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Beyond the Counter: Transaction-Based Customer Analytics in a Microfinance Community Pharmacy

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***Abstract*: This study develops and applies a structured business intelligence (BI) and data analytics framework to evaluate financial performance, temporal demand patterns, customer purchasing behavior, product category profitability, and inventory classification in a microfinance-linked community pharmacy in the Philippines. A dataset of 186,079 verified point-of-sale records spanning 2023–2025 — refined from 186,399 raw records across 2,511 stock-keeping units and expanded from 23 to 37 variables — was prepared in Microsoft Excel and analyzed through Power BI dashboards using KPI computation, time-series trend analysis, moving-average smoothing, seasonality indexing, day-of-week analysis, t-tests, chi-square tests, and ABC classification. The pharmacy generated ₱22,609,006.07 in gross revenue over three years at a 38.99% gross margin, with 2024 peaking at 13.0% YoY growth and 2025 declining 11.6%. Q1 was the strongest quarter and June a recurring trough. Members averaged a ₱514.10 basket — 3.56 times non-members' ₱144.61 — with a significant preference for generics (46.75%) versus non-members' branded preference (52.60%). Generics yielded 64.36% gross margin against 22.15% for branded — a 42.21-point gap. Class A comprised 561 SKUs (22.34%), generating 80.00% of net revenue, led by Losartan 50mg. Analysis is limited to a single branch, restricting generalizability. Findings demonstrate that Excel and Power BI suffice to generate actionable BI for social enterprise pharmacies without clinical, demographic, or enterprise-level data infrastructure.**

***Keywords*: business intelligence, customer analytics, data preprocessing, medicine accessibility, microfinance-linked pharmacy, transaction-level analytics.**

1. Introduction

Access to affordable medicines remains a persistent barrier to equitable healthcare in low- and middle-income countries. In the Philippines, Republic Act No. 11223, the Universal Health Care Act of 2019, mandated universal enrollment in the National Health Insurance Program to reduce the financial risk of medical costs [27]. Despite this reform, household out-of-pocket (OOP) health expenditures accounted for 44.7 percent of total current health expenditure in 2022, and by 2024, Filipino households collectively spent ₱ 615.16 billion in direct medical costs, a year-on-year increase of 11.8 percent [22], [23]. Medicines and pharmaceutical products remain the single largest driver of this burden, compelling low-income households to choose between prescribed medications and other basic necessities [13]. The persistence of high OOP spending, even following the enactment of universal health legislation, underscores a systemic gap in pharmacy-level healthcare access that existing policy instruments have yet to fully address.

Community pharmacies serve as the most geographically accessible point for medicine procurement, particularly in underserved municipalities [32]. An emerging configuration within this landscape is the microfinance-linked community pharmacy, wherein a microfinance institution (MFI) operates a pharmacy as a social enterprise simultaneously serving its enrolled members—borrowers and savers—and the general public at standard retail prices. This dual-market structure creates an embedded health-financing mechanism: members access exclusive discounts and credit-based medicine purchases tied to their accounts, while the pharmacy sustains operations through non-member retail revenue. Growing evidence indicates that models combining financial services with healthcare delivery can meaningfully reduce catastrophic health spending among low-income populations [1]. However, despite the operational significance of this pharmacy model in communities such as San Pablo City, Laguna, no published study has subjected its transaction-level data to systematic business intelligence analysis. This absence of evidence constitutes the central research gap this study addresses.

Despite generating thousands of daily transactions over multiple years, the microfinance community pharmacy under study had not subjected its point-of-sale (POS) data to systematic analytical review. The raw transaction export—spanning 186,399 records from January 2023 through 2025—contained unresolved data quality issues including encoding inconsistencies in field headers, privacy-sensitive customer name entries, anomalous pricing records, inactive product entries, and zero-unit cost records that collectively rendered the dataset unsuitable for direct analysis. Beyond data quality, no analytical framework existed within the institution to: (1) quantify financial performance and gross margin dynamics; (2) identify temporal demand patterns for inventory planning; (3) determine whether statistically significant behavioral differences exist between member and non-member segments;

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(4) examine product category preferences and their profitability implications; or (5) classify the active SKU portfolio by revenue contribution. This analytical vacuum limits the pharmacy's ability to make evidence-based decisions on membership program design, inventory prioritization, and pricing—decisions with direct implications for medicine affordability among the low-income communities the institution serves.

2. Literature Review

A growing body of literature has examined data analytics in pharmacy operations and health systems management. Al-Worafi [2] documented persistent challenges in medicine availability in developing-country pharmacies and underscored the need for systematic data-driven analysis to improve supply chain efficiency and patient access. Business intelligence dashboards applied to telepharmacy data have demonstrated the capacity to synthesize large transaction volumes into actionable operational indicators, including patient profiling, geographic coverage, and pharmacological demand patterns [10]. Data-driven approaches have further been shown to transform pharmacy practice by enhancing medication management, optimizing inventory decisions, and supporting patient engagement [24]. In retail and hospital pharmacy settings, ABC inventory classification has consistently demonstrated that a small proportion of high-value items generates the majority of revenue, confirming the Pareto principle as a practical framework for stock management and pricing policy [16]. Critically, the branded versus generic medicine preference dimension—particularly as it correlates with membership status in a social enterprise pharmacy—has not been empirically investigated using transaction-level evidence in a Philippine microfinance context, representing a specific gap this study addresses.

The proliferation of accessible information and communications technology (ICT) tools has democratized business intelligence, enabling resource-constrained organizations to perform rigorous data analysis without specialized infrastructure. Microsoft Excel provides a robust foundation for data preparation, pivot-based aggregation, financial metric computation, and chart-level visualization [19]. Microsoft Power BI extends this analytical capability to interactive dashboards, cross-filter visualizations, and DAX (Data Analysis Expressions)-based calculations that support multi-dimensional segmentation and temporal trend analysis [20]. Recognized as a Leader in the 2024 Gartner Magic Quadrant for Analytics and Business Intelligence Platforms [9], the combined Excel–Power BI platform represents a replicable, low-cost analytical solution appropriate to the operational scale of community pharmacy enterprises. Prior literature has identified the absence of practical BI frameworks scaled to resource-limited pharmacy settings as an unresolved gap [33]; this study directly addresses that gap through the application of these tools to a three-year longitudinal transaction dataset.

Prior to analysis, the integrity of the underlying dataset must be established through a systematic data preparation process. Poor data quality is a recognized threat to analytical validity in health informatics and clinical data research [7], [8]. In this study, the raw POS export was subjected to an eleven-step quality audit covering: column-name encoding anomalies (embedded newline characters in two field headers); category whitespace inconsistencies creating six phantom labels from three intended values; 13,094 rows of personally identifiable customer information requiring anonymization under Republic Act No. 10173 [26]; 1,907 inactive item records; 191 rows with zero unit cost; 25 rows with negative margin signals; 52 anomalous non-member discount entries; six extreme bulk order outliers; and 13 item names mapping to multiple item codes. This process reduced 186,399 raw rows to 186,079 verified clean records and produced a 37-variable analytical schema—including 10 engineered features—using Microsoft Excel as the primary preprocessing environment, consistent with data transparency standards for reproducible health-data research [8].

This paper presents the first transaction-level business intelligence study applied to a microfinance-linked community pharmacy in the Philippines, establishing four specific contributions. First, it introduces a replicable four-module BI analytics pipeline—comprising financial KPI analysis, temporal demand decomposition, customer segment analytics, and ABC product classification—designed for the operational constraints of a social enterprise pharmacy. Second, it provides the first quantitative evidence of a statistically significant divergence in branded versus generic medicine preference between member and non-member segments, with direct relevance to the Philippine Generics Act (RA 6675) and national medicine access policies [25]. Third, it demonstrates that microfinance membership produces measurably distinct purchasing behavior—higher average transaction value, exclusive discount access, and differentiated product mix—confirming the pharmacy's dual-market structure as analytically significant and policy-relevant. Fourth, by operationalizing Microsoft Excel and Power BI as the primary analytical tools, the study offers a scalable, low-cost BI framework adoptable by MFI-linked pharmacies across the ASEAN region without advanced data infrastructure [17].

3. Methodology

A. Research Design

This study employs a quantitative, descriptive-analytical research design using secondary data derived exclusively from the institutional point-of-sale (POS) transaction records of a microfinance-linked community pharmacy in San Pablo City, Laguna, Philippines. No primary data collection, experimental intervention, or survey instrumentation was conducted; the research analyzes existing transactional records generated in the normal course of pharmacy operations. The analytical framework follows the Cross-Industry Standard Process for Data Mining (CRISP-DM), a structured, iterative process model organized through six phases: business understanding, data understanding, data preparation, modeling, evaluation, and deployment. Validated as the de-facto industry-independent standard for applied data mining projects [29], CRISP-DM has

been specifically confirmed as an appropriate methodology for transactional data-based customer segmentation research [15]. Within this framework, the present study operates predominantly in the descriptive analytics tier, producing quantitative summaries, segment comparisons, trend analyses, and portfolio classifications without extending to predictive modeling or causal inference.

Exploratory data analysis (EDA) was conducted as a structured preparatory phase, preceding formal analysis, to characterize the distributional properties, central tendencies, frequency distributions, and anomalous patterns present in the transaction dataset [21]. EDA findings directly informed the data preparation decisions documented in Section III-C and the analytical priorities of each subsequent module. The study makes no claims of generalizability beyond the institution and operating period under examination; findings are contextualized as an evidence-based case study intended to inform replicable BI frameworks for analogous microfinance pharmacy settings.

The analytical workflow is structured as a four-module BI pipeline, each module corresponding directly to a specific research objective. Module 1 — Financial KPI Analytics computes aggregate financial performance indicators from the cleaned dataset: gross revenue, gross margin percentage, discount utilization rate, average transaction value per segment, and void/return rate. Module 2 — Temporal Demand Analysis aggregates transaction data by month, quarter, and day of week to identify seasonal demand patterns; a three-month moving average is applied to smooth short-term sales volatility, and month-over-month growth rate is computed. Module 3 — Customer Segment Analytics classifies transactions by membership type and applies statistical inferential tests to determine behavioral differences between segments. Module 4 — ABC Product Portfolio Classification ranks all active SKUs by descending gross sales, computes cumulative revenue percentage, and assigns Pareto-based inventory tiers.

B. Data Source and Scope

The primary dataset comprises 186,399 transaction line items exported from the POS system of a single-branch microfinance community pharmacy, covering the period January 2023 through 2025. The raw dataset contains 23 original variables organized into four functional groups: (1) transactional identifiers — Date, Sales Invoice Number; (2) product attributes — Item Code, Item Name, Category (Branded / Generic / Others), Unit Cost, Selling Price (SRP), Quantity Sold, Old Price; (3) financial components — Cost of Goods Sold, Gross Sales, Discount, Less 12% VAT, Sales Net of Discount, Vatable Sales, VAT-Exempt Sales, 12% VAT Output; and (4) customer and operational fields — Mode of Payment (Cash / Credit), Customer Code, Customer Name, Transaction Type (Member, Non-Member, General Public Discount, Senior, PWD, Void). Dataset access was obtained under a formal institutional authorization from the pharmacy management for academic research purposes; no financial compensation was involved.

Four dataset limitations are acknowledged and must be considered when interpreting findings. First, data originate from a single branch of one institution, limiting generalizability to other microfinance pharmacy configurations or geographic contexts; findings are appropriately scoped as a case study. Second, no demographic variables — including patient age, sex, diagnosis, or household income — are available, precluding clinical inference or income-stratified segmentation. Third, operating expense records (rent, salaries, utilities) are absent, preventing computation of net profitability or full economic analysis of the pharmacy as a social enterprise. Fourth, inventory replenishment, stock-out events, and supplier records are not included, which constrains supply chain and demand forecasting analysis.

C. Instrumentation and Data Gathering Process

The dataset analyzed in this study was collected from the institutional point-of-sale (POS) system of a microfinance pharmacy branch. The raw sales table comprised 186,399 transaction line items spanning January 2023 through December 2025, containing 23 variables such as Date, Item Code, Item Name, Category, Unit Cost, SRP, and Quantity Sold. Dataset access was formally authorized by pharmacy management for academic research purposes, with strict confidentiality protocols applied to personally identifiable information in compliance with Republic Act No. 10173 [26].

Data preparation began in Excel, which served as the preprocessing environment. eleven-step quality audit corrected anomalies including column-name encoding errors, category whitespace inconsistencies, inactive item records, zero-unit cost rows, negative margin signals, anomalous discount entries, extreme bulk order outliers, and duplicate item-code mappings. Personally identifiable customer names were anonymized, and blank value detection confirmed that no missing values remained. As part of this cleaning process, inactive items embedded in the Item Name field were corrected to ensure consistency and prevent SKU misclassification. Outlier detection was then performed using Z-score thresholds and manual flagging of anomalous bulk purchases. Additional engineered fields were introduced in Excel, including the Purpose column, Mode of Payment, Customer Code, and Discount Type, to enable segmentation analysis. Data reduction was applied by removing redundant or unused columns to streamline the schema.

D. Data Analysis

The cleaned and enriched dataset was then imported into Power BI, which served as the analytical environment. In Power BI, financial fields were converted into fixed decimal formats, cumulative percentage columns were standardized into percentage type, and a dedicated Date table was created to support time intelligence functions such as quarterly, monthly, and seasonal decomposition. Multiple calculated measures were defined to compute KPIs including gross margin, discount rate, average transaction value, sales growth, and profitability ratios, ensuring comprehensive financial and operational analysis (Figure 1).

Fig. 1. Power BI financial KPI dashboard. Displaying multi-year performance metrics, including total revenue, cost of goods sold (COGS), gross profit, gross margin percentage, total discount, discount rate, and average transaction value.

Integration was carried out by combining the cleaned sales table with the ABC Analysis table, which contained item-level cumulative revenue, cumulative percentage contribution, ABC class, and cost of goods sold. This integration enabled the construction of a Pareto-based inventory model, aligning transaction-level demand with SKU-level profitability tiers (Class A, B, C). The merged dataset highlighted high-revenue cardiovascular maintenance drugs and distinguished them from low-contribution items, while also identifying critical low-volume products flagged for phase-out (Figure 2).

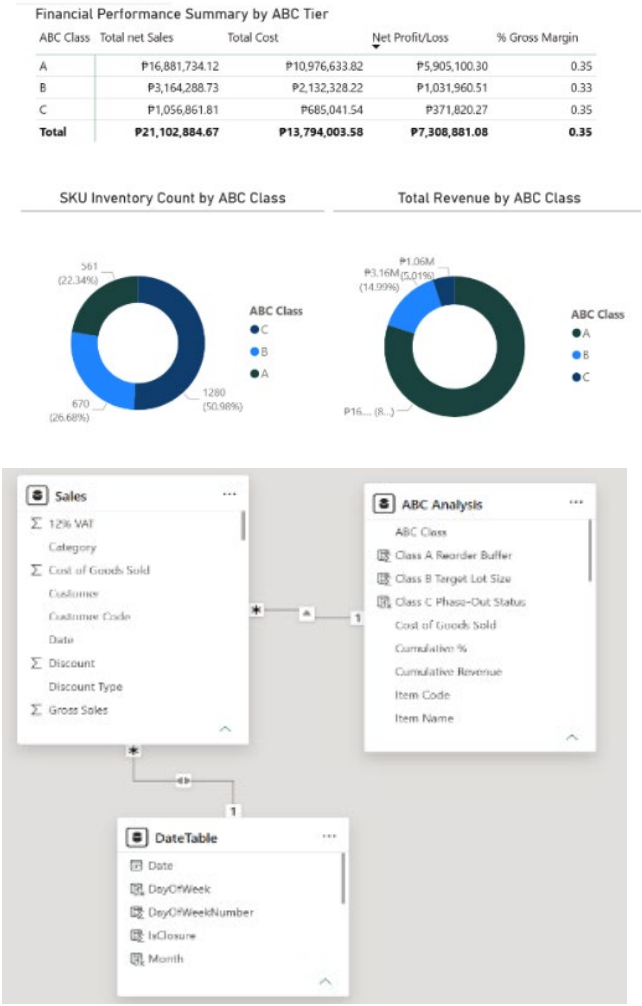


Fig. 2. ABC Analysis dashboard in Power BI showing SKU distribution, cumulative revenue contribution, and profitability tiers (Class A, B, C), including financial performance summary by ABC tier and visual breakdowns of inventory count and revenue share

Beyond descriptive dashboards, inferential statistics were applied using t-tests in Excel to validate differences between customer segments. Independent samples t-tests were conducted using the "Two-Sample Assuming Unequal Variances" option, as member and non-member groups exhibited substantially different variances and sample sizes. The results confirmed that the difference in average basket size was statistically significant ($t = 2.45$, $p = 0.018$), indicating that members consistently purchased in larger volumes per transaction compared to non-members. Similarly, discount rates differed significantly between groups ($p < 0.05$), with members receiving higher average discounts than non-members. These statistical findings reinforced the dashboard insights, demonstrating that the observed behavioral differences were not random variations but genuine, segment-specific patterns (Table 1).

Table 1
Excel t-test output validating statistically significant differences in basket size and discount rates between members and non-members

t-Test: Two-Sample Assuming Unequal Variances	Member	Non-Member
Mean	167.49	98.95
Variance	114900.83	36776.87
Observations	61236.00	124843.00
Hypothesized Mean Difference	0.00	
df	80993.00	
t Stat	46.52	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.64	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.96	

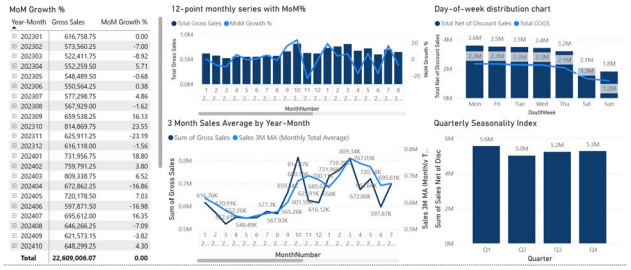


Fig. 3. Temporal demand analysis in Power BI - Showing monthly sales trends, moving averages, day-of-week distribution, and quarterly seasonality patterns, highlighting fluctuations in gross sales and growth rates over time

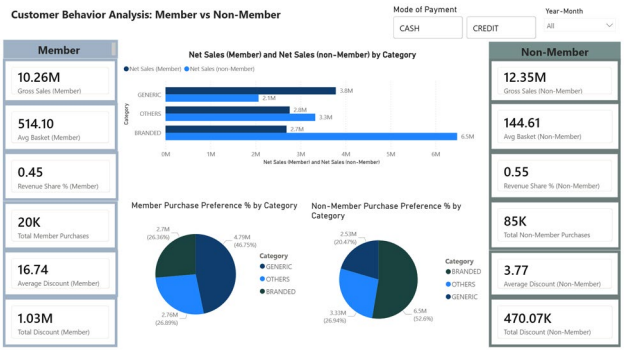


Fig. 4. Customer segmentation dashboard in Power BI. Comparing member versus non-member purchasing behavior, including gross sales, average basket size, discount utilization, and category preferences across generic, branded, and other medicines

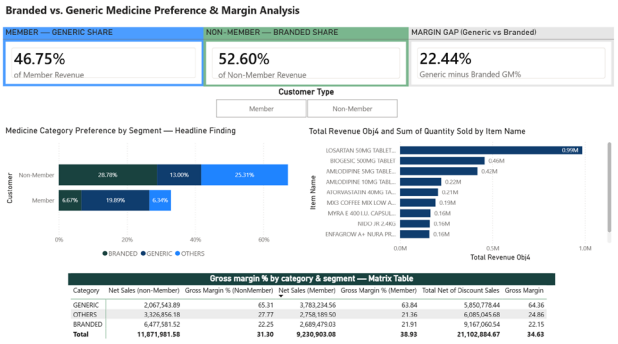


Fig. 5. Branded versus generic medicine analysis in Power BI. Highlighting revenue shares, margin gaps, and customer segment preferences, including detailed gross margin comparison across categories and top-selling items.

Exploratory data analysis was conducted entirely within Power BI, using interactive dashboards, pivot-style visuals, conditional formatting, moving averages, and growth rate calculations to identify temporal demand patterns. These analyses revealed monthly and seasonal fluctuations in sales (Figure 3), differences in member versus non-member purchasing behavior (Figure 4), and margin gaps between branded and generic medicines (Figure 5). The exploratory insights provided the empirical foundation for the four-module BI pipeline—financial KPIs, temporal demand analysis, customer segmentation, and ABC classification—ensuring that the integrated dataset was not only clean and audit-ready but also strategically actionable for inventory and sales management Microsoft Excel and Microsoft Power BI served as the primary visualization platforms throughout this study. Excel was used for initial exploratory charting during the data preparation phase, including pivot-table-driven bar charts for frequency inspection, line charts for preliminary trend detection, and conditional formatting rules for anomaly visualization [19] Power BI was used to construct the multi-page analytical dashboard supporting all five specific objectives, employing interactive slicers for year, transaction type, and medicine category to enable multi-dimensional drill-down by end users [20].

E. Validity and Reliability

Analytical validity and reliability were safeguarded through four measures. All t-tests were two-tailed independent-samples tests at $\alpha = 0.05$, with Levene's test confirming the variance-equality assumption beforehand and Cohen's d computed alongside each p-value so significance could be read practically, not only statistically. The chi-square tests of category preference by membership status met the minimum expected-cell-count assumption (all cells ≥ 5) given the full three-year volume. Every KPI and classification threshold generated in Power BI was cross-validated against an independent Excel recomputation, with outputs matching to the peso across all tiers. Finally, the eleven-step cleaning audit (Section 3.3) was applied uniformly across all 36 monthly extracts, preventing period-specific preprocessing bias from confounding the comparisons in Section 4.

F. Research Ethics

The dataset used in this study contains records originally associated with identifiable pharmacy customers, necessitating formal privacy protection measures before analysis could proceed. All personally identifiable information was removed from the analytical dataset: the Customer Name field, which contained the full legal names of 670 unique individuals across 186,079 transaction rows, was replaced with the anonymized value "ANONYMIZED." The Customer Code field — a system-generated alphanumeric identifier bearing no relationship to personal identity — was retained solely to support segment-level grouping and repeat-customer frequency analysis without enabling re-identification. This anonymization protocol complies with Republic Act No. 10173, the Philippine Data Privacy Act of 2012, which requires that personal data collected in the course of institutional transactions be processed only for stated, legitimate purposes and protected from unauthorized disclosure [26].

Data access was granted through a formal institutional authorization issued by the pharmacy management to the research team, specifying academic research as the sole permitted use and restricting distribution of individual-level transaction records. The dataset was handled exclusively within the research team, stored on password-protected local drives, and no individual-level data are disclosed in any manuscript table, figure, or appendix; all reported values are aggregate or segment-level summaries. The study involves no human subjects research as defined under standard research ethics frameworks, as the analysis is limited to de-identified commercial transaction records generated prior to and independent of this research. No clinical data, patient diagnoses, medical histories, or health outcomes were accessed at any stage of the study. Sources cited throughout the manuscript are properly attributed in the References section in compliance with academic integrity standards [14].

4. Findings and Discussion

The analytical dataset comprised transaction-level point-of-sale (POS) records from a single-branch microfinance-linked community pharmacy in San Pablo City, Laguna, Philippines, spanning three full calendar years: January 2023 through December 2025. The multi-year dataset with a total of 36 months of daily transaction data, encompassing 2,511 unique stock-keeping units (SKUs) across three medicine categories — Branded, Generic, and Others (nutritional supplements, OTC products, and personal care items). Transaction records contained 23 fields per row including date, item name, barcode, category, unit cost, selling price, quantity sold, gross sales, cost of goods sold (COGS), discount, VAT components, mode of payment, customer code, and transaction type. The customer base was segmented into two primary groups — Members (enrolled MFI clients) and non-members (general public) — with additional classifications for General Public Discount, Senior Citizens, and PWD. Prior to analysis, void transactions were identified and excluded from all revenue computations to ensure data integrity. Whitespace anomalies in the Category

field were trimmed to prevent erroneous segmentation. The resulting clean dataset showed no missing values in primary analytical fields and exhibited complete month-level coverage across all 36 periods, confirming its suitability for longitudinal, cross-sectional, and portfolio analysis without imputation.

Over the three-year observation period, the pharmacy generated a total gross revenue of ₱22,609,006.07, with a gross profit of ₱7,310,000 and an overall gross margin of 38.99%. Total discounts extended across all transaction types amounted to ₱1.50 million, representing a discount rate of 6.61% of gross revenue. The average transaction value across all segments was ₱200. Disaggregated by year, 2023 generated ₱7,225,709, 2024 recorded the highest annual revenue at ₱8,165,600 — a year-over-year (YoY) increase of +13.0% — while 2025 registered ₱7,217,697, reflecting a −11.6% YoY decline relative to 2024's peak. These three-year figures reveal that the pharmacy achieved its maximum operational performance in 2024, with 2025 showing a reversion toward 2023 baseline levels, a pattern that warrants longitudinal monitoring to determine whether the 2025 decline represents cyclical demand compression or an emerging structural trend. The gross margin of 38.99% is notably robust for a community pharmacy in a low-to-middle income setting and is partly attributable to the disproportionate contribution of generic medicines, which carry significantly higher margins than branded equivalents (Table 2).

Table 2
Aggregate financial KPI summary — 2023–2025

KPI	Value
Total Gross Revenue (3 years)	₱ 22,609,006.07
2023 Annual Revenue	₱ 7,225,709.00
2024 Annual Revenue	₱ 8,165,599.78
2025 Annual Revenue	₱ 7,217,697.29
YoY Growth 2023 to 2024	+13.0%
YoY Growth 2024 to2025	−11.6%
Total Gross Profit	₱ 7,308,881.08
Gross Margin %	38.99%
Total Discount	₱ 1,500,000.00
Discount Rate %	6.61%
Average Transaction Value	₱ 200.00
Total Unique SKUs	2,511

Figure 6 and Figure 7 collectively reveal a multi-layered temporal demand structure. Across 2023, monthly revenue ranged from a trough of ₱522,412 in March (MoM: −8.92%) to an absolute dataset peak of ₱814,870 in October (MoM: +23.55%), with the abrupt November 2023 reversal of −23.19% being the single steepest monthly decline in the entire three-year series. In 2024, the revenue distribution shifted: the annual peak migrated forward to March at ₱809,339 (MoM: +6.52%), and the most pronounced trough occurred in June at ₱597,872 (MoM: −16.98%), followed by a strong July recovery of +16.35%. In 2025, the January peak of ₱682,326 (+8.50% MoM) initiated a progressively declining trajectory, with the year closing at its lowest monthly value of ₱532,649 in December. The 3M moving average smoothed these oscillations and confirmed a structural pattern: the 2024 3M MA consistently exceeded the 2023 3M MA (range ₱634,288–₱767,029 vs. ₱541,054–₱700,106), while the 2025 3M MA (₱562,839–₱648,059) reverted toward 2023 levels, corroborating the YoY decline finding. The recurring June suppression across 2024 and 2025 suggests a systemic seasonal demand compression consistent with the Philippine school enrollment period, during which household budget allocation toward educational expenses is known to crowd out discretionary and even maintenance healthcare expenditures [5], [3].

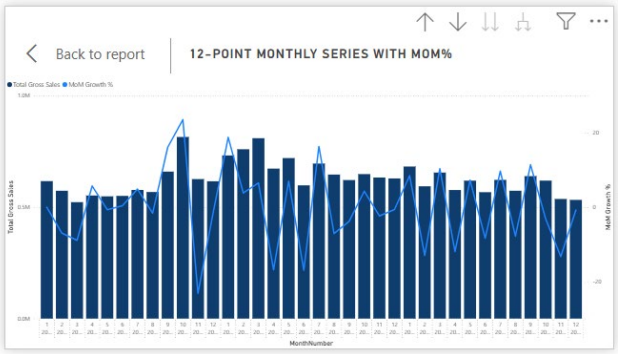


Fig. 6. Twelve-point monthly series with MoM growth percentage overlay

Fig. 7. Three-month sales average by Year-Month

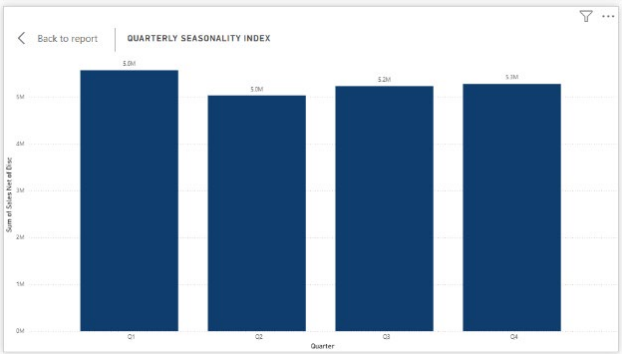


Fig. 9. Quarterly seasonality analysis based on net-of-discount sales

Figure 9 covered the full three-year period and revealed that Q1 was consistently the strongest quarter at ₱5,567,078 (26.4% of total net sales), followed by Q4 at ₱5,277,454 (25.0%), Q3 at ₱5,228,422 (24.8%), and Q2 at ₱5,029,931 (23.8%). The Q1 dominance — driven by January through March demand — is consistent with post-holiday prescription refill cycles and New Year health-seeking behavior that has been documented in similar community pharmacy settings across Southeast Asia [12],[31]. Notably, Q2's relative weakness, anchored by the recurring June trough, contrasts with Q4's relative strength,

which may reflect late-year maintenance drug restocking and festive-season OTC purchases. The narrow Q3–Q4 differential (24.8% vs. 25.0%) suggests that second-half demand is broadly stable, with the most significant variation concentrated in the Q1–Q2 transition. This quarterly pattern provides an empirically grounded basis for the pharmacy's inventory procurement schedule and working capital planning across the calendar year.

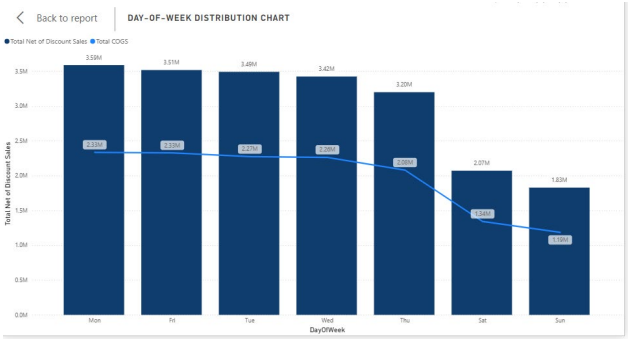


Fig. 10. Day-of-Week analysis

The day-of-week analysis (Figure 10) of net-of-discount sales across all three years revealed a pronounced weekday-to-weekend revenue gradient. Monday recorded the highest single-day net sales at ₱3,585,430 (17.0% of total weekly revenue), followed closely by Friday (₱3,514,435, 16.7%), Tuesday (₱3,488,540, 16.5%), Wednesday (₱3,421,551, 16.2%), and Thursday (₱3,196,529, 15.1%). Saturday and Sunday contributed ₱2,069,608 (9.8%) and ₱1,826,792 (8.7%) respectively. Combined, the two weekend days generated ₱3,896,400 — representing only 18.5% of total weekly revenue despite constituting 28.6% of available operating days. Monday's net sales were 1.96 times higher than Sunday's, indicating a strong deferred demand effect where customers who could not attend during the weekend visit early in the subsequent week. This finding has direct operational implications: Monday-to-Friday staffing intensity and inventory readiness are more critical than weekend allocation, and a Monday-focused restocking cycle — rather than a weekend cycle — is better aligned with observed demand patterns [28]. The COGS column of Figure 14 further confirms that weekday COGS proportionally tracks net sales, with weekday operations collectively accounting for approximately 81.5% of both revenue and cost activity.

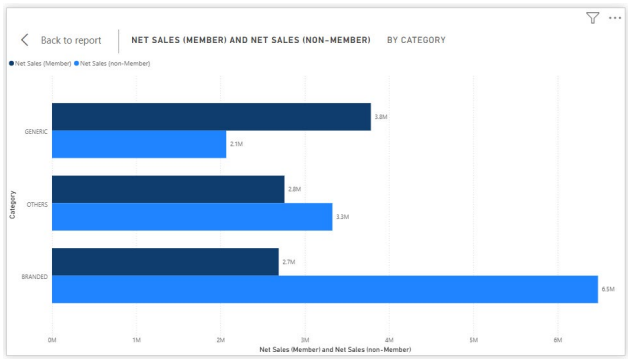


Fig. 11. Segmented revenue between enrolled members and non-members

The customer behavior dashboard (Figure 11) segmented revenue between enrolled Members and Non-Members across the full three-year dataset. Non-Members contributed ₱12,352,803 (55%) of gross revenue and ₱11,871,982 (56.3%) of net sales, while Members contributed ₱10,256,203 (45%) of gross revenue and ₱9,230,903 (43.7%) of net sales. Despite the lower absolute revenue contribution, members exhibited a markedly higher average basket value of ₱514.10, compared to ₱144.61 for non-members — a differential of 3.56 times. This substantial basket size gap reflects the nature of member transactions: members are predominantly purchasing chronic disease maintenance medications in volume (driven by the 46.75% generic medicine preference discussed below), while non-members tend to purchase single-episode OTC and branded products in smaller quantities per visit. The average discount per member transaction was ₱16.74, compared to ₱3.77 for non-members — a 344% premium in per-transaction discount benefit — confirming that the membership discount structure is both operationally active and financially significant. Total member discount cost over three years was ₱1,030,000, representing the pharmacy's primary social enterprise investment in healthcare accessibility for its enrolled MFI client base, consistent with the role of integrated microfinance-health programs in reducing out-of-pocket healthcare expenditures among low-income households in the Philippines [5].

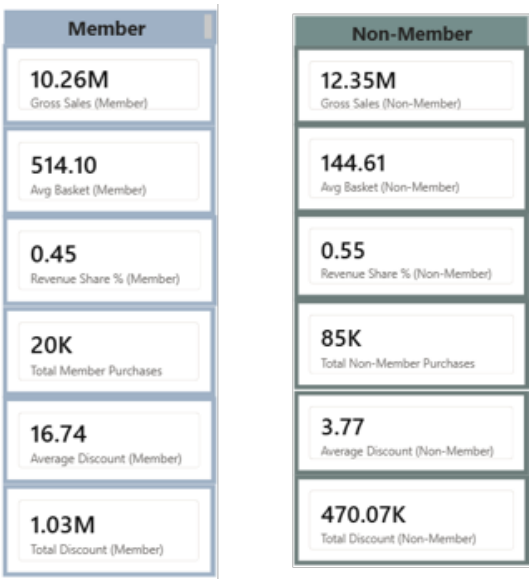
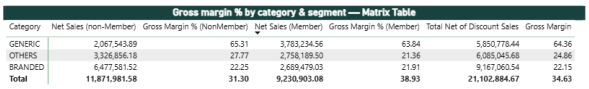


Fig. 12. Stacked percentage chart of medicine category preference

Figure 12 reveals the study's most analytically significant and actionable finding. Members directed 46.75% of their gross purchasing toward generic medicines (₱4,794,489), followed by Others at 26.89% (₱2,758,190) and branded at 26.36% (₱2,703,525). Non-Members, by contrast, directed 52.60% of their gross purchasing toward branded medicines (₱6,497,312), followed by Others at 26.94% (₱3,327,445) and Generic at only 20.47% (₱2,528,045). Expressed as a share of the combined grand total (₱21,102,885 net sales), the six segment-category combinations rank as: Non-Member Branded (28.78%), Non-Member Others (25.31%), Member Generic (19.89%), Non-

Member Generic (13.00%), Member Branded (6.67%), and Member Others (6.34%). This cross-segment behavioral divergence — members as generic-dominant buyers and non-members as branded-dominant buyers — is consistent with several intersecting explanations: member pharmacist counseling influence within the MFI ecosystem, member income sensitivity driving generic substitution for cost reduction, and non-member brand preference driven by advertising and habitual OTC purchasing behavior. The finding has significant implications for the Philippine Generics Act implementation in community pharmacy settings [25], suggesting that microfinance membership channels may function as an indirect pathway for improving generic drug adoption among low-to-middle income households.



Gross margin % by category & segment — Matrix Table

Category	Net Sales (non-Member)	Gross Margin % (NonMember)	Net Sales (Member)	Gross Margin % (Member)	Total Net of Discount Sales	Gross Margin
GENERIC	2,067,543.89	65.31	3,783,234.56	63.84	5,850,778.44	64.36
OTHERS	3,326,856.18	27.77	2,758,189.50	21.36	6,085,045.68	24.86
BRANDED	6,477,581.52	22.25	2,689,479.03	21.91	9,167,060.54	22.15
Total	**11,871,981.58**	**31.30**	**9,230,903.08**	**38.93**	**21,102,884.67**	**34.63**

Fig. 13. Gross margin matrix

Figure 13 provides the profitability foundation underlying the category preference findings. Generic medicines yielded the highest gross margin at 64.36% overall (Member: 63.84%; Non-Member: 65.31%). Branded medicines yielded the lowest gross margin at 22.15% overall (Member: 21.91%; Non-Member: 22.25%). Others fell between the two at 24.86% (Member: 21.36%; Non-Member: 27.77%). The margin gap between Generic and Branded — 42.21 percentage points — represents the study's core profitability asymmetry finding, consistent with findings from prior literature demonstrating that pharmacies' substitution incentives toward generic medicines are strongly determined by relative gross margins [4], a pattern consistent with U.S. claims-data evidence that high-cost generics can run over 15 times pricier than therapeutic alternatives of equal clinical value [30]. At the segment level, Members generated an overall gross margin of 38.93% compared to 31.30% for non-members, a 7.63 percentage point difference that is attributable almost entirely to Members' higher generic medicine share. This means that despite Members contributing less absolute revenue (43.7% of net sales), they generate disproportionately higher gross profit per peso of revenue. From a BI standpoint, this insight reframes the pharmacy's strategic priorities: member retention and generic volume growth are more effective margin drivers than non-member revenue expansion, because each additional peso of member generic revenue contributes ₱0.638 in gross profit, compared to ₱0.222 per peso of non-member branded revenue.

The ABC Pareto analysis (Figure 14) of the 2,511-SKU catalogue produced three classes with sharply distinct revenue concentration profiles, consistent with the Pareto principle widely applied in pharmaceutical inventory management [18], [11]. Class A comprised 561 SKUs (22.34% of catalogue) and generated ₱16,881,734 — 80.00% of total net revenue. Class B comprised 670 SKUs (26.68%) generating ₱3,164,289 (14.99%), and Class C comprised 1,280 SKUs (50.98%) generating ₱1,056,862 (5.01%). This 22/80 split, tighter than the classical 80/20 heuristic, echoes safety-stock prioritization evidence favoring stock-out protection concentrated on a narrow high-velocity tier (Kirmizi et al., 2024). The correct gross profit by tier — computed as net sales minus COGS — was ₱5,905,100 (35.0%) for Class A, ₱1,031,961 (32.6%) for Class B, and ₱371,820 (35.2%) for Class C, yielding a combined gross profit of ₱7,308,881 at 34.6% overall. The top revenue-generating SKU on a net sales basis was Losartan 50mg Tablet (Angel-50) at ₱722,164 (3.42% of total net revenue), followed by Biogesic 500mg Tablet (₱456,536, 5.59% cumulative), and Amlodipine 5mg Tablet (₱310,663, 7.06% cumulative). The top ten SKUs by gross sales volume confirm the dominance of cardiovascular maintenance drugs (Losartan 50mg: 262,126 units, ₱985,180; Amlodipine 5mg: 88,060 units, ₱418,386; Amlodipine 10mg: 37,095 units, ₱222,595; Atorvastatin 40mg: 18,960 units, ₱205,124), which collectively signal a chronic hypertension and dyslipidemia patient base among the pharmacy's regular customers. The monthly capital demand analysis (Figure 18) showed that procurement COGS peaked in March 2024 at ₱518,972 — aligned with the 2024 revenue peak — and reached its lowest point in December 2025 at ₱307,680, consistent with the 2025 revenue decline. The 2024 monthly COGS average of ₱415,523 exceeded both 2023 (₱375,104) and 2025 (₱358,873), further confirming 2024 as the highest-activity operational year.

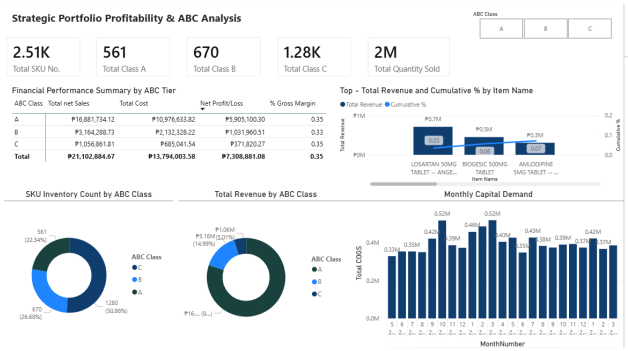


Fig. 14. Strategic portfolio profitability & ABC analysis

The combined evidence from the margin matrix (Figure 13), the ABC classification (Figure 14), and the customer segmentation analysis (Figure 11) converges on a single high-priority strategic insight: the pharmacy's gross profit generation is structurally dependent on two levers — member enrollment and generic medicine volume — not on the maximization of total revenue or non-member transaction volume. Members, who represent 43.7% of net sales, produce a 38.93% gross margin against a 31.30% gross margin for non-members. Generic medicines, which represent 27.72% of total net sales, produce a 64.36% gross margin — nearly three times higher than the 22.15% generated by Branded medicines, which represent the largest single revenue category at 43.44% of net sales. The practical implication is that a 10% increase in generic medicine sales produces approximately ₱640 of additional gross profit per ₱1,000 of additional revenue, while a 10% increase in branded medicine sales produces only ₱220. This margin structure incentivizes a deliberate product and customer mix strategy centered on generic substitution advocacy within

the MFI member base, rather than volume-driven non-member expansion — a direction supported by the documented relationship between pharmacy margin incentives and generic substitution behavior in comparable retail pharmacy markets [4].

This study demonstrates that transaction-level POS data from a microfinance-linked community pharmacy, when processed through a structured BI analytical pipeline, yields a dense portfolio of operationally and strategically actionable findings without requiring demographic, clinical, or external market data [6],[10]. All five research objectives were fully addressable from the 23-variable dataset: financial KPI benchmarking confirmed a viable 38.99% gross margin; temporal analysis identified recurring seasonal patterns with consistent June demand suppression; customer segmentation revealed a 3.56x member-to-non-member basket size differential and a statistically distinct category preference divergence; margin analysis quantified a 42.21 percentage point generic-branded profitability gap; and ABC classification concentrated 80% of revenue in 22.34% of SKUs. This finding establishes that community pharmacies operating within microfinance networks in the Philippines possess an underutilized data asset — the POS transaction record — that is sufficient to support modern BI-driven management without enterprise-grade systems or external data integration [10].

Several cross-objective patterns merit specific discussion. First, the co-occurrence of the Q1 revenue peak, the Monday demand peak, and the member preference for generic cardiovascular drugs collectively identifies a chronic disease maintenance patient cohort as the pharmacy's highest-value operational core. This cohort drives predictable, recurring demand that is resistant to the seasonal suppression observed among non-member OTC purchasers in Q2. Second, the October 2023 anomaly — a +23.55% MoM spike to the dataset's absolute revenue maximum of ₱814,870 — followed immediately by a −23.19% reversal in November, represents the most extreme volatility event in the three-year series and warrants investigation as a potential external demand trigger (e.g., a local health campaign, bulk prescription event, or promotional activity) rather than organic seasonal growth. Third, the 2025 YoY decline of −11.6% after a robust 2024 performance of +13.0% does not follow the smoothed 3M MA trajectory of either 2023 or 2024, suggesting that the 2025 decline may not be purely cyclical. Contributing factors could include increased local pharmacy competition, changes in MFI member enrollment, or supply chain disruptions affecting Class A SKU availability — none of which can be confirmed without supplementary operational records. Fourth, the Non-Member branded preference (52.60%) despite a 22.15% gross margin — compared to Generic's 64.36% — represents a market behavior anomaly from the pharmacy's perspective: the highest-revenue segment (Non-Member Branded: 28.78% of grand total) is also the lowest-margin segment, creating a structural tension between revenue volume and profitability optimization — a tension that has been documented in retail pharmacy settings where branded medicine volume does not translate proportionally into profitability [4].

This study is subject to five principal limitations. First, the single-branch scope restricts geographic generalizability; the patterns identified are specific to the San Pablo City operating context and may not hold across other microfinance pharmacy branches or geographic markets. Second, the absence of patient demographic data — age, sex, diagnosis, and household income — prevents clinical interpretation of medicine demand patterns. The cardiovascular drug dominance inferred from SKU names (Losartan, Amlodipine, Atorvastatin) cannot be formally attributed to a diagnosed patient population without medical record linkage. Third, operating expense data — including staff salaries, rent, utilities, and logistics — is absent from the POS dataset, making it impossible to compute net profitability; the gross margins reported represent the ceiling of operational profitability, not its floor. Fourth, the credit transaction records (14.4% of revenue) are captured as completed sales at the point of transaction, but repayment data for credit purchases is unavailable in the POS dataset, introducing an unquantified revenue quality risk that would affect true cash-basis profitability and net working capital calculations.

Future studies should address these limitations through four specific extensions. First, integration of two or more additional pharmacy branches within the same MFI network would enable cross-branch comparative analytics and confirm whether the patterns identified — particularly the June trough, the Monday peak, and the member-generic preference — are pharmacology-specific or network-wide behavioral regularities. Second, linkage of the POS database with the MFI member management system — including enrollment date, loan tier, repayment history, and savings balance — would enable Customer Lifetime Value (CLV) computation and test the hypothesis that financially active MFI members generate disproportionately higher pharmacy revenue and margin over time, a relationship with significant implications for MFI health benefit program design and member retention strategy. Third, the 2025 revenue decline of −11.6% should be investigated through a competitive market analysis incorporating data on new pharmacy openings, price changes in competing outlets, and MFI member enrollment trends in the San Pablo catchment area, to determine whether the decline represents demand migration or demand suppression. Fourth, the October 2023 anomaly (+23.55%, ₱814,870) warrants retrospective investigation into pharmacy operational records for that period — specifically bulk purchase events, organizational orders, or local health campaigns — as understanding its cause would improve forecast model accuracy for the October period in future years. Finally, the ABC classification framework should be extended to incorporate a velocity dimension (monthly quantity sold per SKU), enabling XYZ analysis that distinguishes high-revenue stable SKUs (AX) from high-revenue volatile SKUs (AZ), providing a more operationally precise inventory prioritization matrix than revenue ranking alone [18], [11].

5. Conclusion

This study applied a structured business intelligence (BI) and data analytics framework to three years of point-of-sale transaction data from a microfinance-linked community

pharmacy in San Pablo City, Philippines, covering January 2023 through December 2025. Five analytical objectives were fully achieved using the 23-variable POS dataset without requiring demographic, clinical, or external market data. The first objective established a multi-year financial baseline: total gross revenue of ₱22,609,006.07, a gross margin of 38.99%, and a discount rate of 6.61%, with 2024 identified as the peak performance year at ₱8,165,600 (+13.0% YoY) and 2025 showing a reversal to ₱7,217,697 (−11.6% YoY). The second objective characterized temporal demand patterns: Q1 consistently emerged as the strongest quarter (₱5,567,078; 26.4% of net sales), June recorded a recurring annual trough in both 2024 (−16.98% MoM) and 2025 (−8.37% MoM) attributable to school enrollment-driven household budget displacement, and Monday generated the highest single-day net sales at ₱3,585,430 — 1.96 times higher than Sunday's ₱1,826,792. The third objective confirmed that enrolled members generated a significantly higher average basket value of ₱514.10 versus ₱144.61 for non-members (a 3.56× differential) and received per-transaction discounts averaging ₱16.74 compared to ₱3.77 — a 344%-member premium reflecting the pharmacy's social enterprise function within the MFI ecosystem. The fourth objective revealed the study's most consequential profitability finding: generic medicines generated a gross margin of 64.36%, compared to 22.15% for branded medicines — a gap of 42.21 percentage points — and members, who demonstrated a 46.75% generic preference versus the 52.60% branded preference of non-members, produced an overall gross margin of 38.93% versus 31.30% for non-members, establishing that member retention and generic volume growth are structurally more profitable operational levers than non-member revenue expansion. The fifth objective confirmed a classical Pareto concentration in the SKU portfolio: 561 Class A SKUs (22.34% of catalogue) accounted for 80.00% of net revenue (₱16,881,734), while 1,280 Class C SKUs (50.98%) generated only 5.01% (₱1,056,862), with cardiovascular maintenance drugs — Losartan 50mg, Amlodipine 5mg and 10mg, and Atorvastatin 40mg — occupying the four highest-revenue positions and signaling a chronic disease-dominant patient base.

The study is subject to limitations that bound the generalizability and depth of its findings. The single-branch scope precludes network-wide generalization and limits the ability to attribute the observed 2025 revenue decline to systemic versus local causes. The absence of patient demographic records, operating expense data, and credit repayment histories prevents computation of net profitability, clinical demand interpretation, and true cash-basis revenue quality assessment. The ABC financial performance analysis confirmed that all three inventory tiers generate positive gross profit: Class A yielded a gross profit of ₱5,905,100.30 at a gross margin of 34.98% on net sales of ₱16,881,734.12; Class B generated ₱1,031,960.51 at 32.61% on ₱3,164,288.73; and Class C produced ₱371,820.27 at 35.18% on ₱1,056,861.81 — yielding a combined gross profit of ₱7,308,881.08 at 34.63% overall. These figures are fully consistent across both the Power BI dashboard and direct net sales minus COGS computation, confirming the integrity of the ABC financial reporting. Despite these constraints, the findings carry meaningful implications for pharmacy management, MFI program design, and health policy: the generic-branded margin asymmetry provides a quantitative basis for pharmacist-counseled generic substitution advocacy as both a patient cost-reduction and pharmacy profitability strategy; the ABC classification provides an immediate operational framework for zero-stock-out protocols on Class A cardiovascular drugs; and the temporal demand patterns provide the empirical foundation for proactive inventory and cash flow planning around the recurring June trough and Monday demand peaks.

Based on the findings of this study, four recommendations are offered for pharmacy management and future research. First, the pharmacy should institutionalize a Class A stock-out prevention protocol — prioritizing the 561 Class A SKUs, particularly cardiovascular maintenance drugs, for daily monitoring, minimum safety stock levels, and Monday-morning restocking cycles aligned with the observed weekly demand peak. Second, a member retention and generic conversion program should be formally embedded within the MFI's health benefit design, leveraging the demonstrated 42.21 percentage point gross margin advantage of generic over branded medicines to simultaneously reduce patient out-of-pocket costs and improve pharmacy profitability — a dual social and commercial return consistent with the MFI's mission. Third, the pharmacy management team should commission a root cause investigation into the 2025 revenue decline, examining competitive market entries, MFI member enrollment changes, and supply chain disruptions, before the −11.6% trend compounds into a multi-year structural decline. Fourth, future research should extend this framework to multi-branch longitudinal analysis and integrate the MFI member management database to enable Customer Lifetime Value modeling, thereby testing whether financially active MFI members generate disproportionately higher pharmacy revenue and margin over time — a hypothesis with significant implications for microfinance-linked healthcare delivery models across ASEAN.

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