

Estimated Direct Costs of Patients Hospitalized for Severe Acute Respiratory Illness in the Mexican Social Security Institute. Winter Season, 2013-2014

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Received date: September 08, 2014, Accepted date: January 05, 2015, Published date: January 12, 2015

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Abstract

Objective: To estimate the direct cost in patients hospitalized for severe acute respiratory infection, 2013-2014 winter season.

Material and methods: We analyzed data on all hospitalizations with severe acute respiratory infection (SARI) and laboratory-confirmed influenza and the days of hospital stay per patient were determined, according to the level of medical care; so the cost bed/day unit cost of 1) was added a query emergency, 2) a survey of basic clinical laboratory, 3) a chest radiograph, 4) antiviral treatment and 5) confirmatory laboratory diagnosis; by a rising cost of illness approach. Costs were converted to U.S. dollars.

Results: 13,242 cases were reported, of which 3,214 were excluded and removed, the universe of study was 10,028 inpatients. The costs in secondary care were \$874,848,088 (US\$66,608,910), while in third level was \$37,435,173 (US\$2,850,227), making the total cost was \$912,283,262 (US\$69,459,137). By delegation, there was heterogeneity in costs and days stay.

Conclusions: It essential to establish appropriate preventive interventions and perform a comprehensive patient care.

Keywords: Influenza; Direct costs; Cost of illness; Severe acute respiratory infection

Introduction

The influenza virus has an annual estimated attack rate of between 5% -10% in adults and 20%-30% in children; that can lead to management in hospital units and death especially among high-risk groups (extremes of life or chronically ill). Globally, it is estimated that these annual epidemics results in about 3 to 5 million cases of severe illness, and about 250,000 to 500,000 deaths [1].

It has been documented that not all influenza infections requiring hospitalization, however, generate significant economic and social burden [2,3]; so derived to analyze the cost of hospital care is important to assess the economic burden of this disease, providing them important for decision-making.

In Mexico, the influenza virus circulation is predominantly winter and has performed in cycles per genotype; in 2009-2010, 2011-2012 and 2013-2014, was the predominant circulating influenza A (H1N1) pdm09 [4], similar situation in the Mexican Social Security Institute (IMSS).

The IMSS, influenza pandemics have had substantial morbidity and mortality burden for several seasons after the initial pandemic waves continued vigilance is prudent; for example in winter 2011-2012, were total of 7,569 Severe Acute Respiratory Infection (SARI) hospitalizations and 443 in-patient deaths [5] and in the next season

were a total of 7,886 SARI hospitalizations and 529 inpatient-deaths; in that season, the progression of daily SARI hospitalizations exceeded that observed during the 2011-2012 A(H1N1)pdm09 epidemic [6].

Each year are published in Official Gazette called "Diario Oficial de la Federación" (DOF), unit costs by level of health care for the determination of tax credits derived from constitutive capital, wrongful registrations and attention not entitled to IMSS, which are dictated by the honourable Technical Council.

In the Institute, the influenza surveillance system operates in all medical units in the three levels of care (1,099 first-level units and 259 hospitals nationwide) [6], using the online reporting in real time through the platform called "Sistema de Notificación en Línea, para la Vigilancia Epidemiológica de Influenza" (SINOLAVE), giving information on the behaviour and epidemiological characterization of clinical cases in real-time. Also, the Institute participates with the Secretary of Health with sentinel surveillance is carried out in the "Unidades Monitoras de Influenza" (USMI) [7,8]. The Institute maintains its surveillance in all hospital units and the 2013-2014 seasons was considered of high circulation of influenza, our interest was to estimate the direct cost of hospitalized patients with SARI treated at the second and third care levels in this season, in order to know the economic impact of this disease entity generates in our Institution.

Material and Methods

We analyzed data on all hospitalizations with SARI and laboratory-confirmed influenza from a retrospective epidemiological surveillance system that was put into place especially for the 2009 influenza pandemic by the IMSS, which is a tripartite Mexican health system covering approximately 40% of the Mexican population comprising workers in the private sector and their families, with a network of medical units nationwide. The age and gender distributions of persons affiliated with the IMSS medical system are representative of the general Mexican population [6]. SARI was defined in a person with respiratory difficulty presenting fever 38°C and cough together with one or more of the following clinical symptoms: confinement to bed, thoracic pain, polypnea, or acute respiratory distress syndrome. Children under 5 years of age with pneumonia or severe pneumonia that required hospitalization were also considered as SARI cases. The SARI cases were obtained from SINOLAVE, version 3.0 [9] a total of 13,242 SARI hospitalizations, which were selected by date of hospital admission and had had the record of the date of hospital discharge, in order to determinate the length of hospital stay per patient, according to the level of care (secondary and tertiary level); this calculation measures of central tendency and dispersion were determined, either from the arithmetic mean was calculated two standard deviations to determine the maximum day stay and eliminated the extreme values. Also, the inconsistent and days above the average values were eliminated. The cost was determined from the cost day/bed for each case depending to the number of hospitalization days according to the level of care in accordance with "ACDO.SA3.HCT.200313/65.P.DF Agreement and Annex dictated by the H. Technical Committee at its meeting held on March 20, 2013, by which approves the Unit Costs by Level of Health Care 2013, Annex 1 (table containing the Unit Costs by Level Health Care for 2013 for the determination of tax credits derived from constitutive capital, wrongful registrations and care not beneficiaries) and Appendix 2 (calculation basis for the estimation of Unit Costs by Level of Health Care 2013)", published in the DOF on April 18, 2013 [10], further unit costs for each reported case of 1) care for a medical emergency consultation, 2) a study of basic clinical laboratory, 3) development of a chest radiograph were added 4) cost of a box of oseltamivir according to the procedure of public tender No. L19GYR047I75-11 by Headquarters and 5) costs of laboratory diagnostic tests. The cost estimate was disaggregated Delegation and age groups: <1, 1-9, 10-19, 20-59 and ≥60, as well as the number of days hospital stay. The method used was cost disease with a bottom-up approach of multi-attribute stated preference. United States dollars conversion was made in exchange rates and historical results of auctions from 15 October 2013 to 20 March 2014 published on the website of the Bank of Mexico [11], by obtaining the median arithmetic rate per day.

Results

In the winter season were notified 13,242 SARI cases, of which 2,965 cases had incomplete and/or inconsistent date records and 249 hospitalized in the first level were not considered cases, so the universe of study was 10,028 SARI cases (Figure 1). The costs in secondary care level were \$874,848,088 (US\$66,608,910), while in the tertiary care level \$37,435,173 (US\$2,850,227), so the total cost was \$912,283,262 (US\$69,459,137). It was noted that the determination of direct costs

was primarily based on the number of days stay and not to the number of reported cases, except: Chihuahua, Jalisco, Mexico East, West Mexico, Oaxaca, Querétaro, Sonora, Veracruz Northern, Veracruz Southern and Yucatán. Likewise, we observed five delegations (Colima, Chiapas, Morelos, Nayarit and Tabasco) had the lowest number of hospitalized cases, the costs were lower (Figure 2).

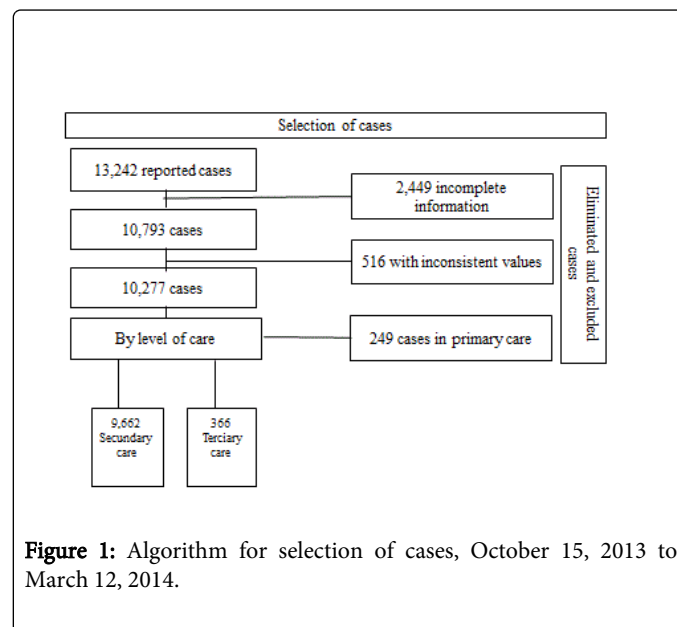


Figure 1: Algorithm for selection of cases, October 15, 2013 to March 12, 2014.

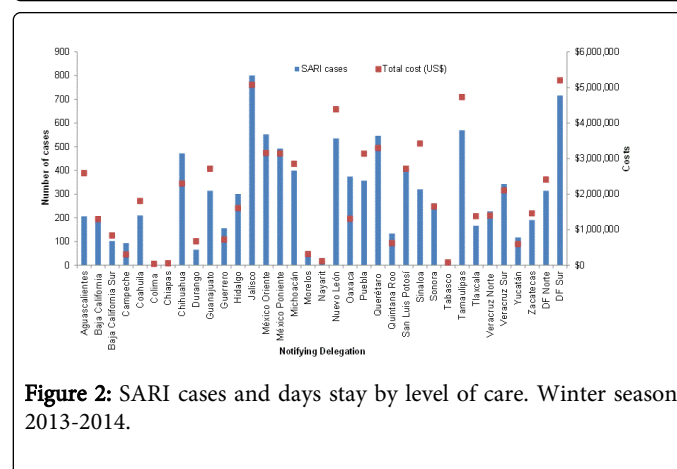


Figure 2: SARI cases and days stay by level of care. Winter season 2013-2014.

By age group, those aged 20 to 59 years were the most accumulated days stay with 76,168 days, followed by the group ≥60 with 41,886 days. However, disaggregated by level of care, children 1-9 years of age who received hospital care in tertiary care level were the second group most days (1,917), preceded the group of 20 to 59; while for the second level the groups 20-59 and ≥60, as the ages more days hospital stay. Also, as many cases were reported in tertiary care level group 20 to 59 years, followed by the group of 1-9 years. Given this, the greatest amount of direct costs was calculated in the group of 20-59 years of age for both levels of care. The lower direct costs in second care level were in the group of 10-19 years, while in tertiary care level older adults (Table 1).

Age group	General	Secondary care	Tertiary care
< 1	\$71,883,293 (US\$5,473,027)	\$68,010,559 (US\$5,178,166)	\$3,872,734 (US\$294,861)
1 to 9	\$113,930,379 (US\$8,674,395)	\$102,476,724 (US\$7,802,340)	\$11,453,655 (US\$872,054)
10 to 19	\$36,454,798 (US\$2,775,584)	\$31,740,644 (US\$2,416,659)	\$4,714,153 (US\$358,924)
20 to 59	\$445,863,941 (US\$33,947,049)	\$432,153,673 (US\$32,903,181)	\$13,710,268 (US\$1,043,868)
> 60	\$244,150,849 (US\$18,589,081)	\$240,466,486 (US\$18,308,562)	\$3,684,362 (US\$280,518)
Total	\$912,283,262 (US\$69,459,137)	\$874,848,088 (US\$66,608,910)	\$37,435,173 (US\$2,850,227)

&Expressed in Mexican pesos (USD).

Table 1: Costs& of SARI cases by age groups according to level of care. Winter season, 2013-2014.

The total number of days of stay was 149,500 in the second care level of attention and 6,344 days for the third level of care; in both levels the eighth and ninth day of hospital stay was the peak for hospitalized cases (Figure 3). The average days stay in second level was 15 (SD=11.6, range 0-53) and the third level was 17 days (SD=12.0, range 1-52).

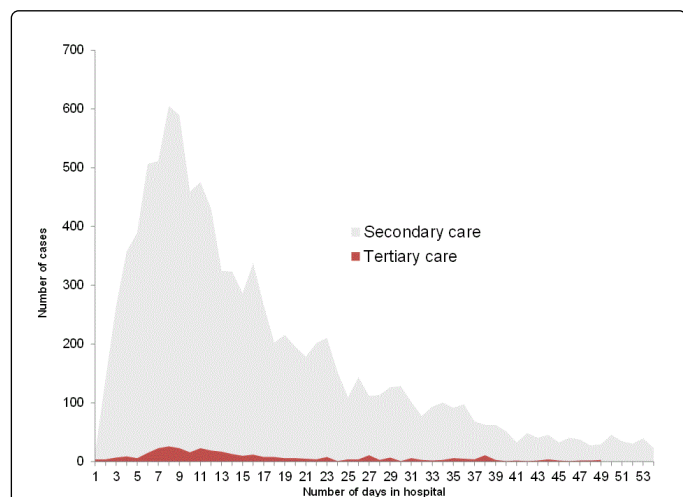


Figure 3: SARI cases and direct costs by Delegation. Winter Season, 2013-2014.

Discussion

In this study, the cost of medical care was estimated in each case by attributes SARI; which represent a decrease in the level of health, which means a loss for the affected person and with it to the lending Institution and society. The costs associated with influenza infection are of great magnitude [12], was evidenced in the present study with a total cost estimated at nine million of mexican pesos (69.4 million dollars); this total figure differs to that published in other countries; the estimated direct cost in United States was \$10.4 billion (95%CI 4.1, 22.2) [12]. However that study looked at 334,185 hospitalizations versus 10,028 hospitalized cases in our study. Similarly, the number of days stay was longer in this study of 3.1 million [12] while in the present study was 155,844 days/stay. Also, previous estimates were heterogenous [13].

Estimates costs in Asia were lower than in the America; in South Korea between 2009 and 2010 were US\$322,600,000 (29.6% of total costs) of the direct medical costs, with an additional US\$105.4 million (9.7% of total cost) of direct nonmedical costs [14]; in Bangladesh were US\$59 million (95% CI: 37-91) [15], in China, the average direct costs in patients hospitalized for SARI were US\$1,797 (80 to 27,545) [16], so that the figures estimated in countries Asians is similar to that obtained in the present study.

By age group, it was heterogeneous, for example in USA the cost of hospitalized patients over 65 years of age was higher [12]; similar situation in China [16], these was different with our results, where seniors were the second group generated more costs, indicated in young adults.

One group in particular have been children, the estimated annual direct cost of hospitalization in children under 5 years of age was between 44 and 163 million, with an average of US\$5,402 [17], these costs were lower than estimated, under-year with US\$5,473,027 and 1-9 years old US\$8,674,395; this situation could be in Mexico because those until 59 months old are a target group for influenza vaccination.

It was determined the attributes for diagnosis and therapeutic action, had the highest cost function day/bed of each patient; in this sense, it has been documented that the higher expenses for hospitalization in patients with SARI were diagnostic and therapeutic actions with 23% and 57%, respectively; and costs of physician services were lowest (<1%) [16], since the cost per diagnosis laboratory was \$8,448,231 (US\$643,228), which represented 0.93%, while antiviral treatment was \$4,177,363 (US \$318,054).

Our findings should be interpreted given the limitations of the study. It has been difficult to agree on monetary estimates because there are a wide range of different groups (suspected cases [14,15,18] and confirmed cases [16,19-22]); medical care (ambulatory [15], hospitalized [12,16-20,23-25] or both [14,26,27]); selection of units of study from hospital [12,16,18-20,23-25] to population [21,22]; type of estimate costs (direct [12,14,15,17,18,23,25,27] and indirect [12,15,18,23,24]); stay in intensive care unit [19,26]; use of mathematical modeling approaches [12,21] and the presence or absence of associated risk factors or the presence of infection related to health care or complications. In summary, the available studies assessing the impact globally or cost per patient, made through modeling or simulation, even in some cases specifically on specific populations or limited use secondary data and perspectives [27].

Other non-measurable elements in the present study that influence care costs were the pathogenicity and virulence of the influenza virus and the absence or delay of timely medical care and hospitalization conditions; late in outpatient care situations that may lead to complications that create the need for a diagnostic hospital management, culture and education of the person to not self-medicate and consult with physician and timely knowledge of the population on general measures of hygiene and alarm data.

Although, unit costs are published for all units of the country in the DOF [10], so the costs were based on existing amounts published in this study did not included other costs, for example symptomatic medicines and antibiotics; healing material, stay in intensive care unit, total number of clinical laboratory tests and imaging follow-up, as well as salaries of health personnel. So the estimate of the same would lead to a partial solution on changing welfare receiving the health service. Also, it is unknown if the total number of days each patient stay were completely attributable to the SARI, if added to it some associated health care infection modify this event.

Although these limitations, the IMSS is a tripartite Mexican health system covering approximately 40% of the Mexican population [6] so this can be considered representative study of the country.

Future work should include direct non-medical cost and indirect costs including transportation and lost productivity. To accurately measure the annual social and economic burden and impact attributed to influenza infections in Mexico, further investigation is needed on the cost of influenza related outpatient care and non-SARI influenza-related hospitalizations. Despite of that, the estimated costs associated with this disease; mainly derived from the costs of lost productivity, which are greater than those directly associated with health services utilization [12,18,28] and distribution costs was asymmetric, with extreme values corresponding to the high costs generated by patients with comorbidities or over 65 years; situation that was not calculated in the present study [23-25].

The estimated total cost was \$912,283,262 (US\$69,459,137) represented 0.19% of the total projected expenditure for 2014 in the IMSS, which was \$476,960,996,089 (US\$36,314,707,219) and 1.6% of curative care (US\$56,046,233,931) [29]. This study gave an overall dimension the direct costs of curative medical care SARI cases in a season high circulation of influenza viruses, so it is essential to establish appropriate preventive interventions and conduct a comprehensive patient care from primary care.

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