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Cost drivers and feasibility of a hospital-at-home programme for geriatric care in northeastern Mexico: a retrospective observational study

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ABSTRACT

Objective The primary objective was to evaluate factors influencing the cost of a 'hospital at home' (HAH) for geriatric patients in a Northeastern Mexican hospital. Secondarily to evaluate the per capita global cost-effectiveness compared with traditional hospital care.

Design This retrospective analysis examined the costs incurred by geriatric patients in an HAH programme from February to December 2022

Setting We collected data from clinical records and assessed medication and procedure costs through the hospital's financial department. Costs for traditionally hospitalised patients were reviewed for comparison.

Participants Subjects of both genders aged 70 and older who were treated in HAH during 2022 and hospitalised subjects with the same age and gender treated in the same period.

Intervention: NA

Primary and secondary outcome measures Primary outcome: factors that influence costs in HAH. Secondary, global per capita cost comparison between HAH and hospital care.

Results We examined the expenses associated with 416 home visits to 49 patients in the HAH programme. The main factors influencing the programme's overall cost were medical care and procedure-related disorders (β=0.333, p=0.002), sleep-regulators (β=0.561, p<0.001), laxatives (β=0.330, p=0.001) and anticoagulants (β=0.228, p=0.025). The HAH programme's per capita cost was three times lower compared with that of traditional hospital care and resulted in a 40% reduction in hospitalisation days.

Conclusions This study highlights that the main factors influencing the HAH programme's costs include medical care and procedure-related disorders, as well as medication extensively used in the elderly population. Additionally, we demonstrated the cost-effectiveness of the HAH programme, which produces substantial savings and is a financially viable alternative to traditional hospital care.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The hospital-at-home (HAH) model has been implemented in Mexico, representing one of the few studies conducted in Latin America.
⇒ The study's methodology allowed for close monitoring and detailed evaluation of cost implications associated with the HAH model.
⇒ The capability to pinpoint cost-driving factors in the HAH model in this study represents an opportunity for enabling targeted interventions to enhance future cost efficiency.
⇒ This retrospective study occurred during the COVID-19 pandemic; there were differences in eligibility criteria and severity in pathologies between HAH and traditional hospitalisation, so randomisation or case–control design was not feasible.
⇒ The sample size of the study is limited by the programme's capacity and operational scale during the study period.

INTRODUCTION

The concept of 'hospital at home' (HAH) was pioneered at John Hopkins University Schools of Medicine and Public Health in the USA in 1995.[1] It refers to a patient care model that provides necessary services directly in the individual's home rather than through hospital admission.[2] This type of programme has focused on managing acute conditions such as pneumonia, cellulitis and urinary tract infection, as well as exacerbations of chronic degenerative diseases such as chronic obstructive pulmonary disease and heart failure.[3] This model addresses the challenge posed by the growing number of people needing medical care, surpassing hospitals' capacity to provide sufficient beds, especially during medical emergencies. Additionally, the aim is to avoid potential adverse effects associated with hospital care, such as functional decline, delirium and iatrogenic diseases, among others.[2]

Spain and Australia have long practised treating acute-care patients in their own residences. Other countries with publicly funded healthcare systems, such as England, Canada and Israel, also have established home-hospital models.[1] The rising cost of hospital care, which accounts for approximately one-third of total medical expenditure in the USA and results in considerable patient debt,[4] poses the question of whether these alternative models are more cost-effective. Previous studies have suggested that HAH models can contribute to cost reduction without compromising the quality of care,[5–13] but only a few have addressed the relationship between factors influencing HAH programme costs and comparative budgets between traditional hospitalisation and HAH.[4]

Research has been conducted on the feasibility of implementing an HAH programme to reduce hospital costs, but there are still unexplored aspects that require attention. Specifically, there is a lack of knowledge about which diagnoses treated in an HAH programme may generate higher expenses and affect hospital economics. Likewise, the trend of studies addressing HAH programmes focuses on the care of specific and isolated diseases.[14–20] Therefore, it is worth conducting a study that explains the impact of HAH on economic outcomes in relation to a broad group of conditions.

The primary objective of this study was to evaluate factors influencing the cost of a HAH model for geriatric patients in a Northeastern Mexican hospital. Secondarily to evaluate the per capita global cost-effectiveness compared with traditional hospital care. We hypothesise that (1) the costs associated with the HAH programme are significantly influenced by specific diagnoses and medications, commonly present in geriatric care and that (2) the HAH programme is more cost-effective than traditional hospital care, resulting in substantial cost savings while maintaining quality of care.

METHODOLOGY

This is a retrospective analytic cross-sectional study focused on the expenses related to geriatric patients visited by an HAH geriatric programme between February 2022 and December 2022. The research adhered to the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidelines.[21]

Patient and public involvement statement

As the study is retrospective, informed consent was not applicable; furthermore, patients or the public *were not* involved in the design, or conduct, or reporting or dissemination plans of our research.

Hospital Clinica Nova and the hospital at home programme

Hospital Clinica Nova (HCN), a small to mid-sized private hospital in northeastern Mexico, serves approximately 52 200 patients, including steelworkers from Ternium—one of Latin America's largest steel manufacturers—and their families in Monterrey, Nuevo León. Of these patients, around 10% (5249 individuals) are aged 70 years or older.

The HAH model at HCN provides a comprehensive service that integrates patients from various entry points, such as inpatient wards, geriatric consultations and emergency services, based on frequency and need. Patients eligible for this service typically include those 70 years and older with conditions like frailty syndrome, cognitive decline, mobility issues, functional deterioration or terminal palliative (end-of-life care) needs. Referrals are authorised by the HAH team and reviewed beforehand by geriatricians, emergency care providers and primary care physicians, following strict admission criteria.

The multidisciplinary team operates daily from 8 a.m. to 8 p.m., consisting of geriatricians, nurses, social workers, psychologists and other specialists. Team members are assigned based on individual patient needs, with flexibility to ensure comprehensive diagnostic and therapeutic support at home. Monitoring is conducted daily in 2–3 shifts or as needed, with responsibility shared among the nursing staff and physicians. This includes both in-person visits and telemedicine support, such as video and phone calls, ensuring continuous supervision. Monitoring tools include vital sign tracking and instant messaging systems, allowing timely responses to patient needs. Emergency situations are managed 24/7 through direct links to urgent care services, with paramedics and ambulances available as needed, along with thorough education for family members on emergency response protocols.

In-home interventions are tailored to each patient's diagnosis and commonly include antibiotic therapy for infectious diseases, intravenous hydration, wound care and the use of feeding and urinary catheters. Additional treatments may involve oxygen administration for patients requiring respiratory support. These interventions aim to address any acute or subacute needs identified through regular assessments. Basic laboratory tests are collected at home by nursing staff and analysed at the hospital laboratory, while advanced imaging studies are scheduled for assisted hospital visits if necessary. This model enhances the continuity of care for acute and subacute conditions, minimising the need for travel and hospital visits.

HCN's HAH model provides hospital-level care at home, closely following the World Hospital at Home Congress (WHAH) definition through specialist-led management, daily nursing visits, telemedicine for remote monitoring and urgent escalation protocols. Our interventions include palliative care, wound care and basic laboratory testing conducted at home, ensuring continuity of acute-level care as an alternative to traditional hospital stays. However, unlike the WHAH model's 24/7 availability, our HAH services operate daily from 8 a.m. to 8 p.m., with education to patients in case of alarm signs, and availability to reference them to the emergency room in case of needing help outside attention hours. Additionally, advanced diagnostic procedures, such as imaging, require patients to visit the hospital, as these are not yet available

in-home. Our model of HAH includes taking care of both acute and subacute patients.

The inclusion criteria encompassed individuals of both genders aged over 70 who received visits from the HAH programme throughout 2022 and had updated clinical records and reported costs generated by the programme as of the study date. Patients who needed intensive care unit treatment throughout the follow-up or died during the study were excluded. No probabilistic sampling was conducted. Data selection relied on the visits made by the HAH programme within the included year. A formal sample size was not determined, as all patients from the HAH programme were included in the analysis.

We examined the expenses associated with a total of 416 home visits made to 49 patients aged over 70 years of age enrolled in the HAH programme during 2022. Data were gathered from the patients' clinical records, and the cost of medication and procedures was assessed by the hospital's financial and technological departments. Additionally, data on the costs and hospitalisations of patients aged 70 and older in traditional hospital settings were analysed to calculate the per capita costs (p.c.c.) for hospitalised patients in 2022. This analysis allowed for a comparison of overall p.c.c. and the cost differences associated with the most common diagnoses treated in the HAH programme. Monetary values were converted from Mexican pesos to US dollars using an exchange rate of 1 dollar to 19.4143, as revised in the Bank of Mexico on the day of the last visit conducted by the HAH programme (28 December 2022). This conversion is reflected throughout this research.[22]

The variables involved in this research were divided into three groups: demographic variables, those related to patients' medical procedures and treatments, and those related to patients' diagnoses. For the first group, variables include gender, age, retired work status, number of days admitted to the hospital through the follow-up and number of days taken care of with the HAH programme. The second group was composed of variables like medications, laboratory studies, provided service and procedure materials, while the second group was composed of different diagnoses. The second group included the following variables: use of laboratory services, antibiotics, wound care materials, anticoagulants, neuropsychiatric drugs, antacids, sleep regulators, geriatric consult, antifungals, procedure materials, IV fluids, dietary supplements, ointments, antihypertensives, analgesics, corticosteroids, hypoglycaemic agents, antispasmodics, antiemetics, diuretics, cardiac drugs, statins, probiotics, dental medications, bronchodilators, mucolytics, nasal sprays, laxatives, thyroid hormone replacement therapy, antidiarrhoeals, antihistamines and hepatoprotective supplements. The aforementioned variables were assessed in a dichotomous manner. The grouping of the variables is shown in online supplemental Table S1.

A total of 71 diagnoses were found, which then were categorised into different groups, including infectious disorders, cancer, muscular system disorders, digestive system disorders, urinary system disorders, neurogeriatric disorders, cardiometabolic disorders, pulmonary system disorders, general health disorders and disorders related to medical care and procedures. Each diagnostic group was developed considering the characteristics of each diagnosis and implications regarding treatment, as well as the specific system of the human body which was affected. The aforementioned variables were assessed in a dichotomous manner, and the categorisation of the diseases is shown in online supplemental Table S2.

Data were gathered from clinical records and hospital expense records using a spreadsheet. The distribution of quantitative variables was analysed using Shapiro-Wilk and histograms, indicating a non-normal distribution. Categorical data were expressed in frequencies and percentages, while non-normal data were described using median and IQRs. A univariable analysis was conducted. The Mann-Whitney U test, a non-parametric statistical method, was applied to compare non-normal quantitative continuous data in our study. The multivariable analysis was a multiple linear regression where the dependent variable was the programme's costs per patient, and the independent variables were groups of diagnosis, procedures and drugs used by the patients. Multiple linear regression was chosen to identify the independent impact of each variable on the total costs, controlling for potential confounders and allowing for the evaluation of the relative importance of each factor. The variables were chosen on significant p-values in the previous tests; collinearity was evaluated and addressed by removing variables with a variance inflation factor exceeding 10. Subsequently, the model underwent refinement, eliminating variables without statistical significance to reach the best R^2 value. All assumptions of multiple linear regression were met. Analysis was conducted through complete case data. A level of $p<0.05$ was considered statistically significant, and data analysis was carried out using SPSS, V.29.0.2.0 (IBM Corp. IBM SPSS Statistics for Windows, Armonk, NY).

Since this was a retrospective cross-sectional study, there was no patient or public involvement.

RESULTS

Descriptive statistics

This study initially involved a total of 64 patients. After applying the previously mentioned selection criteria, encompassing age above 70 years old, data on HAH costs during 2022 and complete data in clinical files, the analysis was conducted on 49 patients (this is the total population). Patients had a median (IQR) age of 86 (9) years and consisted of 31 (63.3%) female subjects, with a median (IQR) of 6 (7) days of HAH visits and 12 (19) days admitted for traditional hospitalisation. Demographic data are shown in table 1.

Table 1 Patient's demographic characteristics

Variable	n=49 (%)
Female	31 (63.3)
Age (years)*	86 (9)
Retirees	46 (93.9)
Consultation service†	46 (93.9)
Laboratories‡	24 (49.0)
Patients with palliative care	25 (51)
Days in HAH programme*	6 (7)
Days admitted in hospital*	12 (19)
Overall cost (US dollars)*	844.87 (1652.19)

*Median (IQR).
†Use of the geriatric consultation service in HAH.
‡Use of laboratory studies regarding blood tests, urine tests, among others during HAH stay.
HAH, hospital at home.

Differences in costs across diagnostic groups, procedures and treatments

A total of 71 diagnoses were presented, which were classified into 10 groups. Among these, the grouping of infectious disorders had the highest number of patients (27 (55.1%)), followed by the groupings of cancer and muscular system disorders, where 9 (18.4%) patients were grouped into each category. Regarding the differences in costs by diagnosis grouping, the median (IQR) cost when a disease from the pulmonary disorders group was present was 2.7 times higher compared with its absence ($2058.48 ($1459.95) vs $753.98 ($1493.54), p=0.027). For disorders related to medical care and procedures, 3.67 times higher ($2931.24 ($1144.72) vs $804.77 ($1558.18), p=0.044), and for infectious disorders, 1.8 times higher compared with its absence ($1319.85 ($2125.65) vs $726.17 ($1198.34), p=0.052). Differences in costs by diagnosis grouping are shown in table 2.

Regarding materials and medications, procedure materials were used for 46 (93.9%) patients, while intravenous solutions were used for 45 (91.8%). Antibiotics were used by 37 (75.5%) of the patients, and analgesics by 32 (65.3%) patients. The median (IQR) of the differences in costs related to medical procedures and treatments was notably higher in several categories, including laboratory studies ($1560.14 ($2112.62) vs $473.05 ($969.18), p<0.001), antibiotics ($1170.07 ($1713.84) vs $376.01 ($543.67), p=0.003), wound care materials ($1319.85 ($1631.43) vs $418.61 ($666.88), p=0.010), anticoagulants ($2976.00 ($930.91) vs $799.62 ($1516.72), p=0.009), neuropsychiatric drugs ($1654.55 ($2007.85) vs $579.42 ($928.03), p=0.009), antacids ($1605.67 ($1764.16) vs $717.92 ($700.82), p=0.010) and sleep regulators ($3231.23 ($1654.50) vs $777.62 ($1292.71), p<0.001). The differences in costs related to medical procedures and treatments are detailed in table 3.

Main predictors of total costs in the HAHA programme

The results from the linear regression analysis for predicting total HAH costs showed a statistically significant positive association with disorders related to medical care and procedures, β=0.333 (95% CI: 12 957.2, 52 211.2). Particularly noteworthy were the associations with sleep-regulating drugs, β=0.561 (95% CI: 26 240.6, 54 044.1), laxatives, β=0.330 (95% CI: 7238.6, 27 828.0) and anticoagulants, β=0.228 (95% CI: 2527.39, 36 594.85). For more detailed information, please consult table 4, which presents a comprehensive breakdown of these results.

Differences between traditional hospitalisation and hospital-at-home programme

In 2022, the hospital incurred a total cost of $2 206 628.26, resulting in a p.c.c. of $5716.61 in patients aged>70 years

Table 2 Cost differences by diagnostic grouping

Variables	n=49 (%)	Adjusted cost		P value*
		Presence, median (IQR) US dollars	Absence, median (IQR) US dollars	
Cancer	9 (18.4)	406.66 (2058.79)	846.39 (1391.04)	0.73
Cardiometabolic disorders	6 (12.2)	528.12 (567.47)	848.03 (1608.56)	0.30
Urinary system disorders	7 (14.3)	1124.27 (2340.13)	804.77 (1582.91)	0.19
Digestive system disorders	8 (16.3)	1402.21 (2008.62)	809.97 (1516.72)	0.23
Neurogeriatric disorders	7 (14.3)	1124.27 (1135.25)	827.33 (1740.27)	1.00
Muscular system disorders	9 (18.4)	871.26 (1348.39)	827.33 (1536.34)	0.60
General health disorders	3 (6.1)	2860.83 (1041.60)	804.77 (1558.18)	0.12
Disorders related to medical care and procedures	3 (6.1)	2931.24 (1144.72)	804.77 (1558.18)	0.044
Infectious disorders	27 (55.1)	1319.85 (2125.65)	726.17 (1198.34)	0.052
Pulmonary system disorders	3 (6.1)	2058.48 (1459.95)	753.98 (1493.54)	0.027

*Performed using the Mann-Whitney U test.

Table 3 Differences in costs by medical procedures and treatments

Variables	n=49 (%)	Adjusted cost		P value*
		Presence, median (IQR) US dollars	Absence, median (IQR) US dollars	
Consultation services	46 (93.9)	859.68 (1572.55)	181.46 (114.55)	0.10
Palliative care	25 (51)	15 725.1 (35484.8)	19 590.1 (31680.3)	0.92
Laboratories	24 (49.0)	1560.14 (2112.62)	473.05 (969.18)	<0.001
Antibiotics	37 (75.5)	1170.07 (1713.84)	376.01 (543.67)	0.003
Wound care materials	33 (67.3)	1319.85 (1631.43)	418.61 (666.88)	0.010
Anticoagulants	4 (8.2)	2976.00 (930.91)	799.62 (1516.72)	0.009
Neuropsychiatrics	22 (44.9)	1654.55 (2007.85)	579.42 (928.03)	0.009
Antacids	23 (46.9)	1605.67 (1764.16)	717.92 (700.82)	0.010
Sleep regulators	6 (12.2)	3231.23 (1654.50)	777.62 (1292.71)	<0.001
Antifungals	9 (18.4)	1352.56 (2029.64)	753.98 (1541.13)	0.046
Procedure materials	46 (93.9)	859.68 (1572.55)	200.88 (119.71)	0.026
IV fluids	45 (91.8)	871.26 (1526.35)	303.75 (230.76)	0.020
Dietary supplements	3 (6.1)	85 (1290.96)	804.77 (1648.42)	0.23
Ointments	14 (28.6)	1261.29 (1981.53)	777.62 (1565.55)	0.21
Antihypertensives	4 (8.2)	1956.75 (2535.19)	844.69 (1581.41)	0.34
Analgesics	32 (65.3)	1368.32 (1628.03)	713.86 (627.37)	0.046
Corticosteroids	11 (22.4)	809.97 (1787.03)	857.98 (1558.18)	0.71
Hypoglycaemic agents	4 (8.2)	2184.83 (2359.65)	809.97 (1581.41)	0.12
Antispasmodics	11 (22.4)	1703.44 (1569.41)	804.77 (1437.29)	0.30
Antiemetics	11 (22.4)	1978.28 (1981.53)	753.98 (1173.05)	0.035
Diuretics	10 (20.4)	2373.82 (2216.77)	799.62 (1292.71)	0.047
Cardiac drugs	1 (2)	3199.65 (0)	827.33 (1584.46)	0.20
Statins	1 (2)	1124.27 (0)	827.33 (1659.86)	0.89
Probiotics	2 (4.1)	508.39 (221.90)	848.03 (1641.78)	0.35
Dental medications	1 (2)	3706.24 (0)	827.33 (1548.86)	0.12
Bronchodilators	8 (16.3)	2009.14 (2628.58)	777.62 (1325.11)	0.07
Mucolytics	1 (2)	1124.27 (0)	827.33 (1659.86)	0.89
Nasal sprays	2 (4.1)	2529.37 (1176.86)	809.97 (1616.64)	0.18
Laxatives	13 (26.5)	2058.48 (1844.47)	680.89 (1307.80)	0.016
Thyroid hormones	2 (4.1)	1889.54 (1310.12)	844.69 (1616.64)	0.58
Antidiarrhoeals	1 (2)	334.24 (0)	846.39 (1634.83)	0.40
Antihistamines	1 (2)	2856.19 (0)	827.33 (1584.86)	0.28
Hepatoprotectors	1 (2)	2689.15 (0)	827.33 (1584.86)	0.36

*Performed using the Mann-Whitney U test.

old. For the HAH programme, including transportation costs, the expense was $86 469.36, with a p.c.c. of $1764.68, p<0.001. The median (IQR) number of days in the HAH programme was 6 (7) days, while the median (IQR) hospitalisation duration for the patients in the study was 12 (19) days. Additionally, the median (IQR) percentage of days spent in the HAH programme instead of traditional hospitalisation was 40% (41.67).

Patients with infectious disease-related conditions incurred significantly higher p.c.c.) and median costs (IQR) in traditional hospitalisation compared with HAH care. Specifically, the traditional hospitalisation group had a p.c.c. of 126 389 and a median cost of 45 271 (142 615), while the HAH group had a p.c.c. of 32 831 and a median cost of 7895 (39 970), with p<0.001. Similarly, patients with muscular system disorders experienced significantly

Table 4 Linear regression for predicting total HAH costs

Variable	β	Standardised β	T value	95% CI Inferior	95% CI Superior	P value
Disorders related to medical care and procedures	32584.2	0.333	3.35	12957.21	52211.20	0.002
Sleep regulators	40142.3	0.561	5.82	26240.57	54044.08	<0.001
Laxatives	17533.3	0.330	3.42	7238.63	27828.01	0.001
Anticoagulants	19561.1	0.228	2.31	2527.39	36594.85	0.025

Corrected R^2: 0.567.
HAH, hospital at home.

higher costs in traditional hospitalisation, with a p.c.c. of 169421 and a median cost of 55884 (76 369), compared with a p.c.c. of 29397 and a median cost of 16915 (26 178) in HAH care (p=0.034). In contrast, for patients with cancer-related conditions, there was no statistically significant difference in costs between traditional hospitalisation and HAH care. The traditional hospitalisation group had a p.c.c. of 58423 and a median cost of 30154 (26 470), compared with a p.c.c. of 30785 and a median cost of 7895 (39 970) in the HAH group (p=0.3).

DISCUSSION

A total of 49 patients were studied to assess the cost of HAH care. We found that the most relevant factors predicting the cost of HAH were medical care and procedure-related disorders, sleep regulators, laxatives and anticoagulants. The p.c.c. of the HAH programme was three times lower than traditional hospitalisation, resulting in 40% of patients' days of care utilising the HAH programme instead of traditional hospitalisation. Figure 1 shows a summary of the development of the study, the explanation of the findings and the economic differences between the costs of the traditional hospitalisation versus HAH approaches, along with the potential impact of the programme's implementation across multiple levels.

Figure 1 HAH programme assessment and potential benefits. In the subheading 'Types of variables', the two types of variables used for the study are described, then for 'Phase 1' of the analysis, a univariable analysis was run to understand which variables affected the HAH programme costs, and they were used to develop the multivariable analysis from 'Phase 2', which underscores the importance of sleep regulators, laxatives, anticoagulants and disorders related to medical care and procedures. Posteriorly, the comparison to the literature was assessed and expressed in the explanation. Then, in the subheading 'Difference of multivariable Analysis from 'Phase 2', which underscores the importance of sleep regulators, laxatives, anticoagulants and disorders related to medical care and procedures. Posteriorly, the comparison to the literature was assessed and expressed in the explanation. Then, in the subheading 'Difference of hospitalisation costs and attention days', total cost and p.c.c. are compared between the classic model of patients staying in the hospital versus the at-home model, and with it, the median number of days spent by the patients in

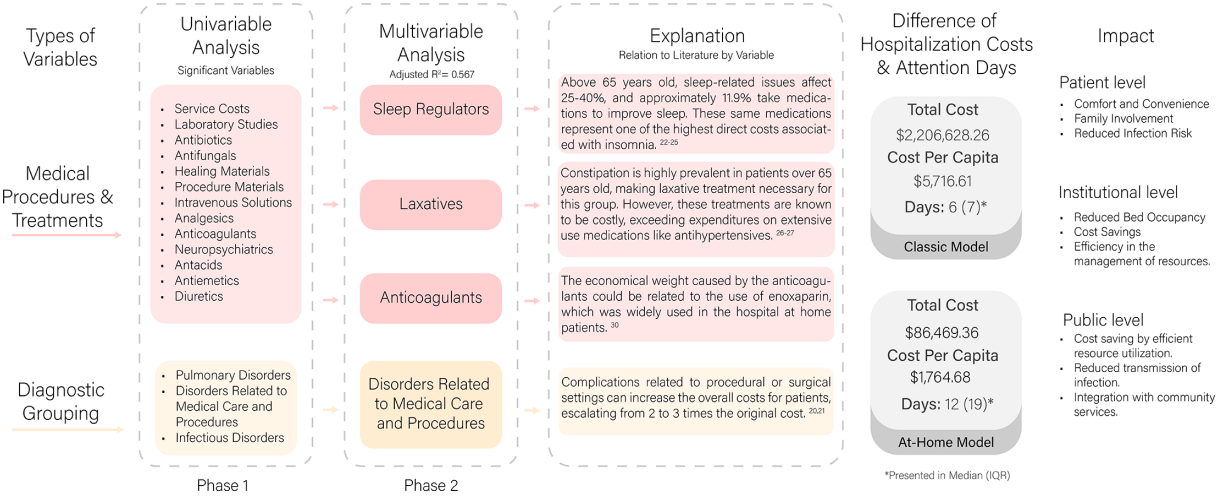

Figure 1 Comparative analysis of the hospital-at-home (HAH) programme and traditional hospital care: this figure summarises the study's phases, highlighting key variables influencing HAH programme costs and presents a direct comparison of total and per capita costs between HAH and traditional hospital care. It also depicts the reduction in hospitalisation days and the broader impact on patient, institutional and public levels.

each one of those. In the end, the possible impact of the HAH programmes is assessed at different levels: patient, institutional and public level.

In our study, a group of diagnoses named medical and surgical care-related disorders, which was composed of sequelae of complications from medical and surgical care, significantly influenced the HAH programme's overall cost. Previous research on the economic considerations of surgical care and healthcare policies found that the financial impact of complications following abdominal surgery costs escalated significantly, with minor complications leading to a doubling of costs.[23] Another study found that complicated cases result in triple the average cost.[24] This aligns with our findings as all three studies show how complications can substantially increase healthcare costs, although in different healthcare settings.

Ageing individuals often encounter increased sleep-related issues, with approximately half of older adults expressing dissatisfaction with sleep quality.[2526] Sleep regulators notably impacted the HAH programme's costs among the drug categories assessed in our study. A prospective observational study on the costs of insomnia revealed that medication expenses comprised the most considerable portion (69.94%) of total direct costs. At the same time, productivity loss was the primary contributor to the overall economic burden, followed by medication.[27] This finding is supported by a review indicating extensive healthcare resource utilisation among patients with insomnia.[28] Our study population primarily comprised geriatric retired individuals, which nullifies the cost of productivity loss and stresses the economic burden attributed to medication. These findings highlight the importance of addressing sleep health in geriatric care to manage costs effectively.

Constipation is a common issue within the ageing population,[29] and half of the overall expenses related to this impediment are due to doctor visits, surpassing expenditures on both antihypertensive drugs and contraceptives in the UK's National Health System.[30] Similarly, we found that laxatives significantly influenced the overall cost of the HAH programme. In a cost-effectiveness analysis evaluating the economic balance of medical intervention against alternative therapies for constipation, the researchers determined that laxatives are costly and not cost-effective compared with dietary management.[31] Our study exclusively enrolled patients aged 70 and above, leading to an increased number of patients requiring laxative therapy. In the elderly, the constraints posed by decreased physical activity, polypharmacy and comorbidities make constipation prevalent and laxative use often necessary.[32]

Approximately seven million individuals globally rely on anticoagulants. These medications are commonly prescribed for health issues, including myocardial infarction, unstable angina and acute coronary syndrome, whether in hospital or outpatient settings.[33] In our study, the cardiometabolic disorders group was not significantly expensive within the HAH programme. However, anticoagulants, a medication group including apixaban, enoxaparin and heparin, represented a significant economic burden. In a prospective cohort study of patients receiving anticoagulants for any indication in the hospital's cardiology ward, enoxaparin stood out as the costliest anticoagulant, contributing even more to the overall financial impact when factoring in the expenses associated with its monitoring.[33] This underscores the importance of carefully managing and monitoring anticoagulant therapy to optimise cost-efficiency while ensuring patient safety.

In our study, the p.c.c. of the HAH programme was three times lower compared with the hospital p.c.c. Specifically, for infectious disease-related conditions, the p.c.c. of traditional hospitalisation was approximately 3.85 times higher than that of the HAH programme. Similarly, for muscular system disorders, the p.c.c. in traditional hospitalisation was approximately 5.76 times higher than in the HAH programme. In a study describing the implementation and evaluation of a healthcare delivery model known as 'HAH', the per-patient cost excluding physician fees for HAH was compared with the variable costs per case for acute care inpatients, which also excluded physician fees, resulting in an average HAH patient cost 19% lower compared with traditional hospital setting p.c.c.[6] In contrast to this study, physician fees were included for both groups, but our HAH costs remained lower. The same study explains that these savings were due primarily to shorter average hospital stays and reduced utilisation of clinical tests. This supports our results since, although patients may have initially required hospitalisation, further care was provided at home, resulting in patients receiving care at home through the HAH programme instead of traditional hospital stay during 40% of their total period of care and probably limiting the request for laboratory studies only when necessary.

Our study has potential implications for practice. At the patient level, HAH programmes could enhance convenience and safety since patients benefit from reduced stress and heightened comfort in home environments and support from family.[34] Furthermore, the reduced risk of infection, a notable advantage of home-based care, suggests improved health outcomes.[35] On an institutional level, HAH can generate cost savings by reducing bed occupancy, alleviating congestion within hospitals, and through more efficient resource management, as was needed during the pandemic of COVID-19.[36] This is also true on a public level, as HAH models contribute to optimised healthcare delivery and disrupt the transmission of infectious diseases, fostering healthier populations. Moreover, integrating home-based care with community services promotes synergistic benefits for the healthcare system across multiple levels.

Implementing HAH programmes on a larger scale presents organisational challenges, such as establishing new departments for patient transportation logistics, medical equipment supplies chain management and coordination with home health providers. These

departments must integrate into hospitals' existing structure through changes in administrative and operational workflows. Additionally, expanding HAH programmes successfully depends on developing robust training programmes for healthcare providers, including training in telemedicine, remote patient monitoring and home-based medical procedures.[1] From a public health policy perspective, scaling up HAH programmes requires substantial investment in healthcare infrastructure and resources. Policymakers need to create supportive frameworks and funding models to integrate HAH into the broader healthcare system, address healthcare disparities and invest in technologies for remote care delivery in underserved areas to ensure equitable access to home-based care.[34]

While our study provides valuable insights into the cost-effectiveness of the HAH programme compared with traditional hospitalisation, some limitations should be considered.

The sample size in our study reflects the total number of patients treated by the HAH programme during the year 2022, representing the entire population served by this programme within that timeframe. While we recognise that 49 patients may appear small, it is important to note that this number is limited by the programme's capacity and operational scale during the study period of 1 year, particularly as it was still developing. Despite the small sample size and the respective nature of this study, the data provide valuable insights into the cost-effectiveness and potential benefits of the HAH programme. Our findings offer a foundation for further research and contribute to the growing evidence supporting the viability of home-based care models, especially in resource-limited settings.

Future research should consider a prospective study to understand the sustainability of the programme and assess variables related to the optimisation and development of logistics for the programme. Although the HAH model has the potential benefit of reducing expenses and increasing patients' comfort, this conclusion was made with the p.c.c. for each patient and does not imply a normal distribution for this data. Additionally, differences in eligibility criteria, acuity levels and diagnoses during the COVID-19 pandemic between the two populations make direct cost comparisons challenging. These factors reflect the early-stage implementation of the programme, which was not designed to mirror the entirety of the patient profile or complexity typically seen in traditional hospital settings. Future research should aim to assess costs after the programme has reached greater maturity, potentially incorporating matched cohorts or adjusted analyses to improve comparability. Before attempting to extrapolate this study's findings, it must be considered that laboratory prices were included for comparing home hospitalisation and traditional hospitalisation. In contrast, other studies do not take laboratory expenses as part of the HAH.

CONCLUSION

The results of this study suggest that the most relevant factors influencing the overall cost of the HAH programme were medical care and procedure-related disorders, sleep regulators, laxatives and anticoagulants. Also, the HAH programme's p.c.c. is three times lower compared with the p.c.c. of hospitalisation, proving the cost-effectiveness of the HAH programme. The results of this research underscore the significance of considering the economic factor when implementing home hospitalisation programmes in Mexico. It is clear that this approach does not just provide a financially viable substitute for the traditional hospital model but also has the potential to yield substantial savings in healthcare costs. HAH programmes can play a pivotal role in advancing healthcare delivery and achieving better economic outcomes by focusing on key cost-driving factors and optimising resource allocation.

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Contributors The contributions of each author to this manuscript are outlined as follows: AG-S and OIGP jointly conceptualised the study, with MER-I also contributing to this phase. AG-S and OIGP developed the methodology. JSGO and AG-S worked on the software used in the study. The validation of the results was conducted by AG-S, OIGP and MER-I. JSGO and AG-S were responsible for the formal analysis and investigation. Resources were provided by MER-I, DLVP, NDTV, MAS-S and MHG. Data curation was handled by JSGO and AG-S. The original draft was written by JSGO, with OIGP assisting in this process. The manuscript was reviewed and edited by JSGO, AG-S, OIGP and IFF-C. The visualisations were created by JSGO and AG-S. MER-I took on the role of supervising the project. Project administration was carried out by MER-I and OIGP. Funding acquisition was managed by MER-I, MAS-S and MHG. Finally, the guarantor is MER-I.

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