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The impact of COVID-19 pandemic on emergency services

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Key words: Covid-19, emergency, public health
Parole chiave: Covid-19, emergenza, sanità pubblica

Abstract

Background. *The SARS-Cov-2 pandemic has placed enormous strain on the global healthcare system. The strict containment measures have adversely affected population movements and mobility, daily activities, and the patterns of healthcare-seeking behavior. Although the Emergency and Admission Departments (EADS) activity has never been disrupted, the pandemic had a significant impact on the routine healthcare delivery. This study aims to assess the changes in healthcare delivery, with a focus on the elderly as a vulnerable component of the general population.*

Design of the study. *Retrospective study.*

Methods. *All non-COVID visits to the EAD of the Local Health Unit (ASL1) in Abruzzo (Italy) from 9 March to 3 May 2020 were analyzed. These were compared to the hospital admissions recorded in the same period of the previous year.*

Results. *We found a 60.4% reduction in overall visits during the study period and an increase in the hospitalization rate from 30% to 39%. Emergency department visits have declined markedly for less acute medical conditions, while we have observed a statistically significant increase in the hospitalization rates for all age groups. Moreover, in 2020 we recorded a decrease in the ratio non-urgent/non-deferrable medical conditions for each age group; while the percentage of hospitalizations for each registered red code increased for each group, particularly for the 65-74 age group.*

Conclusions. *The COVID-19 pandemic has significantly affected the care-seeking behavior of patients. During the COVID-19 epidemic, total hospital admissions have decreased, particularly for less severe illnesses, whereas the percentage of hospitalizations has increased. During 2020, hospital admissions for mild cases decreased, and patients presented to the EAD only in cases of acute medical condition, selecting those in need for more intensive care. However, several patients may have deferred necessary medical care even for potentially urgent conditions. Such reluctance to seek medical care may have caused delays in diagnosis. The impact of deferred care on patients' health is difficult to estimate at this time. This information will serve as a starting point for further research to improve healthcare management not only during emergency but also in non-emergency periods.*

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Introduction

The SARS-CoV-2 outbreak, originated in Wuhan, China, in December 2019, has rapidly grown worldwide, causing the pandemic spread of the Coronavirus Disease 2019 (Covid-19) cases, as declared by WHO on March 11th, 2020 (1-2). Many countries imposed strict measures to curb the spread of the virus, such as lockdowns, social distancing, and shielding measures. These measures had a significant impact on population movements, daily activities, and healthcare-seeking behaviors (3).

During the lockdown period (from March 9 to May 3, 2020), the Italian Health System stopped providing deferrable healthcare services, to reduce patient flow. To limit the spread of the disease, outpatient activity and elective surgery were suspended, leaving space only for urgent or oncological non-deferrable procedures and recommending deferral of all other non-urgent activities. In this context, the Emergency Department (ED) has ensured the provision of the necessary emergency medical services.

With the spread of the COVID-19 pandemic, the working routine in the EDs has profoundly changed. Several studies assessed the impact of the pandemic on ED visits, and some studies reported that the respiratory transmission of the SARS-Cov-2 virus and the high prevalence of asymptomatic infection could have changed the ED visit patterns (4-6).

The present study aims to evaluate how emergency medical services responded to the changes in the general population triggered by the COVID-19 epidemic, comparing time trends of ED visits and hospitalizations of non-COVID patients during the lockdown period with the same period in 2019. The second aim was to determine whether the hospitalizations from the ED changed between 2019 and 2020.

Special attention was given to the elderly (age ≥65 years) as a vulnerable population group. Overall, older adults represent the main users of ED (7), but the older age was shown to be associated with increased susceptibility to infection and high COVID-19 burden (7-9). Therefore, the perception of susceptibility to the SARS-CoV-2 and the resulting patient reluctance to go to public places, may have led older adults to underestimate their symptoms, thus risking delayed access to healthcare, especially for time-sensitive conditions (10).

Methods

A retrospective study of ED visits to the LHU 1 (Local Health Unit 1 or Azienda Sanitaria Locale 1 in Italian) in Region Abruzzo, Italy, was performed during the lockdown period in Italy, from March 9 to May 3, 2020. The territory served by such Unit includes the Province of L'Aquila (Italy), with a resident population of 297,313 people in 2019 (11). To maintain a comparable time window, including the same number of holidays and weekdays, we also reviewed the ED presentations between March 9 and May 3, 2019. COVID-19 as a cause of presentation to ED in 2020 was excluded from the analysis. We specifically excluded admissions for respiratory illness or sepsis, because these patients were triaged under the COVID-19 pathway until their SARS-CoV-2 statuses were confirmed through a positive result of real-time reverse transcriptase-polymerase chain reaction assay from nasopharyngeal swabs. Records of ED visits related to all causes during the period under review were extracted from the LHU 201 database and analyzed. The QUANI-SDO software was used to select individual anonymous administrative data, including age, sex, patient residence, day and time of presentation, and triage color Code. Data refer to ED visits and not to patients, then if a person was re-admitted during the study period, he/she was counted more than once.

At LHU 201, the triage classification was based on four color-coded categories, ranging from red (life-threatening condition) to white (non-critical, non-urgent care) (12). The time of presentation at ED was dichotomized, based on the staff shifts, in day-time (08:00–20:00) and night-time (20:00–08:00) periods.

Length of stay was measured in minutes from ED registration to time of departure from ED for all patients, regardless of whether they were discharged, transferred to another facility, or admitted to an inpatient ward. The hospital ward was classified as clinical, surgical, or intensive care unit (ICU).

To evaluate the variation in the daily activities, we calculated the ratio between the non-urgent visits or subjectively perceived treatment urgency (white and green codes) and the non-deferrable urgency (red code) to highlight any changes in non-urgent visits for each life-threatening condition. Then, we calculated the ratio between the number of hospitalizations and the red codes to measure the variation in hospitalizations for each red code.

To estimate the factors associated with admission (dependent variable) among people aged ≥65 years, we conducted a univariate analysis with the following available variables: year (2019 and 2020), sex (female and male), residence (L'Aquila and other), time of presentation (day-time and night-time), age groups (65-74, 75-84, ≥85 years) and triage, dichotomized as unnecessary presentation (white code) and other. Multivariate logistic regression analysis was conducted using associated variables to identify independent factors correlated with hospitalization rate of people aged ≥ 65 years. To calculate the p-value for logistic regression analysis we used the likelihood-ratio test.

Any p less than 0.05 was considered statistically significant. All analyses were performed using Microsoft Excel and STATA.

Results

Over a 56-day period, we identified 16,998 and 5,675 ED presentations in 2019 and 2020, respectively: a 66.6% reduction in the overall ED visits during the COVID-19 pandemic than the previous year was recorded. At the same time, we observed an increase in the hospitalization rates from 15% to 26% ($p<0.0001$) considering the entire period.

Table 1 shows the reduction in each triage category: the colors with the most significant

Table 1 - Reduction in presentations (N) for each triage color.

All patients	2019	2020	Δ
White	488	98	-79.9%
Green	10,310	2,706	-73.8%
Yellow	5,887	2,673	-54.6%
Red	322	189	-41.3%
Total	16,998	5,675	-66.6%
≥ 65 years	2019	2020	Δ
White	111	27	-75.7%
Green	2,073	612	-70.5%
Yellow	2,705	1,242	-54.1%
Red	217	142	-34.6%
Total	5,106	2,023	-60.4%

reduction were white and green. We observed a significant reduction by 60.4% in ED visits for any non-COVID-19 diagnosis in older adults (≥ 65 years) during the considered period. The observed reduction mainly affected less severe triage codes (white and green), while the proportions of the more severe codes (yellow and red) increased (Tab 2). The Chi-squared test for trends revealed a statistically significant difference between the two years with an increase in the severity pattern of ED visits.

Considering both 2019 and 2020, there was no difference between the overall number of males and females (3,599 vs. 3,530). However, the percentages of males and females were significantly different in people aged ≥65 years between the two years (p=0.026): as shown in Table 2, we observed an increase in the proportion of females in 2020, compared to 2019.

Overall, people aged ≥65 years who accessed ED were 5,106 (30.0% of all ED accesses) in 2019 and 2,023 (35.7%) in 2020: they visited the ED more frequently than younger adults (Tab 2). Moreover, despite the reduction in ED access previously discussed, we reported an increased hospitalization rate from 30% to 39% (p<0.0001) for people aged ≥65 years. Conversely, we found a reduction in ED visits among people under the age of 65, from 11,892 to 3,652 (69.3% reduction) and an increase in hospitalizations from 1,103 (9% of ED visits) to 657 (18%).

Table 2 - Characteristics of the presentation recorded for people aged ≥ 65 years, based on each frame time.

	2019		2020		p value
ED visits	5,106	(30.0%)	2,023	(35.6%)	p<0.0001[c]
Age (years)	78.0	(0.1[a])	78.3	(0.2[a])	p=0.1392[b]
Gender					
Male	2,620	(51.3%)	979	(48.4%)	p=0.026[c]
Female	2,486	(48.7%)	1,044	(51.6%)	
Consult time					
Day	4,002	(78.4%)	1,587	(78.5%)	p=0.949[c]
Night	1,104	(21.6%)	436	(21.5%)	
Residence Area					
L'Aquila	4,527	(88.7%)	1,886	(92.2%)	p<0.0001[c]
Other	579	(11.3%)	157	(7.8%)	
Admissions	1,507	(29.5%)	793	(39.2%)	p<0.0001[c]
Triage					
White	111	(2.2%)	27	(1.3%)	
Green	2,073	(40.6%)	612	(30.3%)	p<0.0001[c]
Yellow	2,705	(53.0%)	1,242	(61.4%)	
Red	217	(4.2%)	142	(7.0%)	
Waiting time(minutes)	215	(2.1[a])	162	(3.2[a])	p<0.0001[b]
Wards					
Medical	4,684	(91.7%)	1,768	(87.4%)	
Surgical	317	(6.2%)	201	(9.9%)	p<0.0001[c]
ICU	105	(2.1%)	54	(2.7%)	

[a]Standard Error
[b]Mann-Whitney Test
[c]Chi-square Test

Table 3 - Differences in ED visits and hospitalization rate between 2019 and 2020 by each age group.

	ED visits					Hospitalization rate		
	2019		2020		p	2019	2020	p
65-74 years	1,941	(38.0%)	774	(38.3%)	0.847	20.8%	25.8%	0.0113
75-84 years	1,915	(37.5%)	676	(33.4%)	<0.0001	29.7%	39.4%	<0.0001
≥ 85 years	1,250	(24.5%)	573	(28.3%)	<0.0001	42.8%	57.1%	<0.0001
Total	5,106	(100%)	2,023	(100%)		29.5%	39.2%	<0.0001

Table 2 summarizes the characteristics of the presentation recorded for people aged ≥ 65 years, based on each time frame.

Table 3 shows the frequency of ED visits and hospitalizations for each age group. We observed no differences in ED visits for people aged 65-74 years. However, our data showed a reduction in the proportion of ED visits in the age group 75-84 years, and a simultaneous increase in the proportion of accesses in the next age group, both statistically significant. The Chi-squared test showed a statistically significant difference in hospitalization rates between 2019 and 2020 by each age group.

We observed a significant increase in the hospitalization rate between 2019 and 2020 in each age group (Figure 1).

Considering the ward of hospitalization, we observed a reduction in admissions to medical wards from 91.7% to 87.4% (Tab 2). At the same time, we recorded an increase in hospitalizations to surgical wards from 6.2% to 9.9%, and ICU from 2.1% to 2.7%

Moreover, we recorded a decreasing ratio between non-urgencies and non-deferable urgencies during 2020, for each age group: (a) for the age group 65-74, from 15.4 in 2019 to 7.3 in 2020; (b) for the age group 75-84, from 9.5 in 2019 to 4.7 in 2020; (c)

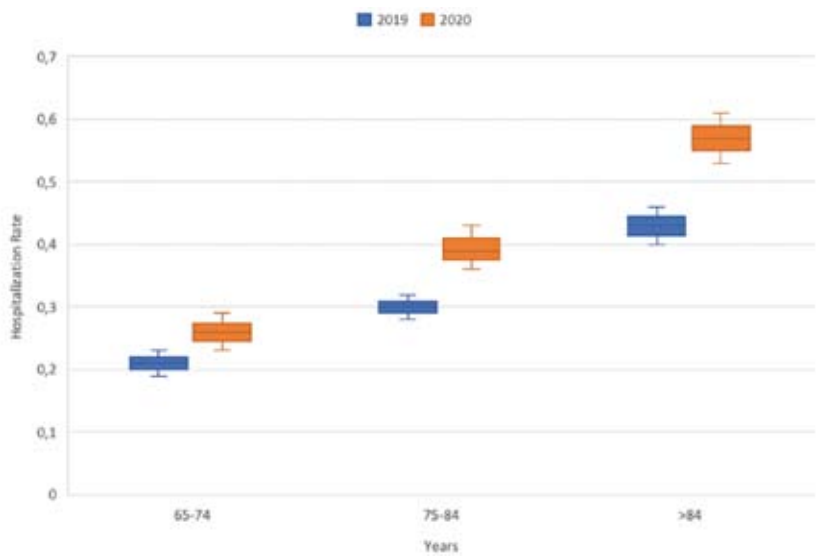

Figure 1 - Differences in hospitalization rate (HR) between 2019 and 2020 by age group.

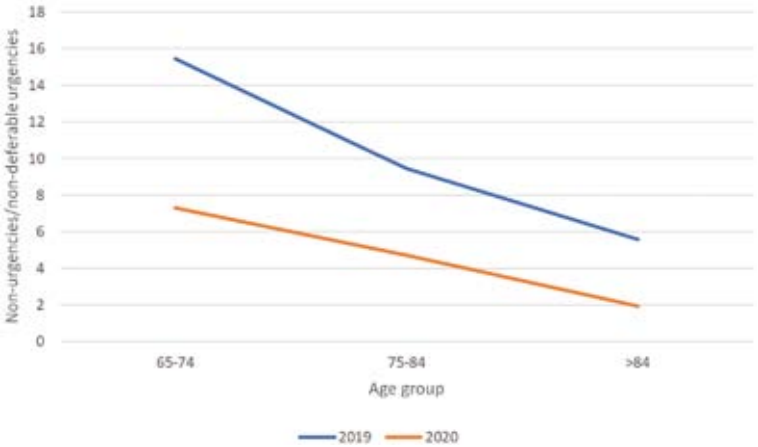

Figure 2 - Ratio between non-urgencies and non-deferable urgencies recorded in 2019 and 2020 for each age group

for the age group 85 or more, from 5.6 in 2019 to 1.9 in 2020 (Fig 2). Figure 3 shows a higher proportion of hospitalization for each red code recorded for each age group, particularly for the 65-74 age group.

The multivariate logistic regression model found that year (2019 vs. 2020, OR 1.51, 95% CI 1.35–1.69, $p < 0.0001$), the presentation at night-time (OR 1.22, 95% CI 1.08-1.38, p=0.001), more severe triage code (OR 20.04, 95% CI 6.36 – 63.16, p<0.0001), and advanced age were independent factors correlated with in-hospital admission (Tab 4).

Discussion and Conclusions

Italy has been one of the first countries mostly exposed to the 2020 spread of the SARS-Cov-2. The high number of infections prompted the authorities to enact stay-at-home orders and to impose a marked reduction in routine hospital

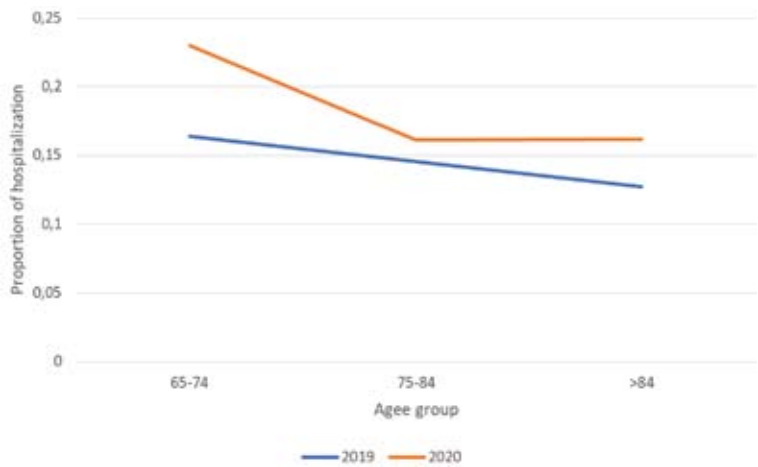

Figure 3 - Ratio between hospitalizations and red codes recorded in 2019 and 2020 for each age group

Table 4 - Multivariate logistic regression in people aged ≥ 65 years.

	Crude OR	C.I.	p-value	Adj. OR	C.I.	p-value
Year						
2019						
2020	1.56	1.38 – 1.72	<0.0001	1.51	1.35 – 1.69	<0.0001
Gender						
Female						
Male	1.05	0.95 – 1.16	0.314	0.93	0.84 – 1.03	0.183
Province of residence						
Others						
L'Aquila	1.2	1.01 – 1.42	0.034	1.09	0.92 – 1.29	0.330
Time of presentation						
Day-time						
Night-time	1.24	1.10 – 1.40	<0.0001	1.22	1.08 – 1.38	0.001
Age group (years)						
65-74						
75-84	1.67	1.47 – 1.88	<0.0001	1.69	1.49 – 1.92	<0.0001
≥ 85	3.14	2.76 – 3.57	<0.0001	3.15	2.76 – 3.59	<0.0001
Triage	6.8	6.04 – 7.67	<0.0001	6.23	5.52 – 7.03	<0.0001
White code						
Other codes	22.02	7.01 – 69.21	<0.0001	20.04	6.36 – 63.16	<0.0001

activities, allowing only urgent or non-deferrable procedures. As already described in specialized medical fields, the COVID-19 pandemic caused a change in the daily number of ED presentations, resulting in a decline in overall stroke and myocardial infarction admissions (2, 4, 13). The ED is one of the main available accesses to primary care and is a crucial operating unit for the LHUs. An emerging highly contagious infectious disease can change the patterns of healthcare-seeking behavior among individuals.

Owing to the Italian Government's recommendations and to the fear of contracting the virus, people were reluctant to leave home, particularly the elderly, as they are more vulnerable to COVID-19. Therefore, the observed reduction in ED visits among people aged ≥ 65 years (-60.4%) is indicative of how much the COVID-19 pandemic has affected healthcare seeking behavior and the use of emergency departments. Moreover, this significant reduction may have led to a worse outcome for patients.

During the pandemic, the virus reduced inappropriate use of the ED (i.e., non-urgent visits and subjectively perceived treatment urgency), forcing people to seek treatment services only in cases of acute life-threatening conditions, selecting those patients who needed more intensive care. On the other hand, people may have been reluctant to access ED, even for potentially serious conditions. Moreover, deferral of care for serious non–COVID-19 conditions may have caused delays in diagnosis, whose impact on patient outcomes is difficult to estimate at this time, as more time is needed to assess the long-term effects of a delayed diagnosis.

We reported a higher proportion of admissions during 2020: the rate of admission increased compared to the previous year (OR 1.51, p<0.0001). The higher proportion of

admissions during the COVID-19 period could be due to a reduction in the number of inappropriate ED visits, induced by fear of contagion. Indeed, during the pandemic, the number of these patients was probably reduced for fear of SARS-CoV-2 as we observed a reduction in the ratio between non-urgent and non-deferrable procedures for each age group during 2020, witnessing a critical reduction in the number of non-urgent ED visits compared to urgent visits. During the COVID-19 pandemic, patients might be reluctant anyway to visit EDs, even with certain high acuity conditions.

In Italy, patients often misuse EDs in an attempt to accelerate their diagnostic pathways, even in case of non-urgent problems (14, 15). This leads to overcrowded emergency departments in ordinary times, overloaded healthcare systems, increased wait times, and over-usage of resources leading to delays in treating seriously ill patients. During 2019, we reported a higher length of stay in ED, indicating a higher number of non-urgent presentations (codes white and green) which are classified as low priority, then resulting in longer ED wait times. Conversely, we observed a shorter length of stay in 2020, witnessing a larger number of high-severity ED visits, that were immediately admitted for in-patient care.

Thus, the reduction in the proportion of non-urgent visits among older adults could indicate that they suffered the most from the fear of contagion, as they are at higher risk for severe illness from COVID-19 (16). Indeed, older adults may represent a specific cluster of high-risk patients for developing COVID-19 with rapidly progressive clinical deterioration (7). The ratio between the number of hospitalizations and the red tags indicates that in 2020 in older age groups we observed a higher number of admissions as result of a greater complexity of the clinical picture, probably induced by an initial underestimation of symptoms.

This indicates that the pandemic period is the only factor that has led to a higher likelihood of hospitalization. During a pandemic, the health needs and the health-seeking behavior of people change: fear plays a fundamental role and can lead to a delay in accessing health services for urgent needs.

Our analysis is based on data derived from routine hospital activity during the peak of the COVID-19 crisis and the maximum pressure on hospitals. Analyzing this type of data can be a useful decision-making tool in public health in the event of a new wave of the virus. Indeed, data on ED visits can serve as an indicator of population behavior in the context of an emerging highly infectious disease and may suggest interventions to improve the response to people's health needs, thus avoiding delays in diagnosing severe diseases. Moreover, the change in the ED presentations led to a better selection of patients, highlighting an inappropriate use of emergency services that usually occurs in non-emergency periods. The ED is one, but not the only, first point of care for the population's health needs, which would require more attention from the local health authorities to reduce inappropriate ED utilization patterns (codes white and green) which lead to increased waiting times and treatment delays. Better management of non-urgent visits and subjectively perceived treatment urgency during non-emergency periods, along with effective public health messages, would be desirable to avoid delayed diagnosis and for a better management of critically ill patients (red code).

About the weaknesses of the study, it did not assess the cases by type of assistance provided and the hospitalization outcome, which could be better investigated in the future by integrating our data with those contained in the Hospital Discharge Record. In this perspective, we support the need for further studies on the medium- and long-term effects of the pandemic on non-COVID-19 patients, in order to enhance

public health emergency preparedness and population health advocacy. Moreover, our data are referred to a single Local Health Unit [although the study is single-centered, the authors believe that it may be representative of the national reality]. Despite these limitations, this study shows that the COVID-19 pandemic could have a significant impact on emergency services. While the percentage of hospitalizations increases, the number of emergency room visits decreases during the COVID-19 pandemic, with a particular decline in low-severity visits; these results are consistent with other studies (17-21). Although our study could not establish the reasons for the observed changes in ED visits and hospital admissions, these data will serve as a starting point for further research useful to improve health management during emergency but also in non-emergency periods. In fact, the pandemic has revealed the issues and shortcomings of EDs, often overcrowded due to minor acute illnesses. In this context, strengthening primary healthcare would be desirable: the implementation of a territorial healthcare system and a greater role of the general practitioner could offer a viable alternative to EDs for minor emergencies, minimizing the number of self-presenting patients (22).

Healthcare capacity changes during the pandemic and, on the one hand, public health authorities should provide guidance and resources to help patients determine the best place to receive treatment and, on the other hand, they should stress the importance of continuing to visit EDs for severe symptoms, diseases and injuries that cannot be managed otherwise (19).

As other studies have pointed out, our findings suggest that the COVID-19 pandemic has significantly affected the patterns of treatment-seeking behavior: the fear of what we could catch might be greater than the fear of what we suffer from (23, 24).

Riassunto

L'impatto della pandemia da COVID-19 sui servizi di emergenza

Premessa. La pandemia da SARS-CoV-2 ha messo sotto pressione i sistemi sanitari di tutto il mondo. Le drastiche misure preventive messe in atto hanno modificato gli spostamenti della popolazione, le attività quotidiane e il comportamento di chi cerca assistenza sanitaria. Nonostante l'attività dei Dipartimenti di Emergenza-Urgenza e Accettazione (DEA) non si sia mai fermata, la pandemia ha modificato sicuramente la loro attività quotidiana. Scopo del presente studio è di valutare come si è modificata tale attività, particolare attenzione alle persone anziane come componente fragile della popolazione generale.

Disegno di studio. Studio retrospettivo.

Metodi. Sono state analizzati tutti gli accessi non-COVID effettuati presso il DEA della ASL1 Abruzzo nel periodo che va dal 9 Marzo al 3 Maggio 2020. Questi sono stati confrontati con gli accessi registrati nello stesso periodo dell'anno precedente.

Risultati. Nel periodo considerato, abbiamo rilevato una riduzione degli accessi pari al 60,4% e un aumento del tasso di ospedalizzazione dal 30% al 39%. La riduzione degli accessi è stata osservata principalmente negli accessi meno gravi, ma abbiamo osservato un aumento statisticamente significativo del tasso di ospedalizzazione in tutte le fasce di età. Inoltre, nel 2020 abbiamo osservato, per ogni fascia di età, una riduzione nel rapporto tra gli accessi non urgenti e quelli per urgenze non differibili; mentre la percentuale di ricovero per ogni codice rosso registrato è aumentata per ogni gruppo, in particolare per il gruppo 65-74 anni.

Conclusioni. La pandemia da COVID-19 ha influenzato in modo significativo il comportamento della popolazione alla ricerca di cure. Il numero di accessi è diminuito, soprattutto quelli meno gravi, la percentuale di ospedalizzazioni aumenta durante l'epidemia COVID-19. Durante il 2020, il virus ha ridotto gli accessi non gravi, spingendo i pazienti ad accedere al DEA solo in casi di estrema necessità, selezionando coloro che avevano bisogno di cure più intensive; tuttavia, anche in presenza di un pericolo per la propria salute, molti possono essere state riluttanti a rivolgersi ai servizi sanitari. Tale riluttanza della popolazione può aver causato ritardi nella diagnosi, i cui effetti sulla salute dei pazienti sono difficili da stimare in questo momento. Queste informazioni serviranno da punto di partenza per ulteriori ricerche utili a migliorare la gestione sanitaria nei periodi, non solo di emergenza ma anche di non emergenza.

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