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COST ANALYSIS OF PHARMACY ON DELIVERY (POD) AND CONVENTIONAL COUNTER DISPENSING (CCD) IN PUSAT RAWATAN WARGA (PRW) UMS

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Abstract

As the demand for more efficient and accessible healthcare services grows, pharmacy services are evolving to better meet patient needs, offering distinct advantages and challenges in terms of cost, convenience, and accessibility. Pharmacy delivery, whereby one's medicine being delivered to the comfort of their home or workplace, is one example of pharmacy services evolution, as compared to a standard dispensing at the clinic. This study aims to determine the cost differences between two pharmacy service models implemented at Pusat Rawatan Warga (PRW), Universiti Malaysia Sabah (UMS): Pharmacy On-Delivery (POD) and Conventional Counter Dispensing (CCD). This cross-sectional study was conducted at Pusat Rawatan Warga (PRW), Universiti Malaysia Sabah (UMS), over a two-week period. We analysed both fixed and variable costs associated with the Conventional Counter Dispensing (CCD) and Pharmacy On-Delivery (POD) services, with a particular focus on personnel and transportation expenses. Descriptive analysis was performed using Microsoft Excel to calculate means and standard deviations. The findings showed the cost of POD averaging RM6.55 per prescription compared to RM3.44 for CCD, while the time taken averaging 9.80 minutes per prescription for POD compared to CCD's 5.69 minutes per prescription. The delivery process was the primary driver of the total time required for POD prescriptions, accounting for approximately 54% of the total time involved. Despite the higher costs, the popularity of POD has grown steadily, with its adoption increasing from 2.49% in 2022 to 6.70% in 2024. This study highlights the need to balance the higher operational costs of Pharmacy On-Delivery (POD) services with their benefits in enhancing medication adherence and convenience, especially for patients with chronic conditions. To support sustainability, strategic improvements such as optimizing delivery routes, using GPS-based tracking, and adopting computerized Hospital Information Systems (HIS) are recommended. These findings provide critical insights for improving the efficiency and cost-effectiveness of POD services at PRW, UMS, particularly in resource-limited healthcare settings.

Keywords: Pharmaceutical service, medication access, cost analysis, economic evaluation.

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INTRODUCTION

The increasing demand for efficient healthcare services has driven many institutions to explore innovative approaches to pharmaceutical care (Smith et al., 2018). At Pusat Rawatan Warga (PRW), Universiti Malaysia Sabah (UMS), pharmacy services play a crucial role in ensuring timely access to medications, particularly for patients with chronic conditions requiring continuous medication refills. To address issues such as time constraints and busy working schedules of UMS staff, beginning of February 2022, Value-Added Service (VAS) models have been implemented: Pharmacy On-Delivery (POD) service, which is offered exclusively to UMS staff, involve delivering medications to their offices, and WhatsApp & Ambil, whereby patients will receive a WhatsApp messaging prior to collecting their medicines at the clinic's dispensary counter (Yussof et al., 2022). World Health Organization (WHO) describes VAS in the context of healthcare delivery as supplementary services that support or enhance patient care, such as mobile health initiatives, adherence support, and community outreach (World Health Organization, 2016). These two pharmacy VAS offered on top of the Conventional Counter Dispensing (CCD), where patients collect medications in person. While CCD remains the standard practice, pharmacy VAS models have gained attention due to their potential to improve medication access and patient adherence, particularly for patients with chronic conditions (Cardoso et al., 2020; Yussof et al., 2022). Each approach has unique advantages and limitations in terms of cost, accessibility, patient satisfaction, and resource utilization (Derqui et al., 2021; Rupp, 2011; Tran et al., 2022).

Previous studies have demonstrated the growing adoption of home delivery and pharmacy services in various healthcare settings, showing both increased patient satisfaction and improved adherence to medication regimens (Smith et al., 2018). For example, Cardoso et al. (2020) highlighted that medication dispensing services in community pharmacies, including home delivery models, incur higher operational costs but are associated with increased patient convenience and satisfaction. Similarly, studies by Yussof et al. (2022) in Malaysia found that these pharmacy delivery services, including POD, were well-received by patients, although they came at a higher cost compared to traditional dispensing methods.

Pharmacy delivery services are increasingly being implemented as part of healthcare reforms aimed at reducing barriers to medication access (Rosli et al., 2021). Based on the report produced by PRW UMS in 2023, the implementation of these VAS since February 2022 has shown positive results in enhancing patients' access to medications (Norlida Che Yaacob & Hanies Yuhana Othman, 2023). Statistical data highlights that from February 2022 to April 2023, PRW recorded a total of 24,568 prescriptions, of which 5.2% (1,278) were

delivered through VAS. Specifically, there has been an increase in adoption rate of VAS from 4.6% in 2022 to 6.3% by April 2023, indicating growing patient preference for POD and WhatsApp & Ambil services.

This trend can be ascribed to the time-saving benefits for busy UMS staff who no longer have to visit the pharmacy in person, as well as enhanced pharmaceutical accessibility, which assures prompt refills for patients with chronic diseases. The use of technology, particularly WhatsApp & Ambil, has improved patient-pharmacy communication, making pre-arranged pick-ups more efficient. Patient satisfaction has increased as a result of favourable experiences with precise and dependable medicine administration, encouraging further uptake and word-of-mouth advertising (Yussof et al., 2022). Furthermore, post-pandemic behavioural changes have increased reliance on remote and contactless healthcare solutions, reinforcing the desire for VAS (Poudel & Nissen, 2016; Rosli et al., 2021). This adoption highlights their vital role in meeting patients' needs for convenience, adherence, and better healthcare experiences while also emphasizing the significance of managing operational expenses for long-term viability (Cardoso et al., 2020; Rupp, 2011).

However, these innovations often come with additional costs associated with logistics and staffing (Poudel & Nissen, 2016; Wlamyr et al., 2022). On the other hand, conventional dispensing remains a widely used method due to its straightforward implementation and lower logistical requirements (Cardoso et al., 2020). While the success rate for delivered medications via VAS has improved from 86% to 90.3% (Norlida Che Yaacob & Hanies Yuhana Othman, 2023), understanding the costs associated with these services remains critical for informed decision-making at PRW, UMS. The logistical and operational costs associated with delivery services may impose additional strain on limited healthcare resources. In contrast, conventional dispensing, while requiring less logistical effort, may not address issues such as medication adherence or accessibility for time-constrained patients. The workflows of completing a prescription for CCD and POD are compared in Figure 1.

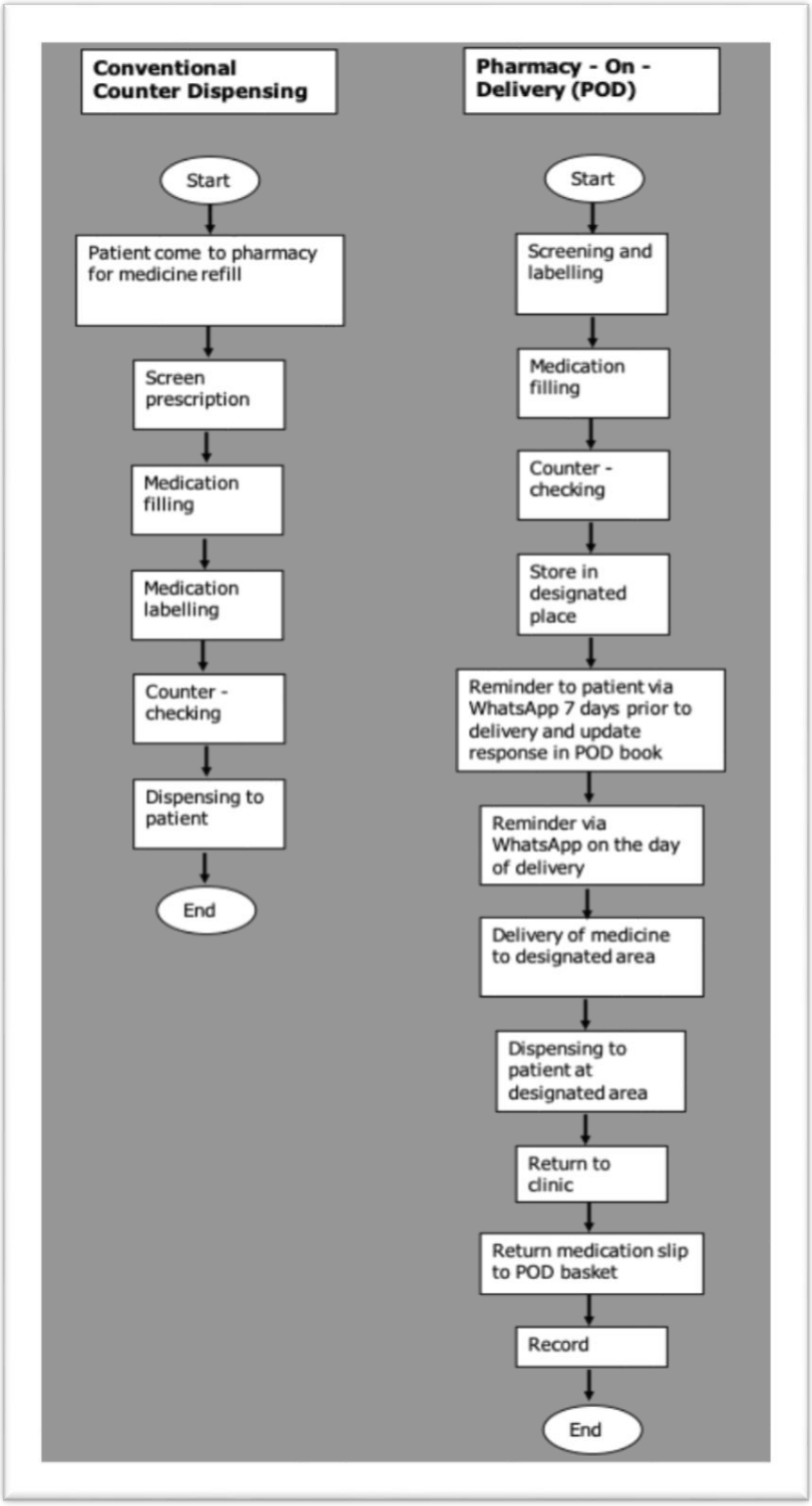

Figure 1: Flow process of CCD and POD

Given that 5.2% of prescriptions were delivered via VAS since its inception until April 2023 and this figure continues to grow, a detailed cost analysis is essential (Norlida Che Yaacob & Hanies Yuhana Othman, 2023). PRW must evaluate whether pharmacy delivery provides value for money compared to conventional dispensing and whether these services can be scaled without compromising quality or financial sustainability. Without this evidence, decision-makers may face challenges in prioritizing resources and optimizing pharmacy service delivery. Cost analysis of both models is essential to ensure economic stability and efficient resource allocation in healthcare systems, particularly in a resource-limited setting such as PRW, UMS (Aniza et al., 2011; Surendra et al., 2018). Furthermore, there are limited research exists on comparing these costs between POD and CCD services in Malaysia public healthcare settings. Hence, this study aimed to determine cost analysis, and to fill the research gap by comparing the fixed and variable costs associated with both POD and CCD services at PRW, UMS. By analysing these costs, this study seeks to contribute to the broader discussion on optimizing healthcare resource allocation and service delivery in resource-limited settings. For the purpose of this study, we are comparing the cost of completing one prescription, which is from the screening of prescription until the end of the process, for CCD (including WhatsApp & Ambil due to similarity in their process) and POD.

METHODS

Study Design

This study employed a cross-sectional design conducted at the Pusat Rawatan Warga (PRW) at Universiti Malaysia Sabah (UMS). The convenience sampling method was used, which may introduce sampling bias, and this limitation is acknowledged in the discussion. Data collection took place over a two-week period, from December 2 to December 13, 2024, due to limited resources and time constraints. Despite this, the timeframe was considered sufficient to capture representative data on the two service models.

Data Collection

The cost analysis was conducted from the healthcare provider's perspective, focusing on personnel expenses and transportation costs associated with preparing and delivering repeat prescriptions. Medication costs were intentionally excluded from this analysis. The study specifically targeted repeat prescriptions for chronic conditions, including non-communicable diseases, while excluding new prescriptions and those related to acute conditions. Due to time constraints, the data collection was limited to 30 prescriptions for each service model.

To ensure data consistency, PRW staff underwent training in standardized recording methods. A predefined workflow was established for each dispensing approach, supported by a standardized data collection form and a time-motion sheet to guide the process. The analysis encompassed only fixed costs (personnel salaries; delivery is carried out only during office hours, therefore, it does not involve overtime allowance) and variable costs (transportation expenses). Capital expenditures, such as facility and vehicle costs, were excluded as both services utilized the same infrastructure and the vehicle was primarily used for other purposes. Similarly, patient-incurred expenses, such as travel to collect prescriptions, were not included, as the analysis focused solely on the provider’s perspective.

Personnel costs were calculated using a formula adapted from Carrol et al., 2016. Monthly gross income for each personnel was divided by 8,640 minutes (an 18-day work

month with 8 working hours per day) to estimate the cost per minute. PRW provided salary data for the involved personnel, and the average cost for each group of personnel was applied in the analysis.

Transportation costs for delivery were calculated based on mileage claims for the journey between PRW and the destination. The vehicle used for every delivery was a Diesel fuelled van. Since the delivery was carried out in batches, we averaged the distance of travelling for each prescription's delivery by dividing the total distances covered and the number of prescriptions dispensed during that particular delivery. For the cost, it was determined by dividing the total fuel refill, in Ringgit Malaysia (RM), and total mileage (kilometer) for a period of 1 month (4th of November 2024 to 4th of December 2024). The total fuel refill (RM) derived from the sum of refilling on the 4th of November 2024 to the last refill on the 28th of November 2024. As for the total mileage (kilometer), it was calculated by subtracting the odometer reading prior to the first December refilling on the 4th of December, and the odometer reading before the fuel refill on the 4th of November 2024. The price of diesel remained constant at RM2.15 per litre during this period. Table 1 provides a detailed summary of the processes and cost calculations for each service.

Table 1: Summary of processes involved and cost calculation for each service.

Service	Cost Calculation
Conventional Counter Dispensing	Time needed for Screening + Drug filling + Labelling + Counter-checking + Dispensing
Pharmacy On Delivery	Time needed for Screening and Labelling + Drug filling + Counter-checking + Storage + Reminder + Delivery + Dispensing + Returning of medication slip

Statistical Analysis

Data were recorded in Microsoft Excel Version 16. The mean and standard deviation was obtained from Microsoft Excel as well and used for continuous data. This study only provides descriptive analysis. No inferential statistics analysis was carried out.

RESULTS

The summary of total number of prescriptions are summarised in Table 2. There was a marked increase of POD service from 2022 (from February onward) to 2023 (2.49% and 6.21%). The demand on POD service increased further in 2024 (up to November 2024) at 6.70%.

Table 2: Summary of total number of prescriptions.

Service	Year					
	2022		2023		2024	
	N	%	N	%	N	%
Counter	17681	97.51	20889	93.79	19772	93.30
Pod	451	2.49	1382	6.21	1420	6.70
Total	**18132**		**22271**		**21192**	

The mean (+ Standard Deviation, SD) for number of items per prescription was 2.43 (+ 1.43) for CCD and 2.03 (+ 1.25) for POD. The cost of personnel per minute and cost of transportation per kilometer (KM) in Ringgit Malaysia (RM) are summarised in Table 3. Meanwhile, Table 4 summarised the average time, distance and cost needed to complete one prescription.

Table 3: Summary of cost of personnel per minute and transportation per KM.

Item	Salary (RM)/ Mean ± SD	Personnel Cost (RM) per minute	Cost (RM) per KM
Personnel			
Pharmacy Officer (PF)	6483.50 ± 445.48	0.75	-
Assistant Pharmacy (PPF)	3455.50 ± 361.33	0.40	
Healthcare Assistant (PPK)	2728.40 ± 0.85	0.32	
Transport	-	-	0.16

SD=Standard Deviation; RM=Ringgit Malaysia; KM=Kilometer

Table 4: Summary of time, distance and cost needed to complete one prescription.

Services	N	Distance (KM)/ Mean ± SD	Average Number of Items per Prescription	Time per Prescription (Minutes)/ Mean ± SD	Cost per Complete Prescription (RM)/ Mean ± SD
Counter	30	-	2.43	5.69 ± 3.06	3.44 ± 1.97
Pharmacy On Delivery	30	0.90 ± 0.35	2.03	9.80 ± 2.40	6.55 ± 1.55

N=Number of prescriptions; SD=Standard Deviation; RM=Ringgit Malaysia; KM=Kilometer

There were 3 groups of personnel involved in completing a prescription for POD, while for CCD, only 2 of those groups of personnel were involved. Based on the formula adapted from Carrol et al. (2016), the cost of personnel per minute were RM0.75 for Pharmacy Officer (PF), RM0.40 for Assistant Pharmacy (PPF) and RM0.32 for Healthcare Assistant (PPK). As for the transportation cost, the average was RM0.16 per KM.

The mean time and cost (± SD) needed for CCD were 5.69 (± 3.06) minutes and RM3.44 (± 1.97) per prescription, while for POD were 9.80 (± 2.40) minutes and RM6.55 (± 1.55). The mean distance for POD was 0.90 (± 0.35) KM. The average time needed to prepare each step of the medication preparation process was compared and shown in Figure 2. The time needed for screening, labelling and drug filling were longer in CCD as compared to time taken in POD. Meanwhile, the time for delivery contributed 54% of the total average time to

complete one prescription in POD, which causing the longer duration needed to complete as compared to CCD.

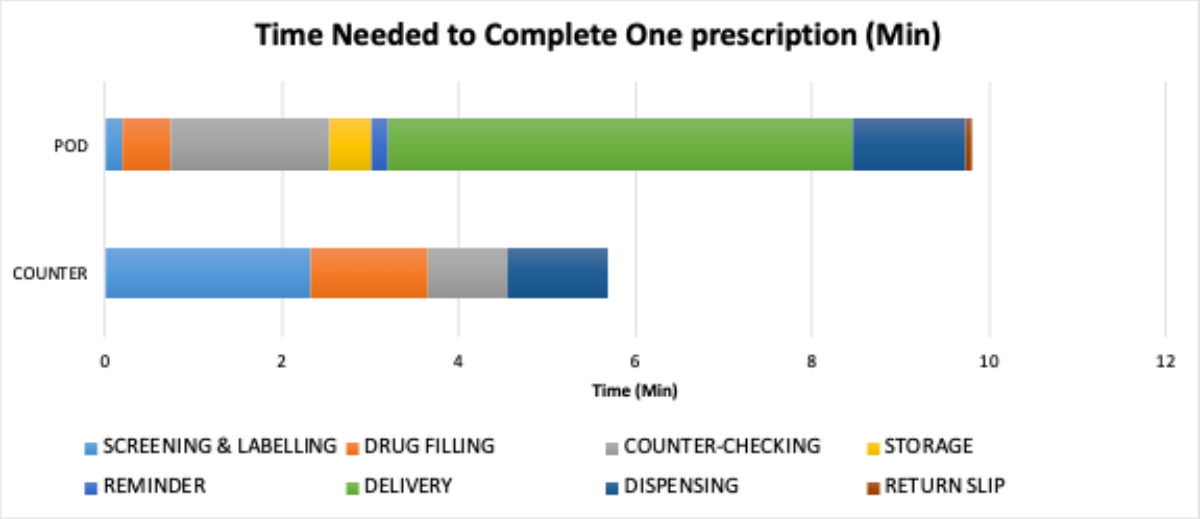

Figure 2: Average time needed to complete each prescription.

DISCUSSION

The study's findings underline the significant cost and time differences between Pharmacy On-Delivery (POD) service and Conventional Counter Dispensing (CCD) at PRW, UMS. While POD service offers notable benefits in terms of convenience and patient adherence, particularly for those with chronic conditions, they come with higher operational costs. The average time and cost to complete a prescription with POD was higher as compared to CCD. The delivery process, which accounted for slightly more than half of the total time taken for POD, and an additional number of personnel required to complete a single prescription in POD, are a major contributor to these higher costs (Yussof et al., 2022).

These results are consistent with previous studies that have highlighted the higher operational costs associated with home delivery services, especially in terms of transportation and personnel time (Carrol et al., 2016; Smith et al., 2018). Yussof et al., 2022, who conducted a similar study in Peninsular Malaysia found the time needed and cost preparation per prescription for counter and Medibox (workflow process almost equivalent to POD) services were 3.99 and 10.25 minutes, and RM1.75 and RM5.49. Comparing the time needed found in this study shows a longer duration taken for the counter service, but a shorter duration for POD. The discrepancies in time needed in counter service may be explained due to the differences in the total workflow process assessed between this study and the previous study as they excluded time of dispensing the medicines, and the average items per prescription (2.43 versus 4.05). However, this study shows the time needed for POD was shorter (9.80 and 10.25 minutes), that may indicate a shorter journey from the PRW to the destination (within UMS campus) and the efficiency in completing one prescription in PRW. In terms of cost per prescription, our study found that both services were higher than the previous study which can be explained by the different method in calculating the personnel cost.

While the higher costs of POD are evident, the potential benefits of enhanced patient adherence and satisfaction could influence healthcare policy decisions, particularly in

resource-limited settings. Policymakers should weigh these factors when considering scaling POD services. From February 2022 to April 2023, the adoption rate of VAS at PRW rose from 4.6% to 6.3% (Norlida Che Yaacob & Hanies Yuhana Othman, 2023). Recent data from PRW report shows total number of prescriptions from 2022 to 2024, were predominantly dispensed through CCD but decline from 97.51% in 2022 to 93.30% in the year of 2024. Meanwhile, POD shows an increment from 2.49% (in 2022) to 6.70% in year 2024, indicating a growing patient preference for these services. The difference in POD latest data as compared to the previous data reported by Norlida et al., 2023, was due to the method of data collection adopted by PRW whereby, currently, the WhatsApp & Ambil data was included in the CCD data.

The economic evaluation of pharmacy services is crucial for healthcare decision-makers to select effective interventions. Studies have shown that pharmacy services, including home delivery, can be cost-effective or cost-saving, particularly in developed countries (Phimarn et al., 2023). For instance, a systematic review of economic evaluations of pharmacy services found that these services often improve patient health outcomes and are cost-effective in various settings, including hospital-based, community pharmacy, and primary care (Phimarn et al., 2023). This aligns with the findings at PRW, where POD services, despite higher costs, have shown positive impacts on patient adherence to medications.

The study also highlights the need for ongoing evaluation and cost-saving strategies to optimize service delivery. While POD services provide substantial benefits in terms of accessibility and patient satisfaction, their higher costs necessitate careful cost management.

To mitigate these costs, strategies such as optimizing delivery routes, improving workflow efficiency, and enhancing staff efficiency could help reduce these costs (Derqui et al., 2021; Wlamyr et al., 2022). Additionally, leveraging on technology, such as GPS tracking and route optimization software, could be used to streamline the POD delivery process, reducing time and operational costs. Studies have shown that optimizing delivery routes significantly enhances the efficiency of home delivery services, reducing both costs and time spent on each delivery (Smith et al., 2018). Additionally, investing in a fully computerized Hospital Information System (HIS) or Clinic Management System (CMS) would improve data management, patient tracking, and prescription accuracy, facilitating seamless communication between pharmacy staff and healthcare providers (Poudel and Nissen, 2016). Automation tools for medication order processing, inventory management, and real-time updates on delivery status could further enhance service efficiency, reduce human error, and ensure timely deliveries (Rosli et al., 2021). Integrating these technologies would not only improve operational efficiency but also enhance patient satisfaction and service sustainability, as they can be tailored to meet the needs of busy patients and healthcare professionals alike (Cardoso et al., 2020; Yussof et al., 2022).

The results from the study indicate that the personnel costs per minute were RM0.75 for Pharmacy Officers, RM0.40 for Assistant Pharmacists, and RM0.32 for Healthcare Assistants. The transportation cost was RM0.16 per kilometer. These costs contribute significantly to the overall expenses of POD services (Cardoso et al., 2020). The mean time and cost needed for CCD were 5.69 minutes and RM3.44 per prescription, while for POD, they were 9.80 minutes and RM6.55 per prescription. The longer time required for POD is largely due to the delivery process, which adds to the overall cost (Yussof et al., 2022).

In essence, these findings carry important implications for key stakeholders. For policymakers, the growing adoption of POD services suggests a shifting patient preference

that warrants strategic investment in infrastructure and digital technologies to support efficient, scalable delivery models. Policy decisions should also consider integrating POD into national health delivery frameworks, especially for chronic disease management, while balancing cost sustainability. For healthcare providers, particularly pharmacy managers and administrators, the results highlight the need to re-evaluate staffing models, workflow processes, and technological integration to reduce inefficiencies and manage costs without compromising service quality. Training programs and operational protocols can be optimized to support the transition toward hybrid service models. For patients, especially those with mobility constraints or chronic conditions, POD services enhance access and convenience, contributing to improved medication adherence and satisfaction. However, there must be clear communication regarding service availability, cost structures, and expectations to ensure equitable and informed utilization. By addressing these different perspectives, future service planning can be more responsive, sustainable, and patient-centred.

This study has several limitations that should be acknowledged. Firstly, the use of convenience sampling may have introduced selection bias, potentially limiting the generalizability of the findings. Secondly, the relatively small sample size and short data collection period, both due to time constraints, may not fully capture cost variability over time. Additionally, the cost analysis was conducted from the provider's perspective and was not comprehensive, as it excluded capital expenditures and recurring costs such as maintenance or long-term infrastructure. While the primary focus was on evaluating the operational cost differences between POD and CCD services, this study did not include an assessment of client or staff perspectives. Future research should incorporate qualitative insights to better understand user satisfaction, adherence factors, and the operational challenges faced by service providers.

CONCLUSION

In conclusion, although POD services at PRW, UMS, are associated with higher operational costs compared to CCD, their growing adoption and demonstrated benefits in improving patient adherence underline their overall value. To ensure the sustainability and scalability of POD services, healthcare administrators should consider practical cost-reduction strategies, such as optimizing delivery routes, leveraging GPS tracking, implementing route optimization software, and adopting computerized Hospital Information Systems (HIS) or Clinic Management Systems (CMS). These technological and operational improvements can streamline workflows, enhance staff efficiency, and reduce unnecessary expenditures. Ongoing evaluation of service efficiency, combined with qualitative insights from patients and providers, will be essential in guiding future enhancements. Future studies should further explore these dimensions to support the development of more cost-effective and patient-centred pharmacy service delivery models. Additionally, a more robust cost-benefit analysis that includes both provider and patient perspectives would offer valuable insights into the long-term sustainability and impact of these services.

Data Availability Statements

The datasets generated and analyzed during the current study are not publicly available due to institutional privacy policies at Pusat Rawatan Warga (PRW), Universiti Malaysia Sabah (UMS). However, they are available from the corresponding author upon reasonable request and with the permission of PRW, UMS. For further information or access to the data, please email to abdul.rahman@ums.edu.my.

Ethical Considerations

As the study involved the analysis of routine pharmacy service data, ethical approval was not sought because no direct interaction with participants occurred, and the data was anonymized and used in aggregate form. Nevertheless, data privacy and confidentiality were prioritized, and the dataset was handled in compliance with the privacy policies of Pusat Rawatan Warga (PRW), Universiti Malaysia Sabah (UMS).

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Conflicts of Interest

The authors have no conflicts of interest to declare.

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Authors' contributions

Conceptualization: all authors; Data curation: all authors; Formal analysis: all authors.; Methodology: all authors; Resources: all authors; Supervision: ARR; Writing-original draft: all authors; Writing-review & editing: all authors. All authors read and approved the final manuscript.

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