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Epidemiological Differences in Emergency Medical Service Utilization before and during the COVID-19 Epidemic in Slovenia: A Retrospective Observational Study

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Abstract

Introduction: The COVID-19 pandemic has significantly impacted emergency medical service (EMS) utilization worldwide. This study aimed to assess changes in EMS outpatient visits in Slovenia before and during the epidemic, focusing on diagnostic trends, referral patterns, and system responsiveness. **Methods:** We conducted a retrospective observational study using data from 5,650 patients who visited the emergency medical services of the Izola Health Centre between January 2019 and June 2021. The study compared patient volume, diagnoses, and referral outcomes during pre-epidemic and epidemic periods. Chi-square tests were used for statistical comparisons. **Results:** Emergency medical services visits slightly increased during the epidemic (2773 pre-epidemic vs. 2877 epidemic). Urgent referrals to secondary care rose significantly (376 vs. 575; $\chi^2 = 120.142$, $p < 0.001$). Respiratory diagnoses declined (250 vs. 102; $\chi^2 = 70.243$, $p = 0.058$), while visits for repeat prescription requests (Z76.0) increased significantly (64 vs. 102; $\chi^2 = 7.581$, $p = 0.007$). **Discussion and Conclusions**: The results indicate that EMS outpatient clinics played a critical and adaptable role during the COVID-19 epidemic, serving both urgent and non-urgent needs. These insights underline the importance of flexible EMS integration within health systems to ensure resilience during future public health emergencies.

Keywords

Primary Care Disruption, Outpatient Triage, Health Service Utilization, Emergency Referrals, Pandemic Healthcare Behavior

1. Introduction

The COVID-19 pandemic was declared a public health emergency of international concern by the World Health Organization in January 2020, profoundly transforming the delivery of healthcare services worldwide [1]. While the spotlight was largely focused on hospital preparedness, intensive care capacity, and vaccination rollout, the pandemic also significantly affected emergency medical service (EMS) utilisation, both in pre-hospital and outpatient settings [2] [3].

During the early stages of the pandemic, many countries—including Italy, Germany, Ireland, and the United States—reported a marked reduction in emergency department (ED) visits [4]-[7]. This decline was especially evident in non-COVID-related cases, particularly among patients with chronic conditions or minor acute illnesses, who often avoided seeking care due to fear of infection, limited service availability, or perceptions of healthcare system overload [8] [9]. At the same time, several studies observed an increase in the severity and urgency of the cases that did present, as delays in seeking care contributed to poorer clinical outcomes [10].

Research from Belgium, Spain, and the United Kingdom also highlighted a growing reliance on EMS and outpatient emergency clinics for chronic disease management and administrative tasks, such as repeat prescription requests, in response to reduced access to general practitioners during lockdowns [9] [11] [12]. In Austria and the Netherlands, EMS providers reported increasing case complexity and urgency, indicating a functional shift whereby these services partly assumed responsibilities traditionally handled by primary care [13] [14].

Although hospital-based EDs have been the primary focus of studies on healthcare utilization during the pandemic, there remains a notable lack of data on the role and response of outpatient EMS clinics—particularly in smaller European countries. Few studies have explored how these services, which operate at the interface of emergencies and primary care, adapted to the evolving demands and systemic pressures during prolonged periods of crisis.

Slovenia, a Central European country with a population of approximately 2.1 million, declared a national epidemic in March 2020 and introduced a series of lockdowns and mobility restrictions [15]. These measures had direct implications for EMS and primary care services, necessitating rapid adaptations in operational procedures, including infection control protocols, triage strategies, and referral pathways. While anecdotal reports from Slovenian EMS teams suggested notable changes in service delivery, systematic and locally focused analyses have been lacking.

The Health Centre, situated on Slovenia's southwestern coast, delivers outpatient EMS care to a diverse population of residents, seasonal workers, and tourists. Its unique geographic and organizational structure—integrating primary, emergency, and specialist care within a single facility—makes it an ideal setting for examining shifts in EMS utilization during the COVID-19 pandemic in a semi-urban context.

This retrospective observational study aims to identify epidemiological changes

in EMS outpatient visits at the Izola Health Centre before and during the COVID-19 epidemic. Specifically, the study seeks to 1) compare the total number of EMS visits across pre-epidemic and epidemic periods; 2) evaluate changes in the proportion of urgent referrals to secondary care 3) examine shifts in the frequency of common diagnostic categories, with a particular focus on respiratory conditions; and 4) determine whether respiratory diagnoses were more frequently referred for specialist or hospital care during the epidemic. These findings are intended to inform future strategies for EMS preparedness and system resilience in public health emergencies.

2. Methods

2.1. Study Design and Settings

The study conducted a retrospective observational design to investigate patterns in emergency outpatient care at the EMS clinic of the Izola Health Centre, Slovenia. The EMS clinic is part of the public primary care system and serves as the first point of contact for patients requiring urgent medical attention outside of hospital settings. As a mixed coastal municipality, Izola receives both local and seasonal populations, offering a unique setting for analyzing healthcare demand during a public health emergency. Retrospective observational studies are particularly useful for exploring healthcare utilization trends during large-scale disruptions, such as pandemics, where randomization and prospective follow-up are not feasible [1].

The Emergency Medical Service (EMS) outpatient clinic operates within the Izola dispatch center and includes an independent triage system upon patient arrival. The team consists of a physician and a paramedic, who provide care both in the clinic and in the field.

2.2. Study Period and Epidemic Classification

The study covered patient encounters between 1 January 2019 and 15 June 2021. Based on official government declarations of the COVID-19 epidemic in Slovenia, two distinct periods were defined: 1) Pre-epidemic period (PE): 1 January 2019 to 11 March 2020 and 2) Epidemic period (EP): 12 March 2020 to 14 May 2020 and 18 October 2020 to 15 June 2021.

The period from 15 May to 17 October 2020, when the epidemic was not officially declared, was excluded to maintain temporal consistency and comparability.

2.3. Study Population

The study included all patients who sought care at the EMS outpatient clinic during the defined periods. The study included a total of 5650 patients, with 2773 patients treated during the pre-epidemic period and 2877 during the epidemic period. Among the total sample, 2932 patients (51.9%) were female, and 2718 (48.1%) were male, indicating a balanced gender distribution. The mean age of all

patients was 47.2 years (±19.1), with a median age of 47 years and an interquartile range (IQR) of 32 - 68 years. The age distribution remained comparable across the two periods, with no significant demographic shifts observed between them. These values suggest that the EMS outpatient clinic served a demographically stable population throughout the study timeline, representative of both working-age adults and elderly individuals.

These demographics reflect a diverse EMS population, like that reported in primary care settings during COVID-19 in other European countries [16]. Notably, pediatric visits decreased, while the proportion of elderly patients with chronic conditions remained stable.

2.4. Data Collection

Data was extracted from the institutional electronic health record system. The dataset was fully anonymized and included the following variables: 1) Date of visit, 2) Diagnosis code (ICD-10), 3) Diagnosis description, 4) Referral status (primary care vs. referral to secondary care or hospitalization, 5) Disease classification (e.g., respiratory, cardiovascular, musculoskeletal) and 6) Administrative triage data (urgency where applicable).

All data were anonymized before analysis. No personal identifiers were collected or processed, and no direct patient contact occurred. As this was a retrospective analysis of routinely collected data, informed consent was waived.

2.5. Hypotheses

The following hypotheses were tested:

- H1: The number of EMS visits decreased during the epidemic.
- H2: The number of urgent referrals to secondary care increased during the epidemic.
- H3: The proportion of respiratory diagnoses increased during the epidemic.
- H4: The proportion of respiratory diagnoses referred to secondary care increased during the epidemic.
- H5: The diagnosis Z76.0 (repeat prescription requests) increased during the epidemic.

2.6. Statistical Analysis

Descriptive statistics (frequencies, percentages) were used to summarise patient characteristics, diagnoses, and referrals across the two periods. The chi-square (χ^2) test was applied to assess differences in categorical variables between periods. All statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA). A p-value of <0.05 was considered statistically significant.

Due to the nature of the data (non-normal distribution and categorical format), non-parametric tests were chosen. Missing data (particularly regarding referral status) were noted and considered in the interpretation of results but not imputed.

2.7. Ethical Considerations

The study was approved by the National Medical Ethics Committee of the Republic of Slovenia (approval no. 0120-468/2022/6). All data were fully anonymized prior to analysis in accordance with the General Data Protection Regulation (GDPR) and Slovenian data protection legislation.

Because the study involved secondary use of routinely collected data and no patient contact, informed consent was waived. The study was conducted in line with the ethical principles outlined in the Declaration of Helsinki [17].

3. Results

This section presents the findings of the retrospective analysis comparing EMS outpatient service utilization before and during the COVID-19 epidemic. The analysis includes data on patient volume, demographic characteristics, diagnostic trends, referral patterns, and the outcomes of five predefined hypotheses. Statistical comparisons between the pre-epidemic and epidemic periods were performed using chi-square tests for categorical variables. The aim was to identify any significant shifts in the type, frequency, and urgency of EMS visits that could inform future emergency healthcare planning in the context of public health crises.

Hypothesis 1: EMS visit numbers decreased during the epidemic

During the epidemic period, 2877 patients visited the EMS outpatient clinic, compared to 2773 during the pre-epidemic period. Although the increase was modest, it represents a deviation from trends observed in many other European healthcare settings, where emergency visit numbers declined due to lockdowns, fear of infection, and changes in healthcare accessibility. In Izola, however, the data suggests relative stability or a slight increase in EMS demand during the pandemic. Hypothesis 1 was rejected.

Hypothesis 2: Urgent referrals to secondary care increased during the epidemic

The number of urgent referrals (to hospitals or specialists) rose from 376 cases in the pre-epidemic period to 575 during the epidemic, representing a statistically significant increase ($\chi^2 = 120.142$, $p < 0.001$). This finding suggests that either the clinical acuteness of patients increased or that primary care services were less accessible, prompting EMS providers to escalate care more frequently. Hypothesis 2 was confirmed (**Table 1**).

Table 1. Urgent Referrals to secondary care increased during the epidemic.

Diagnosis	Period	Yes	No	χ^2	p
Secondary referral	Pre-epidemic	376	1022	120.142	<0.001
	Epidemic	575	98		

Legend: n = number of cases; χ^2 = chi-square statistic; p = p-value.

Hypothesis 3: The proportion of respiratory diagnoses increased during the epidemic

Contrary to the hypothesis, the number of respiratory diagnoses decreased from 250 cases before the epidemic to 102 cases during the epidemic. This trend, although marginally non-significant (χ^2 = 70.243, p = 0.058), may reflect public health interventions such as masking, reduced transmission of other respiratory pathogens, or delayed presentation for milder symptoms. It may also indicate avoidance of EMS for COVID-like symptoms in favor of designated testing or triage centers. Hypothesis was rejected (**Table 2**).

Table 2. The proportion of respiratory diagnoses increased during the epidemic.

Diagnosis	Period	Yes	No	χ^2	p
Respiratory diagnosis	Pre-epidemic	250	2523	70.243	0.058
	Epidemic	102	2775		

Legend: n = number of cases; χ^2 = chi-square statistic; p = p-value.

Hypothesis 4: Referrals for respiratory diagnoses to secondary care increased during the epidemic

Among respiratory cases, 40 patients were referred to secondary care in the pre-epidemic period, compared to 27 during the epidemic. This decrease was not statistically significant (χ^2 = 3.745, p = 0.161). The reduction in respiratory-related referrals is consistent with the overall decrease in respiratory diagnoses and may also indicate a shift toward managing such cases within primary care or telemedicine pathways. Hypothesis 4 was rejected (**Table 3**).

Table 3. Referrals for respiratory diagnoses to secondary care increased during the epidemic.

Diagnosis	Period	Yes	No	χ^2	p
Respiratory referral	Pre-epidemic	40	336	3.745	0.161
	Epidemic	27	548		

Legend: n = number of cases; χ^2 = chi-square statistic; p = p-value.

Hypothesis 5: The number of repeat prescription visits (Z76.0) increased during the epidemic

The frequency of visits with the diagnosis code Z76.0 (Repeat prescription request) rose significantly, from 64 cases before the epidemic to 102 during the epidemic. The increase was statistically significant (χ^2 = 7.581, p = 0.007), highlighting a potential shift in patient behavior and system reliance—especially during periods when primary care physicians were less accessible. EMS outpatient clinics appear to have served as a substitute access point for non-urgent, administrative care during health system strain. Hypothesis 5 was confirmed (**Table 4**).

An overview of the most frequently recorded diagnoses during both the pre-epidemic and epidemic periods provides insight into prevailing health concerns and patterns of EMS utilization in outpatient settings.

Table 4. The number of repeat prescription visits (Z76.0) increased during the epidemic.

Diagnosis	Period	Yes	No	χ^2	p
Repeat prescriptions (Z76.0)	Pre-epidemic	64	2709	7.581	0.007
	Epidemic	102	2775		

Legend: n = number of cases; χ^2 = chi-square statistic; p = p-value.

An overview of the most frequently recorded diagnoses during both the pre-epidemic and epidemic periods provides insight into prevailing health concerns and patterns of EMS utilization in outpatient settings. Notably, Z48.0 (surgical wound care) and I10 (essential hypertension) showed a marked increase during the epidemic period, suggesting continued demand for chronic disease management and post-operative care, even amidst pandemic-related restrictions. Additionally, a significant rise in visits for Z76.0 (repeat prescription requests) was observed, aligning with the shift in patient behavior and reliance on EMS for non-urgent, administrative care. In contrast, B34.9 (unspecified viral infection), which was among the most common diagnoses before the epidemic, slightly declined during the pandemic, potentially reflecting the impact of public health measures in reducing transmission of common respiratory viruses (**Table 5**).

Table 5. Most frequent diagnoses.

ICD-10 Code	Diagnosis Description	Pre-epidemic	Epidemic
B34.9	Unspecified viral infection	196	168
Z48.0	Surgical wound care	98	146
I10	Essential hypertension	87	123
Z76.0	Repeat prescription request	64	102
R33	Urinary retention	26	59

4. Discussion

This study evaluated the impact of the COVID-19 epidemic on emergency medical service (EMS) utilization in an outpatient setting at the Izola Health Centre in Slovenia. While the dominant international narrative reports a marked reduction in emergency department (ED) and EMS use during the pandemic, our results reveal a more nuanced situation. Not only did the total number of EMS visits decline, but a slight increase was observed during the epidemic period. At the same time, the structure of service demand shifted significantly, with an increase in urgent referrals and visits for non-urgent administrative reasons such as repeat prescriptions. These findings illustrate the adaptability of local EMS systems in absorbing both clinical and organizational stress during prolonged health emergencies, and they highlight the need to further understand how such frontline services function under systemic strain [17] [18].

The slight increase in EMS visits stands in contrast to evidence from countries

such as Italy, the UK, the United States, and Germany, where reductions in ED visits ranged from 30% to over 70% in some settings, particularly during the initial lockdown phases. These reductions have been largely attributed to fear of infection, decreased availability of healthcare services, and public messaging that discouraged non-essential visits [5] [6] [8]. In contrast, the stable or increasing use of EMS services in Izola may reflect the community's perception of outpatient EMS clinics as more accessible and safer than hospital settings. The integrated organization of the Izola Health Centre, which combines primary, emergency, and specialist services, may have contributed to this phenomenon by lowering the threshold for access and reducing perceived institutional barriers during the pandemic.

A particularly important finding was the statistically significant rise in urgent referrals to secondary care. This aligns with international trends suggesting that although fewer patients sought care, those who did often presented with more advanced or severe conditions due to delays in seeking help [12] [14] [16] [18]. Another contributing factor may have been the reduced availability of general practitioners during lockdown periods, leading EMS providers to assume an expanded triage role. This supports earlier research from Austria and the Netherlands, where EMS and EDs were increasingly required to manage cases traditionally handled in primary care [9]. These findings raise broader questions about health system preparedness and the flexibility of service lines under crisis conditions.

Perhaps one of the more counterintuitive results was the significant decrease in respiratory diagnoses during the epidemic. Given that COVID-19 is primarily a respiratory illness, a rise in such cases would have been expected. However, several plausible explanations emerge. First, Slovenia implemented functional separation for suspected COVID-19 cases, directing them to designated triage and testing centers rather than EMS outpatient clinics. This structural strategy likely diverted many respiratory cases away from the EMS pathway, resulting in underrepresentation in our data. Second, as seen in Finland and the UK, public health measures such as masking, physical distancing, and movement restrictions led to reduced transmission of other respiratory pathogens, including influenza, RSV, and rhinoviruses [11] [14]. Our data support this interpretation, as the decrease in respiratory diagnoses was paralleled by a broader decline in viral illness codes such as B34.9.

An especially notable trend was the increase in visits for repeat prescription requests (ICD-10-Z76.0), which were significantly more frequent during the epidemic period. While such visits may be viewed as administrative rather than clinically urgent, they serve as indicators of systemic strain. Similar findings have been reported in Spain, Belgium, and the UK, where patients resorted to EMS or ED services for prescription renewals when primary care access was limited or disrupted [2] [8] [15]. This shift illustrates how patient pathways were altered in response to the reduced availability of GPs and how EMS services absorbed non-urgent care traditionally outside their remit. It further reflects a reactive reorganization of care, where formal systems failed to adapt in time to sustain continuity

for chronic disease management.

Another diagnostic shift involved an increase in cases of hypertension (I10) and urinary retention (R33), both of which may point to the indirect impact of the pandemic on chronic disease control and care continuity. Additionally, emerging evidence from Slovenia and elsewhere suggests that cardiovascular and urogenital symptoms are among the most common manifestations of long-term COVID-19, particularly in outpatient populations not hospitalized during acute infection [14] [18]. This further supports the hypothesis that EMS outpatient services may have functioned as a default contact point for post-acute and long-term COVID-19 sequelae in the absence of specialized follow-up structures.

Collectively, these findings shed light on the phenomenon of role drift in EMS during health crises. Role drift—defined as the informal expansion of professional responsibilities beyond their intended scope—has been observed in several healthcare domains during the COVID-19 pandemic. In our study, the rise in non-urgent administrative visits, chronic disease care, and repeat prescriptions suggests that EMS providers assumed roles usually reserved for general practitioners. While such flexibility may enhance system resilience in the short term, it carries long-term risks, including professional burnout, diminished quality of acute care, and resource misallocation [12] [14] [18]. Addressing role drift requires proactive strategies, such as strengthening telemedicine infrastructure, introducing delegated prescription renewal systems, and ensuring that EMS triage protocols are clearly defined and enforced. Additionally, improved data integration between EMS and primary care services could support better coordination and task allocation during crises.

Despite its strengths, including the use of comprehensive EMS records and a demographically stable sample, this study has several limitations. The analysis is limited to a single site, which may reduce generalizability to other regions with different healthcare models or population structures. Furthermore, the study did not include clinical outcome data (e.g., hospital admissions, morbidity, or mortality), limiting its ability to assess the downstream impact of care pathway changes [12] [14]. Missing referral data in a subset of cases also poses a potential source of bias. Future research should aim to link EMS visit data with hospital and mortality registries to provide a more complete picture of service outcomes. Moreover, qualitative investigations into patient experiences, motivations for choosing EMS care, and perceptions of system accessibility could further enrich understanding of health-seeking behaviors during public health emergencies [1] [4] [8].

In conclusion, this study offers important insights into the adaptability and challenges of EMS outpatient services during the COVID-19 epidemic in Slovenia. While EMS clinics demonstrated resilience in maintaining service continuity and absorbing increased demand, they also revealed underlying vulnerabilities in system design, particularly concerning role clarity and resource allocation. Moving forward, EMS should be more formally integrated into national emergency preparedness frameworks, with clear protocols that preserve their core emergency function while providing contingency support for disrupted primary care. Such an approach would not only improve responsiveness during future crises but also protect the in-

tegrity and sustainability of EMS systems as a cornerstone of resilient healthcare delivery.

5. Implications

The findings of this study yield several meaningful implications for clinical practice, healthcare organization, and public health policy. First, the EMS outpatient clinic in Izola demonstrated its role not only as an emergency response unit, but also as a flexible safety net capable of absorbing chronic and administrative care demands during a crisis. This reinforces the importance of recognizing EMS clinics as multifunctional healthcare hubs that require proper resources and structural support in emergency preparedness plans. Second, the increase in urgent referrals alongside a rise in repeat prescription visits highlights a systemic challenge in maintaining primary care access during health crises. To address this, stronger integration of EMS with general practice and telemedicine services is needed to ensure continuity of care and reduce unnecessary escalations. Third, the observed rise in non-urgent administrative visits (e.g., Z76.0) points to the need for redesigning decentralized access pathways for routine services—such as digital or community-based prescription platforms, especially when traditional primary care is constrained. Fourth, the study underscores the public health value of EMS data, which can serve as an early indicator of shifts in population health behavior and system pressure. Enhancing digital infrastructure and real-time data reporting mechanisms would support more responsive health planning. Moreover, the increased presence of chronic disease diagnoses such as hypertension and urinary retention may reflect not only long-COVID sequelae, as observed in other Slovenian research, but also the consequences of disrupted disease management during lockdowns. EMS providers should, therefore, be included in protocols for recognizing and referring patients with possible post-COVID complications. Lastly, these findings raise important questions about workforce sustainability and the risk of role drift in EMS settings. To avoid burnout and preserve the quality of emergency care, EMS personnel must receive clear role definitions, adequate training, and institutional support. The Izola experience—marked by stable EMS utilization and adaptability—also suggests that integrated local health systems may exhibit greater resilience under epidemic conditions, offering valuable lessons for future preparedness in similar regions.

6. Limitations

This study has several limitations that should be considered when interpreting the findings. First, it was conducted at a single EMS outpatient clinic in Slovenia, which limits the generalizability of the results to other regions with different healthcare structures or population profiles. Second, the study relied solely on routinely collected administrative data, which did not include clinical outcomes such as disease severity, hospital admission rates, or mortality. Third, although diagnostic and referral data were analyzed, a significant proportion of referral records (n = 2398)

were missing, which could introduce bias in the interpretation of referral trends. Fourth, behavioral and psychosocial factors—such as fear of infection, patient satisfaction, or reasons for EMS selection—were not captured but may have significantly influenced healthcare-seeking patterns during the epidemic. Lastly, the exclusion of the non-epidemic transitional period between May and October 2020 may have masked important short-term fluctuations in EMS usage.

7. Conclusion

This retrospective study demonstrated that, in contrast to international trends, EMS outpatient visits in Izola, Slovenia, did not decline during the COVID-19 epidemic. Instead, we observed a statistically significant increase in urgent referrals, a decrease in respiratory diagnoses, and a rise in visits for administrative needs such as prescription renewals. These findings highlight the adaptability of EMS services under crisis conditions and their expanding role in covering gaps in primary care. Further integration of EMS into public health planning is essential to ensure effective and sustainable healthcare delivery during future health emergencies.

Ethics Approval and Consent to Participate

Ethical approval for this study was granted by the National Medical Ethics Committee of the Republic of Slovenia (approval no.0120-468/2022/6). All data were fully anonymized prior to analysis in accordance with the General Data Protection Regulation (GDPR) and Slovenian data protection legislation.

Authors' Contributions

J.H.: Conceptualization, Data Collection, Data Analysis, Writing—Original Draft Preparation.

J.H. & M.P.: Interpretation of Data, Writing—Reviewing and Editing.

M.P.: Methodology, Supervision, Finalization of Manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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