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Economic Evaluation of Hospital María Especialidades Pediátricas

Tegucigalpa, Honduras

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Summary

The María Hospital, Paediatric Specialities (HMEP), is a public institution in Tegucigalpa, Honduras, that provides specialised paediatric care while serving as a key centre for medical research and training. Since its establishment in 2014, HMEP has managed over 54,000 patients and performed more than 12,000 surgical procedures.

This study assesses HMEP's performance in 2023 through two complementary analyses: (i) an operational evaluation utilising key performance indicators, including length of stay, bed occupancy, and bed turnover; and (ii) a cost-effectiveness analysis of its services, benchmarking the cost per averted disability-adjusted life year (DALY) against Honduras' willingness-to-pay (WTP) threshold.

Findings from the operational evaluation (Analysis 1) indicate that, despite an occupancy rate of 64.6% (a value above 85% may indicate saturation), HMEP faces significant constraints in reducing surgical waiting times due to limitations in both human resources and operating theatre availability. As of 30 April 2024, 615 patients remained on the surgery waiting list, with cardiology being the most affected specialty. With a bed turnover rate of 36.5, the hospital is considered to have a moderate-to-high rate, suggesting opportunities to enhance efficiency through optimized resource allocation and surgical scheduling.

The cost-effectiveness analysis (Analysis 2) included 168 patients, with a median age of five years and a median hospital length of stay of three days, resulting in a total cost of $790,429. The cost per patient varied by specialty, with neurology incurring the lowest cost ($1,239) and cardiology the highest ($8,234). Overall, HMEP's services were found to be highly cost-effective, as the economic value generated consistently exceeded the costs incurred across all specialities. Neurology demonstrated the lowest cost per DALY averted ($112), while plastic surgery had the highest ($762). The comparison between actual costs and the WTP threshold provided critical information about the efficiency of each specialty. A ratio closer to 1 indicates that the cost per averted DALY closely aligns with the economic value assigned to a DALY under the WTP threshold. Plastic surgery showed the highest ratio (0.25), suggesting that its costs per DALY were one-fourth of the maximum WTP threshold. In contrast, endocrinology and neurology demonstrated the greatest cost-effectiveness (0.04), highlighting optimal resource utilization. Sensitivity analyses confirmed the robustness of these findings, though high-cost specialties such as plastic surgery may require closer monitoring under scenarios of uncertainty.

In conclusion, the analyses indicate that HMEP provides essential paediatric care in a cost-effective manner. However, strategic investment in specialized personnel and additional budgets for medicines and medical technology are needed to reduce surgical waiting lists and improve timely access to essential services.

Key words: Health system performance; Pediatric hospital efficiency; Cost-effectiveness analysis; Disability-adjusted life years (DALYs); Public hospital management; Health economics; Surgical waiting times; Health resource allocation; Value for money in health; Quality and access to health services

Jel Codes: I18; I10; I11; D24; D61; H51

1. Introduction

Hospital María, Pediatric Specialties (HMEP), is a public institution located in Tegucigalpa, Honduras, providing specialized pediatric care with a strong emphasis on teaching and research. As a nationally recognized referral center, HMEP plays a key role in strengthening specialized pediatric services within the Honduran health system, contributing to both the care of patients under 18 and to research aimed at improving child health outcomes across the country.

Construction of the hospital began in October 2000 and was completed in May 2004. In 2002, during the construction phase, Fundación María agreed to donate the facility to the government, on the condition that it be managed under a model different from that of other public hospitals in the national network. To fulfill this requirement, Fundación Amigos del Hospital María (FAHM), a nonprofit organization, was established in 2004 to oversee the hospital's management, while maintaining its integration within the public hospital network under the Ministry of Health (Secretaría de Salud, SESAL).

HMEP began operating on October 1, 2014, and has since provided services in 12 pediatric specialties: cardiology, interventional cardiology, cardiovascular surgery, pediatric and urologic surgery, plastic and reconstructive surgery, dermatology, endocrinology, gastroenterology, immunology, nephrology, neurology, and, as of April 2024, otolaryngology.

The hospital stands out for its exclusive range of services for low-income patients with congenital, critical, chronic, and complex conditions. These are supported by 15 auxiliary services, including pharmaceutical provision, diagnostic imaging, nutrition, psychology, intensive care, and inpatient care. The facility has nine operating rooms, seven of which are currently functional. A decision by SESAL is still pending regarding the opening and resourcing of the remaining two. In addition, HMEP leads a cardiac surgery program aimed at reducing surgical waiting lists for children with congenital heart conditions, as well as a kidney transplant program for patients dependent on dialysis.

As of December 2023, HMEP had treated more than 54,252 patients in various specialties and performed over 12,226 surgical procedures, including 1,380 cardiac surgeries, 424 cardiac catheterizations, 31 kidney transplants, 85 surgeries in the Brain Tumor Unit, and 10,306 procedures in other pediatric and urological areas. The hospital had also delivered more than 1,994,299 patient services, including specialized outpatient consultations and auxiliary services. In 2023 alone, HMEP admitted 6,811 new pediatric patients, carried out 46,787 specialized outpatient consultations, managed 1,293 hospital discharges, and performed 1,901 surgical procedures (HMEP, 2024).

This study presents a comprehensive evaluation of the hospital, consisting of:
(i) a performance analysis based on 2023 patient-level data, offering insights into the hospital's operational efficiency and identifying opportunities for improvement; and
(ii) a cost-effectiveness assessment of services, comparing the cost of preventing disability and improving quality of life with the value that the national health system places on those benefits.

2. Study Objectives

1) The first objective of the study [**Analysis 1**] was to provide a comprehensive assessment of the hospital's performance in 2023, with a particular focus on inpatient care. The analysis was based on detailed patient-level data from HMEP's records and centered on key performance indicators such as average length of stay, bed occupancy rates, and bed turnover rates. The aim was to offer information on operational efficiency and resource utilization[1].
2) The second objective [**Analysis 2**] was to evaluate the cost-effectiveness of the hospital's services by estimating the cost per disability-adjusted life year (DALY) averted and comparing it to the established cost-effectiveness threshold in Honduras (Ochalek et al., 2018). This threshold reflects the maximum amount the national health system is willing to pay to avert one DALY (Ochalek et al., 2018). The cost-effectiveness analysis assesses the hospital's economic efficiency by comparing the costs incurred in preventing disability and improving quality of life, relative to the value the health system assigns to those benefits. In doing so, the study not only determines whether HMEP is operating within economically acceptable parameters but also informs recommendations grounded in economic efficiency in line with national standards.

3. Analysis 1 – Hospital Performance Indicators

3.1 Introduction

Hospitals are a cornerstone of the health system, providing 24/7 essential services for both acute illnesses and complex medical conditions. They are designed to make the most of limited resources through an organized service network, ensuring that care is available where and when it is most needed. Because hospitals absorb a substantial portion of total healthcare spending (Schneider et al., 2021), they are under constant scrutiny by policymakers, who regularly assess them to identify inefficiencies and opportunities for improvement. This continuous evaluation seeks to refine hospital management practices and support health system development by improving both the quality and efficiency of care delivery (WHO, 2024).

The significant financial investment in hospitals highlights the need for continuous performance analysis. While the concept of performance measurement is theoretically recognized in almost all hospitals, the actual use of specific performance indicators varies considerably. This variation is influenced by several contextual factors, including the country, the hospital's size and type, and—most importantly—the availability of data. A systematic review of hospital performance evaluation indicators illustrates this diversity, identifying 1,161 indicators across 91 peer-reviewed studies. This highlights the broad range of metrics used in this field (Hadian et al., 2024). Moreover, the effectiveness of many of these statistical indicators has not yet been rigorously validated. As noted by the World Health Organization (WHO) Regional Office for Europe, the evidence supporting their use often stems from descriptive studies rather than controlled trials, suggesting the need to interpret these indicators with caution (Shaw, 2003).

Despite these limitations, performance indicators remain valuable tools for understanding hospital operations. When carefully analyzed and in the appropriate context, they provide critical insights that can guide strategic decision-making to improve both the quality of care and operational efficiency. These statistics are relevant not only for policymakers and resource allocators but also serve as practical tools for hospital management teams to identify strengths and areas for improvement.

This report uses high-quality patient-level data from the HMEP's administrative health records to estimate key indicators, including length of stay, bed occupancy rates, and bed turnover rates. Given

[1] For a more comprehensive understanding of the hospital's performance statistics, it is recommended to consult additional reports, such as the Quarterly Statistical Bulletin for the October–December 2023 period: HMEP (2024). *Boletín Estadístico Trimestral Octubre-Diciembre 2023.*

the hospital's unique pediatric profile in the country, no direct comparison was conducted with other institutions. Instead, the focus is on gaining a comprehensive understanding of its performance, identifying opportunities for improvement, and promoting evidence-based management practices.

3.2 Data Source

Patient-level data from the HMEP's administrative health records were used to conduct the analysis. These records contain detailed information on hospitalizations throughout 2023. Specifically, the dataset included the following variables (Table 1):

Table 1. Variables from HMEP's administrative health records used for Analysis 1

Variable	Description
Patient record	Unique patient identifier
Sex	Patient's sex specification
Age	Patient's age (years, months, days)
Discharge_bed	Specific identifier of the bed assigned to the patient at the time of hospital discharge
Admission_date	Date on which the patient was admitted to the hospital
Discharge_date	Date on which the patient was discharged from the hospital
Days_rounded	Total number of hospitalization days (rounded to the nearest whole number)
Admission_type	Patient's admission category, either planned or emergency
UGC _admission	*Unidad de Gestión Clínica* (clinical management unit) assigned to the patient at the time of admission
UGC _discharge	*Unidad de Gestión Clínica* (clinical management unit) assigned to the patient at the time of discharge
Discharge diagnosis	ICD-10[a] diagnostic code at the time of discharge
Procedure	Indicates whether a specific medical procedure was performed during the patient's stay
Condition	Patient's status at discharge, indicating whether his/her condition improved, remained the same, or if the patient passed away during hospitalization

[a] International Classification of Diseases (ICD - 10th version)

3.3 Methodology

To estimate the performance indicators, the patient-level data described in Section 3.2 (Data Source) were used. The analysis process began with a thorough data cleaning phase to ensure both accuracy and consistency of the dataset. This step included identifying and managing missing values, correcting data entry errors, and verifying the consistency of patient records. Once the dataset was validated, a series of descriptive and analytical methods were applied to calculate relevant performance indicators based on the available information. These included the following metrics: number and characteristics of admissions, length of patient stays, bed occupancy rate, and bed turnover rate. The selection of indicators was based on recommendations from the WHO (OECD, 2020), the Organization for Economic Co-operation and Development (OECD) (OECD, 2023a), EuroHOPE[2], and other relevant literature sources. All statistical analyses were performed using R Studio (RStudio Team, 2023).

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3.3.1 Number and Characteristics of Admissions

[2] euroHOPE—European Health Care Outcomes, Performance and Efficiency—assesses the performance of European healthcare systems in terms of outcomes, quality, resource utilization, and costs. As part of the indicator selection process, publications related to hospital performance were reviewed.

To describe hospitalizations and patient demographics during 2023, several analyses were conducted on the performance indicator regarding the number and characteristics of admissions. These included calculating the total number of hospitalizations and unique hospitalized individuals, as well as determining the average age and sex distribution of the hospitalized population. In addition, the number of admissions per patient was assessed, along with the specific International Classification of Diseases (ICD-10) codes assigned to patients who had more than four admissions. To visualize time trends, a time series of admissions for 2023 was developed, including a 7-day moving average.

To identify changes in admission patterns, a CUSUM (Cumulative Sum Control Chart) (Gomon et al., 2024) analysis was performed. CUSUM is a statistical method commonly used in quality control and process monitoring to detect small but persistent shifts in the mean of a process over time. It works by accumulating the deviations of individual observations from a target value, allowing for early detection of both upward and downward trends.

Admissions were also categorized as either emergency or scheduled, and the patient's condition at discharge (e.g., cured, deceased, unchanged, or improved) was recorded for both admission types. Additionally, a regression analysis was conducted to examine the association between admission type and health outcomes.

Lastly, a readmission analysis was conducted to evaluate the hospital readmission indicator, defined as a patient being readmitted within 7 and 30 days following their most recent hospital discharge. Both the OECD and the WHO consider hospital readmissions an important indicator of healthcare quality, particularly in terms of the effectiveness of initial treatment and the coordination of follow-up care. Readmissions were then identified by calculating the number of days between each patient's discharge date and the admission date of the subsequent hospitalization, and indicator variables were created for readmissions within these periods. In addition, readmission rates were calculated based on the total number of eligible hospitalizations, and the percentage of patients who experienced at least one readmission within 7 and 30 days was determined. The reasons for readmission were analyzed using discharge diagnosis codes, and differences between the admission and discharge units were examined to identify potential patterns related to readmissions.

3.3.2 Length of Stay (LOS)

To assess the length of stay (LOS) indicator, the total hospitalization duration for each patient at HMEP, from admission to hospital discharge, was analyzed. The analysis used the variable *días_redondeado* (days_rounded), previously included in the dataset provided. Descriptive statistics, including the mean, median, and range, were calculated to summarize the overall distribution of the length of stay.

Further analyses were conducted to evaluate LOS in different contexts. First, seasonal variations were analyzed by examining monthly admission patterns to identify potential trends. Second, LOS was evaluated based on the patient's condition at discharge, distinguishing between those who improved, those whose condition remained unchanged, and those who passed away during hospitalization. Finally, this indicator was analyzed by clinical specialty to determine whether LOS varied according to the type of care received.

3.3.3 Bed Occupancy Rate

To assess the bed occupancy rate, data on the total number of days that hospital beds were occupied and the total number of bed-days available during 2023 were used. First, bed codes and corresponding occupancy dates were extracted from HMEP's administrative records. Next, the bed occupancy rate was calculated using the following formula:

$$Occupancy\ Rate = \left(\frac{Total\ bed - \text{days}\ occupied\ in\ 2023}{Total\ bed - days\ available\ in\ 2023}\right) * 100$$

This calculation is a key indicator of hospital efficiency, as it reflects how effectively bed capacity and available resources are being utilized (OECD, 2023b). A higher bed occupancy rate generally indicates optimal use of resources and effective hospital management, while lower rates may suggest underutilization or potential inefficiencies. However, the interpretation of bed occupancy rates is highly context-dependent, as the ideal rate can vary according to hospital type, medical specialty, patient demographics, and healthcare system constraints.

For example, specialty hospitals may operate with lower occupancy rates to maintain flexibility for emergencies, whereas general hospitals often aim for higher rates to optimize resource use. Understanding the bed occupancy rate is essential for hospital capacity planning and for ensuring that available resources are aligned with patient demand.

3.3.4 Bed Turnover Rate

To calculate the **bed turnover rate**, data on the total number of patients who occupied beds and the total number of beds available during 2023 were used. The bed turnover rate is defined as the frequency with which beds are used by different patients over a specific period. The formula used for this calculation is as follows:

$$Turnover\ Rate = \left(\frac{Total\ number\ of\ patients\ who\ occupied\ beds\ in\ 2023}{Total\ number\ of\ available\ beds}\right)$$

This indicator provides valuable insights into bed utilization dynamics within the hospital, highlighting the efficiency of management in accommodating new patients (Aloh et al., 2020; OECD, 2020). A high bed turnover rate suggests effective management and quick patient transitions, enhancing the hospital's ability to meet demand and optimizing the overall flow of care. It is particularly useful for assessing the hospital's capacity to handle varying patient volumes while maintaining optimal service delivery.

3.4 Results

3.4.1 Admissions and Patient Characteristics

Table 2 presents a summary of admission statistics for HMEP during 2023. A total of 1,293 admissions were recorded, corresponding to 892 unique patients, of whom 50.35% were male. The average age for male patients was 8.03 years, while female patients had a slightly higher average age of 8.65 years. **Figure 1** illustrates the age distribution of admitted patients by sex, showing a relatively balanced age profile across both groups.

Regarding hospitalization frequency, most patients (77.9%) were admitted only once in 2023 (**Table 2**). However, a significant proportion (13.1%) had two separate admissions, suggesting a potential need for ongoing care or follow-up. Notably, 3.1% of patients experienced five or more hospitalizations, which may indicate a subgroup with chronic or complex conditions requiring recurrent medical attention. A more detailed evaluation of the ICD-10 codes associated with these frequently hospitalized patients offers further insight into the specific conditions driving these repeated admissions, as explained later.

Table 2. Statistics — Summary

Statistics	Value
Total Number of Admissions	1,293
Number of Unique Patients	892
Sex Distribution (% male)	50.35 %
Mean Age in Years (standard deviation)	
Male	8.03 (5.83)
Female	8.65 (6.25)
Number of Admissions Per Patient (%)	
1 admission	695 (77.9 %)
2 admissions	117 (13.1 %)
3 admissions	32 (3.6 %)
4 admissions	20 (2.2 %)
>= 5 admissions	28 (3.1 %)

Figure 1 — Age Distribution of Hospitalizations (by sex)

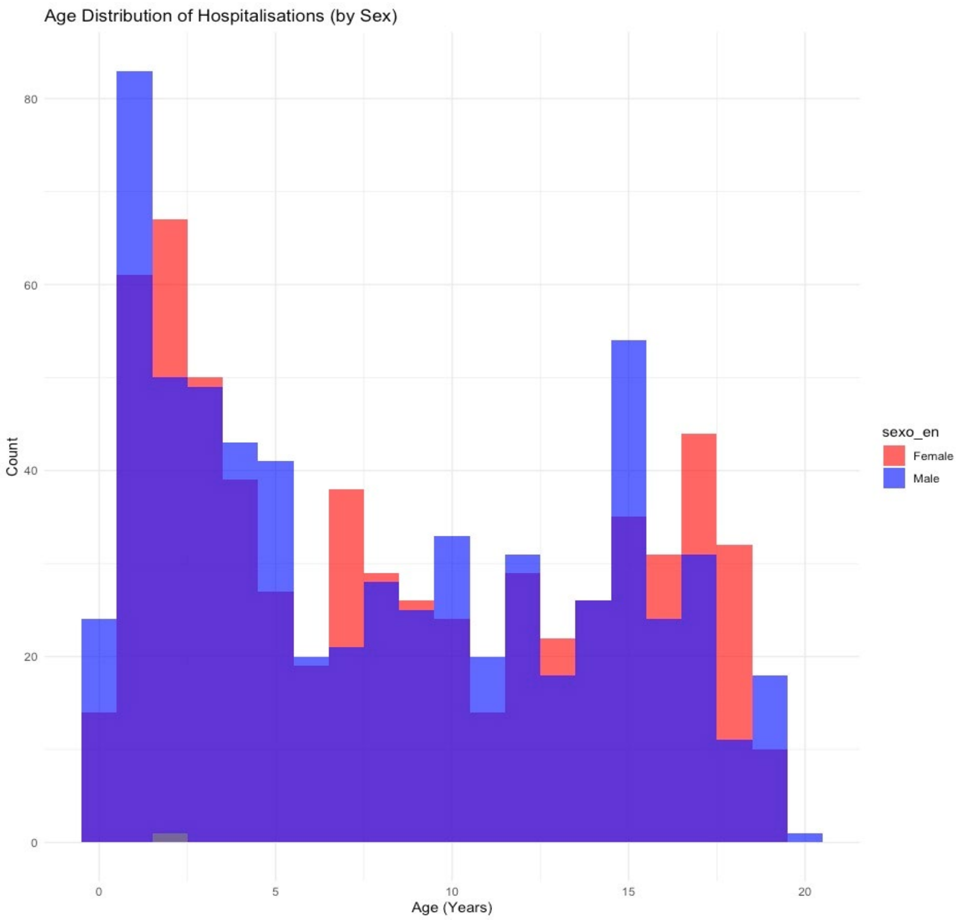


Table 3 provides a detailed summary of the ICD-10 codes assigned to the 188 admissions recorded for the 28 patients who had more than four hospitalizations during 2023. Observations with fewer than two occurrences were excluded to focus on the most frequent conditions within this high-risk group. The most assigned ICD-10 code was 'N18.6 (End-Stage Renal Disease)', accounting for 62% of the cases. This finding suggests that a significant proportion of recurrent hospitalizations was related to chronic kidney diseases, which typically require frequent and complex management strategies, such as regular dialysis or specialized follow-up care.

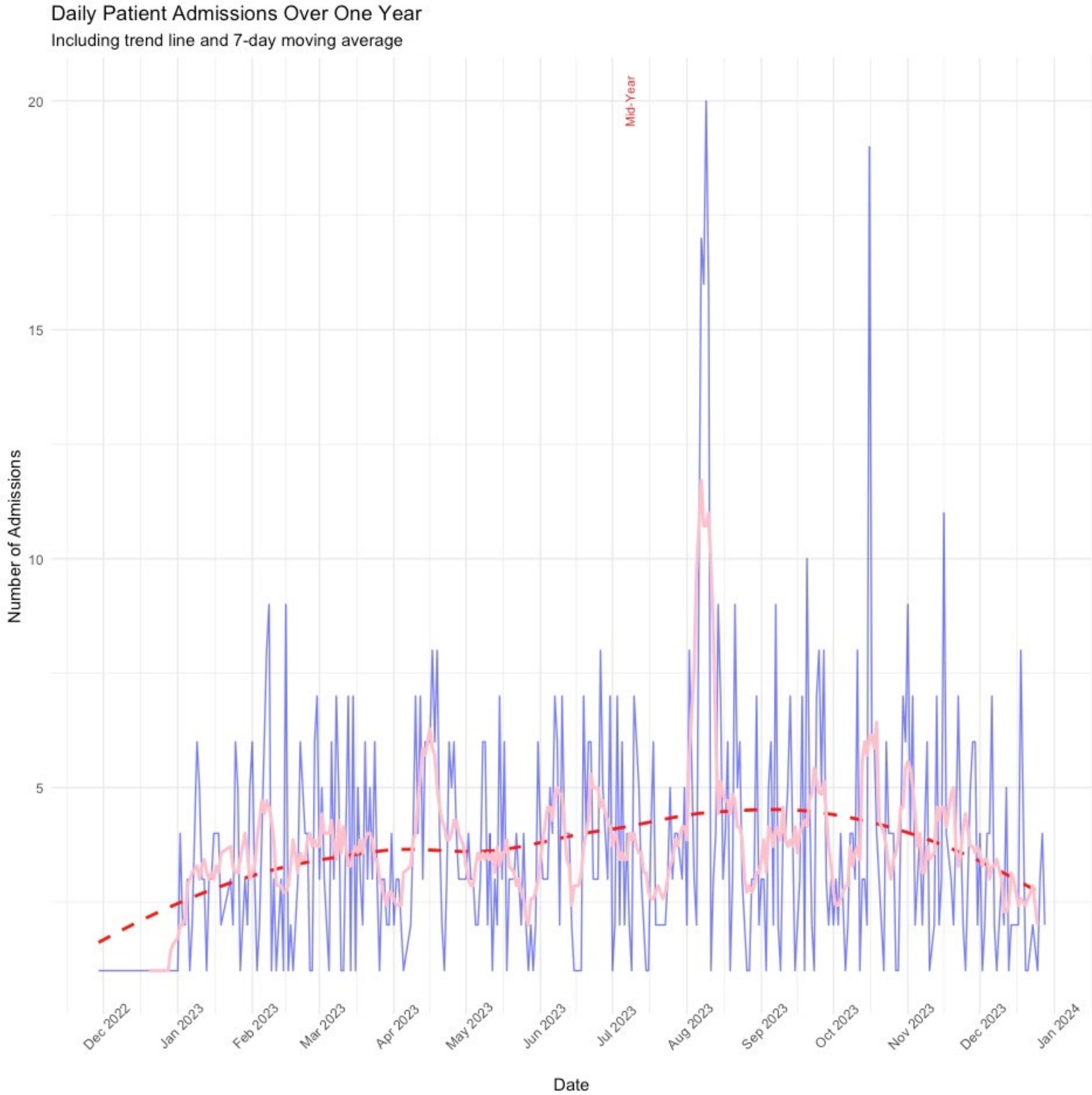
Table 3. ICD-10 Codes Assigned to Admissions of Patients with More Than Four Hospitalizations

ICD-10 Code	**n**
N18.6 - End-stage renal disease	116
N04.9 - Nephrotic syndrome, unspecified	10
N18.5 - Chronic kidney disease, stage 5	9
N18.4 - Chronic kidney disease, stage 4 (severe)	8
N18.0 - End-stage renal failure	6
Z94.0 - Kidney transplant status	6
N17.9 - Acute renal failure, unspecified	3
E87.5 - Hyperkalemia	2
G40.9 - Epilepsy, unspecified type	2
I50.0 - Congestive heart failure	2
N13.0 - Hydronephrosis with ureteropelvic junction obstruction	2
N18.1 - Chronic kidney disease, stage 1	2
Q20.9 - Congenital malformation of cardiac chambers and connections	2

The high prevalence of ICD-10 code N18.6 (End-stage renal disease) among patients with multiple admissions highlights the hospital's role in managing severe chronic conditions that drive higher hospitalization rates and longer stays. These findings suggest that many of these patients may require not only recurrent hospitalizations but also intensive, ongoing treatment plans to control disease progression.

Figure 2 shows a time series plot of daily hospital admissions during 2023. The blue line represents the raw daily admission counts, while the red dashed line depicts the 7-day moving average, which smooths fluctuations and highlights general patterns. The trend remains stable during the early months, shows a slight increase around mid-year, and declines toward the end. Peaks and troughs suggest seasonal variations, with the highest admissions levels occurring mid-year, indicating a period of increased demand. The blue line also illustrates daily variability, suggesting that admissions can shift rapidly due to unexpected increases in patient inflow. Overall, admissions remain mostly stable, though mid-year variability is noticeable.

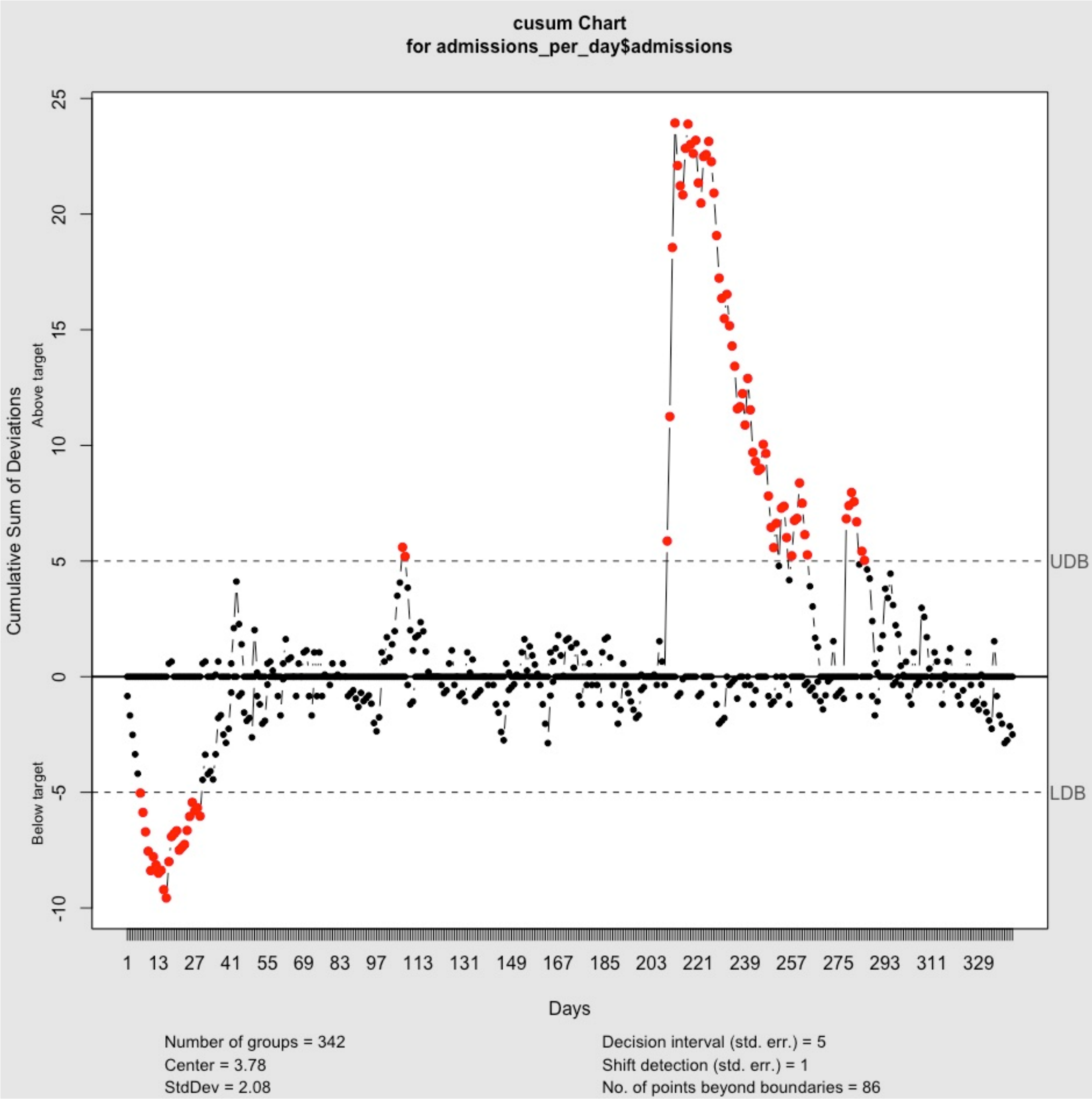
Figure 2. Time Series Plot of Admissions During 2023



Note: Number of daily patient admissions during the year 2023. The red dotted line represents the trend line and 7-day moving average.

To detect changes in patterns, a CUSUM (Cumulative Sum Control Chart) was created (**Figure 3**). As previously explained, this tool, commonly used in quality control and process monitoring, helps identify small shifts in a process's average level over time. In this case, the chart tracks the cumulative sum of deviations in daily hospital admissions throughout 2023 and includes the Upper Decision Bound (UDB) and Lower Decision Bound (LDB) lines, which indicate significant increases or decreases in admissions. The chart also shows notable deviations exceeding these limits in January, as well as in August, September, and October, suggesting the occurrence of unusual events or changes in the underlying process during those periods.

Figure 3. CUSUM Chart for Daily Admissions in 2023

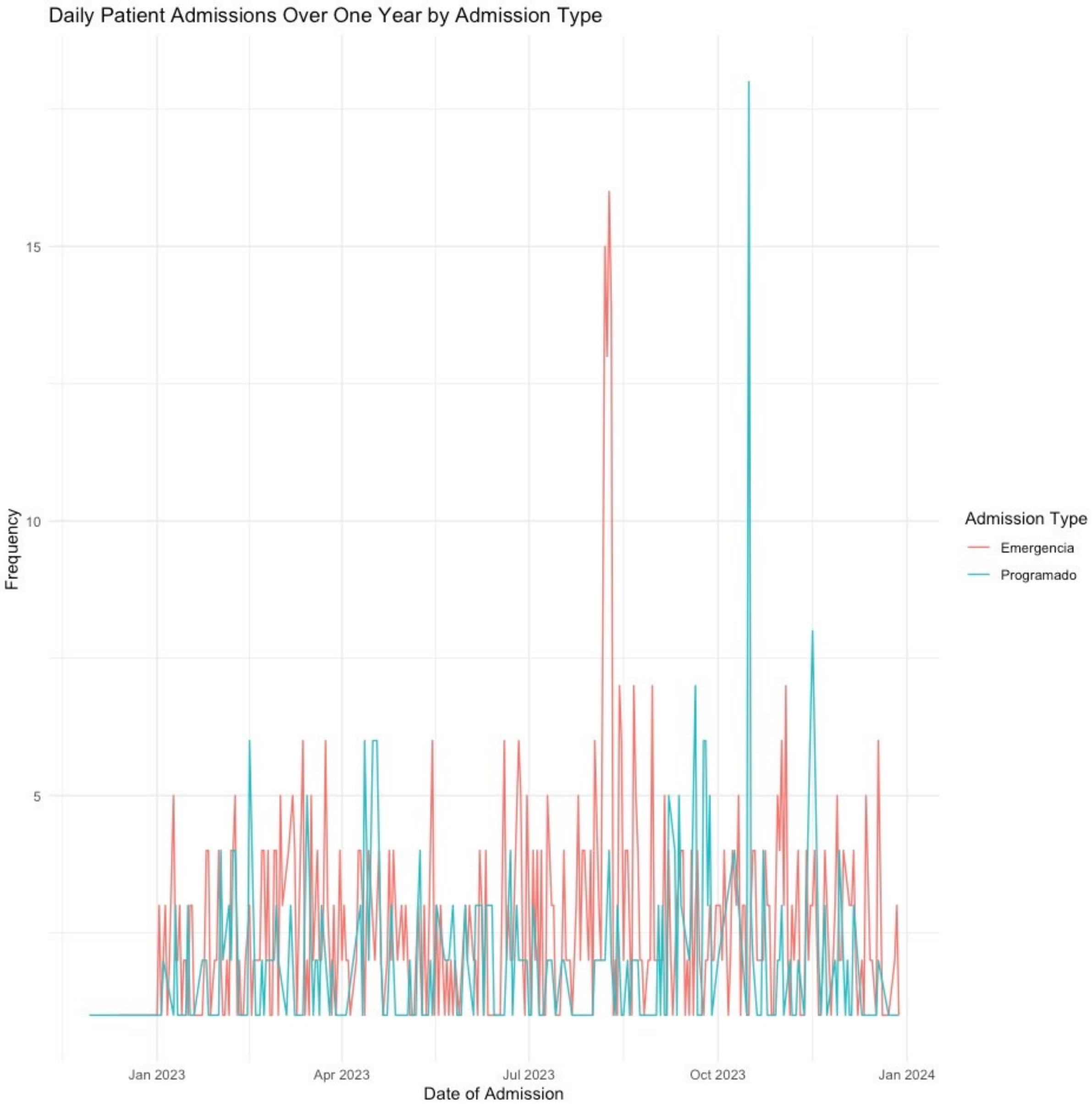


When looking at the type of admission, out of the 1,293 recorded cases, 64% were unplanned admissions, while 36% were scheduled. **Figure 4** provides a graphical overview of the seasonal patterns for both types of admissions. Unplanned admissions show a substantial increase on August[3] (133 compared to an annual average of 69).

A chi-square goodness-of-fit test was performed to determine whether the distribution of emergency admissions over the 12 months of the year deviated significantly from a uniform distribution. The test yielded a p-value of less than 0.05, indicating that the monthly differences in unplanned admissions are statistically significant. This suggests that in certain months—August, in this case—the number of admissions was considerably higher than would be expected under a uniform distribution.

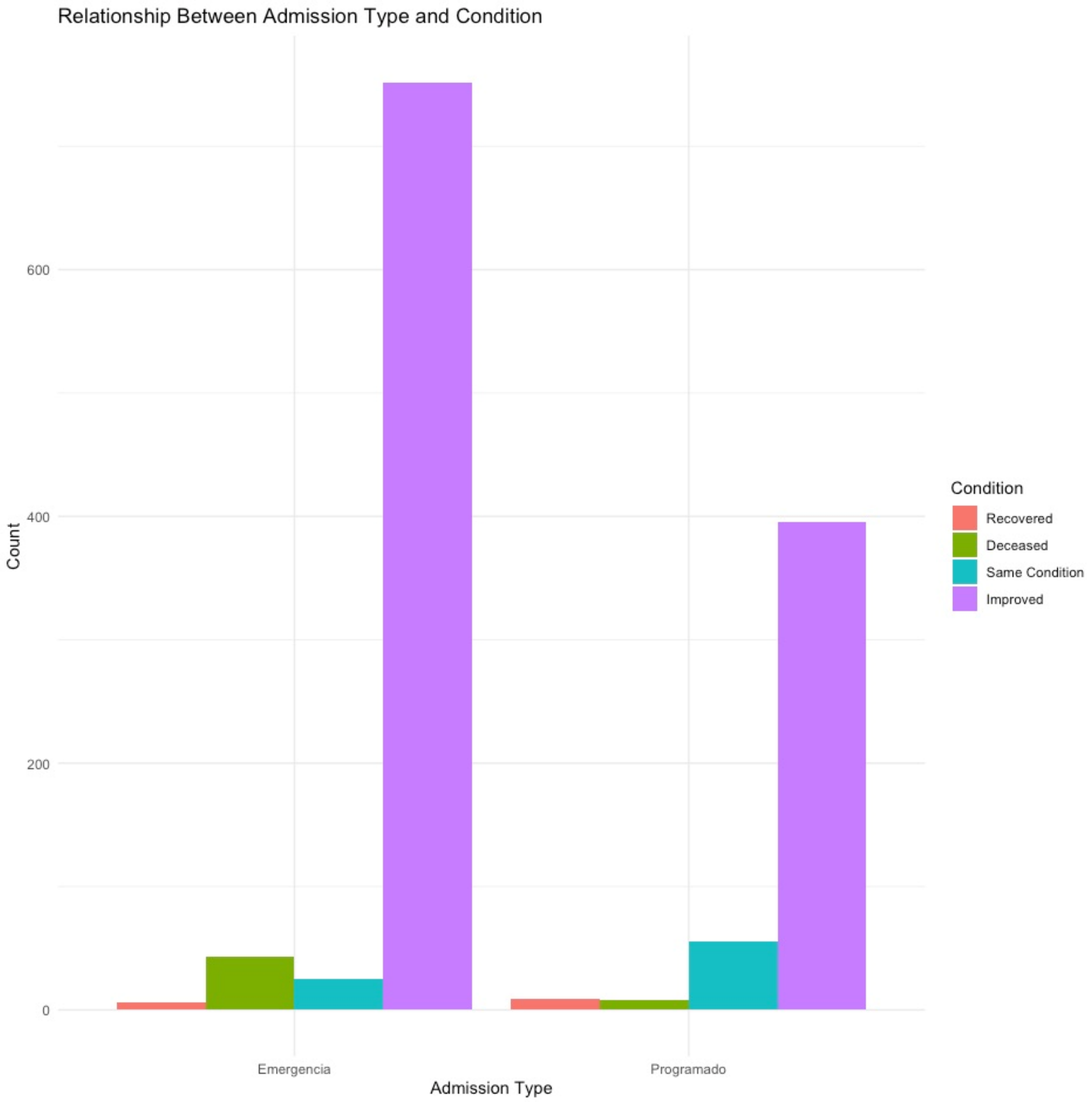
[3] The increase in admissions in August 2023 was due to the *Operación Sonrisa* (Smile Operation) medical mission, which took place from August 7 to 10.

Figure 4. Daily Admissions by Type of Admission



Additionally, for both scheduled and unscheduled admissions, the patients' condition at discharge (cured, deceased, unchanged, improved) was analyzed to better understand the outcomes associated with each type of hospitalization (**Figure 5**). This comparative analysis showed that 5.2% out of the 826 unscheduled admissions resulted in death, which may reflect the more critical nature of these cases. In contrast, only 1.7% of scheduled admissions ended in death, which is expected given that these cases typically involve elective procedures or planned treatments for patients in stable condition. The marked difference in mortality rates between the two admission types highlights their distinct risk profiles and underscores the need for specialized management strategies for unscheduled cases to improve clinical outcomes.

Figure 5. Relationship Between Admission Type and Patient Condition



An additional regression analysis was conducted to explore the relationship between the patient's age at admission and health outcomes. The results indicate that for each additional year of age, the log-odds of a patient being classified as "improved" increase by 0.0492 (Model 1), suggesting a positive and statistically significant association ($p = 0.0016$). When the log-odds are exponentiated, the odds ratio is 1.0504, meaning that for every additional year of age, the likelihood of being discharged as "improved" increases by approximately 5.04%. This implies that older patients are more likely to show clinical improvement at discharge compared to younger patients.

However, this could also suggest that younger patients are less likely to show clinical improvement at discharge, which may be attributed to the presence of critical malformations, such as congenital heart defects, that often involve severe complications and even a higher risk of death during the early months or years of life.

To refine the model, the length of stay (in days) was included as an additional covariate in Model 2 (**Table 4**). However, this did not enhance its predictive power, as indicated by a non-significant change in the association with the outcome. This suggests that the length of hospitalization has a limited impact on the likelihood of clinical improvement, implying that a prolonged stay does not necessarily translate into better health outcomes[4]. These findings highlight the importance of age as a predictor while suggesting that extended hospitalizations do not inherently improve recovery outcomes.

Table 4. Regression Model Results

	Dependent Variable	
	Condition: Improved	
	(Model 1)	(Model 2)
Age (SE)	0.049***	0.050***
	(0.016)	(0.0160)
Rounded Days (SE)		0,001
		(0,009)
Constant (SE)	1.680***	1.680***
	(0.141)	(0.160)
Observations	1.293	1.293
Log-Likelihood	-451.000	-451.000
Akaike Information Criterion	905.000	907.000
Note: *p<0.1; **p<0.05; ***p<0.01		
SE = Standard Errors		

The readmission analysis showed rates of 17.7% at 7 days and 51.9% at 30 days. Since the latter was notably high, the subsequent analyses focused on this indicator. A 30-day readmission rate exceeding 50% represents a significant burden on healthcare resources and may point to premature discharges, inadequate post-discharge care, or a high prevalence of complex conditions requiring frequent hospitalization. This elevated rate suggests that a considerable proportion of patients experience complications or exacerbations shortly after discharge, highlighting the need for a closer examination of discharge procedures and follow-up care. The analysis also revealed that 110 patients (12.3%) had at least one readmission within 30 days.

Figure 6 shows a histogram of the number of days until readmission within 30 days post-discharge, displaying a slightly right-skewed distribution with a higher frequency of readmissions occurring in the early days. This pattern suggests that many readmissions happen soon after discharge, possibly reflecting gaps in immediate post-discharge support.

Additionally, **Figure 7** shows the 30-day readmission rates by age group, highlighting that children under six years have a slightly lower rate.

The analysis of readmission causes, based on ICD-10 codes, revealed that 75 readmissions were associated with ICD-10 code N18.6 (End-stage renal disease), consistent with the findings presented in **Table 2**. Readmissions were also assessed by clinical specialty, with nephrology reporting the highest number of cases (145), followed by cardiology (33). These findings suggest that specialties linked to chronic diseases, such as nephrology and cardiology, face a higher risk of 30-day readmissions post-discharge.

[4] It has been generally observed that longer hospital stays are associated with poorer outcomes. However, this is a qualitative observation made by clinical staff and is not based on the data analyzed in this study. It is considered appropriate to include the variables "type of admission" (scheduled or unscheduled) and "type of illness" in the model. Nonetheless, a broader and more comprehensive analysis is recommended as a next step, using multi-year, patient-level data, as this likely falls beyond the scope of the initial analysis.

Figure 6. Distribution of Days until Readmission (Within 30 Days)

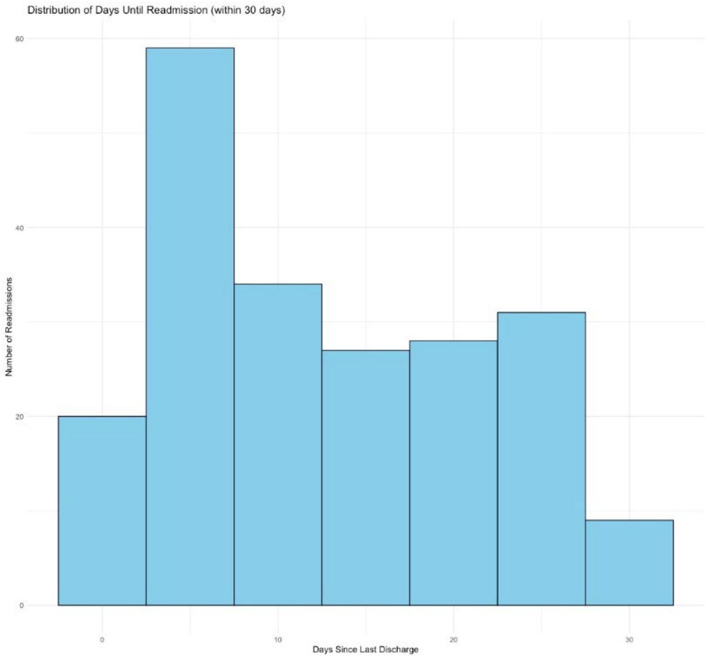
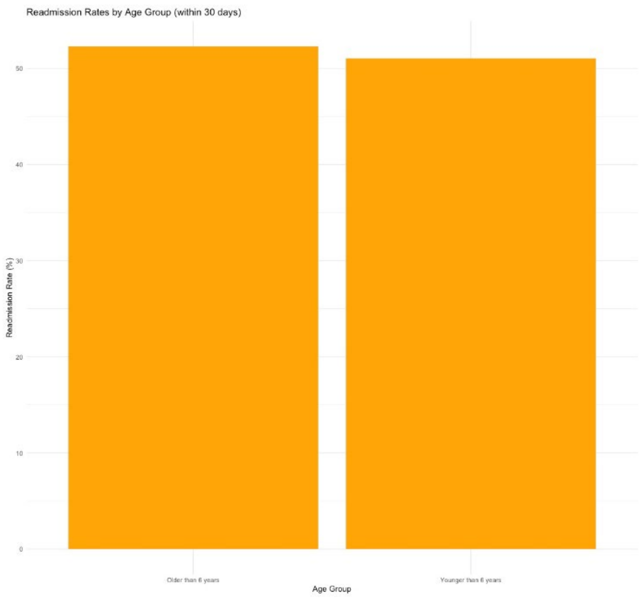


Figure 7. Readmission Rates by Age Group (Within 30 Days)



3.4.2 Length of Stay

Length of stay (LOS) was previously examined in the regression model and was not found to be a significant predictor of the likelihood of clinical improvement. This suggests that longer hospital stays do not necessarily lead to better outcomes and, in some cases, may even reflect inefficiencies. On average, patients were hospitalized for 6.5 days. However, the distribution of LOS values is not symmetrical. The histogram in Figure 8 shows a skewed distribution: while most patients had short stays, a small number experienced very long hospitalizations, which raised the overall average.

To quantify this asymmetry, the skewness of the distribution was calculated using the standardized third moment, yielding a positive skewness value of 5.23. This indicates a right-skewed distribution, meaning that some patients remained hospitalized much longer than the majority.

Figure 8. Histogram of the length of stay

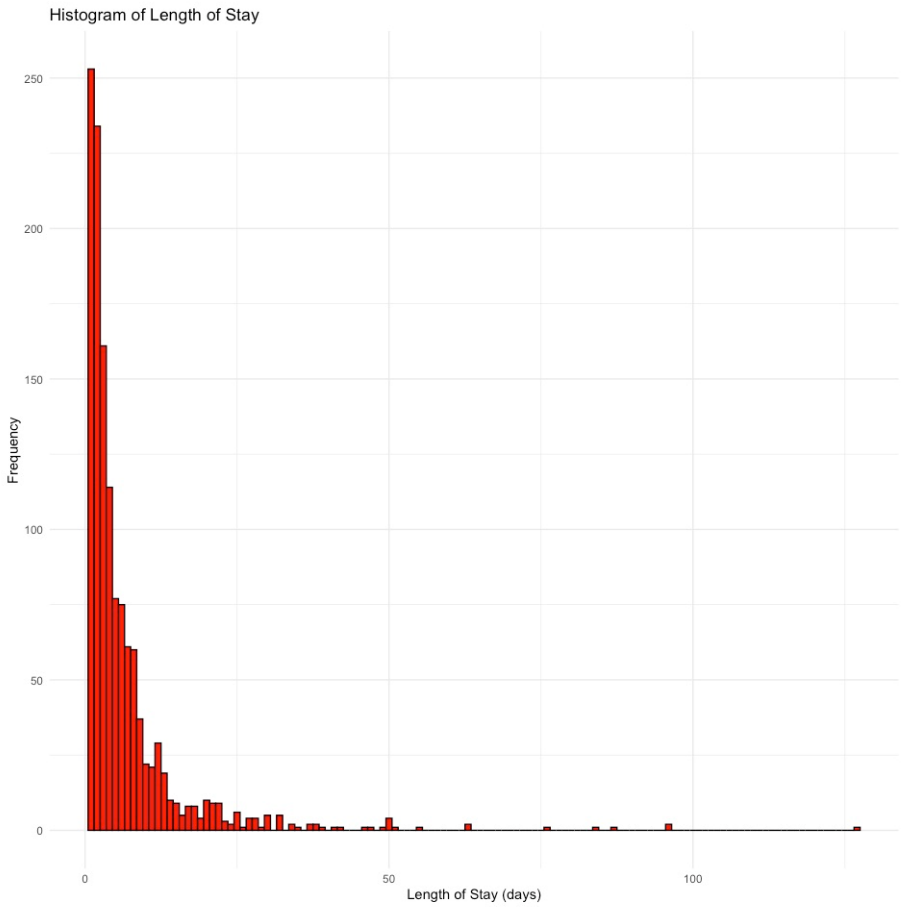


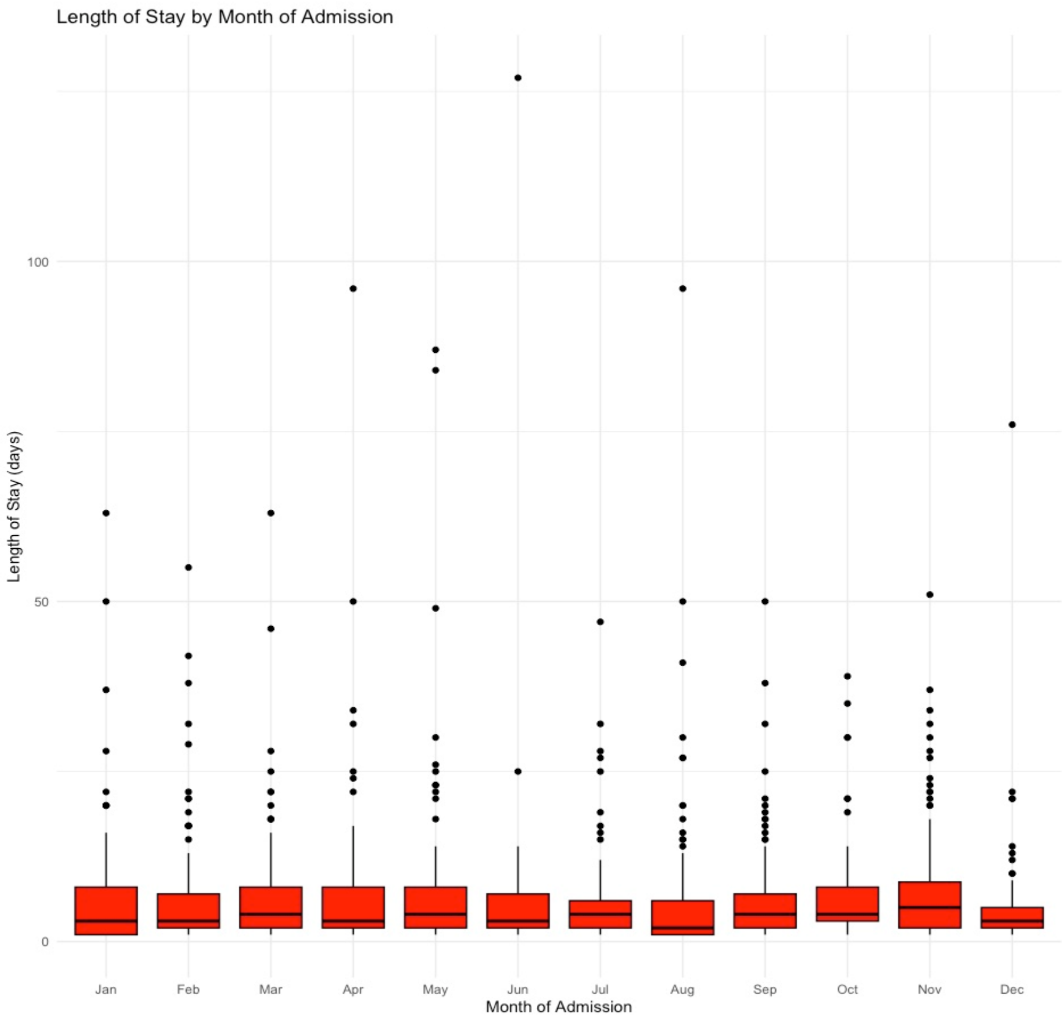
Table 5 confirms this pattern, showing that the median length of stay is only three days, significantly lower than the average of 6.5 days. This indicates that although some patients experienced exceptionally long stays, most were discharged much earlier. It underscores the importance of using both the mean and the median to accurately interpret the length of stay. For comparison, the average hospital length of stay in nine Latin America and Caribbean (LAC) countries with available data is 5.36 days, lower than the 7.70-day average reported by OECD countries (OECD, 2020).

Table 5. Descriptive Statistics of the Length of Stay

Descriptive Statistics	Values (days)
Minimum	1
First quartile	2
Median	3
Mean	6.5
Third quartile	7
Maximum	127
Standard deviation	9.75
Interquartile range	5

A possible variation in the length of stay (LOS) by month of admission was assessed using an Analysis of Variance (ANOVA), with the results presented in **Figure 9**. ANOVA is a statistical technique designed to test whether the means of three or more groups differ significantly. It does so by comparing the variability between group means to the variability within each group. If the variability between groups is large relative to the variability within groups, this suggests the existence of a real difference rather than random variation.

Figure 9. Length of Stay by Month of Admission



In this analysis, ANOVA was used to assess whether the average length of hospital stay varied significantly by month of admission. The test yielded a non-significant p-value of 0.51, indicating that the differences in monthly average lengths of stay are not statistically significant. This suggests that the month of admission does not play a meaningful role in determining the length of hospitalization. From a practical standpoint, the absence of significant differences reinforces the idea that other factors—such as the severity of illness or the type of treatment—may have a greater impact on the length of stay than seasonal or temporal variations.

To further explore length of stay as a predictor of health outcomes (Han et al., 2022), a more advanced model was developed, based on the previous regression analysis that examined its relationship to patient improvement. **Table 6** presents the descriptive statistics for length of stay, broken down by health outcome. The median stay for patients classified as having the "same condition" was two days, whereas for those who died, it was six days.

Table 6. Descriptive Statistics for Length of Stay (days) by Health Outcome

Condition (health outcome)	Mean	Standard Deviation	Median	Count
Cured	8.67	11.38	4	15
Deceased	10.86	10.86	6	51
Same Condition	3.83	6.41	2	80
Improved	6.5	9.78	4	1.147

To expand the analysis, two logistic regression models were constructed: one to evaluate the relationship between length of stay and patient improvement (i.e., classified as improved or cured), and another to examine its association with mortality (**Table 7**).

The results indicate that even after applying a logarithmic transformation to correct for bias, length of stay did not significantly predict the likelihood of improvement (p = 0.32). However, the second model showed that a longer hospital stay was significantly associated with a higher probability of death (p = 0.0005), suggesting a strong link between prolonged hospitalization and mortality risk.

This finding implies that while the length of stay does not appear to influence recovery rates, it is a strong predictor of mortality, likely reflecting the severity of the underlying illness rather than the effectiveness of the care provided.

Table 7. Logistic Regression Results (Rounded Days)

	Dependent Variable	
	Condition_Improved	Condition_Deceased
	(Model 1)	(Model 2)
Log of Days_Rounded (SE)	0.115	0.554***
	(0.115)	(0.159)
Constant (SE)	1.880***	-4.200***
	(0.203)	(0.348)
Observations	1,293	1,293
Log-Likelihood	-455.000	-209.000
Akaike Information Criterion	915.000	422.000

Note: *p<0.1; **p<0.05; ***p<0.01

SE = Standard Errors

These findings should be interpreted with caution, given the unique profile of the patient population served at HMEP and the complexity of pediatric cases. The significant association between prolonged hospital stays and higher mortality highlights that the most severe cases—which require longer hospitalizations—tend to experience poorer outcomes. This pattern is expected in pediatric hospitals that manage complex conditions, where extended care often reflects more serious underlying health issues (González-Cortés et al., 2011).

On the other hand, the absence of a significant relationship between length of stay and patient improvement suggests that recovery in complex pediatric cases may not be directly linked to the duration of hospitalization. This underscores the importance of prioritizing the quality of care provided during the hospital stay rather than focusing solely on its length.

This finding is consistent with the existing literature, which emphasizes that the length of hospital stay is shaped by a combination of factors, including the patient's medical condition and the hospital's operational practices (Eskandari et al., 2022; Kim et al., 2024). To analyze length of stay more effectively—beyond the scope of this report—the use of risk adjustment methods is recommended. These approaches allow for the distinction between extended stays driven by patient-specific characteristics and those associated with inefficiencies in hospital management or service delivery.

Addressing length of stay without accounting for these underlying causal relationships could lead to misguided strategies. Therefore, the use of advanced methodologies—such as discrete event simulation or agent-based modeling—is recommended to enable a more comprehensive analysis of complex hospital systems (Ceballos-Acevedo et al., 2014).

3.4.3 Bed Occupancy Rate

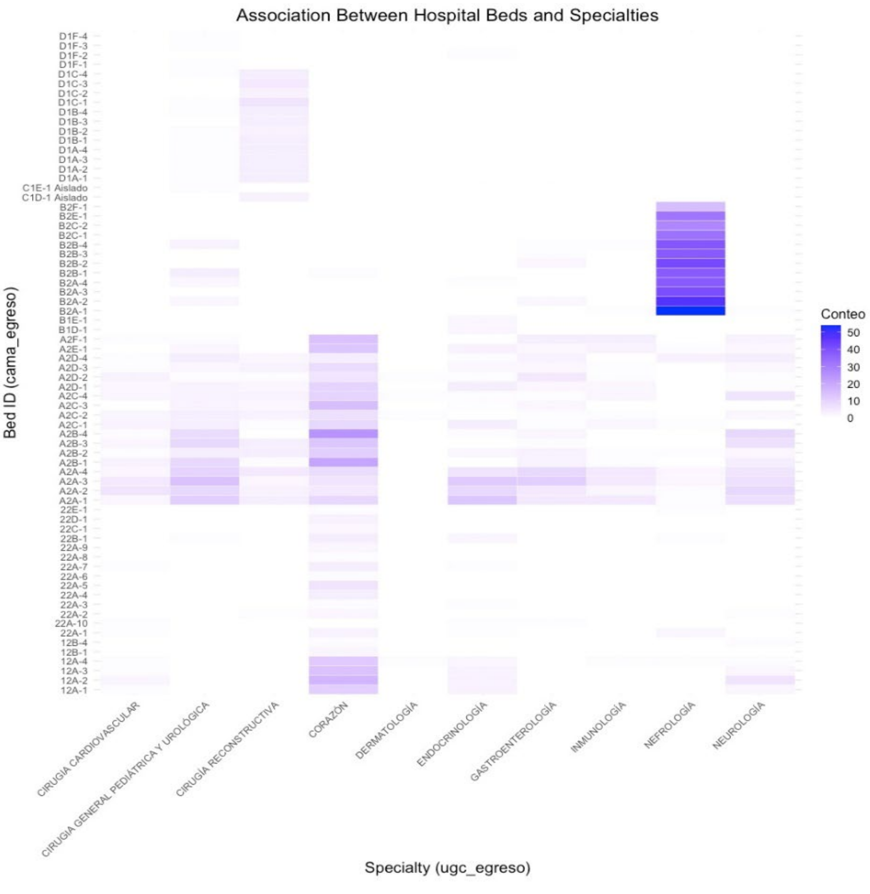
HMEP's electronic health record system assigns a unique bed ID to each of the 1,293 hospital admissions recorded in 2023. This identifier not only specifies the bed used for each admission but also establishes a key link between patient data and hospital resources, enabling a detailed analysis of bed utilization across different clinical specialties.

To explore whether certain beds are primarily used for specific specialties, the data were filtered and reviewed to identify patterns in bed allocation. The objective was to understand how hospital resources—in this case, individual beds—are distributed across departments and how this distribution influences patient care.

Figure 10 presents a heat map that visually illustrates the association between bed IDs and clinical specialties. The color intensity scale represents the number of hospitalizations linked to each bed ID and specialty, providing a clear visual summary of bed utilization patterns.

The results reveal significant variation by specialty. For example, beds grouped under the ID "D" show a notably low number of hospitalizations—a pattern that is expected, as these beds are reserved almost exclusively for reconstructive surgery, a specialty that typically handles lower patient volumes compared to more general services.

Figure 10. Association Between Hospital Beds and Specialties



In contrast, the beds grouped under ID "B" register a much higher number of hospitalizations and are predominantly associated with the nephrology service, indicating high demand, possibly related to the intensive nature of treatments such as dialysis or the management of chronic kidney diseases. On the other hand, the beds in group ID "A" show a more diverse usage pattern, as they are utilized across multiple specialties, reflecting their flexible role in meeting various patient needs within the hospital.

Understanding these patterns is essential for optimizing hospital capacity and ensuring the efficient allocation of resources. Beds designated for specialized care, such as those in group "D," require strategic planning to avoid underutilization, while high-demand beds, like those in group "B," may require additional support to adequately manage patient flow. By analyzing these associations, hospital management can identify potential bottlenecks, anticipate periods of high demand, and implement targeted interventions to balance patient load and improve the quality of care.

It is also essential to distinguish between the different types of hospital beds recorded in the HMEP electronic system, as not all are classified as *countable beds*. This term refers specifically to beds included in the hospital's official capacity count and available for standard admissions. This classification is crucial for accurate planning and effective resource management, as it directly affects metrics such as the bed occupancy rate.

At HMEP, countable beds include all those in group ID "A" (n = 18 beds) and group "B" (n = 10 beds), for a total of 28 beds classified as countable. These beds are typically used for the regular care of hospitalized patients and are considered when determining the hospital's capacity to admit new patients. Beds not included in this classification are excluded from occupancy calculations, as they serve different functions or are assigned to specific units.

In addition to these 28 countable beds, the hospital has ten support beds used for more specialized care. These include six in the Pediatric Intensive Care Unit (PICU) and four in the intermediate care unit. These beds are essential for managing critically ill children or patients requiring specialized monitoring, but they are not included in the official count of beds due to their specific function and usage patterns.

For the analysis of the hospital's bed occupancy rate, only the 28 countable beds were considered to ensure accurate assessments of capacity and utilization. To this end, the dataset was refined at the patient level, including only hospitalizations associated with these beds. As a result, the total number of admissions decreased by 20.88% (from 1,293 to 1,023), and the number of unique patients declined by 19.17% (from 892 to 721). This reduction reflects the exclusion of beds intended for specialized or non-standard uses, ensuring that the occupancy rate analysis focuses exclusively on the hospital's official capacity.

It is important to note that the reduction in the total number of hospitalizations does not necessarily imply the exclusion of the same group of patients, as multiple admissions may correspond to different individuals.

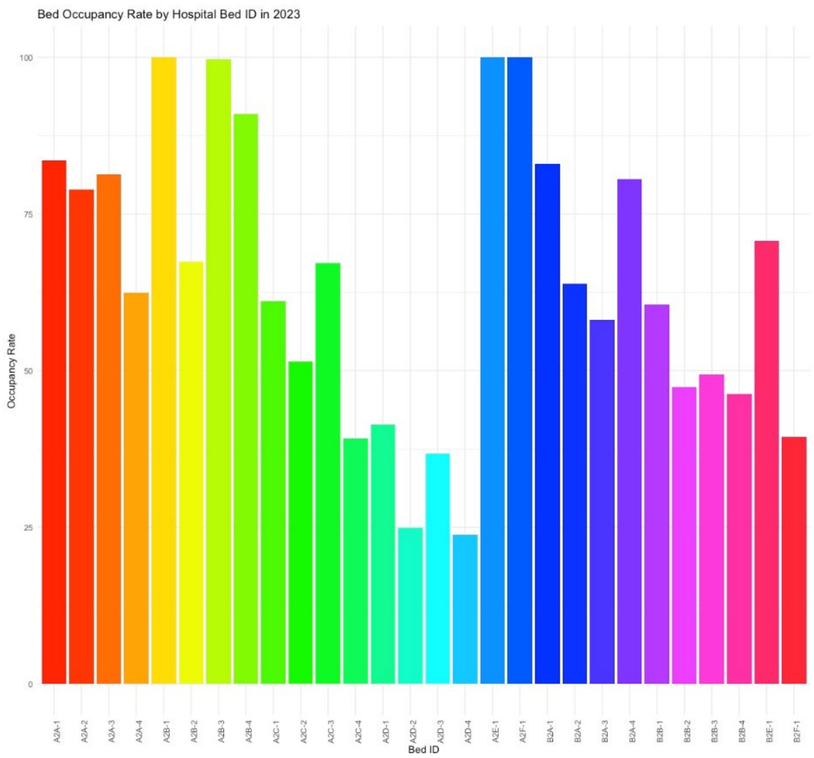
On average, each countable bed was occupied for 236 days in 2023, with a standard deviation of 83.5 days, indicating variability in bed usage depending on the type of care provided and patient demand. **Table 8** presents detailed descriptive statistics on these beds, including information on distribution and occupancy across the different bed IDs.

Table 8. Descriptive Statistics for the Number of Days a Bed was Occupied

Descriptive Statistics	Values (days)
Minimum	87
First quartile	172
Median	230
Mean	236
Third quartile	298
Maximum	365
Standard deviation	83.5
Interquartile range	126

Additionally, **Figure 11** visually shows the bed occupancy rate by ID, which provides a better understanding of each specific bed's contribution to hospital capacity and overall utilization patterns. Identifying these patterns is essential for optimizing resource allocation, as it helps identify beds that may be underutilized or overloaded, which could guide future adjustments in bed management strategies.

Figure 11. Bed Occupancy Rate by Hospital Bed ID in 2023



The estimated hospital bed occupancy rate at HMEP is 64.6%. According to the OECD, "hospital bed occupancy rates offer complementary information to assess hospital capacity. High occupancy rates of curative (acute) care beds can be symptomatic of a health system under pressure. Some spare bed capacity is necessary to absorb unexpected surges in patients requiring hospitalization. Although there is no consensus about the 'optimal' occupancy rate, a rate of about 85% is often considered a maximum to reduce the risk of bed shortages" (OECD, 2023b). This recommendation reflects a balance between maximizing resource utilization and maintaining the flexibility needed to respond to unexpected surges in demand.

Internationally, countries such as the Netherlands, Hungary, and the United States have reported bed occupancy rates ranging from 63.4% to 64.3%, similar to the rate observed at HMEP (OECD, 2023b). This suggests that while HMEP's occupancy rate is below the recommended maximum, it is in line with international standards, particularly in health systems seeking to balance efficiency with operational capacity.

Improving bed occupancy rates in a specialized pediatric hospital like HMEP requires an approach tailored to its specific needs. Occupancy challenges can be addressed by increasing financial and staffing resources, allowing for more specialized care without compromising bed availability. However, maintaining a full nursing staff per bed when the occupancy rate is only 64.6% could be inefficient, as staffing resources would not reflect the actual patient load, resulting in high costs and potential underutilization of capacity. Expanding support services and optimizing patient flow within the hospital would also help keep occupancy within a manageable range, preventing both underutilization and resource overload.

Further research is recommended to assess the impact of these strategies and explore flexible staffing models that allow for maximum efficiency without compromising the quality of care.

3.4.4 Bed Turnover Rate

In 2023, HMEP recorded a bed turnover rate of 36.5, meaning each bed was occupied by a new patient approximately 36.5 times over the course of the year. This rate is considered moderate to high, depending on the context and the hospital's specialty (Perdomo, 2011)[5]. For a specialized pediatric hospital like HMEP, this suggests a relatively high frequency of admissions and discharges, pointing to efficient use of available beds. However, determining whether this turnover rate is optimal or needs improvement requires consideration of several factors, including the average length of stay (LOS), the hospital's total capacity, and the quality of care.

With an occupancy rate of 64.6% and a median length of stay of 3 days, the observed turnover indicates effective bed utilization, although some capacity remains underutilized[6]. This pattern suggests that, while beds are regularly in use, the hospital is not operating at full capacity, leaving room for potential increases in admissions. Nevertheless, increasing patient flow in a specialized pediatric setting requires carefully balancing available resources, such as staffing levels and financial constraints.

The current turnover rate reflects a delicate balance between patient care and resource availability. While a higher turnover might seem desirable from an efficiency standpoint, it can also place additional strain on staff and potentially compromise care quality if not properly managed. For example, a spike in demand or delays in discharge could quickly drive up the occupancy rate, leading to overcrowding and potential disruptions in patient flow.

Maintaining the current turnover rate while gradually increasing occupancy—without exceeding capacity limits—is therefore a strategic goal for optimizing resource use at HMEP. This approach could be supported by targeted strategies, such as improving discharge planning, expanding specialized care units, or adding staff during periods of peak demand to accommodate a higher volume of admissions. As previously noted, this scenario also highlights opportunities to improve efficiency, as higher occupancy helps prevent the underutilization of human resources. When medical and nursing staff are hired to cover a fixed number of beds, low occupancy can indicate inefficient use of the workforce. Ultimately, achieving the right balance between bed turnover and occupancy ensures that the hospital maintains high-quality care while maximizing the use of its available capacity.

[5] Although there is no single standard, a rate of fewer than 25 discharges per bed per year is generally considered underutilization; between 25 and 50 reflects acceptable efficiency; and above 50 may suggest intensive use, especially in services with short stays such as surgery or maternity. In contrast, specialties like psychiatry tend to have naturally lower turnover rates.

[6] Ibid.

3.5 Discussion and Conclusion

The findings of this analysis offer valuable insights into hospital management, resource utilization, and patient care dynamics at HMEP.

One of the hospital’s most pressing challenges is its ability to meet the high demand for specialized pediatric services. As a national referral center, HMEP offers a broad portfolio of 12 pediatric specialties, including complex fields such as cardiovascular surgery, neurology, and nephrology. This level of specialization attracts a large number of patients with congenital, chronic, and complex conditions who often require intensive and continuous care. However, the hospital’s capacity to provide timely treatment is significantly limited by resource constraints, as reflected in its extensive surgical waiting lists (Lobo Rosa, 2024).

As of April 30, 2024, 615 patients were awaiting surgery, 379 of whom (61.63%) were classified as overdue, meaning they had been waiting for more than 90 days. The cardiology specialty faces the most severe backlog, with 348 patients on the list, 302 of whom (86.78%) were overdue for surgery. These figures highlight the hospital’s ongoing struggle to keep pace with demand, mainly due to budgetary constraints and a shortage of specialized human resources.

These operational challenges are further exacerbated by HMEP’s limited ability to fully utilize its surgical infrastructure. Although the hospital has nine operating rooms, only seven are currently functional, and on average, just three to four are used per week. This underutilization is mainly due to the shortage of specialized staff and insufficient funding to enable additional shifts or hire more specialists. As a result, the hospital has been forced to rotate its available personnel to prioritize only urgent cases, leaving many non-urgent procedures indefinitely delayed.

These findings underscore the urgent need for strategic resource planning to optimize bed turnover and reduce the backlog of surgical cases. Although the hospital’s current bed occupancy rate stands at 64.6%—suggesting available capacity to accommodate more patients—the shortage of staff and the limited availability of operating rooms create a bottleneck, preventing the hospital from fully leveraging its infrastructure. Increasing admissions without first addressing these underlying limitations could overwhelm staff and jeopardize the quality of care.

The observed bed turnover rate of 36.5—along with the high number of patients on the surgical waiting list—indicates that the hospital is operating below its potential efficiency. For a specialized pediatric center, this rate could be considered moderate; however, it also suggests that, with improved resource allocation and expanded staffing, the hospital could significantly enhance its operational capacity. This would not only optimize the use of existing beds but also enable the expansion of surgical services to reduce the backlog, particularly in high-demand specialties such as cardiology.

It is also essential to consider the impact of prolonged waiting times on patient outcomes. Delays in surgical interventions—especially in critical pediatric cases—can lead to a deterioration in the patient’s condition, potentially increasing the complexity of future treatments and reducing the likelihood of successful outcomes. Reducing the backlog is therefore not only a matter of operational efficiency but also essential to ensuring timely, effective, and high-quality care.

In addition, a readmission analysis was carried out to assess discharge quality and post-hospital follow-up. The results showed a 7-day readmission rate of 17.7% and a 30-day rate of 51.9%—both high compared to benchmarks from other institutions. However, a review of the associated ICD-10 codes revealed that the majority of these readmissions involved patients diagnosed with end-stage renal disease (N18.x), a group that— given the chronic and advanced nature of their condition—requires frequent hospitalizations as part of their routine clinical management. This suggests that the high readmission rate does not necessarily reflect issues with discharge quality or post-discharge care, but rather the inherent clinical complexity of these patients. In this context, readmissions are more likely to indicate the severity of the underlying conditions than deficiencies in the care provided by the hospital.

Therefore, although the readmission rate is high, it should be interpreted with caution and not viewed in isolation as a negative indicator of the quality of care. When nephrology cases are excluded, the rate drops significantly. Moreover, unlike other hospitals in the country, HMEP has a strong outpatient care program, which has helped reduce hospital admissions and stands as one of its greatest strengths, positively impacting patient care.

To address these challenges, HMEP requires a comprehensive strategy that includes increased funding, the recruitment of additional specialists, and the potential activation of more operating rooms. Implementing a more flexible staffing model—such as adjustable shifts or part-time contracts for specialized professionals—could also help ease some of the current resource constraints. Furthermore, optimizing patient flow through improved discharge planning and the prioritization of high-risk cases would reduce unnecessary hospital stays and create room for new admissions.

In conclusion, although HMEP has demonstrated effectiveness in managing complex pediatric cases, its current resource limitations and long waiting lists highlight the need for strategic interventions. Reducing wait times, particularly in surgical services, must be a priority to improve clinical outcomes and overall hospital performance. Achieving the right balance between bed turnover and occupancy—supported by targeted investments in human resources, supplies, and medications—will be key to ensuring that HMEP continues to deliver high-quality care to its pediatric patients without compromising operational sustainability.

4. Analysis 2 – Cost-Effectiveness Analysis

4.1 Introduction

Honduras' healthcare system is predominantly public, with services divided between the Ministry of Health (Secretaría de Salud, SESAL) and the Honduran Social Security Institute (Instituto Hondureño de Seguridad Social, IHSS) (Luis Bermúdez-Madriz et al., 2011). SESAL provides care to the general population—particularly those unable to afford private services—through a network of hospitals, health centers, and clinics distributed nationwide, including the Hospital María, Pediatric Specialties (HMEP)[7]. However, these services often face underfunding, resource shortages, and staffing deficits.

The IHSS—funded through payroll contributions—provides healthcare to formal sector workers and their dependents. Despite its comparatively stable funding structure, the IHSS also faces significant challenges, including long waiting times and insufficient capacity to meet demand (Perdomo, 2011).

Table 9 presents an overview of key economic indicators of Honduras' healthcare system, comparing them to those of neighboring countries. According to the most recent data from 2021, total health expenditure in Honduras represented 9.2% of GDP—a figure comparable to El Salvador (9.7%) and Nicaragua (9.7%), and considerably higher than Guatemala (6.9%) and Mexico (6.1%). It is worth noting, however, that this estimate was likely influenced by the COVID-19 pandemic. In 2019, the year before the pandemic, total health expenditure accounted for 7.2% of GDP, a significant decline from the 9% recorded in 2009 (WHO, 2022).

Nevertheless, this indicator does not account for population size and does not directly reflect per capita spending. Using the metric of total health expenditure per capita in 2017 international dollars, Honduras recorded the lowest figure among these countries in 2019, at just US$427 per person. In contrast, El Salvador and Mexico spent nearly twice and three times as much, respectively.

Regarding public health expenditure as a share of total health spending, Honduras showed little variation between 2010 and 2019, fluctuating between 44% and 39%. The latter figure was the lowest among the countries analyzed, only slightly higher than Guatemala (38.4% in 2019) (WHO, 2025b). This suggests that the state covers just under 40% of total health spending, pointing to a significant reliance on private sources for healthcare coverage. This is further confirmed by the share of out-of-pocket expenditure, which stood at 52.47% of total current health spending in Honduras in 2019, slightly below Guatemala (55.99%) but considerably higher than Nicaragua (33.22%) (WHO, 2025a).

A particularly positive indicator is Honduras's significant progress in reducing infant mortality. As public health spending per capita (measured in 2017 PPP-adjusted international dollars) increased from US$160 to US$427 between 2000 and 2019, the infant mortality rate (deaths per 100 live births) declined from 3.7% to 1.8% (UN Inter-agency Group for Child Mortality Estimation, 2024). Despite this increase in public health expenditure, 34.2% of Hondurans remain at risk of falling into poverty due to out-of-pocket payments if surgical care is required, and nearly 50% are at risk of incurring catastrophic health expenditures (i.e., expenses exceeding 10% of total annual income) under such circumstances (World Bank, 2025a, 2025b).

[7] Ibid.

Table 9. Performance Indicators of Health Systems in Honduras and Neighboring Countries

Indicators [year]	Honduras	Guatemala	Nicaragua	El Salvador	Mexico
Total health expenditure as % of GDP [2021]	9.2	6.9	9.7	9.7	6.1
Total health expenditure per capita in 2017 international dollars [2019]	US$427	US$541	US$477	US$799	US$1,103
Public health expenditure as % of total health expending [2019]	39.3	38.4	61.6	55.4	49.2
Out-of-pocket expenditure as % of current total health expending [2019]	52.5	56.0	33.2	36.0	42.3
% of people at risk of falling into poverty due to surgical care payments [2019]	34.2	18.2	30.8	7.4	5.0
% of the national population at risk of catastrophic expenditure when surgical care is required [2019]	48.8	34.2	31.8	11.7	10.1

Source: Based on the references cited in the preceding paragraph.

Assessing the economic indicators of a health system is essential for understanding how resources are allocated and where improvements can be made. These indicators help identify inefficiencies or gaps within the system and guide policymakers in their efforts to optimize resource use. Appropriate allocation is crucial to ensuring the health system can effectively meet the population's needs. Economic evaluations play a key role in this process, as they provide evidence to support government decision-making, leading to better health outcomes and more sustainable systems.

Policymakers often face critical decisions, such as whether to build a new hospital or increase funding for existing infrastructure. This is precisely the dilemma currently facing HMEP. A useful analytical method for assessing the hospital’s financial impact is a cost-effectiveness analysis, using a specific health outcome indicator as the unit of effectiveness. This type of analysis has been widely applied in other global contexts and has provided solid evidence on whether allocated funding generates net benefits. For example, McCord and Chowdhury (2003) evaluated the cost-effectiveness of a small hospital in Bangladesh and demonstrated that the cost per disability-adjusted life year (DALY) averted was US$10.93. Similarly, Gosselin et al. (2006) estimated that a hospital in Sierra Leone averted 11,282 DALYs at a total cost of US$369,774, which equates to US$32.78 per DALY averted.

This analysis draws on methodological approaches validated in peer-reviewed studies to assess both the number of DALYs averted and the associated costs at HMEP. This approach enables a comprehensive evaluation of the hospital’s cost-effectiveness. By quantifying health outcomes in terms of DALYs and comparing them against the costs incurred, we provide policymakers with a solid evidence base, critical for informed decision-making and efficient allocation of limited resources, and for ensuring investments yield a high impact on outcomes. The goal is to demonstrate the value of HMEP in improving public health outcomes while maintaining fiscal responsibility, thereby supporting long-term, sustainable health policies.

4.2 Methodology

4.2.1 Study Context

As mentioned in the introduction to this report, the HMEP is a pediatric specialty hospital serving children under the age of 18. The hospital opened its doors in 2014 and, since then, has treated more than 54,252 patients across various specialties, delivering nearly two million services, including specialized outpatient consultations and support services.

In 2023 alone, the hospital provided 46,787 specialized outpatient consultations, recorded 1,293 hospital discharges, and performed 1,901 surgical procedures. These included 194 cardiovascular surgeries, 79 cardiac catheterizations, 4 kidney transplants, and 1,624 pediatric, urological, reconstructive, and other types of surgeries. In addition, 244,851 support services were delivered (HMEP, 2024).

The hospital’s general management is detailed in its 2023 accountability report (HMEP, 2023). That year, HMEP had total available funds of L335,366,645 (US$13,588,000), 83.7% of which came from SESAL. Over the same period, total expenditures reached L322,890,394 (US$13,085,000).

For this study, we used the hospital's 2023 electronic health records to extract data on hospital admissions. The analysis focused on three specific months—March, June, and September—to ensure a representative sample across different periods throughout the year. For each month, we analyzed individual patient records, reviewing the details of their admissions, health status, and associated outcomes (described in the next section). We also estimated the total healthcare resource costs for each patient, including both hospitalization expenses and the costs related to the comprehensive care provided during their stay.

4.2.2 Sample Selection

The sample was selected to ensure it accurately represented the population of hospitalized patients at HMEP in 2023, while minimizing potential biases in the estimation of healthcare costs and outcomes. Specific patient inclusion criteria were applied to this end.

First, only patients with a single recorded hospitalization in 2023 were considered. This decision served two key purposes. The first was to avoid including patients with chronic conditions or complex conditions that typically require multiple hospitalizations over time. Limiting the sample to single admissions made it easier to allocate costs to a specific clinical episode. In cases involving multiple admissions, it would have been difficult to separate costs by illness, especially if diagnoses varied from one admission to another.

Second, to reduce the likelihood of including patients with admissions before or after 2023, only those admitted during March, June, and September were selected. This approach served a dual purpose. On one hand, it reduced the risk of including patients with prior admissions not captured in the 2023 database—for example, those hospitalized in December 2022. Since the available data only covered 2023, identifying such cases was not possible, which could have led to misclassification. On the other hand, selecting non-consecutive months helped control for potential seasonal effects on hospital demand. Factors such as weather changes, the circulation of infectious diseases, and fluctuations in healthcare demand can vary throughout the year. Including months spread across different quarters helped minimize the impact of these temporary variations on the study's results.

Together, these criteria allowed us to obtain a representative sample of patients hospitalized at HMEP in 2023, while minimizing the methodological limitations associated with case selection.

4.2.3 Cost Estimation

The economic analysis applied a patient-level cost allocation approach to estimate the expenses associated with the various services provided at HMEP during 2023. The allocation process followed four key steps to accurately allocate costs across outpatient consultations, hospitalizations, surgeries, and medications. The methodological stages detailing the data sources, calculations, and allocation procedures used are described below.

Monthly Cost Estimation by Specialty and Service

HMEP's Administrative and Financial Directorate prepares monthly cost estimates for outpatient consultations, hospitalizations, and operating room services, broken down by specialty (Clinical Management Units, or UGCs). The financial data used in this study were extracted from the 2023 cost summary reports, which categorize expenditures by specific Cost Centers linked to each UGC and their respective services. Based on these monthly data, an annual average was calculated to establish the baseline costs by specialty and service type.

Service-Level Cost Allocation

Using the average monthly costs determined in the previous step, the Administrative Management Department linked these costs to patient-level data for those who received outpatient, hospitalization, and surgical services in 2023. Patients were identified using their unique medical record number, which corresponds to their birth ID. Excluding laboratory and pharmacy costs, average service costs were assigned to each patient using Excel's "VLOOKUP" function. Data were drawn from multiple administrative databases, including attendance records, discharge logs, and surgical production reports. This process allowed for a comprehensive allocation of costs to each patient for all services received.

Medication Cost Allocation

The Pharmacy Module of HMEP's information system generates detailed records of medications dispensed to patients, identified by their medical record number. Using the same "VLOOKUP" function, medication costs were linked to the corresponding patients across the different service categories—outpatient consultations, hospitalization, and surgeries. The 2023 Medication Database was the primary source for this allocation, ensuring accurate attribution of pharmaceutical costs to each patient in the economic analysis.

Laboratory Cost Allocation

HMEP's laboratory services are outsourced, and the external provider maintains an automated record of all tests performed. This database includes information such as the requesting physician, the patient's ID, and the UGC responsible for the order. Using these records, laboratory costs were assigned to patients through the "VLOOKUP" function, matching the type and frequency of tests performed with the appropriate service categories. The 2023 Laboratory Database was used to distribute diagnostic costs across outpatient consultations, hospitalizations, and surgeries, ensuring a precise estimate of these expenses in the economic evaluation.

Based on this methodology, a total cost estimate was generated for each patient included in the analysis. This approach captures all healthcare resources used during the hospitalization period, providing a comprehensive view of the expenses associated with each patient. Values in local currency were converted to U.S. dollars using the 2023 average exchange rate (US$1 = HNL 24.681) (Exchange rates org, 2023).

4.2.4 Estimation of Health Outcomes

As previously described, health outcomes associated with hospitalization were measured in Disability-Adjusted Life Years (DALYs). DALYs are a synthetic indicator of the global burden of disease, originally developed by the World Bank in the 1990s and later adopted by the World Health Organization (WHO) as the preferred metric for burden of disease studies across countries (Berkley et al., 1993).

DALYs reflect both the burden of disease in the form of disability—measured as Years Lived with Disability (YLDs)—and the associated health disutility, along with the years of life lost prematurely—measured as Years of Life Lost (YLLs) (**Figure 11**) (YHEC, 2016).

One DALY represents one year of healthy life lost due to illness, disability, and/or premature death. It is calculated as the sum of the YLLs—the years a person did not live due to premature death, compared to a standardized life expectancy—and the YLDs—the years a person lives with a disease or disability that affects their quality of life. These years are weighted by a "disability weight" ranging from 0 to 1, where 0 indicates no disability and 1 represents a disability as severe as death[8] (Murray CJ, 1994):

$$\boldsymbol{DALY = YLL + YLD}$$

$$\boldsymbol{where}:$$

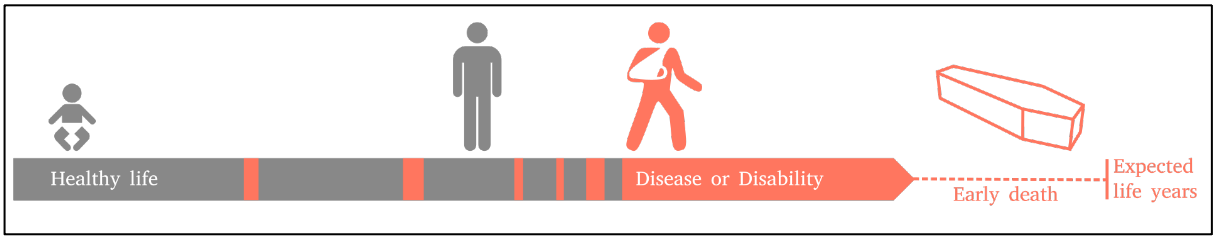
$$\boldsymbol{YLL = LE\ x\ D}$$

$$\boldsymbol{YLD = L\ x\ DW}$$

[8] For example, a mild illness may have a disability weight of 0.2, meaning that during those years, the person experiences a 20% loss of health due to the severity of the illness or disability.

- LE = standard life expectancy at age of death
- L = years lived with disability
- DW = disability weight (severity scale 0-1)

Figure 11. Illustration of the Components of DALYs *(Wikipedia contributors,2025)*



For each hospitalized patient, a DALY value was estimated based on the available clinical information. This value reflects both the years of life saved by preventing premature death and the years lived with disability that were avoided thanks to the treatment provided. The specific steps in the DALY estimation process were as follows.

First, a team of medical experts reviewed each patient's clinical records. This review included an assessment of the associated ICD-10 codes, an evaluation of whether the patient's condition had improved or worsened at the time of discharge, and a detailed examination of any comorbidities. The medical experts also consulted peer-reviewed literature to determine the expected life expectancy with and without treatment for each condition. This comprehensive review informed an evidence-based clinical judgment of each patient's health status.

Second, two DALY values for each patient were estimated based on two scenarios: with treatment and without treatment. Disability weights were identified for each condition, both before and after treatment. For example, for a patient with congenital heart disease and moderate intellectual disability, one disability weight was assigned for the severity of the condition without treatment, and another for the severity after treatment. The sources for these disability weights were peer-reviewed publications or the Global Burden of Disease Study (2019) disability weights database (Global Burden of Disease Collaborative Network, 2020).

Next, using the clinical evidence gathered, the patient's expected age at death was estimated. In cases where premature death was likely due to the severity of the condition—with or without treatment—the remaining years of life were estimated using evidence from specialized literature or clinical expert opinion. When treatment was expected to allow the patient to reach a normal life expectancy, standard age-specific values were applied, based on Honduras-specific data from the United Nations World Population Prospects (2022). An illustrative example of these estimations is presented below:

> *A one-year-old male patient is diagnosed with a specific congenital heart disease. Without treatment, the patient is expected to die, resulting in the loss of 72.4 years of life (29.4 years when discounted), based on the age-standardized life expectancy for a one-year-old. Since death would occur almost immediately, no years would be lived with disability. In total, the patient would accumulate 29.4 DALYs without treatment. With treatment, the patient is expected to reach a normal lifespan, with only a minor disability weight of 0.019. In this case, the total DALYs accumulated would be 0.56 (29.4 remaining years multiplied by an annual disability weight of 0.019). In conclusion, the treatment would avert 28.81 DALYs.*

4.2.5 Monetization of Health Outcomes

Two methods were used to monetize the averted DALYs. First, for each patient, the specific medical care costs were divided by the number of DALYs averted. This approach allows for assessing the efficiency of the intervention by assigning a monetary value to the health benefits achieved. In doing so, it produces a metric that compares the costs incurred to the positive health impact (measured in DALYs), thereby facilitating value-based decision-making and helping identify opportunities for improved resource management and cost optimization.

Second, the averted DALYs were multiplied by a threshold value specific to each patient. There are several methods to estimate this value. Traditionally, studies have equated the value of a single DALY to between one and three times the country's per capita GDP. This practice stems from early World Health Organization (WHO) recommendations, although the estimate lacks precision and is not grounded in an empirical analysis of the potential health opportunity cost associated with the investment (Bertram MY, 2016).

Health interventions will only improve population outcomes if their additional benefits exceed the health opportunity costs, meaning the benefits that would be lost if the same resources or budget were invested in alternative health interventions. The "one to three times GDP per capita" rule does not account for this and risks judging an intervention as cost-effective even when its opportunity cost is higher, potentially resulting in missed opportunities (Chi et al., 2020).

To address this limitation, Ochalek et al. (2018) developed a framework to estimate the threshold value per DALY from the perspective of health opportunity costs[9]. As part of their work, the authors calculated country-specific cost-effectiveness thresholds per DALY using four different methods (the methodological differences stem from how the national budget for health care is defined). For this economic evaluation, the threshold estimated using Method 4 was selected, which assigns a value per DALY averted equivalent to 90% of Honduras's per capita GDP (US$3,030 for the year 2024)[10].

The monetized DALYs were indirectly discounted at a 3% rate by adjusting the remaining expected years of life. This discount rate reflects inter-temporal preferences—that is, how individuals value present versus future benefits (or costs). In the case of health benefits, it indicates how Quality-Adjusted Life Years (QALYs) or DALYs are valued over time. A 3% rate suggests a moderate preference for present over future benefits, balancing the importance of current and future health outcomes. Empirical evidence supports the use of a 3% discount rate (Weinstein, 1996), and it has become the global standard in health economic evaluations. This rate is recommended by both the Panels on Cost-Effectiveness in Health and Medicine and the International Decision Support Initiative (iDSI) for cost-benefit studies (Neumann et al., 2016). Both the WHO and the Intergovernmental Panel on Climate Change (IPCC) have also recommended discount rates within this range for evaluating health and environmental projects. These recommendations are based on a consensus on best practices that balance ethical and economic considerations (Baltussen et al., 2003).

4.2.6 Sensitivity Analysis

To assess the robustness of the results, a deterministic sensitivity analysis was conducted. This type of analysis makes it possible to examine how variations in certain assumptions or key parameters might affect the study's overall outcomes. In this case, two analytical scenarios were considered:

1. **50% reduction in estimated health outcomes per patient:** In this scenario, it was assumed that DALYs averted per patient—used as a measure of health outcomes—might have been overestimated. To address this uncertainty, the number of DALYs averted was reduced by 50%, providing a more conservative estimate of the health benefits.
2. **Combined 50% reduction in health outcomes and willingness-to-pay (WTP) threshold per DALY averted:** In this scenario, both the estimated DALYs averted and the willingness-to-pay

[10] According to Ochalek et al. (2018), Method 4 stipulates the following: "The combined effect of changes in expenditure on survival and morbidity burden of disease can be estimated directly from the cross-country data using country-level estimates of DALY burden of disease. State specific estimates of DALY burden ($DALY_i^{all\ ages}$) are calculated as the sum of $YLL_i^{all\ ages}$ and $YLD_i^{all\ ages}$ for each $state_i$. Therefore, a direct estimate of DALYs averted for a 1% change in provincial health expenditure is simply the product of the estimated DALY burden for that state and the estimated elasticity E_iDALY."

threshold for each averted DALY were reduced by 50%. This combination allowed for the exploration of a more conservative case in which both the estimated health benefits and their monetary valuation are simultaneously lowered.

4.3 Results

4.3.1 Patient Population

A total of 168 hospitalized patients were selected from electronic health records. The median age was 5 years (range: 0.83 to 18 years), and the median length of stay was 3 days (range: 1 to 63 days). Patients received treatment across eight clinical specialties: plastic surgery (n = 15), pediatric surgery (n = 20), cardiology and cardiovascular surgery (n = 64), endocrinology (n = 10), gastroenterology (n = 11), immunology (n = 8), nephrology (n = 25), and neurology (n = 15).

4.3.2 Hospitalization Costs

During the study period, the total direct and indirect hospitalization costs for all patients amounted to US$790,429. **Table 10** summarizes these costs by clinical specialty, along with the average cost per patient. Cardiology, with 64 patients, accounted for the highest total expenditure at US$526,972, while neurology, with 15 patients, reported the lowest at US$18,578. In terms of cost per patient, cardiology also recorded the highest average at US$8,234, compared to US$1,239 for neurology.

It is important to note that these figures are for informational purposes only and should be interpreted with caution, as they do not reflect the health outcomes achieved by each specialty. This limits their relevance for comparative analysis. The following section, which focuses on health outcomes, offers a more comprehensive view of the health gains associated with each clinical specialty.

Table 10. Total Direct and Indirect Costs by Clinical Specialty and Cost per Patient (2024 US$)

Clinical Specialty	Total Cost	Number of Patients	Cost per Patient
Plastic Surgery	27,220	15	1,815
Pediatric Surgery	52,482	20	2,624
Cardiology	526,972	64	8,234
Endocrinology	30,212	10	3,021
Gastroenterology	31,705	11	2,882
Immunology	29,108	8	3,639
Nephrology	74,151	25	2,966
Neurology	18,578	15	1,239

4.3.3 Health Outcomes (DALYs)

Table 11 summarizes the total number of DALYs averted and their corresponding monetary value. Over the course of the study period, across all clinical specialties, a total of 1,904 DALYs were averted as a result of the treatments provided. The majority of DALYs averted were achieved in the cardiology specialty, with 768.5 DALYs averted among 64 patients. The lowest figure was recorded in gastroenterology, with 81.3 DALYs averted among 11 patients. It is important to note that these figures are heavily influenced by the number of patients treated and are presented for reference only. The following section, which focuses on the cost per DALY averted, offers a more detailed view of the cost-effectiveness of the clinical care delivered at HMEP.

Table 11. DALYs Averted by Clinical Specialty

Clinical Specialty	Total of DALYs Averted	Number of Patients	DALY per Patient
Plastic Surgery	35.7	15	2.4
Pediatric Surgery	129.9	20	6.5
Cardiology	768.5	64	12.0
Endocrinology	233.61	10	23.4
Gastroenterology	81.3	11	7.4
Immunology	114.0	8	14.2
Nephrology	374.37	25	15.0
Neurology	166.6	15	11.1

4.3.4 Cost per DALY Averted and Cost-Effectiveness

Table 12 provides a detailed breakdown of the cost per DALY averted and the cost-effectiveness ratio across different clinical specialties at HMEP. The performance of each specialty was assessed by calculating the cost per DALY averted, obtained by dividing the total cost incurred in each specialty by the number of DALYs averted. For instance, neurology recorded the lowest cost per DALY averted at US$112, while plastic surgery reported the highest, at US$762 per DALY averted.

Tabla 12 – Cost per DALY and Cost-Effectiveness (in US$)

Clinical Specialty	Cost per DALY	Total Value of DALY Using the Threshold	Ratio Between Threshold Value and Actual Total Costs
Plastic Surgery	762	108,179	0.25
Pediatric Surgery	404	393,361	0.13
Cardiology	686	2,326,631	0.23
Endocrinology	129	707,285	0.04
Gastroenterology	390	246,138	0.13
Immunology	255	345,005	0.08
Nephrology	198	1,133,458	0.07
Neurology	112	504,388	0.04

The economic evaluation also included a comparison of these costs with the maximum willingness-to-pay threshold per DALY averted, defined as 90% of Honduras's national per capita GDP, to estimate the total economic value of the DALYs averted. In the case of plastic surgery, the monetized value of the 35.7 DALYs averted was US$108,179. However, the actual cost of averting these DALYs was significantly lower (US$27,220), resulting in a threshold-to-cost ratio of 0.25. This ratio suggests that the economic benefits generated by the interventions far exceeded the costs incurred, indicating a high level of cost-effectiveness for this specialty.

In contrast, specialties such as endocrinology reported even lower costs per DALY averted (US$129), with a threshold-to-cost ratio of 0.04, reflecting an extremely favorable cost-effectiveness profile. This indicates that endocrinology generated a significantly higher economic value relative to the costs incurred. On the other hand, plastic surgery—which recorded the highest cost per DALY averted (US$762) and a threshold-to-cost ratio of 0.25—reflects the higher complexity of the cases treated and the corresponding intensive resource demands required to manage more complex conditions, indicating a higher intensity of resource use necessary for treating such cases.

The ratio between the economic value (based on the willingness-to-pay threshold) and the actual costs provides relevant insights into the efficiency of each clinical specialty. Values closer to 1.0 suggest that the economic value of the DALYs averted is nearly equivalent to the total costs, indicating a balanced cost-effectiveness profile. For example, cardiology—with a ratio of 0.23—though higher than in other specialties, shows that the costs incurred are relatively proportional to the substantial economic value generated by its interventions, likely due to the intensive nature of the treatments provided.

On the other hand, specialties such as endocrinology and neurology, with ratios of 0.04, suggest they are highly cost-effective. The low cost per DALY averted, combined with a substantial number of DALYs generated, highlights that resources are being used efficiently to deliver positive health outcomes. Immunology also falls into this category, with a ratio of 0.08, demonstrating an effective use of resources relative to the benefits achieved.

In summary, the results presented in **Table 11** show that, despite differences in the ratio between the threshold and total costs across HMEP's clinical specialties, none approached a ratio of 1. Even in the specialties with the highest costs, such as cardiology, which reported a ratio of 0.23, the values did not reach levels indicative of significant inefficiency. Rather, these results suggest that although the interventions may be expensive, the value of the DALYs averted still represents a considerable fraction of the total cost incurred—an encouraging sign.

Moreover, this trend underscores that, with strategic adjustments in resource allocation and further process optimization, there is substantial potential to improve economic efficiency across all specialties without major structural changes. Most specialties displayed low threshold-to-cost ratios, suggesting that additional investments in these areas would yield high returns in terms of DALYs averted. As HMEP continues to expand its service portfolio and strengthen its capacities, there is room to achieve even greater efficiency and maximize the impact of every dollar invested.

Overall, the findings reflect an encouraging outlook: despite resource limitations and the complexity of the cases treated, HMEP uses its resources effectively, generating tangible health benefits for its patients and the country.

4.3.5 Sensitivity Analysis

Assuming a 50% reduction in DALYs averted per patient, the results showed a clear increase in the cost per DALY averted. As expected, when the health benefits (DALYs averted) were cut in half, the cost per DALY averted doubled, since the actual treatment costs remained constant. In addition, the total monetary value of the DALYs averted, based on the willingness-to-pay threshold, was also reduced by half. It is important to note that the monetary threshold was not adjusted in proportion to the reduction in DALYs averted, resulting in a shift in the ratio between the threshold value and actual total costs. Consequently, the cost-effectiveness ratios doubled, reflecting the significant impact of reduced health benefits on the overall economic results. As shown in **Table 13**, the clinical specialty of plastic surgery was the most affected by this change, with the new ratio reaching 0.5.

Table 13. Sensitivity Analysis 1: Cost per DALY and Cost-Effectiveness (in US$)

Clinical Specialty	Cost per DALY	Total Value of DALY Using the Threshold	Ratio Between Threshold Value and Actual Total Costs
Plastic Surgery	1,524	54,089	0.50
Pediatric Surgery	808	196,681	0.27
Cardiology	1,371	1,163,316	0.45
Endocrinology	259	353,643	0.09
Gastroenterology	780	123,069	0.26
Immunology	511	172,502	0.17
Nephrology	396	566,729	0.13
Neurology	223	252,194	0.07

When a combined 50% reduction was applied to both health outcomes and the willingness-to-pay threshold per DALY averted, the results were, as expected, even less favorable (**Table 14**). Of the eight clinical specialties, one (plastic surgery) recorded a ratio greater than 1, indicating that the costs of the clinical services provided exceeded the country's willingness-to-pay threshold. The remaining seven specialties maintained a favorable ratio, ranging from 0.15 (immunology) to 0.91 (cardiology). A simultaneous reduction in both health outcomes achieved and the willingness-to-pay threshold per DALY averted can be considered an extreme scenario. From this perspective, the results suggest that some of the more resource-intensive clinical specialties would not meet cost-effectiveness criteria under such conditions.

Table 14. Sensitivity Analysis 2: Cost per DALY and Cost-Effectiveness (in US$)

Clinical Specialty	Cost per DALY	Total Value of DALY Using the Threshold	Ratio Between Threshold Value and Actual Total Costs
Plastic Surgery	1,524	27,045	1.01
Pediatric Surgery	808	98,340	0.53
Cardiology	1,371	581,658	0.91
Endocrinology	259	176,821	0.17
Gastroenterology	780	61,534	0.52
Immunology	511	86,251	0.15
Nephrology	396	283,364	0.26
Neurology	223	126,097	0.34

4.4 Discussion and Conclusion

The results of the cost-effectiveness analysis indicate that the health services provided by HMEP are highly valuable and, in many cases, generate economic benefits that exceed the costs incurred. This is reflected in the fact that none of the clinical specialties approached a ratio of 1, meaning that for every dollar spent, the economic value of the produced health outcomes was significantly greater than the associated costs required to achieve them. The highest ratio was observed in plastic surgery (0.25), which demonstrates that even in the most resource-intensive specialty, costs represented only about a quarter of the economic value generated through DALYs averted.

This finding is encouraging and suggests that HMEP is not only delivering essential pediatric care but also operating efficiently by generating health outcomes that justify the investments made. For example, specialties such as endocrinology and neurology reported particularly favorable results, with ratios of 0.04. These low figures indicate that the costs incurred to avert each DALY were far lower than the economic value of the improved health outcomes. Thus, for every dollar invested in these specialties, the hospital yields a multiple return in economic value through the prevention of health losses, making these areas highly cost-effective.

The cardiology specialty, with a ratio of 0.23, reflects the relatively higher costs of advanced cardiovascular interventions. Nonetheless, the results justify the expenses, as these interventions prevent severe complications and deliver long-term health benefits. Given the life-saving nature of many of these procedures, investment in this specialty is not only justified but crucial for improving both patient survival and quality of life.

Overall, the analysis highlights that HMEP is making optimal use of its limited resources to achieve substantial improvements in health. The ratios between the threshold value and total costs across all clinical specialties suggest that the hospital's services are more cost-effective than the economic value of the DALYs averted, confirming that it is operating within economically efficient parameters.

The sensitivity analyses—specifically the combined 50% reduction in health outcomes and the willingness-to-pay threshold per DALY averted—offer additional perspective on the robustness of the results. These analyses showed that, under an extreme and conservative scenario, the plastic surgery specialty would have a cost-threshold ratio greater than 1, indicating that costs would exceed the economic value of the DALYs averted. However, most clinical specialties maintained favorable ratios even under this conservative scenario, reinforcing the conclusion that HMEP remains highly cost-effective overall, though areas with higher costs require closer monitoring in contexts of greater uncertainty.

In conclusion, the findings underscore the value of the specialized care provided by HMEP. The hospital's ability to generate significant economic returns through effective health interventions—despite resource constraints and the complexity of cases—is commendable. With continued investment and process improvements, HMEP has the potential to further enhance its efficiency and maximize the health benefits delivered to its pediatric population. This study offers strong evidence that the care provided by HMEP is not only clinically essential but also economically viable, solidifying its role as a key provider of specialized pediatric services in Honduras.

5. Limitations

One of the main limitations of Analysis 1 is its exclusive focus on the year 2023, as data were only available for that period. Going forward, it is recommended to conduct similar analyses over a longer time horizon to better understand the evolution of HMEP's performance in recent years. Additionally, it is recommended that the hospital conduct quarterly monitoring of the evaluated indicators, leveraging its extensive and detailed datasets to track progress and support more timely, evidence-based decision-making.

For Analysis 2, several limitations must be considered when interpreting the results. First, costs were assigned using HMEP's administrative and financial records, which may introduce considerable variability in estimating actual costs due to the potentially uneven allocation of indirect costs across departments and services. This variability could affect the accuracy of total cost estimates per patient and per DALY averted. Moreover, the sample's representativeness and the study's timing pose significant limitations. The data were drawn from patients treated during three specific months in 2023, which may not capture seasonal or annual variations in service utilization. This limits the possibility of generalizing the results to other periods or contexts not represented in the sample.

Another important consideration is the methodology used to calculate DALYs, which relies on reviews of clinical records and medical literature. The accuracy of these calculations may be affected by the quality of clinical data and the updating of disability weights used, potentially influencing the accuracy of DALY estimates. It is also important to note that the interpretation of the relationship between the actual cost per DALY and its monetized value based on a threshold is limited. This approach assumes that the cost per DALY represents a maximum acceptable level, which may not fully capture the economic efficiency of the interventions or the intrinsic value of the health benefits achieved.

The generalizability of the results is also a limitation, as the findings are specific to HMEP and may not necessarily apply to other hospital settings or health systems, particularly those with different financing structures or demographic profiles. These limitations should be carefully considered when interpreting the results and designing policies based on this analysis, to ensure that decisions are evidence-based and aligned with the realities of the Honduran health system.

While the results of Analysis 2 suggest that the medical services provided by HMEP are cost-effective, it is important to remember that, beyond these hospital facilities, there are many other health technologies and services across the country that could be even more cost-effective. The cost-effectiveness evaluation at HMEP provides a valuable, but limited, insight into the broader landscape of healthcare spending efficiency in Honduras.

It is also important to note that the country's Basic Package of Health Benefits may not necessarily include the specialized services offered by a tertiary pediatric hospital like HMEP (Pamela Góngora & Giedion, 2021). In a diverse health system with varied resources, such as Honduras's, there are likely alternative treatment or prevention options that are more cost-effective. This highlights the need for broader, more systematic evaluations that include a range of health technologies and services to ensure the optimal allocation of healthcare resources nationwide.

In this context, decision-making around who should receive which services poses a significant policy dilemma. On the one hand, it is essential to provide basic health services, which have a lower cost per DALY averted and contribute to greater equity and universal access. On the other hand, offering specialized tertiary care is also crucial for the country's development. These services not only raise the standard of medical care and expand the health system's capacity, but they also generate technical knowledge that benefits the system as a whole.

Striking a balance between offering cost-effective basic services and building specialized care capabilities is a key challenge for policymaking and investment decisions. These decisions must weigh both the immediate benefits of improving population health through basic services and the long-term gains of establishing services capable of addressing more complex conditions and improving health outcomes on a broader scale. This theoretical debate is essential for shaping health policies that are not only sustainable and cost-effective but also promote a long-term vision for the development of the Honduran health system.

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