



## Direct Medical Costs Analysis of Covid-19 Patients in the Hospitals of Ilam University of Medical Sciences

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### ABSTRACT

**Background:** The most well-known classification of the cost of diseases is direct medical cost. The aim of this study is to investigate and analyze direct treatment costs of patients with Covid-19 by hospitals affiliated with Ilam University of Medical Sciences.

**Methods:** This was a descriptive-analytical, cross-sectional study performed retrospectively. The hospital expenditure information in Ilam province from March to October 2020 was used. Cost information related to all patients was collected and classified and reviewed using Excel 2016 software. The average direct treatment costs of hospitalized patients were also determined.

**Results:** The direct costs of treatment in hospitalized patients in Ilam were estimated at \$ 2349272.094 (98669427959 billion Rials). The per capita direct medical costs were calculated to be \$ 1228.056 (51578373 million Rials). The largest share of the cost related to pharmaceutical services and the share of basic insurance was equal to \$ 934.570 (39,252,109 million Rials).

**Conclusion:** Results of the study indicated that the treatment costs of patients entering Ilam province are high, and the highest cost concerns pharmaceutical services. Taking necessary measures to prevent and control the spread of coronary artery, using the most cost-effective drug interventions and reducing unnecessary hospital stays of patients can increase the efficiency of financial resources and reduce direct medical costs in Ilam province.

**Key words:** Covid-19, Direct costs, Hospital, ILAM

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## Introduction

On December 31, 2019, outbreak of a respiratory disease was reported in China (1). As a result, the world started to experience a pandemic known as Covid-19. The spread of such disease is critical to the international community and has been unprecedented over the past decades (2).

Covid-19 is the seventh coronavirus to infect humans and the third coronavirus to cause significant mortality and disability over the past two decades (3). In addition to causing death and disability, coronaviruses have come at a high economic cost.

The results of a 2004 study demonstrated that if SARS continued between 2003 and 2004, its global costs would reach more than \$ 40 billion (4). Moreover, a study of MERS disease costs in Saudi Arabia showed that the direct cost of treatment for each person varied from \$ 1248.41 to \$ 75987.95 depending on the severity of the disease (3).

Estimates suggested that the economic losses of Covid-19 in some countries ranged from \$ 283 billion to \$ 9170 billion (5). According to the World Bank report, this pandemic will lead to a reduction of 2.500 to 4.57 percent of the global exports and a decrease of - 2.09 to - 3.86 percent regarding the world economy (6). The International Monetary Fund also forecast that, as a result of this pandemic, the world economy will shrink by about 3 % and will be worse than the 2008-2009 financial crisis (7).

Disease-related costs are generally categorized in different ways. The most well-known classification is direct medical costs. These costs are directly related to the provision of medical services to patients and include costs incurred by health centers (hospitals, outpatient clinics), staff (physicians, nurses and other specialists), medical services, alternative and complementary care, and any medications taken (8). In other words, direct treatment costs are resources spent in the health sector during evaluation, treatment and follow-up services for patients (9). Examining disease cost information as well as analyzing it allows

managers and policymakers to make accurate comparisons between different uses of financial resources. They can use these analyzes as tools to track treatment patterns. Moreover, they can benefit from cost forecasting as well as issues related to measuring the efficiency and effectiveness of health services (10).

After 11 days from the official announcement of the release of Coronavirus disease in the country, in Ilam province, the first case was reported on March 31, 2020 (11). Ilam is one of the most deprived provinces in the country, with a lack of infrastructure and resources. It has constantly been faced health problems (12). According to the latest data from the Statistical Center of Iran in 1394, Ilam province, with 998 fixed beds, 602 active hospital beds and 9 hospitals, has approximately 0.700 % of active hospital beds and 1 % of the country's hospitals (13). Spatial analysis of health indicators in different cities of Ilam revealed that Ilam province is developing in terms of health indicators and deprivation (9).

As mentioned, Covid-19 in the country has imposed heavy costs on health sector, so, it is necessary to study and analyze these costs due to limited resources. Therefore, the aim of the present study was to investigate the expenditures and estimate the direct treatment costs of hospitalized patients with Covid-19 by hospitals affiliated with Ilam University of Medical Sciences.

## Materials and Methods

This was a descriptive-analytical, cross-sectional, and retrospective study which used hospital expenditure information in Ilam province from March to October 2020. In order to conduct the present study, all patients admitted to the hospitals of Ilam University of Medical Sciences with the main diagnosis of Covid-19 were examined. As a result, in this study, sampling was not performed and all patients were included in the study through a survey.

All financial information of these patients from admission to discharge was collected from the Hospital Information System (HIS) and studied to



estimate direct treatment costs. This information was divided into 9 groups according to the following formula (8):

Total direct medical expenses = (per capita cost of stay) + (per capita cost of medical visit and consultation) + (per capita cost of medicine and supplies) + (per capita cost of nursing services) + (per capita cost of imaging services) + (per capita cost of surgery) + (per capita cost physiotherapy and dialysis) + (per capita laboratory cost) + (per capita other services)

In general, Ilam province has 9 hospitals and medical centers affiliated with the University of Medical Sciences (Table 1). 3 hospitals are located in the center of Ilam province and other hospitals are active in other cities of the province. In order to conduct the present study, the authors first received the code of ethics for the research plan and the necessary correspondence. Then, the information of treatment costs related to hospitalized patients in the studied period was classified for each hospital and examined using Excel 2016 software. Comparison was made, and finally, the average direct costs in hospitalized patients with the main diagnosis of Covid-19 in the province was determined. In addition, costs were calculated based on purchasing power parity (PPP) 2020, adjusted by, equivalent 42000 Rials per 1 dollar (14).

This study was taken from the research project "Calculating the Economic Burden of Covid-19 in the hospitals of Ilam University of Medical Sciences" with the code of ethics "IR.MEDILAM.REC.1399.087". It has been approved by Ilam University of Medical Sciences.

## Results

From March to the end of October 2020, a total of 1913 patients with the main diagnosis of Covid-19 have been admitted to the hospitals of Ilam University of Medical Sciences. 1020 male and 893 female patients were admitted during this period. The frequency distribution of these patients, by gender and city, is presented in the diagram.

The total number of services provided to

patients admitted to Ilam hospitals was 700,127,000. The highest number of services were provided in Shahid Mostafa Khomeini Hospital in (467552) and the lowest number belonged to Ayatollah Taleghani hospital in Ilam (3765). The highest amount of services were provided in Ilam city (87 %) and the lowest (1 %) were in Sarableh city.

The total expenditure related to the provision of inpatient services in Ilam was 2349272.094 \$ (98,669,427,959 billion Rials)<sup>1</sup>. The largest share was for Shahid Mostafa Khomeini hospital in Ilam which was 1594732.450 \$ (66,978,762,967 billion Rials). The total cost of hospitalization divided by hospitals in Ilam province is presented in Table 2.

The highest hospitalization expenses were related to the city of Ilam and amounted to 1964439.480 \$ (82,506,458,170 billion Rials). Imam Ali hospital in Sarableh, with the amount of 23055.980 \$ (968,351,427 million Rials), had the lowest cost of inpatient services.

The average direct costs of treatment for hospitalized patients, based on the nine cost divisions in the present study, are presented in the table below. The results of expenditure classification revealed that the highest cost was for medicine and consumables, and the lowest cost related to physiotherapy and dialysis services.

Insurance costs 1787840.110 \$ (75,089,284,981 million Rials) accounted for the largest share (76 %) of total hospitalization costs. The share of out-of-pocket payment expenses was 281364.100 US Dollar (11,817,292,388 billion Rials), equivalent to 12 % of the total medical expenses. Government subsidies 215160.210 \$ (9036729228 million Rials) accounted for approximately 9 % and supplementary insurance 64907.650 \$ (2726121362 million Rials) for 3 % of direct medical expenses.

Per capita costs of inpatient services for patients with Covid-19 in hospitals affiliated with Ilam University of Medical Sciences, based on information on the total costs incurred, insurance costs and out-of-pocket contributions of patients

<sup>1</sup> Official exchange rate (LCU per US\$): 42000



are presented in Table 2.

Based on the results of this study, the per capita direct costs of treatment in the city of Ilam

amounted to 122.800 \$ (51,578.370 million Rials).

The largest share of these costs was related to basic insurance.

**Table 1.** Distribution of hospital centers of Ilam University of Medical Sciences

Hospital	County
Mustafa Khomeini	Ilam
Imam Khomeini	Ilam
Ayatollah Taleghani	Ilam
Valiasr	Darrehshahr
Shohada	Dehloran
Rasul Akram	Abdanan
Imam Reza	Ivan
Imam Ali	Sarablah
Imam Hussein	Mehran

**Table 2.** Frequency distribution of patients' hospitalization costs in hospitals of Ilam University of Medical Sciences

Hospital	Direct costs (Rial)	Percent
Mustafa Khomeini	66978762967.00 (1594732.45 \$)	68
Imam Khomeini	14.987.276.15 (356839.90 \$)	15
Shohada	4589498755.00 (109273.77 \$)	5
Valiasr	4347087194.00 (103502.07 \$)	4
Imam Reza	2368690468.00 (56397.39 \$)	2
Imam Hussein	2285547239.00 (54417.79 \$)	2
Rasul Akram	1603794706.00 (38185.58 \$)	2
Imam Ali	968351427.00 (23055.98 \$)	1
Ayatollah Taleghani	540419049.00 (12867.12 \$)	1
Total of direct costs	98669427959.00 (2349272.09 \$)	100

**Table 3.** Direct treatment costs by types of costs

Type of cost	Total cost (Rial)	Mean of cost (Rial)
Drugs and supplies	35313698490 (840802.34 \$)	18459853 (439.52 \$)
Stay	32723349900 (779127.37 \$)	17105776 (407.28 \$)
Visits and consultations of Doctors	14212716165 (338398.00 \$)	7429543 (176.89 \$)
Surgery	1737203107 (41361.97 \$)	908104 (21.62 \$)
Nursing services	1794185950 (42718.71 \$)	937891 (22.33 \$)
Imaging	1015864861 (24187.25 \$)	531032 (12.64 \$)
Physiotherapy and dialysis	291517930 (6940.90 \$)	152388 (3.62 \$)
Laboratory	8890891556 (211687.89 \$)	4647617 (110.65 \$)
Other services	2688369394 (64008.79 \$)	1406168 (33.48 \$)
Total direct costs	98669427959 (2349272.09 \$)	51578373 (1228.05 \$)

**Table 4.** Per capita direct costs of treatment for patients hospitalized with Covid-19 in Ilam

Expenditures	Per capita (Rial)
Direct costs	51578373 (1228.05 \$)
Basic insurance	39252109 (934.57 \$)
Disease	6177361 (147.08 \$)
Government subsidy share	4723825 (112.04 \$)
Complementary insurance	1425050 (33.92 \$)

## Discussion

The aim of this study was to estimate the average direct treatment costs of patients admitted to Ilam University of Medical Sciences with coronavirus infection. The results of this study

demonstrated that the average direct treatment costs of Covid-19 patients in Ilam province was 51,578,373. Due to the limited financial resources of the health system and the conditions created by the outbreak of Covid-19 for the economies of the



world and Iran, researchers around the world have identified and examined the dimensions of medical expenses of patients in different countries.

In the United States, direct medical cost was estimated regarding both hospitalization and the one-year post-hospitalization. The average cost of hospitalization was \$ 14,366. These costs have increased to \$ 18579 thousand during the year after the patients' discharge (15). Per capita direct medical spending in China in the first three months of 2020 was estimated at \$ 25,578,000 (16). Indirect medical costs in Iran for intensive care units were estimated at \$ 2979, and in general, the care units at \$ 13267 thousand (8).

In Iran, declining revenues due to global fall of oil prices, harsh sanctions, lack of access to some drugs and medical equipment, and the economic downturn caused by quarantines, severely limited the health system's financial resources. Accordingly, controlling the costs of treatment of this disease in Iran in this complicated situation is much needed (8).

The first project in Iran to study the costs of treatment regarding this disease was the one by Ghaffari Darab. In this study, which was conducted in Fars province, the author estimated the per capita direct medical costs which were 59,203,409 Rials. The results of this study are very close to the results of the present study and are in line with its findings (8).

In China, the results of a study suggested that the total cost of treating patients with Covid-19 as of March 2020 was \$ 0.620 billion. In this study, costs were calculated by province. The results showed that pharmaceutical costs accounted for the largest share of medical expenditures in China (17).

In general, in the hospitals affiliated with Ilam University of Medical Sciences, the highest expenditures were related to medicine services and consumables, stay and visits. Pharmaceutical services in most centers were the most expensive. Therefore, pharmaceutical services can be considered one of the key elements of the costs by the health policymakers of the province. The management of these services causes the medical expenses of Ilam University of Medical Sciences

to be largely controlled.

Out-of-pocket contributions to university hospitals accounted for 12 % of the total expenditures. In some centers, out-of-pocket payments had been more than 10 percent. Some of the services provided at these centers have were not covered by insurance and government subsidies. Consumption patterns and consumer services in these centers should be examined to identify services and departments with high out-of-pocket payments. The sharp decline in hospital revenues and the consequent limited financial resources of the University of Medical Sciences indicated the need to address these issues (18).

### Conclusion

The high cost of diagnostic services in some city centers of the province suggests the lack of attention to the principles of health economy. Health resources in these centers are spent on diagnostic services, while the managers of these centers must, in the current critical situation, direct financial resources and limited equipment and facilities toward the most effective interventions. Wrong patterns in the consumption of medicines and services both impose financial pressure and a high share of out-of-pocket payments and waste the limited financial and structural resources of the province that should be spent on the most efficient sectors and services.

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### Conflict of interests

The authors declared no conflict of interests.

### Authors' contributions

Karimi F, Sadeghifar J, Ezzati F M and Dragahpour M designed research; Karimi F and Bazyar M conducted research; Karimi F and Ezzati F analyzed data; and Karimi F and Dargahpor M wrote the paper. Karimi F and Dargahpor M had primary responsibility for final content. All authors read and approved the final manuscript.



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