

Estimating the cost of treating patients with liver cirrhosis at the Mexican Social Security Institute

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Abstract

Objective. To estimate the annual cost of treating patients with cirrhosis at the Mexican Institute of Social Security (IMSS per its abbreviation in Spanish). **Material and Methods.** The annual cost of treating three stages of cirrhosis (Child-Pugh A, Child-Pugh B and Child-Pugh C) was estimated using micro-costing techniques and medical experts. These results were compared and contrasted with prices reported by IMSS. **Results.** The annual cost of treatment, in USA dollars, by Child-Pugh stage was: a) micro-costing results: \$1 110.17 stage A, \$549.55 stage B and \$348.16 stage C; b) opinion of medical experts: \$1 633.64, \$6 564.04 and \$19 660.35, respectively; and c) IMSS costs: \$4 269.00, \$16 949.63 and \$30 249.25, respectively. **Conclusions.** The cost of treating patients with cirrhosis is considerable, and costs increase as the disease worsens. Cost estimates vary depending on the source of information, and the methodology used. There are discrepancies between the procedures reported in medical records and treatment recommendations by IMSS liver experts.

Key words: costs and cost analysis; liver cirrhosis; Mexico

Quiroz ME, Flores YN, Aracena B, Granados-García V, Salmerón J, Pérez R, Cabrera G, Bastani R. Estimación de costos de la atención de pacientes con cirrosis hepática en el Instituto Mexicano del Seguro Social. *Salud Publica Mex* 2010;52:493-501.

Resumen

Objetivo. Estimar el costo anual de atención de pacientes con cirrosis hepática en el Instituto Mexicano del Seguro Social (IMSS). **Material y métodos.** Se estimó el costo de atención de la cirrosis en tres estadios de la enfermedad (Child Pugh A, Child Pugh B y Child Pugh C) mediante micro-costeo y consulta a expertos. Los resultados se compararon entre sí, y con los costos reportados por el IMSS. **Resultados.** El costo anual de atención en dólares por estadio fue: a) con microcosteo \$1 110.17 etapa A, \$549.55 etapa B y \$348.16 etapa C, respectivamente; b) mediante consulta a expertos \$1 633.64, \$6 564.04 y \$19 660.35, respectivamente; y c) con costos del IMSS \$4 269.00, \$16 949.63 y \$30 249.25, respectivamente. **Conclusiones.** El tratamiento de cirrosis es costoso y generalmente los costos aumentan al avanzar la enfermedad. Además, los costos varían dependiendo de la fuente de información y la metodología utilizada. Existen diferencias entre los procedimientos reportados en los expedientes clínicos y el tratamiento recomendado por los hepatólogos del IMSS.

Palabras clave: costos y análisis de costo; cirrosis; México

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The high incidence of, and mortality due to cirrhosis and other chronic liver diseases is a serious public health problem in Mexico. Cirrhosis and other liver diseases are the third leading cause of death in general, and the second cause of death among individuals aged 15 to 64 years.^{1,2} In 2008, there were 31 528 deaths attributable to liver disease in Mexico,³ and the mortality rate from cirrhosis was 25.9 per 100 000.¹ Although 75% of deaths due to cirrhosis in Mexico are male, this disease is also a significant cause of mortality for women. Cirrhosis and other chronic liver diseases were the sixth leading cause of death among women in 2007.⁴

Cirrhosis is the final stage of hepatocellular damage. The time frame and progression of the various stages of liver disease vary from person to person.⁵ If left undetected or not treated appropriately, chronic liver diseases can progress to cirrhosis and liver cancer.^{6,7} The prognosis for cirrhosis is based on the Child-Pugh scoring system⁸ in which cases of cirrhosis are classified as Child-Pugh A, B or C, based on specific clinical parameters. Class A patients are the least serious and mainly require outpatient attention, while class C patients require mostly inpatient care. The one-year survival prognosis is 100% for Child-Pugh A patients, 80% for Child-Pugh B, and 45% for Child-Pugh C.⁵ Treatment of class A patients requires fewer resources and thus costs less than treatment of Child-Pugh B and C patients.⁶

The treatment of cirrhosis and its complications is expensive, with costs increasing as the disease progresses. In the US, hospitalization costs for cirrhosis-related complications are estimated at \$18 000 dollars for each episode of care.⁹ Although cirrhosis is a very common disease in Mexico, there is a lack of information about treatment costs. For example, the Mexican Institute of Social Security (IMSS per its abbreviation in Spanish –one of the key institutions in the Mexican health system that provides health care services to approximately 43% of the population)¹⁰ does not have reliable information about treatment costs for specific diseases such as cirrhosis (communication with the IMSS Office of Costs, Goals and Budgets, Department of Planning and Finance, about the unitary costs of medical care at IMSS in February 2006). An objective of economic analyses is to identify and report the costs and resources used for different procedures so that decisions can be made about how to allocate limited resources.¹¹ Knowing the high medical and patient costs associated with cirrhosis and other liver diseases is important in order to quantify the corresponding economic burden of these pathologies.^{12,13}

The aim of this study was to estimate the annual cost and resources required to diagnose and treat cirrhotic patients from the perspective of IMSS. Base-case estimates were compared with two alternative estima-

tions: one using micro-costing results and the opinion of IMSS medical experts, and the other using prices reported by IMSS and the opinion of medical experts.¹⁴ The purpose of this comparison was to observe the variability of different sources of information and their impact on the cost of treating cirrhosis based on alternative scenarios. Identifying the cost of diagnosing and treating cirrhosis will help policy makers at IMSS decide how to allocate resources for this disease in a more effective and appropriate way.^{15,16}

Materials and Methods

Description of the study

The study design is retrospective and observational. The ethical committees of all participating institutions approved the study protocol and consent forms for this study. Resource consumption data and unitary costs to diagnose and treat cirrhotic patients were obtained from medical records and other sources. The study population consisted of all cirrhotic patients classified as Child-Pugh classes A, B, and C who were treated from January 1, 2005 to December 31, 2006 at the IMSS Hospital Liver Clinic in Cuernavaca, Morelos. Base-case estimates of treatment costs were determined using information from patient medical records and prices were calculated using micro-costing techniques.^{12,13} To account for the variability of costs and robustness of estimates, we compared the base-case results with other scenarios using different sources of information to determine resources used and unitary prices. The average annual treatment costs, which were initially reported in 2007 pesos, were adjusted for inflation and converted to 2009 US dollars.^{17,18}

Identification, measurement and valuation of costs

A guide was created to identify the quantity of resources used to diagnosis and treat patients with cirrhosis. The guide was based on published treatment recommendations^{19,20} and the results of a pilot study conducted by a physician (referred to herein as MEQ) in which she reviewed a sample of ten medical records. The following cost categories were identified: 1) medical visits, 2) emergency care, 3) hospitalization, 4) pharmaceuticals, and 5) diagnostics. Medical records were reviewed to measure the quantity of goods and services that were used to diagnose and treat cirrhotic patients, using a methodology that was previously used to review the medical charts of AIDS patients at IMSS.^{21,22} Unitary costs were calculated using a standard

micro-costing methodology,²³ the results obtained from a time and motion study and input prices from official IMSS sources.

MEQ reviewed the medical records of all patients who attended the IMSS Liver Clinic from 2005 to 2006 to collect information about diagnosis, treatment, duration of treatment, and resource allocation for each patient. Patients were selected based on the following inclusion criteria: (a) age 18 to 80 years; (b) a confirmed diagnosis of cirrhosis by the Liver Clinic Director (GC) and confirmatory liver function tests (such as a liver ultrasound, liver enzyme studies, and / or prothrombin time);^{24,25} and (c) having a complete medical record, with Child-Pugh classification. Less than 5% of the cirrhotic patients had a histological confirmation. This data was not available because in many cases, the risks of performing a liver biopsy outweighed the benefits and in most cases, a diagnosis of liver cirrhosis can be made without a biopsy.²⁶

The medical records of all cirrhosis patients (n = 141) were carefully examined to determine the exact quantity of resources used for their diagnosis and treatment. A total of 88 met the study selection criteria, of which 50 patients were classified as Child-Pugh class A, 35 as class B, and 3 as class C. The information from patient medical records was supplemented with data from other sources, including clinic file records, nurse reports and monthly laboratory reports.

Costs were determined by assigning unitary costs to the quantity of goods and services used. The unitary costs for the different cost categories were estimated using micro-costing techniques, which consist of measuring and appraising every resource required to produce a service or final good.²⁷ A time and motion study was conducted to identify the time, quantity, supply, labor, overhead, equipment, and capital costs associated with hospitalization services, emergency care, medical visits, pharmaceuticals, and diagnostics. The following procedures were used to determine the costs: recurrent cost prices were obtained from the IMSS price catalog;²⁸ personnel costs (physicians, nurses, specialists, etc.) were calculated by multiplying the hourly salary rate paid by the time spent treating patients;²⁹ the cost of human resources were based on payroll data reported by the Integrated Personnel and Payroll System (SIAP, or Sistema Integral de Administración de Personal) of the IMSS Personnel Department;²⁹ the number of working days was established as 30 days per month and 365 days per year for hospitalization, and 20 days per month and 240 days per year for outpatient care (such as gastroenterology and other specialty visits); unitary cost estimates for diagnostics included recurrent costs, capital costs, and overhead costs, and for medications we

only considered the cost of each dose and did not include other costs related to the hospital building, equipment, personnel, and storage.

Overhead costs (such as utilities and waste management) were calculated and then prorated based on the following: inpatient services were assigned 60% of these costs, and outpatient services were assigned 40%;²¹ the cost of autoclave and hazardous biological and infectious waste services were considered part of inpatient hospitalization services; the cost of furniture and medical equipment was estimated based on the prices IMSS paid to acquire them;³⁰ capital costs were based on the annual equivalent costs using a discount rate of 3% over 50 years.¹³

Cost analysis

Microsoft Access was used for data collection and Stata 9.1 for data analysis. The annual base-case cost estimates were calculated using information obtained from patient medical records and the unitary costs from micro-costing results. The base-case cost results were compared to two alternative estimates. Estimate 1 was calculated using the unitary prices obtained from the micro-costing results and the treatment recommendations reported by IMSS medical experts, and estimate 2 was obtained using prices reported by IMSS and the opinion of IMSS medical experts regarding the recommended treatment for patients with cirrhosis. Table I indicates the methods employed to determine the quantities and prices that were used to calculate the three estimates described above.

Two liver experts from IMSS were interviewed to obtain an alternative estimate of the types and quantity of resources used to diagnose and treat cirrhosis. Prior to the interviews, a list was prepared of all the procedures required for Child-Pugh A, B and C patients, including medical visits, referrals, laboratory analyses, hospitalizations, and emergency room visits. The medical experts estimated the inpatient, outpatient, and emergency room

Table I
METHODS FOR ESTIMATING QUANTITIES AND PRICES*

Methods for estimating quantities	Methods for estimating prices	
	Costs estimated by micro-costing	IMSS-reported prices
Patient files	Base-case scenario	
IMSS Medical Experts	Estimate 1	Estimate 2

* Mexican Institute of Social Security (IMSS), Cuernavaca, Mexico, 2005-2006

requirements for the diagnosis and treatment of cirrhosis patients during one year of follow-up. Experts were interviewed individually so that each could provide a description of the appropriate course of treatment for each class of cirrhosis patients. A single list of requirements was created by combining the information provided by the experts so that the final list included the quantity of treatments needed per year of follow-up for each class of cirrhosis patient. Unitary prices and the official cost of each service and treatment provided at IMSS (i.e., initial medical visit, subsequent visit, laboratory and clinical tests, emergency room services, and hospitalizations) were obtained from the Cost Center at the IMSS Department of Administration and Finance.

Results

A total of 56.8% of the patients were Child-Pugh A ($n = 50$), 39.7% class Child-Pugh B ($n = 35$), and the remaining 3.4% were Child-Pugh C ($n = 3$). The average age of the patients was 58 years (SD 10.2 years), with a slight difference in the average age of the patients depending on the Child-Pugh classification: 57.2 years (SD 10) for Child-Pugh A, 58.8 years (SD 11) for Child-Pugh B, and 61.6 years (SD 7.8) for Child-Pugh C. Approximately 60% of the patients were women.

Table II compares the cost estimates obtained using micro-costing techniques with those reported by IMSS for some of the main services required to treat cirrhotic patients. There are some important differences between these estimates. For instance, the micro-costing results for the cost to perform various laboratory tests varied from \$5.01 to \$24.70 dollars, compared to the fixed cost of \$5.33 dollars for all laboratory tests as reported by IMSS. The micro-costing results for the various types of medical consultations ranged from \$9.76 to \$13.55 dollars, compared to the fixed cost reported by IMSS of \$60.39 dollars for all medical consults. For hospitalization, the micro-costing result was \$78.32 dollars as compared to the reported IMSS cost of \$120.79 dollars.

As illustrated in Table III, the cost of treating patients with cirrhosis of the liver varies based on the Child-Pugh classification and the sources of information used to estimate the costs. The base-case cost estimates were consistently lower than the costs calculated using estimate 1 or estimate 2 methodologies. The highest costs were those obtained using the prices reported by IMSS and the opinion of IMSS medical experts (estimate 2). For Child-Pugh A patients, outpatient care represented the bulk of treatment costs (75%) for the base-case, 57% of total costs for estimate 1, and 46% of total costs for estimate 2; emergency room and hospitalization services were the most significant sources of costs for Child-Pugh B and C patients.

Table II
SELECTED MICRO-COSTING ESTIMATES VS COSTS
REPORTED BY IMSS*

	Micro-costing [‡]	IMSS Costs [§]
Laboratory tests		
Hematic cytometry	\$5.01	\$5.33
Blood chemistry	\$8.31	\$5.33
Serum electrolytes	\$9.85	\$5.33
Viral panel	\$24.70	\$5.33
Out-patient services		
Emergency room	\$13.55	\$60.39
Gastroenterology	\$13.38	\$60.39
Other specialty	\$9.76	\$60.39
Hospitalization		
Emergency room	\$78.32	\$120.79

* Data collected at the Mexican Institute of Social Security (IMSS), Cuernavaca, Mexico, 2005-2006
[‡] Costs in 2009 US dollars
[§] Costs reported by IMSS in 2009 US dollars

talization services were the most significant sources of costs for Child-Pugh B and C patients.

There are large differences between the results of the base-case cost estimation and the two alternative estimates. The base-case costs showed a drop in annual treatment costs as the disease advanced, with \$1 110.17 dollars for Child-Pugh A patients, \$549.55 dollars for Child-Pugh B, and \$348.16 dollars for Child-Pugh C. The estimates based on micro-costing results and the IMSS liver experts (estimate 1) indicated that treatment costs increased as cirrhosis progresses, with \$1 633.64 dollars for Child-Pugh A, \$6 564.04 dollars for Child-Pugh B, and \$19 660.35 dollars for Child-Pugh C. The estimates based on the costs reported by IMSS and the opinion of IMSS liver experts (estimate 2) also showed an increase as the disease worsened, with \$4 269.00 dollars for Child-Pugh A, \$16 949.63 dollars for Child-Pugh B, and \$30 249.25 dollars for Child-Pugh C (see Table III).

Table IV presents the annual cost estimates based on the micro-costing results and the opinion of IMSS liver experts (estimate 1), in greater detail. The cost of all services increased as the Child-Pugh classification worsened. For Child-Pugh A patients, out-patient clinical (\$655.73 dollars) and laboratory tests (\$182.64 dollars) were the most expensive procedures. For a Child-Pugh B patient, the greatest expenses were the cost of clinical tests during hospital stays (\$1 565.06 dollars) and the cost of a hospital day (\$1 008.07 dol-

Table III
COMPARISON OF THREE COST* ESTIMATES FOR OUT-PATIENT, EMERGENCY, AND HOSPITALIZATION SERVICES BY CHILD-PUGH CLASSIFICATION[‡]

	<i>Out-patient services</i>	<i>Emergency room</i>	<i>Hospitalization</i>	<i>Total</i>
Child-Pugh A				
Base-case estimate: micro-costing and medical records	\$837.22	\$136.60	\$136.35	\$1 110.17
Estimate 1: micro-costing and IMSS medical experts	\$937.06	\$375.68	\$320.90	\$1 633.64
Estimate 2: IMSS costs and IMSS medical experts	\$1 954.00	\$1 387.53	\$927.47	\$4 269.00
Child-Pugh B				
Base-case estimate: micro-costing and medical records	\$105.39	\$247.58	\$196.58	\$549.55
Estimate 1: micro-costing and IMSS medical experts	\$1 410.27	\$1 897.77	\$3 256.00	\$6 564.04
Estimate 2: IMSS costs and IMSS medical experts	\$2 610.38	\$3 767.24	\$10 572.01	\$16 949.63
Child-Pugh C				
Base-case estimate: micro-costing and medical records	\$79.09	\$114.70	\$154.37	\$348.16
Estimate 1: micro-costing and IMSS medical experts	\$2 628.07	\$4 145.09	\$12 887.19	\$19 660.35
Estimate 2: IMSS costs and IMSS medical experts	\$3 685.11	\$8 786.51	\$17 777.63	\$30 249.25

* Costs in 2009 US dollars

[‡] Data collected at the Mexican Institute of Social Security (IMSS), Cuernavaca, Mexico, 2005-2006

Table IV
ANNUAL COST ESTIMATES FOR OUT-PATIENT, EMERGENCY, AND HOSPITALIZATION PROCEDURES BY CHILD-PUGH CLASSIFICATION.*[‡] (ESTIMATE 1 CALCULATED USING MICRO-COSTING AND IMSS MEDICAL EXPERTS)

<i>Procedure</i>	<i>Out-patient services</i>		
	<i>Child-Pugh A</i>	<i>Child-Pugh B</i>	<i>Child-Pugh C</i>
Medical visit	\$98.69	\$291.72	\$845.49
Laboratory tests	\$182.64	\$233.18	\$344.47
Clinical tests	\$655.73	\$885.37	\$1 438.11
Total	\$937.06	\$1 410.27	\$2 628.07
<i>Emergency room services</i>			
Emergency room visit	\$26.78	\$66.92	\$80.31
Day in emergency room	\$156.64	\$783.21	\$1 409.77
Laboratory tests	\$97.43	\$334.37	\$510.20
Clinical tests	\$76.42	\$667.24	\$2 001.71
Medical referral	\$18.41	\$46.03	\$143.10
Total	\$375.68	\$1 897.77	\$4 145.09
<i>Hospitalization services</i>			
Hospital day	\$134.42	\$1 008.07	\$2 016.14
Laboratory tests	\$141.17	\$406.68	\$686.60
Clinical tests	\$26.90	\$1 565.06	\$1 898.68
Medical referral	\$18.41	\$276.19	\$8 285.78
Total	\$320.90	\$3 256.00	\$12 887.19

* Costs in 2009 US dollars. Mexican Social Security Institute, Cuernavaca Morelos, Mexico, January 1, 2005 to December 31, 2006

[‡] Data collected at the Mexican Institute of Social Security (IMSS), Cuernavaca, Mexico, 2005-2006

lars). For a Child-Pugh C patient, the most expensive service was the cost of medical referrals during a hospital stay (\$8 285.78 dollars), followed by the cost of a hospital day (\$2 016.14 dollars). The results of estimate 1 indicate that the annual cost to treat a Child-Pugh B patient was four times greater than that for a Child-Pugh A patient, and treating a Child-Pugh C patient was 12 times more expensive than treating a Child-Pugh A patient.

Table V reports the annual costs that were calculated based on prices reported by IMSS and the opinion of IMSS liver experts (estimate 2). As with estimate 1, the cost of all services increased as the Child-Pugh classification worsened. For Child-Pugh A patients, the cost of out-patient clinical tests was the greatest expense (\$1 309.21 dollars), followed by the cost of clinical tests performed in the emergency room (\$836.88 dollars). For Child-Pugh B patients, the greatest expenses were the cost of a hospital day (\$5 261.60 dollars) and the cost of clinical tests performed during hospital stays (\$4 159.38 dollars). For Child-Pugh C patients, the most expensive services was the cost of a hospital day (\$10 523.20 dollars) followed by the cost of emergency room clinical tests (\$5 173.55

dollars). The estimated costs to treat Child-Pugh A and B patients using the estimate 2 scenario were more than two times higher than the estimated costs obtained using the estimate 1 scenario.

Discussion

Our results indicate that the cost of treating cirrhotic patients varies by Child-Pugh classification. We hypothesized that the annual cost to treat a Child-Pugh A patient would be lower than the cost of treating a Child-Pugh B or C patient. This was found to be true for the two alternative estimates that were obtained, but not for the base-case estimate. According to the latter, the total annual cost to treat a Child-Pugh A patient was much higher than the cost to treat a Child-Pugh B or C patient. The fact that the cost of treatment actually declined as the disease progressed in severity leads us to conclude that the micro-costing estimates may not accurately reflect the true cost of treating cirrhotic patients at IMSS. Such estimates may not be as reliable because they were obtained using medical records, which may be incomplete or inaccurate due to the recordkeeping

TABLE V
ANNUAL COST ESTIMATES FOR SELECTED OUT-PATIENT, EMERGENCY, AND HOSPITALIZATION PROCEDURES BY CHILD-PUGH CLASSIFICATION.*‡ (ESTIMATE 2 CALCULATED USING IMSS COSTS AND IMSS MEDICAL EXPERTS)

Procedure	Out-patient services		
	Child-Pugh A	Child-Pugh B	Child-Pugh C
Medical visit	\$543.54	\$422.76	\$603.93
Laboratory tests	\$101.25	\$133.22	\$202.50
Clinical tests	\$1 309.21	\$2 054.40	\$2 878.68
Total	\$1 954.00	\$2 610.38	\$3 685.11
	Emergency room services		
Emergency room visit	\$120.79	\$301.97	\$362.37
Day in emergency room	\$245.13	\$1 225.63	\$2 206.14
Laboratory tests	\$63.95	\$213.15	\$319.73
Clinical tests	\$836.88	\$1 724.52	\$5 173.55
Medical referral	\$120.78	\$301.97	\$724.72
Total	\$1 387.53	\$3 767.24	\$8 786.51
	Hospitalization services		
Hospital day	\$701.54	\$5 261.60	\$10 523.20
Laboratory tests	\$79.93	\$245.13	\$420.98
Clinical tests	\$25.21	\$4 159.38	\$5,021.64
Medical referral	\$120.79	\$905.90	\$1,811.81
Total	\$927.47	\$10 572.01	\$17 777.63

* Costs reported by IMSS in 2009 US dollars

‡ Data collected at the Mexican Institute of Social Security (IMSS), Cuernavaca, Mexico, 2005-2006

practices at IMSS. Missing medical chart information could also be due to the fact that some cirrhotic patients at IMSS may miss or delay their treatment or seek medical care elsewhere. Another possible explanation is that the base-case estimates were calculated using a limited number of Child-Pugh B cases (n=35) and C cases (n=3).

In addition, cost estimates based on the prices reported by IMSS and the opinion of medical experts (estimate 2) were always greater than the base-case estimates and the estimate 1 scenario. This can be explained by the fact that these costs were estimated using prices that IMSS reported, which were generally much higher than the costs obtained by micro-costing. The results of both of the alternative estimates, which are based on the opinion of IMSS medical experts, do indicate that treatment costs increase significantly as patients progress from Child-Pugh class A to C.

By comparing three different scenarios, we were able to identify the strengths and limitations of the sources of data that were used to estimate costs. Our findings indicate that there are significant discrepancies between the treatment procedures reported in patient medical records and the treatment recommendations based on the opinion of IMSS liver experts. Cirrhosis patients at the IMSS hospital in Cuernavaca, especially Child-Pugh class B and C, are either not receiving the recommended course of treatment or their medical records do not accurately report the treatment they received. The base-case results probably underestimate the actual cost of treating cirrhosis patients at IMSS. Conversely, cost estimates calculated using the prices reported by IMSS and the opinion of IMSS medical experts (estimate 2) may overestimate the annual cost to treat cirrhosis patients at IMSS. This is because the prices IMSS reports for certain medical procedures are significantly higher than the costs that were estimated by micro-costing. The estimates obtained using the micro-costing results and the opinion of IMSS medical experts (estimate 1) may be the most appropriate and accurate due to the source of information used to calculate them.

Economic approaches have been used by other researchers who have investigated different populations and diseases to inform decision-making at IMSS, including the cost of breast cancer care at IMSS³¹ and the direct costs associated with the appropriateness of hospital stays in an elderly population.³² Other researchers estimated the cost of treating severe rotavirus,³³ hospital costs due to fractures in postmenopausal women,³⁵ the most cost-effective antibiotic treatment for acute and chronic rhino-sinusitis at IMSS,³⁶ and the medical cost of hypertension.³⁷ Due to the variation in the method-

ologies used for these studies, it is not possible for us to make comparisons between our cirrhosis cost estimate results and these other studies.

Another limitation of this study is the potential problem associated with the use of patient medical records to identify the costs and quantity of goods and services needed to diagnose and treat cirrhotic patients. Although we reviewed all cases of cirrhosis (n=141) diagnosed during a two year period, only 88 patient charts had complete data. Due to the limited number of Child-Pugh B and Child-Pugh C patients, and the likelihood of missing data from the medical records, our base-case cost estimates likely underestimated the actual costs of treating patients with cirrhosis at IMSS. A final limitation is that this study did not consider patient costs, which may include the cost to seek treatment at other medical institutions, including the private sector. Future studies should investigate the discrepancy between the recommended treatment for patients with cirrhosis and the actual treatment that these patients receive at IMSS.

Despite these limitations, this is the first study to estimate the cost of treating cirrhosis in Mexico. By taking into account the survival rate of patients with cirrhosis and the estimated cost of treatment for each Child-Pugh classification, we can calculate the approximate lifetime cost to treat a patient with cirrhosis at IMSS. The median survival of patients with compensated cirrhosis (Child-Pugh class A patients) is approximately 12 years and for patients with decompensated cirrhosis (Child-Pugh class B and C patients) it is approximately 5 years.^{5,37,38} If we assume that a patient with cirrhosis will spend 12 years in Child-Pugh class A at a cost of \$1 633.64 dollars per year, this represents a total cost of \$19 603.68 dollars. Assuming that this same patient will spend approximately 4 years in Child-Pugh class B at a cost of \$6 564.04 and 1 year in Child-Pugh class C at a cost of \$19 660.35 dollars per year, this represents a total additional cost of \$45 916.51 dollars. Based on these estimates, the lifetime cost to treat a patient with cirrhosis at IMSS is \$65 520.19 dollars.

Finding ways to prevent cirrhosis in Mexico is very important, especially as the rates of obesity, diabetes and other related metabolic disorders continue to increase. The fact that diabetes disproportionately affects the Mexican population is also relevant since several studies have shown that diabetes is associated with an increased risk of liver disease.³⁹⁻⁴¹ The incidence of, and mortality from cirrhosis could be greatly reduced through the use of effective primary, secondary, and tertiary prevention strategies⁴² which, in turn, would help reduce medical costs at IMSS.

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Declaration of conflicts of interest

We declare that we have no conflicts of interest.

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