Non-accidental head injury in children: medical care direct economic cost in a tertiary care hospital

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Abstract

Introduction: Abusive head trauma (AHT) is an extreme form of physical abuse that is produced by abruptly shaking an infant or toddler. **Objective:** To describe the direct economic cost of care during hospitalization of 14 children with confirmed diagnosis of AHT in a pediatric hospital. **Method:** Analysis of the cost of disease in patients with AHT attended to between 2001 and 2010. Partial direct economic cost of medical care (days of hospital stay, laboratory tests and imaging studies, surgical procedures and subspecialist consultations) was calculated adjusting for inflation, with year 2001 taken as base year. Patients were classified in three groups (moderate, severe and fatal AHT). Descriptive and sensitivity analysis was carried out. **Results:** Patients with severe AHT generated higher medical care costs (\$105,794.88 ± 33,201.91) in comparison with the group of moderate (\$37,012.95, ± 7,154.87) and fatal AHT (\$18,595.04 ± 6424.47) ($p < 0.05$). Total cost was \$665,467.98 Mexican pesos (\$71,249.25 international dollars). **Conclusions:** Total cost for the 14 patients was an elevated figure, as in other parts of the world. The direct economic cost is closely related to the severity of the clinical presentation.

KEY WORDS: Child abuse. Shaken baby syndrome. Abusive head trauma. Costs and cost analysis. Medical economics.

Introduction

Abusive head trauma (AHT) or shaken baby syndrome (SBS) is an extreme form of physical abuse^{1,2} that is produced by abruptly shaking an infant or toddler. This mechanism generates rotation of the head and acceleration and deceleration movements, which can cause the rupture of the communicating vessels of the brain (causing hemorrhages), hypoxia, diffuse brain damage, damage to the cervical spine and to some structures of the eyeball. Intracranial trauma occurs, which, in most cases, does not show external evidence on the skull suggesting internal damage. It manifests itself by a series of clinical and pathological alterations that make up a well-defined syndrome.^{3,4} There is a close relationship between the strength of the sway, its duration and the degree of hypoxia that is generated. Hypoxia triggers cerebral edema with

intracranial pressure elevation, and therefore there is blood perfusion lower pressure, thus producing cerebral ischemia and subsequent axonal damage. The higher the hypoxia, the greater the presence of cerebral edema, which is a determinant in clinical evolution that increases severity and, therefore, the cost of medical care.^{5,6}

The most common signs and symptoms these patients present with include alterations of the state of consciousness (43 to 77 %), lethargy (24 to 77 %), irritability (7 %), seizures (40 to 76 %), increased or decreased muscle tone, vomiting (15 to 24 %), food rejection (29 %), breathing disturbances or apnea (34 to 41 %) and developmental delay or regression (12 %). Most common radiological findings on cranial computerized axial tomography include subdural hemorrhage (29 to 80 %), subarachnoid hemorrhage (12 to 50 %), intracerebral hemorrhage (8 %), epidural

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hemorrhage (4 to 9 %), parenchymal hemorrhage or injury (9 to 37 %), cerebral edema (4 to 59 %), and hygromas (11 to 29 %). In addition to intracranial injuries, fractures in different parts of the body can be found (mainly ribs and long bones).^{4,7-10} Approximately half of patients with AHT present with severe deterioration, they arrive unconscious or moribund. These patients are often complicated with hypotension and hypoxemia.¹¹ Survivors have been reported to have important sequelae: between 55 and 80 % of cases experience severe cerebral atrophy, as well as neuro-functional deficit; follow-up studies have been carried out for 4 or 5-year periods. Mortality has been reported in 19 to 35 % of cases, which is significant considering that this pathology is 100 % preventable.^{3,7,10-13}

The American Academy of Pediatrics indicates an AHT incidence ranging from 17 to 24 % in the United States.³ In Mexico, its frequency has not been able to be specified, basically because the diagnosis is not established, and when it is, only isolated reports are made.^{12,13} Notwithstanding, research on this pathology allows to know the clinical picture at home and at admission to the emergency services, its pathophysiology, the required services, as well as morbidity and mortality.¹⁴⁻¹⁹

One aspect of this pathology that has been scarcely described internationally and has not been described at the national level is the economic impact for the medical institution for its care.

To assess the economic burden of a disease, there are cost-of-illness studies, which identify, quantify and assess associated economic resources. Drummond²⁰ recognizes the methodology used to calculate the costs of a disease and considers that the cost of a disease is comprised by three components: direct costs, mainly in charge of the health system for the treatment of disease; indirect costs, in terms of production lost due to morbidity or premature mortality from the disease; and intangible costs, in terms of pain, suffering or quality of life reduction for those who suffer from the disease.²⁰

There are only few specific reports on the cost of care for patient victims of AHT and those that have been generated come especially from the United States, where lifetime average cost for an AHT fatality has been estimated to be 5.7 million dollars (95% CI = 3.2-9.2 million dollars). For patients who survive, average cost in 2010 was estimated to be 257 million dollars for medical care and related direct costs. On that same year, an incidence of 4824 AHT cases was estimated. Lifetime cost of these cases was

13.5 billion dollars (95% CI = 5.5-16.2 billion), including 257 million dollars for medical care, 552 million dollars for special education, 322 million dollars for child protective services/criminal justice, 2 billion for lost work, and 10.3 billion dollars for lost quality of life.^{21,22}

The cost of the care of patients with AHT has also been reported to be higher when compared to that of patients with similar socio-demographic characteristics attended to for other causes, especially because they require longer hospitalization time, higher use of medical services at discharge, as well as larger use of medications.²³ With regard to the cost of care at the department of emergencies and hospitalization at the moment of diagnosis, in the United States, providing care to 6827 patients (95 % CI = 6072-7582) in the emergency department and 12,533 (95% CI = 10,395-14,671) hospitalizations (28 % hospitalized in the same hospital where the emergency department was consulted), the average of this cost was 2,612 dollars for emergency care and 31,901 dollars for hospitalization.²⁴

Thus far, the economic cost that implies the specific care of cases with the AHT diagnosis has not been described in Mexico and, therefore, the impact on the administrative sphere of a tertiary care pediatric hospital of our country is not known.

The purpose of this study is to describe the partial economic direct cost generated during the hospitalization of 14 patients with confirmed diagnosis of abusive head trauma in a tertiary care pediatric hospital of Mexico City, at the moment of diagnosis.

Method

Economic evaluation of the cost-of-illness analysis-type with a retrospective approach, from the perspective of the health care system and only considering healthcare costs,²⁵ over a 10-year period of, given the low frequency this pathology is detected with. The project was approved by the National Institute of Pediatrics Research Committee, with registration number 026/2016.

Partial direct economic cost of medical care was calculated by reviewing secondary sources: clinical records (physical and electronic), as well as electronic radiological and laboratory records. The target population were patients with confirmed diagnosis of AHT and for whom consultation with the Clinic for Comprehensive Care of the Abused Child of the National Institute of Pediatrics (CAINM-INP – *Clínica de Atención Integral al Niño Maltratado del Instituto Nacional de*

Table 1. Characteristics of 14 patients diagnosed with abusive head trauma (AHT) during hospitalization, at diagnosis, and sequels identified during hospitalization

Characteristic	Moderate AHT (n = 4)		Severe AHT (n = 4)		Fatal AHT (n = 6)		Total (n = 14)	
	n	%	n	%	n	%	n	%
Main characteristics at admission that were used to classify AHT severity								
Altered state of consciousness at admission	1	25	4	100	5	83	10	71
Required intubation	1	25	4	100	5	83	10	71
Presence of cerebral edema on cranial CT scan	0	0	4	100	6	100	10	71
Required PICU attention	0	0	4	100	0	0	4	29
Sequels identified during hospitalization								
Motor sequels	3	75	4	100	NE		7	50
Visual sequels	3	75	4	100	NE		7	50
Auditory sequels	0	0	4	100	NE		4	29
Speech sequels	4	100	3	75	NE		7	50
Persistence of seizures	2	50	4	100	NE		6	43
Overall growth retardation	2	50	4	100	NE		6	43
	Median	Min-max	Median	Min-max	Median	Min-max	Median	Min-max
Age in months	5	4-8	7.5	2-9	5	2-14	6	2-14

AHT = abusive head trauma; NE = not evaluable; PICU = pediatric intensive care unit.

Pediatría) was requested for their management, during the 2001 to 2010 period.

Operational definitions and data collection

The AHT diagnosis was established by the presence of intracranial hemorrhage and retinal hemorrhage, together with a comprehensive assessment by the CAINM-INP medical, nursing, social work and psychology areas in said period.

The patients were classified according to the severity of the clinical presentation, based on the presence of cerebral edema and the need to be treated at the pediatric intensive care unit (PICU). This way they were classified in three groups:

1. Moderate AHT, without cerebral edema and not requiring care at the PICU.
2. Severe AHT, with cerebral edema that required care at the PICU.
3. Fatal AHT, with cerebral edema that caused death (Table 1).

The cost of used medical resources was calculated with the values of the tabulator costs for recovery rates at level 6 of the National Institute of Pediatrics (INP), expressed in Mexican pesos. This tabulator at

level 6 considers services total cost, both direct and indirect, and is adjusted annually according to inflation. For its calculation, macrocosting and microcosting combined techniques are used.^{26,27} The procedure for the calculation of these fees adheres to the Federation Income Law and this in turn to the General Statute of Health.²⁶ The cost of more immediate complications (other diagnoses that develop owing to the severity of the condition) related to AHT and that are part of AHT care is included in this calculation.

The same procedure was used to calculate the cost that patients paid to the institution according to their assigned level.

To establish the cost for the stay at different departments, the cost per bed-day was used, where direct costs during patient hospitalization are considered, and this includes medications, wound dressing, procedures, resident physicians' and nursing staff intervention, except for the children's feeding.²⁸

Since in this economic evaluation patients treated at different years were included, the values of the costs of the monetary nominal (current) units were converted to real (constant) units in order to eliminate the effect produced by inflation (they were deflated). To carry out the deflation of the cost value of each

Table 2. Amount of resources used in the medical care of 14 patients diagnosed with abusive head trauma during their hospitalization, at the moment of diagnosis

Resource that generated cost	Moderate AHT		Severe AHT		Fatal AHT		Total	
	Median	Min-max	Median	Min-max	Median	Min-max	Median	Min-max
Days of emergency department stay	0.50	0-5	1	0-11	5	2-9	2.5	0-11
Days of hospitalization area stay	29.5	13-31	34	20-117	0	0	16.5	0-117
Days of PICU stay	0	0	13	1-25	0	0	0	0-25
Number of laboratory tests	4.5	3-8	67	59-81	16	5-34	16	3-81
Number of imaging examinations	7.5	5-11	9	6-17	7.5	4-11	8.5	4-17
Number of surgical procedures	0.5	0-1	1.5	0-4	0.5	0-1	1	0-4
Number of consultations with subspecialties	7	5-9	7	7-10	5.5	4-8	7	4-10

AHT = abusive head trauma, PICU = pediatric intensive care unit.

annually used resource per patient, the annual deflator coefficient was calculated (Fig. 1), with the values of the quota tabulator for recovery of the INP in 2001 being taken as a basis. This yielded the real value as a result (Fig. 2).

Cost calculation procedure

Using the down-up approach,²⁵ cost generators that were directly related to medical care were identified: days of hospital stay, number of consultations per specialist, surgical procedures and laboratory and imaging exams performed. The cost of each component was separately estimated and then added to obtain the total cost.²⁹ The cost-of-illness analysis was carried out in two stages: in the first one, the used medical resources that were cost generators were quantified (Table 2). In the second one, the unit cost values corresponding to each resource were determined. For this, the nominal value was first obtained and subsequently the real value (deflated).

Direct medical costs were estimated³⁰ by multiplying the real value of each medical resource used by its frequency of use (Fig. 3). Total costs and per group were calculated in Mexican pesos, and subsequently they were converted to international dollars (Geary-Khamis dollar monetary unit), with the equivalence cost of 9.34 Mexican pesos of December 31, 2001 (base year for the calculation in Mexican pesos) issued by the World Bank therefore being used.³¹

Statistical analysis

The data analysis was performed with the SPSS software, version 21.

$$\text{Deflator coeff.} = \frac{CPI_f}{CPI_i}$$

Where:

Deflator coeff. = deflator coefficient.

CPI_f = final consumer price index (CPIs of the years the patients were attended to were used).

CPI_i = initial consumer price index (the 2001 CPI was used)

Figure 1. Deflator coefficient calculation.^{28F}

$$RV = \frac{NC}{\text{Deflator coeff.}}$$

Where:

RV = real value.

NC = nominal cost.

Deflator coeff. = deflator coefficient.

Figure 2. Deflation calculation.

A descriptive statistical analysis was carried out for the total sample and by analysis groups. Frequencies and percentages were calculated for patient characteristics' variables. For age and amount of used resources, median, minimum and maximum values were used. For the costs, the mean and standard deviation were calculated, as well as median, minimum and maximum values (due to the data distribution).

To identify significant differences between groups and contrast the hypothesis of equality between them, the Kruskal-Wallis nonparametric test was performed, with a p-value of < 0.05 being considered to be statistically significant. For sensitivity analysis, the

$$CT_{jkw} \sum_{i=1}^n QR_{jki} * PR_{jki} -$$

Where:

CT = total cost for the care of event j , for the k individual, with the w health condition.

QR = amount of resource i used for the medical care of a j medical event of patient k with the w medical condition.

PR = resource i price or unit cost.

i = resources used to carry out medical care {1,2,...,n}.

j = type of medical resource (1. Days of hospital stay, 2. Number of consultations per specialist. 3. Performed surgical procedures, 4. Laboratory tests performed and 5. Imaging tests performed). k = Patients {1,2,..., n}.

Figure 3. Deflation calculation.

calculation was carried out by severity strata (moderate, severe and fatal AHT).

Results

Fourteen patients with confirmed diagnosis of AHT were identified, out of which 10 (71 %) were males; median age was 6 months (minimum 2 and maximum 14); 6 patients (43 %) died during their stay at the emergency department, median hospital length of stay was 22 days (minimum 2, maximum 129). Other patient characteristics are described in Table 1.

Cases with severe AHT represented a higher total medical care average cost (105,794.88 ± 33,201.91 Mexican pesos) in comparison with the group with moderate AHT (37,012.95 ± 7154.87) and with the group with fatal AHT (18,595.04 ± 6424.47) ($p < 0.01$).

The breakdown of the cost of each resource is shown in Table 3. The cost in international dollars is shown in Table 4.

The cost for hospital stay was also higher in the group with severe AHT (52,803.15 ± 29,633.69 Mexican pesos) ($p < 0.01$) than in patients with moderate AHT (22,650.00 ± 6786.35) and the group with fatal AHT, the cost of which was the lowest (4174.55 ± 2421.21) since their hospital stay was shorter, with a median of 2.5 days (0-11).

Regarding laboratory tests, there was no difference ($p > 0.05$) between the costs in patients: moderate AHT, 892.05 ± 397.59 Mexican pesos; severe AHT, 23,517.73 ± 9465.91 and fatal AHT, 4752.71 ± 3270.27.

Figure 4. Sensitivity analysis (Kruskal-Wallis test with $p < 0.05$).

Neither did the costs for imaging examinations show differences ($p > 0.05$) between the three groups: moderate AHT, 7175.56 ± 4953.61 Mexican pesos; severe AHT, 10,040.05 ± 6285.74 and fatal AHT, 5372.96 ± 2294.97.

In the surgical procedures, the cost also showed no differences ($p > 0.05$), between groups: severe AHT, 16,327.77 ± 12,522 Mexican pesos; moderate AHT, 3378.32 ± 3996.57 and fatal AHT, 242.68 ± 2626.69.

Neither did the cost for the consultations with different subspecialists show differences between groups: 2911.96 ± 657.94 Mexican pesos in moderate AHT, 3105.73 ± 692.99 in severe AHT and 1490.36 ± 725.69 in fatal AHT.

Total cost for the care of all 14 patients was 665,467.98 Mexican pesos (71,249.25 international dollars). The amount paid to the institution for the care of the patients was 65,360.58 Mexican pesos, which means that 90.17 % (600,107.4 Mexican pesos) of the cost of care was subsidized.

The sensitivity analysis showed a difference ($p < 0.01$) in total cost of care between the different severity strata (Fig. 4).

Discussion

In this study, partial direct costs of the medical care involved with the care of patients with AHT are shown in a disaggregated way, unlike the analyses thus far referred (which describe them globally). This breakdown included the number of days of hospital stay, the required surgical procedures, the different laboratory and imaging studies and their number in these patients, as well as the number of specialists,

Table 3. Cost of the resources used in the medical care of 14 patients diagnosed with abusive head trauma during their hospitalization, at the moment of diagnosis*

Resource that generated cost	Moderate AHT		Severe AHT		Fatal AHT		Total	
	Media ± DE Median (min-max)		Media ± DE Median (min-max)		Media ± DE Median (min-max)		Mean ± DE Median (min-max)	
Cost of emergency department days of stay	1187.55 ± 1920.78 363.91 (0-4022)		2352.85 ± 3783.30 702.7 (0-8006.02)		3892.53 ± 2 416.88 3556.99 (1346.16-7244.46)		2679.77 ± 2792.49 1682.70 (0-8006.02)	
Cost of hospitalization area days of stay ^y	21 172.95 ± 6 012.70 22 582.24 (12 714-26 813.32)		36 748.34 ± 32 683.31 23 892.09 (14 054.17-85 155)		NA		16 548.94 ± 22 657.73 13 384.08 (0-85 155)	
Cost of PICU days of stay ^y	NA		13 410.57 ± 10 085.42 13 401.36 (1067.71-25 771.85)		NA		13 410.57 ± 10 085.42 13 401.36 (1067.71-25 771.85)	
Hospitalization total cost ^y	22 650.00 ± 6 786.35 24 988.80 (12 989-27 633.83)		52 803.15 ± 29 633.69 44 118.86 (278 447.04-94 527.86)		4174.55 ± 2421.21 3 844.87 (1622.79-7 526.02)		23 347.17 ± 25 540.37 17 925.28 (1 622.79 94 527)	
Cost of laboratory tests ^y	892.05 ± 397.59 819.00 (527-1 403.22)		23 517.73 ± 9465.91 22 007.41 (14 320.10-35 736.01)		4752.71 ± 3270.27 3 964.00 (1 568.94-10 918.01)		9011.10 ± 10 873.42 3 964.00 (527 35 736.01)	
Cost of imaging examinations	7175.56 ± 4953.61 5 289.18 (3617.25-14 506.64)		10 040.05 ± 6285.74 9 642.55 (3 784.78-17 092.11)		5372.96 ± 2294.97 4 633.97 (2 913.11-8260.19)		7221.57 ± 4563.76 5 389.29 (2 913.11-17 092.11)	
Cost of surgical procedures	3378.32 ± 3996.57 2 846.14 (0-7 821)		16 327.77 ± 12 522 18 253.53 (0-28 804.02)		242.68 ± 2 626.69 1292.99 (0-6580.05)		6505.74 ± 9187.69 2 838.03 (0-28 804.02)	
Cost of consultations with subspecialties	2911.96 ± 657.94 2958.95 (2101.81-3628.12)		3105.73 ± 692.99 2 786.88 (2708.91-4 140.27)		1490.36 ± 725.69 2 195.34 (1599.21-3131.04)		2684.45 ± 755.08 2 195.34 (1599.21-4140.27)	
Total cost of care ^y	37 012.95 ± 7154.87 35 818.00 (29 621-46 793.16)		105 794.88 ± 33 201.91 97 096.54 (77569.11-151 417.35)		18 595.04 ± 6424.47 17 880.42 (9186.85-26 406.01)		48 771.54 ± 41 778 32 487.72 (9186-151 417.35)	

*Expressed in Mexican pesos. AHT = abusive head trauma, PICU = pediatric intensive care unit, NA = does not apply. ^yThe cost was calculated with socioeconomic level 6 of the INP tabulator, which entails 100 % of each procedure.

^yKruskal-Wallis test to compare independent samples medians with statistical significance (p < 0.05).

Table 4. Cost of the resources used in the medical care of 14 patients diagnosed with abusive head trauma (AHT) during their hospitalization, at the moment of diagnosis*

Used resource that generated cost	Moderate AHT		Severe AHT		Fatal AHT		Total	
	Mean $\pm$ DE	Median (min-max)	Mean $\pm$ DE	Median (min-max)	Mean $\pm$ DE	Median (min-max)	Mean $\pm$ DE	Median (min-max)
^a Cost of emergency department days of stay	127.15 $\pm$ 205.65 38.96 (0-430.62)		251.91 $\pm$ 475.06 75.24 (0-857.18)		416.76 $\pm$ 258.77 380.83 (144.13-765.64)		286.91 $\pm$ 298.98 180.16 (0-857.18)	
^a Cost of hospitalization area days of stay ^b	2266.91 $\pm$ 643.76 2 417.8 (1 361.24-2 870.81)		3934.51 $\pm$ 3499.28 2 558.04 (1504.13-9 117.24)		NA		1771.84 $\pm$ 2425.88 1432.99 (0-9117.24)	
^a Cost of PICU days of stay ^c	NA		1435.82 $\pm$ 1079.81 1 434.81 (114.32-2 759.30)		NA		1435.82 $\pm$ 1079.81 1 463.03 (114.32-2 759.30)	
^a Hospitalization total cost ^d	2425.05 $\pm$ 726.59 2 675.4 (1 390.69-2 958.65)		5653.44 $\pm$ 3 172.7 4 723.5 (29 812.35-10 120.76)		446.95 $\pm$ 259.23 411.66 (173.75-7 805.78)		2 499.70 $\pm$ 2 734.51 1 919.19 (173.75-10 120.66)	
^a Cost of laboratory tests ^e	95.51 $\pm$ 42.57 87.69 (56.42-150.24)		2517.96 $\pm$ 1013.48 2 356.25 (1 533.20-3 826.13)		508.86 $\pm$ 350.14 424.41 (167.98-168.95)		964.79 $\pm$ 1 164.18 424.41 (56.42-3 826.13)	
^a Cost of imaging examinations	768.26 $\pm$ 530.37 566.29 (387.29-1 553.17)		1074.95 $\pm$ 672.99 1 032.39 (405.22-1 829.99)		575.56 $\pm$ 245.71 496.14 (311.90-884.39)		773.19 $\pm$ 488.63 577.01 (311.90-1829.99)	
^a Cost of surgical procedures	361.70 $\pm$ 427.90 304.73 (0-837.37)		1748.16 $\pm$ 1343.90 1 954.34 (0-3 083.94)		218.70 $\pm$ 281.23 138.44 (0-704.50)		696.55 $\pm$ 983.69 303.86 (0-3 083.94)	
^a Cost of consultations with subspecialties	311.77 $\pm$ 70.44 316.80 (225.03 388.45)		332.52 $\pm$ 74.20 298.98 (290.03-443.28)		159.57 $\pm$ 77.70 235.05 (171.22-335.23)		287.41 $\pm$ 80.84 235.05 (171.22-443.28)	
^a Total cost of care ^f	3962.84 $\pm$ 766.05 3 834.90 (3 171.41-5 009.97)		11 327.07 $\pm$ 3554.81 10 395.78 (8 305.04-16 211.71)		1990.90 $\pm$ 687.84 1914.39 (983.60-2 827.20)		5221.79 $\pm$ 4473.02 3 478.34 (983.51-16 211.71)	

*Expressed in international dollars, price by December 13, 2001 = 9.34 Mexican pesos. Exchange rate published by the World Bank.³¹

AHT = abusive head trauma, PICU = pediatric intensive care unit, NA = does not apply.

^bThe cost was calculated with socioeconomic level 6 of the INP tabulator, which entails 100 % of each procedure.^cKruskal-Wallis test to compare independent samples medians with statistical significance ($p < 0.05$).

mainly in critical medicine and neurosurgery, whose intervention is necessary. This explains why the cost of medical and surgical care it is that high.²¹⁻²⁴

Taking into account the severity of these patients' clinical presentation, prolonged hospitalization is explained, as well as the need for them to be cared for in the pediatric critical medicine department (emergency and intensive care areas) and that most of them require at least one surgical procedure, in which we agree with Miller and Peterson.^{22,24} In the children who survived, the severity of the condition determined hospital stay duration, which was longer in children with severe AHT.

In these patients, the establishment and surveillance of the metabolic condition and nosocomial infections explains the number of laboratory tests, which generates a high cost, especially when they are cared for in the PICU. Among the imaging studies, the performance of 32 cranial CT scans, 32 radiographs of different parts of the body and diverse ultrasounds stood out. All the studies were indispensable for the neurological, ocular and bone condition of the patients, as well as the aggression modality, to be specified.

The children underwent various surgical procedures, mainly cranial interventions, to solve the existence of depressed fractures, hematomas and hygromas.²⁴ The number of specialists that intervened in the care of these patients was important (an average of 7 per patient), which elevated the cost of their care.

The investigation of cases with AHT in our setting has been oriented towards specific knowledge of the fundamental characteristics in the medical pediatric, social and legal fields. In the clinical area, AHT-triggering factors, the severity of the clinical presentation, the studies required to specify the diagnosis and medical-social-legal management of each patient have been described.¹⁰

One aspect of this form of child abuse that has been studied in other countries is that related to specifying the cost required for the comprehensive management of patients who are AHT victims.^{23,32-34} Initial hospitalization costs reported by some researchers range from 18,000 to 70,000 dollars per child and average medical costs can exceed 300,000 dollars per child.³⁵ Medical and administrative costs required for long-term care exceed 300,000 and 1,000,000 dollars per case, respectively.³⁶ In Mexico, no study addressing the direct cost of the medical care of patients with AHT in a tertiary care pediatric hospital center had been carried out.

The severity of the clinical presentation of this modality of physical abuse requires attention in three specific hospitalization areas (emergency, PICU and hospitalization areas), the intervention of doctors with various specialties and the performance of very specific laboratory and imaging studies; therefore, only tertiary care pediatric hospital institutions can provide the comprehensive care this type of patients require, with the consequent economic impact for the institution. In addition to the above, if these children survive, they will have neurological, visual, auditory and osteoarticular sequelae of variable degrees and severity, which require specialized medical and paramedical care for a prolonged period, with the consequent economic burden for the family and the health sector. Although there are studies in other countries in this sense, no one completely covers the specific costs of immediate and long-term comprehensive care, since, in general, one or several situations of child abuse are analyzed.^{23,37}

The costs that have been able to be established in this study allow to show that the expenditure is rather elevated for our setting, as it occurs in other parts of the world, where the cost is established in dollars. Therefore, we insist on the relevance of supporting to the maximum the development of preventive programs for child abuse and specifically for AHT, since their application will surely be more profitable than to invest in the care and correction of the morbidity and mortality of these patients.

Study limitations

As mentioned in the methods section, the cost of medical care that was calculated for these patients included the most immediate complications (other diagnoses), which were not separately calculated and the cost of these diagnoses was attributed to the underlying diagnosis (AHT).

Since having uniform information on the follow-up of these patients in the consulted sources of information was not possible, a cross-sectional study was carried out, which is why the long-term cost could not be established. It is advisable for an analysis that includes follow-up to be performed in order to establish the probability of years of survival and the cost of the care of sequels.

The calculated costs do not reflect the national cost because the recovery fee tabulator of a tertiary care hospital such as the National Institute of

Pediatrics was used. Although it is pertinent to clarify that usually this type of patients are attended to at tertiary care institutions, owing the seriousness they arrive with at the moment of asking for medical care.

The complete analysis of the cost of an illness should ideally include direct, indirect and intangible costs; however, the present investigation was carried out focusing on prevalence rather than incidence,^{38,39} which includes the lifelong cost estimate. Carrying out this type of analysis in order to complete the economic panorama that represents this pathology is suggested, considering that in the past decades, health services production costs have increased, both in absolute figures per capita, and as a fraction of the internal gross product and in relation to inflation.⁴⁰

Conclusions

The direct economic cost of hospital care for the 14 patients diagnosed with AHT was high for our setting, although it is not comparable with those reported in the United States.

In general terms, it is closely related to the severity of the clinical presentation, which entails prolonged hospital stay, especially at critical medicine departments (emergency and intensive care areas), a significant volume of laboratory and imaging tests, and the participation of different specialists for its care.

The need to develop preventive programs is insisted on, considering that this pathology is preventable in 100 % of cases.

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