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Implementation of Medical Device Logistics Management: A Qualitative Study

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Abstract. *The total expenditure on medical devices in 2016 was IDR 16.9 trillion from the total health budget in Indonesia. The main problems were the accessibility and quality of medical devices. Good logistics management of medical devices at the Public Health Center (PHC) will affect the quality and financing of health services. This research to find out logistics management of medical devices in Palu City Health Office. The method used Qualitative with case studies. In January-March 2017 in Palu City Health Office. The primary data was obtained through observation, in-depth interviews, and document review. The finding in this research are Palu City Health Office conducted bottom-up planning. However, the allocated budget was limited. Sources of funds were taken from the state budget (APBN) and local government budget (APBD). There was an involvement of official institutions and partners in the procurement of devices. The method of procurement was a tender and direct appointment that referred to e-catalog. But, the items would be available after a long wait. Misunderstanding of information occurred when distributing medical devices in the PHC. There was no special warehouse that was suitable for storing medical devices. The control process in the form of recording and reporting was experiencing errors. Logistics management of health device has not been carried out effectively and efficiently. Thus, it's necessary to improve optimal coordination and commitment in logistics management of medical devices. This study aligns with SDG 3 (Good Health and Well-being), particularly Target 3.8 on universal health coverage and Target 3.b on access to quality health technologies. Findings also connect to SDG 9 (resilient health infrastructure) and SDG 12 (efficient resource use). Although data were collected in 2017, the structural challenges identified remain pertinent to ongoing health system strengthening in Indonesia and comparable settings.*

Keywords: *Logistics; Management; Medical Devices; Health Office; Public Health Center*

1. Introduction

One of the health development problems is the accessibility and quality of medical devices (WHO, 2017). Based on data from the Ministry of Health of the Republic of Indonesia (2017) regarding pharmaceuticals and medical devices, the total expenditure on medical devices in the health devices expenditure budget in 2016 was IDR 16.9 trillion from the total health budget in Indonesia.

Public Health Center (PHC) is one of the first level health facilities in implementing health attempts in Indonesia. An important substance in supporting the implementation of health attempts at the PHC is health devices. The availability and good use of medical

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devices will affect the quality and financing of health services at the PHC (Manso, et al., 2013).

Logistics management is a process that regulates the procurement, transfer, and storage of organizational components in a certain way to meet the needs in a cost effective manner (Ballou, 2004). Law of Health number 36 of 2009 states that to support health services, good logistics management of medical devices is needed starting from planning, budgeting, procurement, storage, distribution and control.

According to the results of a 2013 research conducted by Manso, et al., (2017) in order to ensure the regular availability of health commodities, it is important to integrate all logistical functions controlled by the organization to ensure effective and efficient logistics management as a key in the organization and economy. Therefore, logistics management of medical devices is needed at the Palu City Health Office.

Effective logistics management of medical devices is directly aligned with the United Nations Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being). Specifically, Target 3.8 calls for achieving universal health coverage (UHC), including access to quality essential healthcare services, which cannot be realized without reliable supply chains for medical devices and equipment (United Nations, 2015). Furthermore, Target 3.b emphasizes supporting research and development of affordable essential medicines and health technologies, necessitating an efficient procurement and distribution system at all levels of the healthcare system (United Nations, 2015). The availability of functional medical devices in primary healthcare facilities is also linked to SDG 9 (Industry, Innovation, and Infrastructure) in terms of building resilient health infrastructure (WHO, 2017), and to SDG 12 (Responsible Consumption and Production) through efficient resource use and minimizing waste in the procurement process (United Nations, 2015). Indonesia's commitment to achieving UHC through the national health insurance program (JKN) further underscores the urgency of optimizing medical device logistics at the district and primary care levels (Ministry of Health of the Republic of Indonesia, 2021).

Recent international studies have examined various dimensions of health supply chain management. Raj et al. (2024) demonstrated that patient satisfaction is strongly correlated with supply chain visibility, cost management, and integration in healthcare logistics (Raj et al., 2024). Wahab et al. (2023) conducted a systematic review of qualitative evidence identifying key challenges in healthcare supply chain systems in low- and middle-income countries, including fragmented systems, inadequate infrastructure, and insufficient human resources (Wahab et al., 2023). Moody (2024) highlighted that suboptimal supply chain management leads to avoidable shortages and health commodity wastage due to a lack of real-time data visibility (Moody, 2024). In the context of primary healthcare, a study evaluating supply chain management of diagnostic services at primary healthcare clinics in South Africa found widespread non-compliance with storage, procurement, and distribution guidelines, underscoring the systemic nature of these challenges (Nkomeje et al., 2023).

Furthermore, digital transformation is increasingly recognized as a potential solution; a framework proposed by Atnafu et al. (2024) identified digital initiatives in health product supply chains as critical enablers of access, quality, and efficiency (Atnafu et al., 2024). A qualitative exploration of logistics automation in the healthcare industry similarly found that adoption of automation remains low, yet is critical for improving accuracy and efficiency in health commodity management (Park et al., 2025).

While previous studies have examined logistics management in hospital or central warehouse settings (Manso et al., 2013; Ferretti et al., 2014), this study provides a novel examination of medical device logistics at the district health office level in Indonesia, specifically at the Palu City Health Office and its affiliated Public Health Centers (PHC). This study makes a unique contribution by illuminating the multi-source funding challenges (APBN/APBD) and the coordination complexities between the district health office and primary care facilities in an Indonesian decentralized governance context. Furthermore, the study highlights persistent operational bottlenecks from inaccurate planning and procurement delays to inadequate storage and control systems that remain largely undocumented at this level of the health system, filling an important gap in the health logistics literature for developing countries.

2. Methods

This research study used qualitative methods with case study approach. The study was conducted in 2017 at Palu City Health Office and 5 PHC. This study used primary data obtained through observation, in-depth interviews, and document review. The informants in this study were head of the health office, head of planning division, head of facility division, as well as some staff at the Palu City Health Office and special treasurer at the PHC.

3. Results and Discussion

Palu City Health Office had implemented health devices management but it had not been effective and efficient in its implementation until 2017. Palu City Health Office, namely the infrastructure division, planning division, and program division, conducted planning of medical devices by involving the PHC as the proposal provider. The findings of this study are analyzed through the lens of the WHO Logistics Cycle Model, which encompasses product selection, quantification and procurement, inventory management, storage, distribution, and logistics management information systems as interdependent functions of a well-functioning health supply chain (USAID, 2011). The WHO's six building blocks for health supply chains further emphasize that effective logistics requires coordinated attention to governance, human resources, financing, information systems, products, and service delivery (WHO, 2019). Consistent with this framework, the findings reveal that weaknesses in each component of the logistics cycle at the Palu City Health Office contribute to the overall ineffectiveness of medical device management.

This research study was in line with Subagya's theory (1994) that planning had to be supported by all stakeholder. The preparation of the planning framework began with recapitulating all needs and then proposed to the planning department of the Health Office in the form of RKA, which would be accompanied by the next head of service controlled by the mayor, and the DPR for the APBD budget. For the APBN was directly controlled by the ministry using online applications that adjusted to PHC based on Regulation of the Minister of Health number 75 of 2014. However, some medical devices that were not in the DAK menu, lack of APBD, not-valid records and reporting of PHC, and length of time for drafting the RKA were the obstacles in planning.

This is consistent with findings from studies in comparable low- and middle-income country contexts, where inadequate forecasting and weak coordination between facility levels are identified as principal causes of planning failures (Wahab et al., 2023). The supply chain workforce literature similarly identifies a lack of qualified logistics personnel as a

driver of inaccurate quantification and procurement planning in resource-constrained settings (Moody, 2024). Furthermore, Yadav (2015) identified weak information systems and poor quantification capacity as root causes of supply chain underperformance in developing countries, recommendations that remain directly applicable to district-level facilities in Indonesia (Yadav, 2015). Sakulwichitsintu et al. (2022) similarly emphasized that systematic inventory management practices are foundational prerequisites for overcoming planning failures in healthcare settings (Sakulwichitsintu et al., 2022).

This was in accordance with the Minister of Home Affairs Regulation in 2007, namely the activity of formulating the details of regional property needs to connect the past procurement of goods with the current situation as a basis for meeting subsequent needs. Each unit according to RKA (Ministry of Home Affairs of the Republic of Indonesia, 2007).

In the planning process, several things would be considered in determining the priority scale. One of them is the benefits to the development and improvement of health services, logistics needed in accordance with the budget provided and allocated, effective and efficient in terms of financing (Imron, 2010).

Budgeting was a series of activities in fulfilling needs by taking into account regional financial capabilities and had to be detailed by including the number and names of goods, time and amount of costs required (Ministry of Home Affairs of the Republic of Indonesia, 2007). Budgeting of medical devices at Palu City Health Office involved the facilities and infrastructure division, the planning department, the department head, TAPD, and the mayor. Sources of funds came from the APBN and APBD. Budgeting was adjusted to the number of costs and available funds. The head of the agency would internally assist proposals for needs made in the form of RKA after it was assisted by TAPD. Then it was delivered to the mayor to be submitted to the DPR and gave it back again to the mayor. If approved, the RKA document would become DPA. Budgetary constraints were generally caused by the limited budget or lack of funds available from the APBD. The proposed medical devices were not included in the DAK menu for the APBN, delays in drafting and incorporating the draft of RKA. This was in line with Kumurya's research (2015), that after the product had been selected, the amount needed and the cost of each product had to be determined (Kumurya, 2015).

Procurement of goods for the government was an activity funded from the APBN or APBD, carried out by direct appointment or through tenders/auctions by the goods providers. The implementation of procurement of goods had to implement several basic principles namely efficiency and effectiveness (Imron, 2010). Furthermore, in the technical implementation there were procurement officials from official institutions, namely PPK, PPTK, and PPA/KPA as well as suppliers or partners. After the goods were available, the role of the goods inspection team was from the department. In the procurement process, there were obstacles caused by long procurement times because the delay of third parties in carrying out their work which was not in accordance with the contract. This was in line with the study on the management of assets/local property that procurement was carried out through the procurement service unit existing in permanent regional government (Nuryamin, 2015). Procurement of goods and services was still not optimal due to the unrealized implementation of procurement through direct appointment in accordance with a predetermined schedule of implementation (Wahyuningsih et al., 2013).

The distribution of medical devices at Palu City Health Office involved the treasurer of the official assets along with the service assistant as the recipient and examiner committee,

treasurer of the PHC. The distribution mechanism started from the Health Office to the PHC to the unit and its network. However, a number of medical devices from Palu City Health Office immediately handed over to PHC network, which made the process of recording and reporting inventory disrupted. This was in accordance with Subagya's theory (1994) that the factors that influenced the distribution of goods included administrative processes, news delivery processes, and transportation processes. These distribution challenges are widely documented in comparable sub Saharan African settings, where poor last-mile distribution systems and inadequate transportation infrastructure contribute to inequitable access to medical devices at the facility level (Nyangaresi et al., 2022). Avan et al. (2019) similarly found that availability of essential resources for maternal and newborn care was substantially compromised by distribution system failures in Ethiopia, India, and Tanzania, underscoring the cross contextual nature of these challenges (Avan et al., 2019).

Palu City Health Office did not have a storage warehouse, but there was still involvement of the treasurer of the Health Office. The choice of storage location for medical devices was in the temporary storage warehouse by utilizing the empty space of the PHC. There were several PHC that already had storage warehouses but they were not special medical storage warehouses and were not feasible because they did not meet the good requirements. The results were in accordance with research conducted by Ferretti, et al. (2014), which suggested that the implementation of centralization of storage warehouses could be advantageous in terms of cost reduction, and service quality available. The unavailability of storage space for goods belonging to the area that had been received caused disruption of the management system (Piri, 2016). This finding aligns with evidence from studies evaluating supply chain management at primary healthcare facilities in low-resource settings, which found that non compliant storage conditions were among the most prevalent challenges directly compromising health commodity quality (Nkomeje et al., 2023).

Good storage practices, including temperature control, proper shelving, and adequate space, are fundamental requirements of the WHO Logistics Cycle and are essential for maintaining the efficacy of medical devices and preventing wastage (USAID, 2011). The lack of dedicated storage infrastructure represents a structural gap that requires targeted investment, as similarly documented in comparable district-level health systems (Seidman & Atun, 2017). Chikumbi and Mukangu (2023) further identified inadequate storage infrastructure as a key barrier to effective medicine and medical supply management in public health facilities across sub-Saharan Africa, and recommended dedicated capital investment in storage as a policy priority (Chikumbi & Mukangu, 2023). Tofighi et al. (2016) also highlighted that logistics network design, including storage facility placement, significantly affects the responsiveness and cost effectiveness of health supply chains (Tofighi et al., 2016).

In order to control the administration of regional property management that included bookkeeping, recording, and reporting, the manager determined the management of goods in each SKPD as a form of control (Ministry of Home Affairs of the Republic of Indonesia, 2007). The control was in the form of recording and reporting inventory of medical devices. However, there was still negligence in recording process that the inventory records between Palu City Health Office and PHC were uncoordinated and there were several PHC that did not have records of inventory of medical devices. This actually needed to be followed up as an evaluation material for the Health Office. Jimmy (2014) stated the same thing in his

research. The poor order in carrying out the supervision of the management of regional property could be seen from the administrative aspect, especially in submitting periodic reports and handover reports.

This is consistent with a growing body of international evidence demonstrating that poor inventory information systems and weak recording practices are among the most pervasive challenges in health supply chains in developing countries, contributing directly to stockouts, wastage, and service disruptions (Wahab et al., 2023; Brown et al., 2025). Raj et al. (2024) further demonstrated that supply chain visibility the extent to which real-time data on stock levels, demand, and logistics performance is available to decision-makers is a critical determinant of healthcare supply chain effectiveness and patient satisfaction (Raj et al., 2024). The absence of an integrated logistics management information system at the Palu City Health Office thus represents a fundamental barrier to achieving the transparency and coordination required for effective medical device management (Atnafu et al., 2024). Kaafarani et al. (2024) demonstrated through a systematic review that digital transformation in healthcare supply chains, particularly adoption of real-time inventory tracking systems, is significantly associated with improved supply chain performance outcomes (Kaafarani et al., 2024). Shafiq et al. (2017) further underscored that service quality in healthcare settings, including availability of functional medical equipment, is directly linked to operational logistics efficiency (Shafiq et al., 2017).

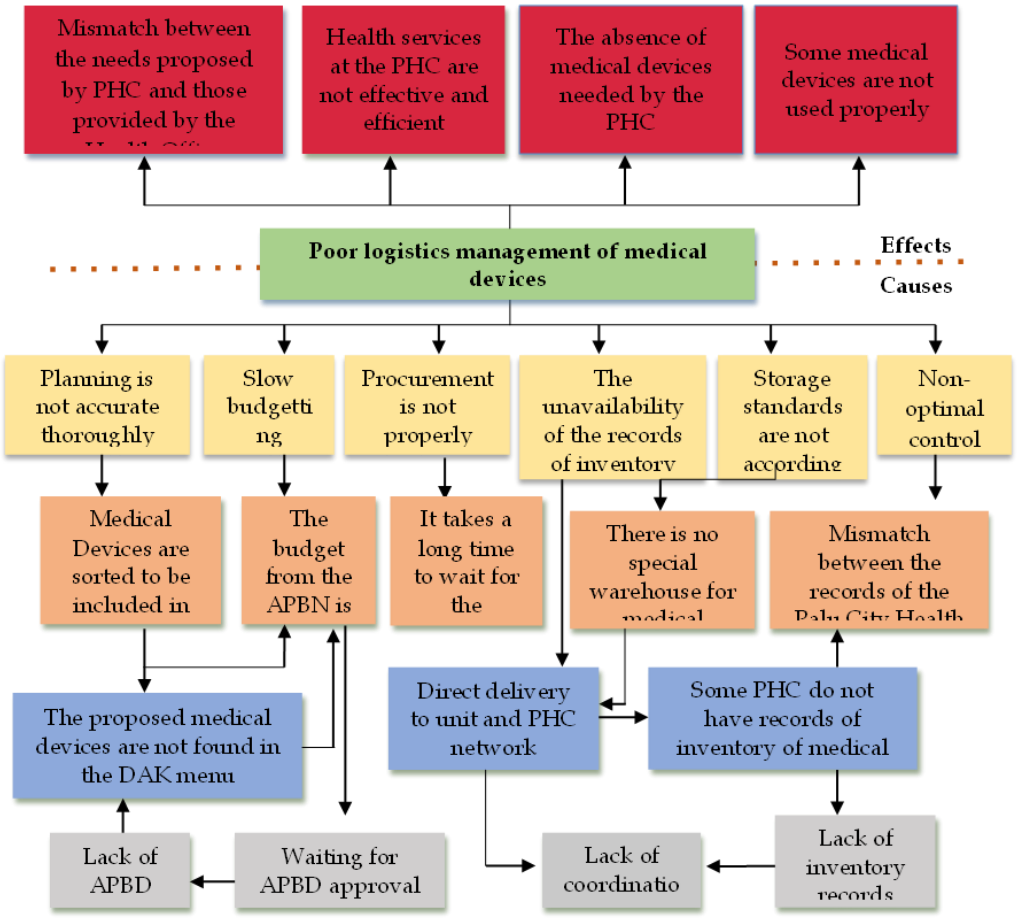

Figure 1. The Results Empirical Problem Tree of Logistics Management of Medical Devices in Palu City Health Office

Conclusions

Logistics management of medical devices at Palu City Health Office in terms of planning, budgeting, procurement, distribution, and control had not been carried out effectively and efficiently. It could be seen from several obstacles from every aspect. These findings are consistent with those reported in comparable settings in developing countries, where planning inaccuracies, procurement delays, inadequate storage, and weak inventory control systems collectively undermine the effective delivery of health services.

Based on these findings, specific recommendations are offered for key stakeholders. For the Palu City Health Office, it is recommended to: (a) implement an integrated health logistics information system to improve accuracy of planning and real-time inventory monitoring, aligning with Indonesia's national Digital Health Transformation Roadmap; (b) establish a dedicated, standards-compliant storage warehouse for medical devices; and (c) develop a structured training program for logistics staff to strengthen recording, reporting, and inventory management competencies.

For provincial and national policymakers, it is recommended to: (a) improve the responsiveness of the national e-catalog system to include a broader range of medical devices required at the PHC level; and (b) strengthen coordination mechanisms between national and subnational levels to reduce funding fragmentation.

For future research, it is recommended to: (a) conduct quantitative studies measuring logistics performance indicators across multiple district health offices; (b) undertake comparative analyses between districts with different governance structures; and (c) investigate the impact of post 2017 digital health reforms on medical device logistics outcomes at the primary care level.

Limitations

This study has several limitations that should be acknowledged. First, the single-city design (Palu City) limits the generalizability of findings to other districts in Indonesia or other developing country contexts, as local administrative, budgetary, and geographic conditions may differ significantly. Second, the data collection was conducted in 2017, nearly a decade prior to publication. While the structural challenges identified such as limited APBD budgets, e-catalog delays, and inadequate storage remain pertinent, subsequent policy developments including e-catalog improvements, the COVID-19 pandemic's impact on supply chains, and Indonesia's ongoing digital health transformation may have altered some aspects of medical device logistics at the local level.

Third, as interviews were conducted with government officials, potential social desirability bias may have influenced responses, with informants potentially presenting more favorable accounts of their own performance. Fourth, the study relied solely on qualitative methods and did not include quantitative performance indicators (e.g., stockout rates, procurement cycle time, storage compliance rates) that could have provided a more complete picture of logistics system performance. These limitations suggest opportunities for future research using longitudinal, multi-site, and mixed-methods designs.

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Conflicts of Interest

The authors declare no conflict of interest. This research received no external funding.

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