Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original Article/Research

Direct and indirect cost of COVID-19 patients in Iran

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ABSTRACT

Objectives: This study aimed to estimate the cost of COVID-19 patients and some affecting factors in Iran.
Methods: This was a prevalence-based cost-of-illness study based on a bottom-up costing approach which was conducted from March 2020 to July 2020. Data were extracted from the hospital's Hospital Information System (HIS) and Cost-of-illness (COI) assessment checklist. Indirect costs were assessed based on the Human Capital Approach. Data were analyzed using SPSS software version 22 and Microsoft EXCEL 2016.
Results: A total of 745 Covid-19 patients were included in the analysis. The mean total cost was estimated at 8813.15 (PPP, Current International $), accounting for 60% of GDP per capita. The mean direct and indirect cost was 3362.49 (PPP, Current International $) (38% of the total cost and 23% of the GDP per capita), and 5450.66 (PPP, Current International $) (62% of the total cost and 37% of the GDP per capita), respectively. The mean hospitalization cost was higher among patients who died and those who were covered by supplemental insurance. Also, the costs of disease experienced a dramatic rise with increasing age. For different scenarios in terms of outbreak rate, hospitalization rate and mortality rate, the total estimated cost of illness for Covid-19 ranged from 6263 million (PPP, Current International $) to 63,474 million (PPP, Current International $).
Conclusions: Covid-19 imposes a substantial financial burden on people, health care systems, insurance organizations and the country's economy as a whole. Since the economic burden of this disease increases dramatically by increasing disease outbreak, more attention should be paid to the development and implementation of appropriate preventive programs.

Introduction

Coronavirus disease 2019 (COVID-19) is the most dangerous and deadly outbreak in the last hundred years [1]. Owing to the rapid increase in the number of infections across the world, the WHO declared Covid-19 as a pandemic in March 2020 [2]. According to global statistics, there have been so far 153,598,296 cases and 3218,287 deaths in 222 countries (5/3/2021) [3].

Covid-19 has had massive impacts on countries' health, society, communications, politics and even the economy [4]. This virus, undoubtedly, is causing the most severe economic crisis after the great recession of the 1930s [5]. The economic crisis has a negative impact on health and reduces the available financial resources for public health countermeasures needed to control the epidemic [6]. This pandemic is a health crisis that is damaging the world economy and is causing the most severe losses to the economies of many nations [7]. A large number of people has lost their jobs due to the pandemic. Many economic and social sectors are indirectly affected by the Covid-19. Some of the business sectors, which the pandemic has already impacted, include general transport, general insurance, manufacturing and some form of

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healthcare [7]. The results of a study in the U.S.A indicated that approximately 50% of participants reported income and wealth losses due to the coronavirus, with the average losses being $5293 and $33, 482, respectively [8]. A study in Russia showed that the socioeconomic burden of COVID-19 would amount to 4.6 trillion rubles ($71.1 billion) or 4% of GDP [9].

Prevention and treatment of COVID-19 can impose a considerable economic burden on many people and societies. According to previous studies [10,11], all confirmed cases of Covid-19 should receive inpatient care. Furthermore, Covid-19 patients often require costly treatment such as mechanical ventilation and extracorporeal membrane oxygenation, potentially considerably increasing healthcare costs [11].

A study in the U.S.A (2020) indicated that a single symptomatic Covid-19 infection accounted for a median of $3045 direct medical costs. They also reported that Covid-19 coronavirus in the U.S.A could result in direct medical costs incurred during the infection from $163.3 billion if 20% of the population infected to $654.0 billion if 80% of the population infected [12]. In a study in China, the total estimated healthcare and societal costs associated with Covid-19 were US$ 0.62 billion and US$ 383.02 million, respectively [11].

Iran is a country located in the Middle East, with a population of 83 million (2020). Population ages 65 and above (% of the total population) is 6.3% [13]. The median age and Life Expectancy (LE) (BOTH SEXES) in Iran in 2020 was 32.0 years and 77.3 years, respectively [14,15]. GDP per capita, (PPP, current international $) was estimated at 12,937.5 (2019) [16]. Current health expenditure (% of GDP) is 8.6% [17]. So far, there have been 5055,512 cases and 108.988 deaths caused by the Covid-19 in Iran (9/3/2021). Iran ranked 86th and 54th out of 222 countries in terms of the total number of confirmed cases and deaths per million, with 29,862 cases and 854 deaths per million populations, respectively. Further, the country currently ranked 14th and 12th worldwide in terms of total cases and deaths, respectively (May 2, 2021) [3].

With a growing incidence and mortality rate related to Covid-19, health systems in most countries, especially those in developing countries, which have fragmented health systems with poor population health outcomes [18], are facing many challenges in terms of preventing disease transmission, diagnosing new cases and providing care [19]. The estimation of coronavirus disease burden on the health system can not only assist policymakers in effectively allocating resources and prioritizing various measures but also can emphasize the importance of long-term planning for sustainable financing in similar conditions in future. To the best of our knowledge, very few studies have estimated the outpatient costs of COVID-19. This study, therefore, aimed to estimate the costs of patients with Covid-19 and the factors affecting it in Iran.

Methods

This was a prevalence-based cost-of-illness study, using a Bottom-Up approach performed in the Vali-e-Asr Hospital affiliated to Birjand University of Medical Sciences from March 2020 to July 2020. The sample size included all hospitalized patients with a definite diagnosis of Covid-19 (patients whose disease was confirmed by the Covid-19 PCR test) who were selected using the census method.

In this study, we mainly focus on direct and indirect costs. The direct costs consist of medical costs and non-medical costs. The former includes medical care expenditures for diagnosis, treatment, and rehabilitation, etc., while the latter includes the consumption of non-healthcare resources like commuting costs, food costs and accommodation costs. Indirect costs include lost productivity due to premature deaths and missed workdays.

Direct medical costs attributable to hospitalization were extracted from the electronic patient record through the Hospital Information System (HIS) (Appendix 1). Direct medical costs related to outpatient and direct non-medical costs and lost productivity due to missed workdays were collected via the COI assessment checklist, which was designed by a team of authors after a rigorous literature review. The checklist consisted of demographic variables (gender, age, monthly income, job status, supplemental insurance status, and the type of basic insurance), questions related to outpatient costs (9 items), direct non-medical costs (3 items) and indirect costs (2 items). The checklist was completed via a telephone interview with patients and their family members. In our study, outpatient costs consisted of two parts: 1) outpatient diagnostic costs incurred out of the hospital (e.g. diagnostic test, CT Scan and radiology) and 2) post-discharge care costs (e.g. visit, oxygen capsule rental, medicine, physiotherapy, nurse for injection at home, complementary therapies and traditional medicine) (Appendix2).

In our study, indirect costs were estimated based on the Human Capital Approach. This cost was calculated as follows, 1) lost productivity from missed workdays for patients and their family caregivers due to Covid-19 and 2) lost productivity due to premature death from Covid-19. To estimate the cost of lost productivity, the number of missed workdays for patients and caregivers was calculated through the designed checklist. Furthermore, the average missed workdays was multiplied by wage rate (the average wage rate was calculated using a checklist), and through this, indirect costs arising from missed workdays were estimated. After that, the total number of missed years due to premature death was calculated by subtracting the age of premature death from retirement age (60 years old) and then was multiplied by the average annual income and, by this way, the cost of premature death was calculated. Finally, the total lost productivity was obtained by summing these two parts.

The equations used for calculating indirect costs are as follows:

1 Lost productivity due to missed workdays = the mean (patients missed workdays + patient family's missed workdays) * average daily wage rate
2 Lost productivity due to premature death = the mean {(retirement age-age at premature death) * (the number of patients who died /sample size)} × (average daily wage rate * the number days of the year)
3 Total Indirect costs = the cost of lost productivity due to missed workdays + The Cost of lost productivity due to premature death

Statistical analyses were conducted using SPSS software version 22 and Microsoft EXCEL 2016. Mean ± SD Standard Deviation was used to estimate the costs of the disease. Non-parametric tests (Mann-Whitney or Kruskal-Wallis) were used for the inferential analysis. The univariate and multivariate linear regression models were used to examine the association between variables and hospitalization costs. This model is proper to describe, estimation and prognostication the relationship between a continuous variable (dependent variable) and continuous or category variables (independent variable). As Cost-of-Illness (COI) data are continuous variables, we used this model. In our study, independent variables were: gender, disease outcome, type of insurance, supplementary insurance coverage, age, job income; and dependent variables were: direct medical costs. Variables with p-values of < 0.20 were included in the Multiple Linear Regression model. All costs in this study were adjusted to current international dollars based on the World Bank's purchasing power parity (PPP) conversion factors [20]. Sensitivity analysis was carried out for outbreak rate, hospitalization rate and mortality rate. The total economic burden in Iran for different scenarios is predicted as follows: 3%, 5%, 7%, 10% for outbreak rate, 15%, 20%, 30%, 35%, 40%, 45% for hospitalization rate and 5%, 7%, 11%, 13%, 15% for mortality rate.

Results

The demographic and socioeconomic characteristics are shown in Table 1. A total of 745 hospitalized patients with Covid-19 were included in the analysis. The mean ±SD age of patients was estimated at

Table 1
Demographic characteristics of patients.

Variables	Mood	Frequency (Percent)	Mean± SD	Z	P-Value
Outcome	**Discharge**	671(90.1)	29,478,214.10±36,469,127.16	−8.38	< 0.001
	Death	74 (9.9)	79,166,809.47±89,501,661.68		
Supplemental insurance	**Yes**	44 (5.9)	59,722,129.72±67,367,535.61	−3.95	< 0.001
	No	701 (94.1)	32,825,180.96±44,965,400.29		
Type of insurance	**Iranian health insurance**	332 (45.5)	35,425,945.90±48,036,816.26	7.36	.061
	Social security	251 (34.4)	33,358,209.34±40,766,918.19		
	Armed force	117 (16.0)	30,684,937.81±31,588,819.33		
	Not covered	30 (4.1)	27,915,773.66±30,797,808.66		
Gender	**Male**	402 (54.0)	35,614,479.60±49,723,266.00	−0.36	.719
	Female	343 (46.0)	33,006,427.88±43,519,527.22		
Age	**<40years**	195 (26.2)	23,049,601.18±32,275,461.65	86.22	< 0.001
	40–60 years	239 (32.1)	30,952,177.67±42,952,135.61		
	>60years	310 (41.7)	44,273,535.82±55,181,106.21		
Job-status	**Housewife**	243 (32.6)	32,300,847.75±23,444,744.49	18.41	< 0.001
	Farmer	69 (9.2)	22,466,419.52±9,823,686.14		
	Retired	100 (13.4)	37,892,121.06±30,295,981.97		
	Employee	150 (20.2)	29,116,456.34±53,785,182.70		
	Self-employed	183 (24.6)	26,131,430.88±21,967,787.46		
Income status	**<40,000,000 Rial**	441(59.19)	34,657,549.10±49,250,987.95	−1.42	.15
	>40,000,000 Rial	304 (40.81)	25,226,032.24±24,503,680.20		

54.95±18.93 years, and 41.7% were aged over 60 years. 54% were men. The mean± SD monthly income of most participants was 34,657,449.10±49,250,987.95 Rials (PPP). The mean length of hospital stay was 6.8 ± 5.28 days.

As shown in Table 2, the mean total cost of patients with Covid-19 was estimated at 8813.15±3388.58 PPP. The mean± SD of total direct cost incurred by patients due to Covid-19 was 3362.49±2853.89 PPP (38% of the total cost and 23% of the GDP per capita) (GDP per capita= 5219.11 (2017)). The mean± SD direct medical cost of treating Covid-19 patients was 3212.14± 2768.10 (PPP) (95% of the total direct cost), with 30% (953.43) of this cost attributed to hospital bed day. The mean± SD direct non-medical cost was estimated at 150.35±167.88 (PPP) (5% of the total direct cost).

The mean total indirect costs were estimated at 5450.66 PPP (62% of the total costs and 37% of the GDP per capita). The mean total missed workdays was estimated at 44.66±19.29, 27.31± 14.1days for patients and 15.74±6.57 days for family caregivers. The mean cost of productivity lost days due to COVID-19 in patients, and their family caregivers were 4787.68±2068.32 (PPP) (88% of the total indirect cost), and the mean cost of premature death due to COVID-19 was 662.98±332.82 (PPP) (12% of the total indirect cost).

The mean total hospitalization costs of COVID-19 patients were 2634.79±3595.05 (PPP), making up 82% of the total direct medical costs. The mean hospitalization cost for patients who died was 2.6 times higher than those who were discharged ($P < 0.001$). Furthermore, the mean hospitalization cost among insured patients was 1.8 times higher than uninsured patients ($P < 0.001$). A statistically significant difference was revealed between hospitalization costs and the age of patients. According to the Kruskal-Wallis test, the mean hospitalization cost in each age group increased 1.4-fold with increasing age compared with

Table 2
mean± SD of cost items in Covid-19 patients.

Variable	Rial		Current international $	
	Mean	SD	Mean	SD
Hospitalization costs				
Diagnostic	5,617,765.70	6,000,574.30	430.11	459.42
Visit	5,821,511.03	7,369,065.36	445.71	564.19
Others	2,210,478.14	6,789,772.63	169.24	519.84
Medicine	7,563,714.95	21,214,416.15	579.09	1624.22
Nursing services	747,184.28	807,435.36	57.21	61.82
Hoteling	12,453,071.46	13,457,256.12	953.43	1030.32
Total hospitalization costs	**34,413,725.59**	**46,956,042.62**	**2634.79**	**3595.05**
Health insurance contribution	28,727,165.28	38,874,597.24	2199.41	2976.32
Patient contribution	4,999,784.321	12,091,314.73	382.79	925.74
Outpatient costs				
Diagnostic	2,608,862 0.96	4,355,602.78	199.74	333.47
Visit	1,049,395 0.38	1,899,419.26	80.34	145.42
The cost of renting a portable oxygen	615,645.16	4,600,078.19	47.14	352.19
Medicine	2,465,443.53	6,506,074.07	188.76	498.12
The cost of home nursing care for injections	461,290.32	6,380,952.29	35.32	488.54
Complementary therapies and traditional medicine	340,282.25	1,577,017.22	26.05	120.74
Total outpatient costs	**7,540,919.46**	**12,636,720.65**	**577.35**	**967.49**
Total medical costs	**41,954,645.05**	**36,154,917.67**	**3212.14**	**2768.10**
Direct nonmedical costs	1,963,829.787	2,192,717.743	150.35	167.88
Total Direct costs	**43,918,474.837**	**37,275,552. 43**	**3362.49**	**2853.895**
Indirect costs				
Cost of missed workdays (families' patient)	22,037,037.03	9,206,471.15	1687.20	704.87
Cost of missed workdays (patient)	38,234,677.41	19,749,449.003	2927.33	1512.06
Costs of missed workdays	62,533,333.33	27,014,921.80	4787.68	2068.32
Cost of premature death	8,659,328.859	4,347,012.226	662.98	332.82
Total Indirect costs	71,192,662.18	31,361,934.02	5450.66	2401.14
Total cost	**115,111,137.01**	**44,259,164.04**	**8813.15**	**3388.58**

another group.

The results of the multivariate linear regression model are presented in Table 3. There was a significant association between disease outcome, supplemental insurance status, age, and hospitalization costs. The total cost of the disease for patients who were died was 3804 (PPP) higher than those who were discharged. The total cost in patients >60 years old was 1625 (PPP) higher than in those <40 years old. Moreover, the total costs for patients who were not covered by supplemental insurance were significantly lower than those covered by supplemental insurance ($p < 0.001$).

It is projected that with an outbreak rate of 1% of the Iran population (842,503) and the hospitalization rate of 30% of patients (252,750), the medical costs would be 811 million (PPP, Current International $) (10,604 billion Rials) and with a mortality rate of 5%, the total cost of the disease would be 2087 million (PPP, Current International $) (27,270 billion Rials). Sensitivity analysis was performed in terms of outbreak, hospitalization and mortality rates. Given the percentage of outbreak, hospitalization and mortality rates, the estimated total cost of the disease ranged from 6263Million (PPP) to Million 63,474 (PPP) in Iran Table 4.

Discussion

This study was designed to estimate the direct and indirect cost of COVID-19 and the factors influencing it. The total cost of the disease was estimated at 2087 Million (PPP, Current International $). A cross-sectional cost-description study performed in Iran aimed to estimate direct medical and indirect costs of treating the Covid-19 found that the economic burden of the disease for inpatient cases was $1439,083,784 [21]. Jin et al. conducted a cost-of-illness study to estimate the economic burden of Covid-19 in China (2021). In their study, the total estimated healthcare and societal costs associated with Covid-19 were US$ 0.62 billion and US$ 383.02 million, respectively [11]. In another study by Chen et al. in the U.S.A., the economic burden of COVID-19 for the 10-year time span (2020–2030) was estimated at US$1.4 trillion, which was equivalent to around 7.7% of GDP in 2019 (in constant 2010 US$) [22]. These results show that Covid-19 impose a considerable burden on patients and societies as a whole, so high priority should be placed on preventing future pandemics at the outset and designing intervention strategies that allow for optimal response in case of a future outbreak [22].

In our study, the total mean cost of the disease was estimated at 8813.15 PPP, comprising 60% of the GDP per capita. Li et al. retrospectively conducted a cost and affordability analysis to determine the medical costs of COVID-19 patients in China. In their study, the mean total cost was estimated at USD 6827 per treated episode [23]. Given the high medical costs, early interventions are of high clinical importance for reducing the financial burden of Covid-19 disease.

In the current study, indirect costs were the main component of total costs. The total indirect and direct costs were estimated at 5450.66 and 3362.49 PPP, respectively. Our results are consistent with a previous study in Iran, in which the total mean indirect and direct medical costs were estimated to be $ 11,634 and $3755, respectively [21]. Kim et al. performed a study to determine cost breakdowns associated with the 2009 pandemic H1N1 influenza in Korea (2013). The authors found the total indirect costs of Influenza were about two times higher than total direct costs [24]. In a study in Germany, total indirect costs of Influenza were about four times higher than total direct costs [25]. In another German study in the 1990s, influenza-related costs for a sample of 281 patients were conducted, and indirect costs accounted for 82.2% of total costs [26]. According to these results, it can be concluded that the main component of total costs of a pandemic such as COVID-19 and Influenza are indirect costs. These results provide insights into the financial burden which can be caused by indirect costs and draw attention to the differences in health care responses to this disease within countries. Bartsch et al. in the U.S.A using developed a Monte Carlo simulation model representing the U.S. population indicated that a single symptomatic Covid-19 infection would cost a median of $3045 in direct medical costs incurred only during the infection [12].

In our study, hospitalization costs (2634.79 PPP) were the major driver of total medical costs, approximately 4.5 times higher than outpatient costs. The largest proportion of total hospitalization costs was related to hoteling (hospital bed day) (953.43 PPP) and medicine (579.09 PPP). Our results are in line with a study from China (2021) that the main components of routine healthcare costs were inpatient care (44.2%) and medicines (32.5%) [11]. Similarly, in a study in China (2020), the highest mean cost was medicine, representing 45.1% of the total cost [23]. Also, in a study in Iran, the main direct costs were related to medicines and medical consumables (28%) [21]. Likewise, our results showed that after diagnostic costs (199.74 PPP), medicine costs (188.76

Table 3
Univariate and multivariate Linear Regression Models to identify variables associated with the medical direct costs of Covid-19 patients.

Variable	Univariate		Multiple	
	B (SE)	p-value	B (SE)	p-value
Gender (male)				
Female	−2,608,052 (3,452,510)	0.45		
Outcome (discharge)				
Death	49,688,595 (5,459,217)	<0.001	43,162,011 (5,776,347)	<0.001
Supplementary insurance coverage (yes)				
No	−26,896,949 (7,235,606)	<0.001	−13,555,366 (7,046,082)	0.05
Type of insurance (Not covered)				
Social security	5,442,436 (8,245,013)	0.51		
Armed force	2,769,164 (8,734,555)	0.75		
Iranian health insurance	7,510,172 (8,136,924)	0.92		
Age (<40years)				
40–60 years	7,902,577 (4,458,940)	0.07	6,605,875 (4,283,578)	0.12
>60years	21,223,935 (4,223,287)	<0.001	12,257,488 (4,194,525)	0.003
Job (Housewife)				
Farmer	−9,834,428 (7,520,136)	0.19		
Retired	5,591,273 (6,573,072)	0.39		
Employee	−3,184,391 (5,724,316)	0.58		
Self-employed	−6,169,417 (5,395,755)	0.25		
Income (<40 Million Rial)				
>40 Million Rial	−9,431,517 (7,861,643)	0.23		
			R^2=0.11, R^2 adj=0.11	

Table 4
Sensitivity analyses (Million $).

Outbreak rate	Hospitalization rate				Mortality rate
	30%	35%	40%	45%	
3%	6263	7293	8323	9353	5%
5%	10,495	12,211	13,928	15,645	7%
7%	14,771	17,174	19,578	21,981	9%
10%	21,214	24,647	28,080	31,513	11%
15%	31,988	37,138	42,288	47,438	13%
20%	42,874	49,741	56,608	63,474	15%

PPP) were the main component of outpatient costs. It seems that COVID-19 patients incur high costs for hospital stay and medicines.

We found that the mean hospitalization costs for patients who were died were 2.6 times higher than those who were discharged. This may be due to the acute condition of patients and the increased length of hospital stay, and more expensive and advanced health measures for improving patients' conditions. A study in China suggested that pre-existing diseases and advanced disease severity were strongly associated with higher costs [23]. Similarly, in a study in Iran, ICU patients incurred higher costs than non-severe patients ($13,267 VS $2979) [21]. Another study showed that length of hospital stay and in-hospital mortality increased with intensive care unit (ICU) and/or IMV usage, and costs increased with ICU and/or IMV usage [27].

Furthermore, in our study, the mean cost incurred due to hospitalization for patients with supplemental insurance was 1.8 times higher than for those without supplemental insurance. One plausible reason could be that the induced demand arising from supplemental insurance and supplemental insurance increase patients' acceptability to more and better care. A study in China demonstrated that in order to prevent catastrophic health expenditure, the proportions of health insurance coverage among rural households should be increased to 70% for severe cases and 80% for critically ill cases [23]. We also found that the mean hospitalization costs for patients over 60 years old was 1.43 times higher than for those 40–60 years old, and for those 40–60 years old was 1.34 times higher than for patients <40 years old. It seems that the costs of disease increase significantly with increasing age. A study showed that the length of hospital stay and in-hospital mortality increased with an increase in age [27].

In our study, the main components of the total indirect costs were caused by missed workdays (88%), followed by premature death (12%). In contrast, in another study in Iran, income loss due to premature death was the main component of indirect costs ($10,190), followed by job absenteeism during the recovery course ($1065) and economic production loss due to hospitalization ($378) [21]. Additionally, we found that direct non-medical costs accounted for a small proportion of total indirect costs (1.7%).

It has been shown that even when only considering the costs during the acute infection and not the costs of follow-up care after the infection, the direct medical costs of Covid-19 tend to be considerably higher than other common infectious diseases, as the virus can have a higher probability of hospitalization and death than seasonal influenza and/or other pathogens [28,29]. For example, based on the average cost of $ 3045 in the U.S.A in 2020, the cost of the disease is estimated to be four times higher than seasonal influenza on average ($696 of direct cost) and 5.5 times higher than Pertussis (rang from $412 to $555) [29].

In this study, COVID-19 coronavirus could result in 811 million (PPP, Current International $) medical costs incurred during the infection if one percent of the population (842,503) were to become infected and 30% of patients were hospitalized (252,750) and 2087 million (PPP, Current International $) total costs with the mortality rate of 5%. Moreover, this disease could result in 2435 million (PPP, Current International $) medical costs incurred during the infection if three percent of the population (2,527,510) were to become infected and 30% (758,253) of patients were hospitalized, and 81,811 million (PPP, Current International $) total costs with the mortality rate of 5%. The considerable rise in medical costs due to an increase in outbreak rate represents the importance of preventive measures to reduce the outbreak rate of this disease. A study in the U.S.A showed that Covid-19 coronavirus could result in direct medical costs incurred during the infection from $163.3 billion if 20% of the population gets infected to $654.0 billion if 80% of the population gets infected sensitivity [12]. The results of the sensitivity analysis of a study from Russia showed that the extension of the self-isolation period from 1 month to 1.5 and 2 months will lead to an increase in the share of indirect expenses from 40.65% (1 month) to 56.08 (1.5 months) and 67.76% (2 months) of total expenses in connection with the Covid-19 epidemic [9]. The results of a study showed that the long-term economic burden of the disease could be far higher than the cost of developing and delivering vaccines and effective treatments for the disease [30]. If there is not enough focus on serious preventive measures, the rate of virus outbreak will quickly exceed the capacity of healthcare facilities [31], which in turn imposes a huge financial burden on health systems in addition to human and social damage. Therefore, most countries are trying to prevent the further spread of this potentially fatal virus by implementing preventive strategies [32].

Our study has limitations. Firstly, we did not include costs resulting from preventive measures, screening, outpatients' treatments without referring to hospital, costs related to development, repair, and equipping of health centers, increased workload of healthcare staff, costs related to providing Personal Protective Equipment (PPE) and subsidy allocated to medicine were not examined. Secondly, costs related to losing the healthcare workforce, intangible costs such as the pain, sorrow, and inconvenience in patients and their family caregivers, and the opportunity cost of resources allocated to research projects were not calculated. Therefore, the real economic burden of this disease is much higher than the estimated burden. Finally, we applied the linear regression analysis, which is not the best option for analyzing COI studies due to truncated data, but as the costs were high in our study, this model provides a good approximation.

Conclusions

This study highlights a considerable economic burden of the recent Covid-19 outbreak in Iran. A considerable proportion of COVID-19 disease burden results from lost productivity due to disability, which is often hidden from the health policymakers' perspective. Therefore, health policymakers must consider all the costs of the disease in developing preventive measures. Besides, given that the economic burden of this disease increases dramatically by increasing the outbreak rate, more attention should be paid to the development and implementation of appropriate preventive strategies. Further studies are warranted in outpatient settings, especially with longer study time frames.

Author statement

NA

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Declaration of Competing Interests

The authors declare that they have no competing interests.

Ethical approval

This was a Master's thesis for a Financial Management degree in the Islamic Azad University, Birjand Branch, Medical Sciences Division, which was approved by the Ethics committee of Birjand University of Medical Sciences (Ref No: IR.BUMS.REC.1399.246). Besides, study objectives were explained to the participants, and they were assured that their information was kept confidential. **Consent to participate**: Before conducting the interviews, the objectives of the study were explained to the participants and informed consent was obtained from them. They were informed that the data was kept confidential and anonymous.

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