse	Single Use
ABC method	1,102,848	1,197,184
DD Method	948,756	1,043,092
INACBGs Rates Outpatient hemodialysis for Class B Regional 1 Hospital (according to the location of A private hospital in Bekasi)	**800,360**	**941,600**
Tariff gap		
-ABC vs INACBGs rates	**302,488**	**255,584**
- DD vs INACBGs rates	**148,396**	**101,492**

The tariff gap for single-use dialyzers is lower than for reuse dialyzers, making single-use less loss-prone despite both being above INA-CBGs rates. Using the ABC method, unit costs were Rp 1,102,848 (reuse) and Rp 1,197,184 (single use), which are 27–37% higher than INA-CBGs tariffs, resulting in potential annual losses of Rp 357.8–423.5 million for 350 patients. ABC highlights major cost contributors—primarily hemodialysis maintenance and

consumables—enabling targeted efficiency measures to potentially reduce costs below INA-CBGs rates.

With the DD method, unit costs were Rp 948,756 (reuse) and Rp 1,043,092 (single use), 10.7–18.5% above INA-CBGs, leading to potential annual losses of Rp 142.1–207.8 million. While DD distributes all costs and minimizes omissions, it lacks unit-level detail, relies on estimates, and may be less accurate for service cost analysis. Overall, ABC provides more precise cost tracing for efficiency improvements, whereas DD offers broader but less detailed cost allocation.

Wilcoxon Signed Rank Test Results between ABC Unit Cost and INA-CBGs Tariff

The Wilcoxon test was conducted to determine whether there was a significant difference between the unit cost of outpatient hemodialysis based on the Activity-Based Costing (ABC) method and the applicable INA-CBGs rates.

Table 9. Results of Rank Statistical Test of ABC Unit Cost and INA-CBGs Tariffs

		N	Mean Rank	Sum of Ranks
Unit Cost ABC – INACBGs tariff	Negative Ranks	0a	.00	.00
	Positive Ranks	350b	175.50	61425.00
	Ties	0c		
	Total	350		

a. Unit Cost ABC < INACBGs tariff
b. Unit Cost ABC > INACBGs tariff
c. Unit Cost ABC = INACBGs tariff

Table 10. Results of the Wilcoxon Signed Rank Test between Unit Cost ABC and INA-CBGs rates

	UnitCostABC - INA rates
Z	-16.217a
Asymp. Sig. (2-tailed)	.000

a. Based on negative ranks
b. Wilcoxon Signed Ranks Test

All unit costs calculated using the ABC method were consistently higher than those calculated using the INA-CBGs tariff. A significance value of $p = 0.000$ (<0.05) indicates a statistically significant difference between the two calculation methods. Therefore, the null hypothesis (H_0) stating that there is no difference in unit costs between the ABC method and the INA-CBGs tariff is rejected, and the alternative hypothesis (H_1) is accepted.

Since $p < 0.05$, there is a statistically significant difference. This indicates that the ABC method produces unit costs that exceed government-set claim rates, potentially causing financial losses for hospitals if not managed efficiently.

Wilcoxon Signed Rank Test Results between DD Unit Cost and INA-CBGs Tariffs

Similar testing was conducted between the Double Distribution (DD) method unit cost and the INA-CBGs tariff.

Table 11. Results of Rank Statistical Test of Unit Cost DD and INA-CBGs Tariffs

		N	Mean Rank	Sum of Ranks
Unit Cost DD – Tarif INACBGs	Negative Ranks	0a	.00	.00
	Positive Ranks	350b	175.50	61425.00
	Ties	0c		
	Total	350		

a. Unit Cost DD < INACBGs tariff
b. Unit Cost DD > INACBGs tariff
c. Unit Cost DD = INACBGs tariff

Table 12. Results of the Wilcoxon Signed Rank Test between Unit Cost ABC and INA-CBGs rates

	Unit Cost DD - INACBGs tariff
Z	-16.217a
Asymp. Sig. (2-tailed)	.000

d. Based on negative ranks
e. Wilcoxon Signed Ranks Test

Similar to the ABC method, all unit cost values based on DD were higher than the INA-CBGs claim rates. The very low significance value (p = 0.000) indicates that the difference is statistically significant. Therefore, the null hypothesis (H_0) stating that there is no difference in unit cost between the DD method and the INA-CBGs claim rates is rejected, and the alternative hypothesis (H_1) is accepted. This means that both the ABC and DD methods produce unit costs greater than the INA-CBGs claim rates, although the DD value is slightly lower than the ABC.

Friedman Test Results: Comparison of ABC, DD, and INA-CBGs Tariff Methods

The Friedman test was used to determine whether there were significant differences between the three methods compared in this study:

- INA-CBGs rates,
- Unit Cost ABC, and
- Unit Cost DD.

Table 13. Results of Rank Statistical Test of Unit Cost ABC, DD and INA-CBGs tariffs

	Mean Ranks
INA rates	1.00
UnitCostDD	2.00
UnitCostABC	3.00

Table 14, Results of the Friedman Test between Unit Cost ABC, DD, and INA-CBGs rates

N	350
Chi-Square	700,000
Df	2
Asymp. Sig.	.000

Friedman Test

A highly significant p-value (p = 0.000) indicates that there is a statistically significant difference between the three cost groups. The significance value of p = 0.000 (<0.05) indicates that there is a statistically significant difference between the three calculation methods. Therefore, the null hypothesis (H_0) stating that there is no difference in unit costs between the ABC, DD, and INA-CBGs tariff methods is rejected, and the alternative hypothesis (H_1) is accepted.

Based on the average rank value (mean rank), it can be concluded that:

- The INA-CBGs tariff is the lowest value,
- Followed by unit cost DD,
- And the highest unit cost is based on the ABC method.

To provide a more concise and comprehensive overview of the statistical analysis results, the following table summarizes the conclusions of the three tests used: the Wilcoxon Signed Rank Test and the Friedman Test. This table compares unit costs calculated using the two methods (ABC and DD) with the INA-CBGs rates, as well as the comparison between the three cost components. All tests showed statistically significant results, indicating a significant difference between the cost calculation methods and the government-set claim rates.

Table 15. Comparison table of Unit Cost ABC, DD, and INA-CBGs Tariffs

Comparative Method	Wilcoxon/ Friedman Test Results	Hypothesis Conclusion	Conclusion
Unit Cost ABC vs INA Tariff	p = 0.000 → significant	H_0 is rejected, H_1 accepted	UC ABC > INA Rates (all patients)
Unit Cost DD vs INA Tariff	p = 0.000 → significant	H_0 is rejected, H_1 accepted	UC DD > INA Rates (all patients)
ABC vs DD	p = 0.000 → significant	H_0 is rejected, H_1 accepted	UC ABC > UC DD (all patients)
INA, UC ABC, UC DD rates	p = 0.000 (Friedman)	H_0 is rejected, H_1 accepted	There is a significant difference between the three UC ABC > UC DD > INA Rates

This finding aligns with Hansen, Mowen, & Guan (2021) and Taschner & Charifzadeh (2020), who highlighted that unit costs are often higher than externally imposed tariffs due to the limitations of bundled payment mechanisms. This discrepancy signals potential financial deficits for hospitals if efficiency strategies are not implemented.

Efficiency Recommendation Model for Hemodialysis Services

The analysis shows that unit costs of outpatient hemodialysis, whether using single-use or reuse dialyzers, exceed INA-CBGs tariffs, creating potential financial losses for hospitals. The findings of this study show that the outpatient hemodialysis unit cost, for both single-use and reuse dialyzers, is higher than the INA-CBGs tariff. This result is consistent with Fuad et al. (2021) at Harapan Keluarga Mataram Hospital, who also reported a gap between unit cost

and INA-CBGs claims. These conditions highlight the need for efficiency strategies, such as controlling medical supplies, rationalizing drug use, and increasing service volume, to minimize financial losses without compromising care quality.

From a managerial perspective, Blocher et al. (2019) argued that cost management systems should be positioned strategically to sustain competitive advantage. The findings of this study reinforce the importance of adopting clinical pathways in hemodialysis to reduce variability in cost, as well as implementing single-use dialyzers as the operational standard. Although single-use dialyzers incur higher costs, this option enhances patient safety and aligns with the *value-based healthcare* approach, which emphasizes efficiency without compromising service quality (WHO, 2022).

Cost composition analysis revealed lower direct material costs compared to literature benchmarks, but disproportionately high overhead allocation. Efficiency strategies are therefore recommended across three main cost components: (1) direct materials through vendor negotiation and bulk purchasing, (2) overhead via optimized scheduling, preventive maintenance, and improved resource utilization, and (3) direct labor through shift redesign to reduce overtime and balance workloads.

Simulation results suggest that these strategies could reduce costs by 2–5% without compromising service quality. Moreover, redesigning shifts from three to two with additional dialysis machines may improve efficiency, reduce nurse fatigue, and enhance patient safety. This aligns with prior evidence linking balanced workloads to improved care outcomes.

In addition, collaboration with third-party providers can offer investment efficiency, professional resource management, operational risk transfer, and standardized service quality, although hospitals must maintain strong quality oversight.

Finally, the study underscores the role of management accounting information systems. Consistent with Ramadhan (2018), higher-quality systems enable more accurate cost allocation, supporting tariff negotiation and financial decision-making. The use of ABC at this private hospital provided more realistic cost estimates than DD, highlighting the need for integrated cost information aligned with clinical pathways to strengthen both efficiency and patient safety strategies.

The successful implementation of modern costing methods also depends on managerial factors. Anggreini, Hasyim, and Kusumapradja (2022) emphasized that resistance to change in hospitals can hinder innovation, thus transformational leadership and effective communication are needed to support cost management initiatives. This is critical for hospital in applying a clinical pathway for hemodialysis as part of cost control.

Synthesis of Research Findings

This study provides a comprehensive overview of outpatient hemodialysis services, their cost structure, and a comparison of unit cost calculations using Activity-Based Costing (ABC) and Double Distribution (DD). All financial data were validated by the hospital's finance department, ensuring the reliability of the analysis.

The main findings are as follows:

1. **Standardized service flow**: The clinical pathway ensures systematic care delivery and supports cost mapping in the ABC method.

2. **Major cost components**: The largest expenses derive from consumable medical supplies (particularly dialyzers and bloodlines) and personnel salaries.
3. **Comparison of costing methods**: ABC produced higher unit costs than DD but more accurately reflected actual resource consumption, as it accounts for detailed clinical activities, whereas DD relies on proportional allocations.
4. **Gap with INA-CBGs tariffs**: Unit costs exceeded the reimbursement rates, indicating potential financial losses without efficiency strategies.
5. **Dialyzer reuse vs. single-use**: Although single-use dialyzers are more expensive in terms of direct cost, they carry a lower potential financial loss compared to INA-CBGs reimbursement, while being safer, more practical, and associated with reduced clinical risk

These findings highlight the importance of applying more precise costing methods and aligning clinical efficiency with patient safety to support sustainable hospital financial management.

CONCLUSION

This study provides comprehensive insights into hemodialysis unit cost analysis using ABC and DD methods compared to *INA-CBGs* tariffs. The service flow for outpatient hemodialysis follows established clinical pathways with four major cost centers: Administration and General, Hemodialysis unit, Radiology, and Laboratory. The ABC method consistently produces higher unit costs than DD for both reuse and single-use dialyzers, with ABC being more accurate in reflecting actual resource consumption due to its activity-based allocation approach rather than DD's proportional cost distribution. Regarding dialyzer selection, single-use dialyzers are more expensive directly but demonstrate lower potential losses compared to *INA-CBGs* rates, while offering superior safety, practicality, and reduced clinical risks. Conversely, reuse dialyzers are nominally cheaper per procedure but present higher potential losses against *INA-CBGs* rates and require greater logistical investment with increased clinical risks. The ABC method proves more suitable for overall unit cost calculation as it better represents actual resource consumption by considering activity complexity. Both ABC and DD methods yield unit costs exceeding *INA-CBGs* rates, with ABC showing 27-37% higher costs (potential losses of *IDR* 255,584-302,488 per procedure) and DD showing 10.7-18.5% higher costs (potential losses of *IDR* 101,492-148,396 per procedure). Statistical analysis confirms significant differences between both calculation methods and government-set *INA-CBGs* rates. Efficiency improvements through maintenance cost reduction for hemodialysis units and consumables optimization can minimize the gap between calculated unit costs and *INA-CBGs* tariffs. Future research should explore longitudinal cost trends, expand to multi-center studies, and investigate the impact of technological advances on hemodialysis cost efficiency. Hospitals should implement ABC-based cost management systems, consider single-use dialyzer adoption for improved patient safety, and develop comprehensive efficiency strategies to ensure sustainable hemodialysis service delivery within the national health insurance framework.

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