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ORIGINAL ARTICLE

Reduced Hospital Admission, Emergency Department Visit, and Urgent Surgeries and its Correlation with Non-COVID-19 Mortality

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A B S T R A C T

Background: The reduction of hospital admissions, emergency visits, and urgent surgeries during the COVID-19 pandemic were reported in various countries. The present study aimed to evaluate these changes in Iran.

Methods: A retrospective study of regional secondary utilization and mortality data from multiple official sources was performed. The data were collected from hospitals located in the center of Iran (Yazd) between March 1st, 2020 (before COVID-19) and February 30th, 2021 (after COVID-19). The data were analyzed using Microsoft Excel® and $SPSS_{24}$ The Mann-Whitney test was utilized to compare the variables' changes before and after COVID-19 pandemic. Spearman's correlation coefficient was used to evaluate the connection between non-COVID-19 mortality and the quantity of urgent surgeries conducted in hospitals.

Results: The percentage changes in hospital admissions, emergency department visits, and urgent surgeries following COVID-19 were 33.7%, 39%, and 23%, respectively. The correlation between the number of urgent surgeries and the non-COVID-19 mortality during the pandemic was negative(r=-0.9).

Conclusions: Our results provide empirical support for concerns about the widespread public health impact of the COVID-19 pandemic. The development of novel technologies including telemedicine, consultations and online visits, as well as the use of remote monitoring technology could lead to improved access to health care during a pandemic, particularly for vulnerable populations.

Keywords: Hospital admission, Emergency Room visit, Urgent surgeries, COVID-19, Iran

Introduction

COVID-19 is regarded as a new infectious disease which was detected in Wuhan, China in late December 2019 and quickly spread to all countries in the world, resulting in a global concern (1-3).

Moreover, this pandemic is considered as an important social issue (4) which caused fear and anxiety, psychological damage, severe health effects and serious consequences for economic growth and social development (5-8).

The spread of the coronavirus has posed unprecedented challenges to health care systems (9, 10) . It has emerged as a threat and a global health crisis (6, 11-13) which has historical dimensions and forced governments around the world to impose significant restrictions, including social distancing, restrictions on gatherings, and nationwide

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quarantine within and between countries (12) .

Additionally, the COVID-19 pandemic has significantly affected individual behavior, containing the use of healthcare services (14, 15). The fear of contracting coronavirus has led to a significant decrease in hospital visits, particularly emergency visits, as well as postponing numerous surgeries (3, 16- 27), which can exacerbate complications and increase mortality, especially in acute cardiovascular patients (28, 29).

The reduction in hospital admissions and emergency visits during the COVID-19 pandemic is not unique to a particular country and has been reported in various countries of the world, including the United States and Europe (17, 30-32). In addition to the decrease in hospital admissions and emergency visits, an increase in non-COVID-19 mortality has been reported during the pandemic compared with the identical period prior to the pandemic, particularly among acute respiratory, cancer and cardiovascular patients (12, 28, 33, 34). According to the reports of the US Centers for Disease Control and Prevention (CDC), the number of visits to the emergency department in the united states has decreased by 42% at the onset of the COVID-19 pandemic compared to the identical period in the previous year (35). Furthermore, Xiang (2021) identified a 28.4, 31.1 and 5 percent decrease in the number of hospital admissions during the first, second and third waves of Coronavirus and an increase in the mortality rate during this period (34).

A study conducted at Auckland Hospital in New Zealand revealed a significant 26% reduction in the hospital admissions, as well as a 43.6% reduction in surgeries during the COVID-19 pandemic, compared to the pre-COVID-19 period (36). Another investigation in Jordan demonstrated a 28% reduction in urgent surgeries in the summer of 2020 compared to the same period in 2019, as corona restrictions were not yet applied (33). At the George Hospital in London, the number of surgeries in the hospital following quarantine decreased in comparison with the period prior to the general quarantine (37). In addition, a 66% reduction in emergency department visits and a 60% decrease in emergency surgeries at the onset of the coronavirus outbreak in Italy have been reported (3). The average number of hospital admissions in Croatia during the COVID-19 pandemic declined by 21% compared to the three-year average prior to the COVID-19 pandemic (38).

As the studies displayed, numerous countries in the world have experienced a decrease in the hospital admissions, emergency visits, and urgent surgeries during the COVID-19 pandemic, and Iran is no exception to this rule.

The first case of coronavirus infection in Iran was detected on 18th of February 2020. The virus spread throughout the country in a short period of time and resulted in a concern among the individuals and officials. According to the worldmeter statistics, 7,603,697 cases of corona infection and 145,837 deaths due to COVID-19 had been recorded in Iran by April 21, 2023 (39). Simultaneously with the spread of Coronavirus in Iran, especially during the first, second and third waves, in spite of the unknown nature of the disease and the fear and worry of the individuals, as well as the restrictions and quarantine imposed by the government, many daily affairs were influenced, especially the use of medical services. The city of Yazd, which is one of the central cities of Iran with a population of about 826000, 11 hospitals and 2313 hospital beds (40), received a considerable number of patients from the eastern, southern and south-eastern provinces of Iran due to the availability of qualified specialists and appropriate diagnostic and treatment facilities prior to the outbreak of COVID-19. However, the imposition of nationwide restrictions and quarantines, the provision of services to patients was severely influenced.

Therefore, this research was designed with the aim of comparing the hospital admissions, emergency department visits, and urgent surgeries before and after the COVID-19 pandemic in Yazd, Iran. Furthermore, the correlation between emergency surgeries and non-COVID-19 mortality during the COVID-19 pandemic was investigated.

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Materials and Methods

A retrospective study of regional secondary utilization and mortality data from multiple official sources, covering the periods from March 1, 2020 (almost 10 days following the identification and official announcement of the first case of COVID-19 infection in Iran) to February 30, 2021, was conducted. The data were compared to the identical period in the year 2019. Data collection included the number of hospital admissions, age and sex of the admitted patients, the number of visits at the emergency department (ED), all the urgent surgeries performed and the number of Mon-COVID-19 mortality during and prior to COVID-19 pandemic in Yazd, a world heritage city, is located in center of Iran. The required data were extracted from hospital information system (HIS) and health insurance information system. The data were analyzed using Microsoft Excel® and $SPSS_{24}$ (SPSS Inc., Chicago, IL). Descriptive statistics such as frequency, mean and standard deviation were reported. In addition, the Mann-Whitney test was applied to compare changes in variables in the period before and after the COVID-19 pandemic. Spearman's correlation coefficient was utilized to explore the association between deaths and the number of hospital admissions, the number of visits at the emergency department (ED), and all the urgent operations performed in hospitals.

Ethical considerations

This research was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences in Yazd based on the approval of IR.SSU.SPH.REC.1399.155.

Results

As illustrated in Figure 1; From March 1, 2020 to February 30, 2021 (following the COVID-19 pandemic), a total of 117131 hospital admissions were recorded in the hospitals with a decrease of 33.7% compared to the baseline (176726 hospital admissions from March 1, 2019 to February 30, 2020) and this difference was statistically significant (*P-value* <001).

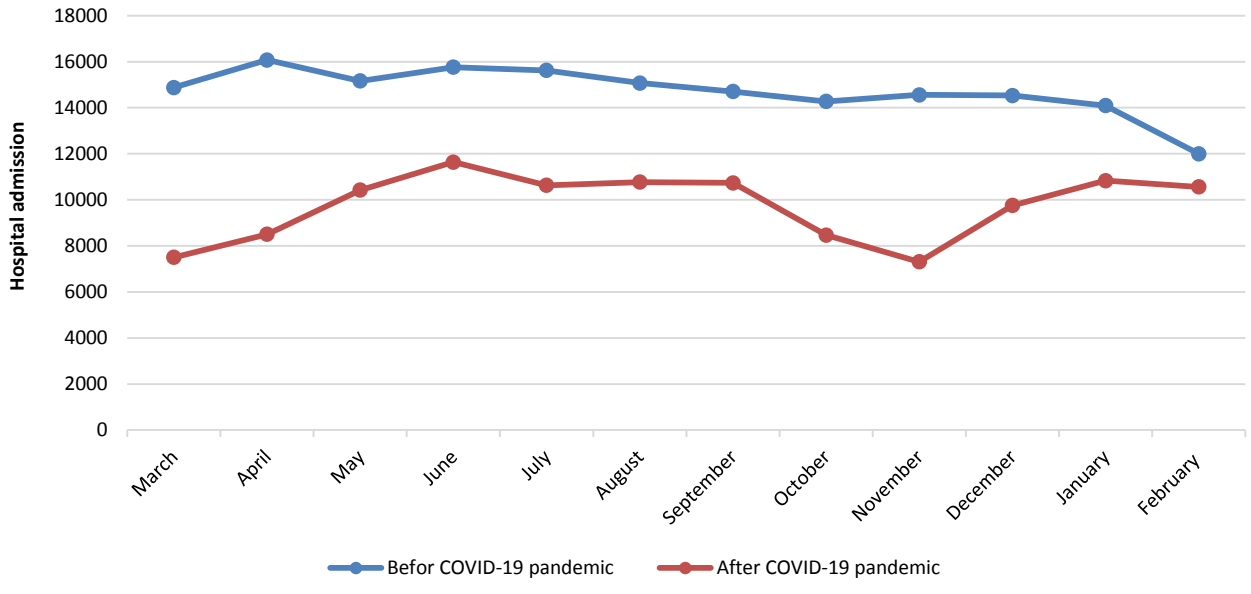

Figure 1. Comparison of monthly hospital admissions before and after the COVID-19 pandemic

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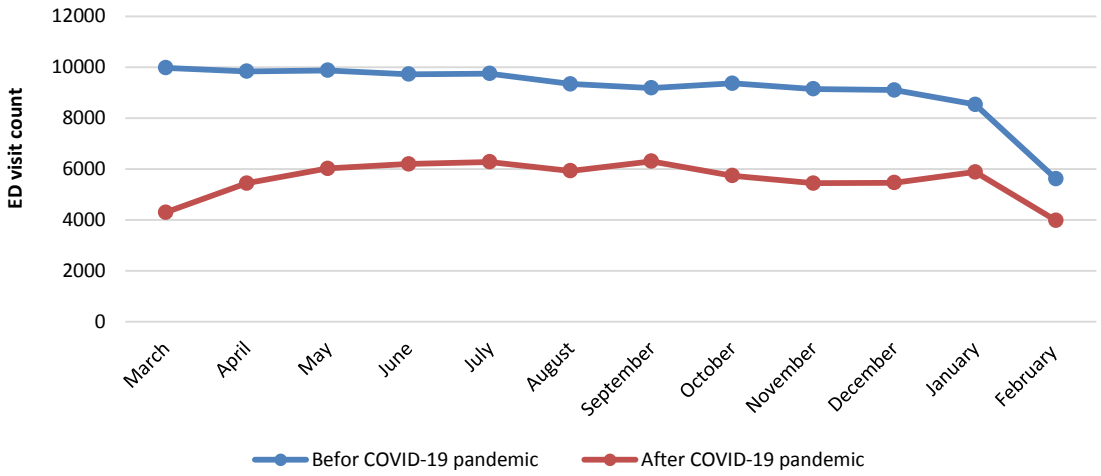

Figure 2. Comparison of monthly Emergency Department visit before and after the COVID-19 pandemic

Figure 2 illustrate the comparison of monthly Emergency Department visits before and after the COVID-19 pandemic. From March 1, 2020 to February 30, 2021, a total of 67001 Emergency Department visits were recorded, which is 39% less than the identical period prior to the COVID-19 pandemic (۱۰۹۴۴ Emergency Department visits from March 1, 2019 to February 30, 2020). Compared with the baseline, this variation was statistically significant (*P-value<001*).

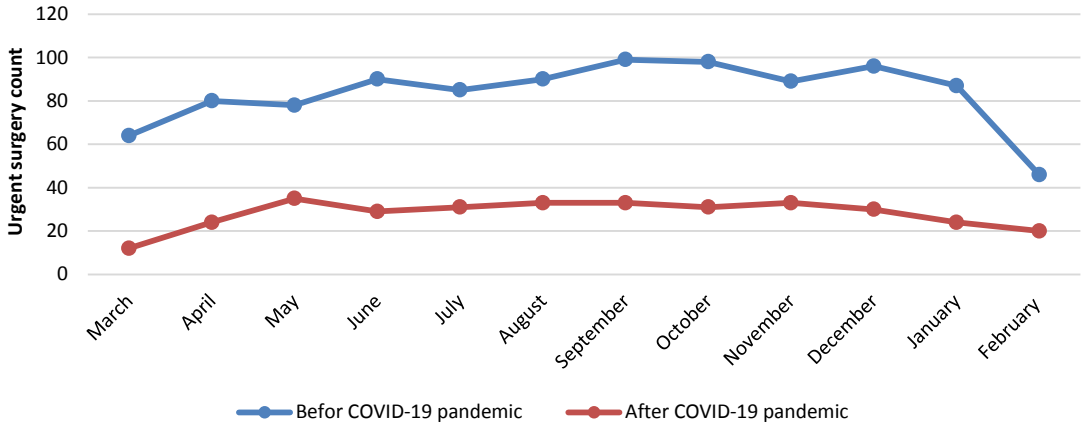

Figure 3. Comparison of monthly emergency surgery before and after COVID-19 pandemic

Comparison of monthly emergency surgery before and after the COVID-19 pandemic is presented in Figure 3. From March 1, 2020 to February 30, 2021, a total of 335 urgent surgeries were observed which is 56.5% less than the identical period before the COVID-19 pandemic (1002 urgent surgeries from March 1, 2019 to February 30, 2020). The change percentage in urgent surgery after the COVID-19 outbreak compared to baseline was -23.47% and statistically significant (*P-value*<001*).*

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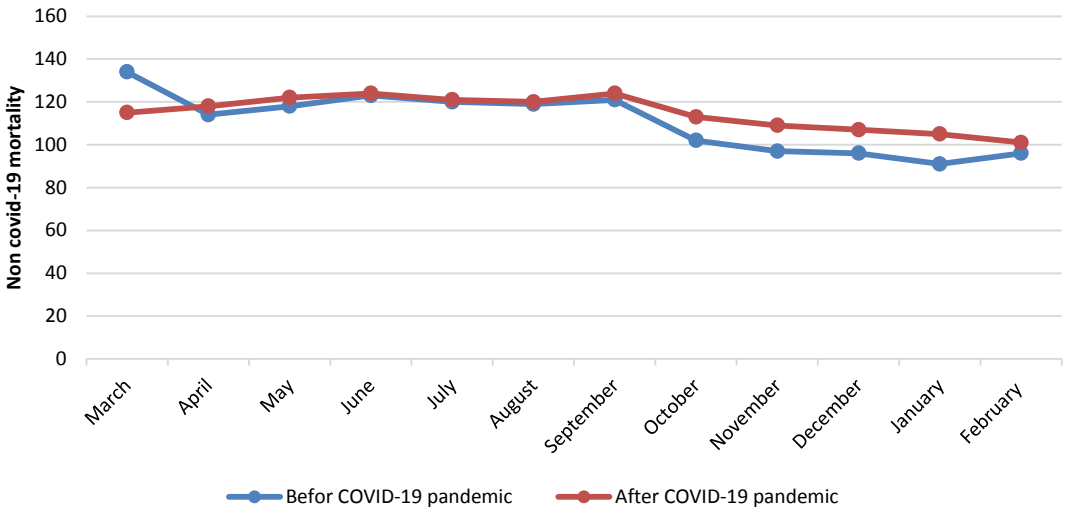

Figure 4. Comparison of monthly Non-COVID-19 mortality before and after the COVID-19 pandemic

Figure 4 uncovers the comparison of monthly non-COVID-19 mortality before and after COVID-19 pandemic. From March 1, 2020 to February 30, 2021, a total of 1379 non-COVID-19 mortality has been identified, which is 38 deaths more than the same period prior to the COVID-19pandemic (1341 non-COVID-19 mortality from March 1, 2019 to February 30, 2020).

Table 1. Correlation between urgent surgeries and non-COVID-19 mortality during the COVID-19 pandemic

Variable	Non-COVID-19 mortality	
	correlation	*P*
Urgent Surgeries	-0.9	0.3

Table 1 indicates that there is a strong and negative correlation between the number of urgent surgeries and the non-COVID-19 mortality during the pandemic (r=-0.9), however it was not statistically significant (*P-value*=0.3*)*.

Discussion

The objective was to describe the changes in hospital admissions, emergency department visits, emergency surgeries and to ascertain the association between the number of urgent surgeries and non-COVID-19 mortality during the pandemic.

There was a significant reduction in the hospital admissions, emergency department visits and urgent surgeries, especially during the first and second waves of the pandemic. The current work also presented a strong and inverse correlation between the number of urgent surgeries and non-COVID-19 mortality during the COVID-19 pandemic, although the observed result was not statistically significant. The results of this study support various studies.

According to a study in Hong Kong, the hospital admission rate declined by 28.4, 31.1 and 5% during the first, second and third waves periods of the COVID-19 pandemic (34).

With regard to another study conducted in Auckland Hospital in New Zealand, a significant 26% decrease in hospital admission rate *(p-value*=0.00*)* during the COVID-19 pandemic (36) was observed.

At George Hospital in London, the admission rate and the average of patients' stay in the hospital following the national quarantine decreased in comparison with the period before it (37). The average number of admissions to Croatian hospitals during the COVID-19 pandemic has decreased by 21% compared to the average three years prior to the COVID-19 pandemic (38). similarly, in the United State, all hospital admissions and even non-COVID-19 admissions decreased significantly in 2020 compared to the

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same period in 2019 (17). Various investigations revealed that many countries in the world have encountered a decrease in hospital admission rate during the COVID-19 pandemic (17, 26, 27).

Additionally a reduction in the emergency department visits during the COVID-19 pandemic has been observed in various countries, including the United States and Europe (30-32, 41). The US Center for Communicable Disease Control (CDC) reported a 42% decrease in emergency department visits at the onset of the COVID-19 pandemic compared with the identical period in the previous year(35). There is also evidence of a reduction in the number of the emergency department visits in comparison with the period prior to the COVID-19 pandemic in other countries (18-20). A reduction in surgeries during the COVID-19 pandemic has been shown in several investigations as well; The study conducted at Auckland City Hospital (36), George Hospital in London (37) and also Jordanian hospitals (33) demonstrated a significant reduction in surgeries during the COVID-19 epidemic compared to the previous period. The decline in hospital admissions, emergency department visits, and urgent surgeries during the pandemic can be attributed to a number of factors, including patients' reluctance to seek services due to fear of spreading the coronavirus because of the unknown nature of the virus and the scary news published in the media, as well as the emphasis of government officials on staying at home to maintain health (32, 42). There is considerable international evidence to support that patient reluctance to visit hospitals can be a major contributing factor (10, 12, 13, 26).

Deerberg-Wittram and Knothe argue that the avoidance of medical care by patients in a situation such as the COVID-19 pandemic is an instance of panic risk, a behavioral response in which rare and unexpected events including a pandemic can trigger irrational responses to escape from danger (26). Furthermore, the reduction in receiving care can be related to the lifestyle changes and increased attention to personal hygiene, reduced car travel (and as a result less traffic accidents) due to the imposition of nationwide restrictions and quarantines, and reduced transmission of infectious diseases due to social distancing and the use of masks. There is also evidence that the use of telemedicine, such as visits and medical consultations on the Internet, in has declined the desire of patients to go to the hospital. However, physician reluctance to admit patients due to limited resources and the allocation of hospital beds to COVID-19 patients is also a determining factor (34). There is a slight increase in the total number of non-COVID-19 deaths during the pandemic. This can be due to delays in patients arriving for care or delays in service delivery. However, a potential and worrisome consequence of patients not seeking medical care can be an increase in mortality and complications, particularly for cancer and cardiovascular diseases (12, 28, 29, 34). The results of previous studies regarding the trend of non-COVID-19 mortality are different. Several studies have reported an increase in non-COVID-19 mortality in 2020 (17, 28, 29, 43), and many others have reported no significant difference in this regard (26, 42, 44). Moreover, there are various reasons for the differences in the results of these studies, including various data sources, different types of government interventions, and the different methods of data analysis.

The results of present study uncover a strong correlation between the reduction of in emergency surgeries and the increase in non-COVID-19 mortality. However, it can be expected that the potential consequence of not receiving medical care is an increase in patient mortality (12). Given the observed reduction in hospital admission rates, and the association between delayed care and increased mortality rate, it is hypothesized that many patients who delay receiving essential care may die or have more severe complications in the future.

The current work should be interpreted in the light of its limitations. One of the most essential limitations was the absence of accurate recording of patients' information in the information systems. This resulted in a considerable amount of

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information, much of which was incomplete and occasionally unrelated, making it very challenging and time-consuming to refine the data to ensure the accuracy of the data. Furthermore, the research data was limited to the timeframe of March 2020 to February 2021, making it impossible for us to assess the prolonged impacts of delays in receiving care due to the COVID-19 pandemic.

Conclusion

The obtained findings provide empirical support for concerns about the widespread public health impact of the COVID-19 pandemic, in line with previous studies. The results demonstrated significant reductions in hospital admissions, emergency department visits and urgent surgeries, particularly during the first and second waves of the pandemic. Numerous diseases necessitate effective medical care in hospitals to prevent adverse consequences. Therefore, limiting availability of medical services, particularly urgent surgeries during in a pandemic, can lead to disastrous outcomes for patients. In parallel, health policy makers and public health authorities should focus on identifying the appropriate ways for patients to access hospital services.

However, further research is required to evaluate the effects of avoiding hospitalization on mortality, morbidity and quality of life in patients during the epidemic.

The advancement of alternative triage methods, incorporating artificial intelligence and new technologies including telemedicine, consultation and online visits, as well as the use of remote monitoring technology can create conditions for patients to feel more secure during epidemics. Ultimately, the development of such techniques could result in increased availability to health care during a pandemic, especially for vulnerable populations.

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Conflict of interests

The authors declared no conflict of interests.

Authors' contributions

M.R, MH.L, SM.D, H.D, and H.A contributed to the conception and design of the study; M.R and H.D collected the data; M.R, MH.L, and H.A analysed and interpreted the data; M.R wrote the first draft of the manuscript; MH.L, SM.D, H.D, and H.A reviewed and wrote sections of the manuscript; and M.R, MH.L, SM.D, H.D, and H.A critically revised the manuscript. All authors read and approved the submitted version.

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