Impact of the COVID-19 Pandemic on Primary Care Referral Patterns and Resource Utilization in a Hospital Emergency Department: A Comparative Pre- and Post-Pandemic Study

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Article

Impact of the COVID-19 Pandemic on Primary Care Referral Patterns and Resource Utilization in a Hospital Emergency Department: A Comparative Pre- and Post-Pandemic Study

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Abstract

Background: The COVID-19 pandemic profoundly disrupted healthcare utilization patterns at both primary care (PC) and hospital emergency department (ED) levels. This study aimed to assess the impact of the pandemic on referral patterns from PC to a hospital ED and on the resource consumption associated with those referrals. Methods: describe briefly the main methods or treatments applied. Methods: A descriptive, retrospective, longitudinal comparative study was conducted at a first level hospital of Madrid (Spain). All consecutive PC-to-ED referrals received during two observation windows were included: a pre-pandemic period (1 June-31 December 2019; $n = 946$) and a post-pandemic period (1 January-30 June 2022; $n = 1{,}797$). Sociodemographic characteristics, referral form quality, diagnostic specialty, and in-ED resource utilization variables were collected and compared using χ^2, Student's t-test, and Mann–Whitney U tests as appropriate. Results: A total of 2,743 referrals were analyzed. The monthly referral rate increased by approximately 122% between periods (135/month vs 300/month). No significant differences were found in patient age (mean 53.1 ± 18.3 vs 54.9 ± 19.0 years; $p = 0.015$) or sex. Referral form completion improved significantly for clinical history (94.5% vs 98.2%; $p < 0.001$). Orthopedics referrals nearly tripled (5.8% vs 18.4%), while respiratory/COVID-19-related referrals represented 22.0% of the 2022 caseload. ED length of stay between 3 and 6 hours increased from 13.0% to 42.8% ($p < 0.001$), while the need for urgent blood tests fell from 68.9% to 56.0% ($p < 0.001$), hospital admission from 68.4% to 10.9% ($p < 0.001$), and referral to another center from 12.3% to 0.9% ($p < 0.001$). Conclusions: indicate the main conclusions or interpretations. The abstract should be an objective representation of the article, it must not contain results which are not presented and substantiated in the main text and should not exaggerate the main conclusions. After the initial COVID-19 waves, PC-to-ED referrals increased substantially while requiring fewer complementary investigations and generating fewer hospital admissions, suggesting improved coordination and clinical resolution capacity between PC and the ED. These findings have important implications for post-pandemic healthcare planning.

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1. Introduction

The Spanish National Health System operates through a multilevel, multidisciplinary structure in which primary care (PC) and hospital emergency departments (EDs) constitute the two main entry points for patients [1]. Both levels of care have experienced a sustained increase in demand over recent decades, making effective coordination between them essential for delivering safe, high-quality, and efficient care [2,3].

PC physicians have a pivotal role in regulating patient flow to EDs. Appropriate referral not only ensures that patients receive the level of care they require but also prevents unnecessary overcrowding of EDs, which is associated with increased adverse outcomes and healthcare costs[4,5]. The proportion of patients who may be safely managed at the PC level depends on the accessibility and technical capacity of PC services, including the availability of point-of-care diagnostics and specialist teleconsultation [5,6]. When PC capacity is insufficient, patients who could be managed in the community end up attending the ED with benign or low-acuity conditions, straining hospital resources [4].

The COVID-19 pandemic, declared by the World Health Organization in March 2020, caused unprecedented disruption to health systems worldwide [7,8]. In Spain, as in many other countries, the successive pandemic waves forced a rapid reorganization of healthcare delivery at all levels: telehealth consultations were scaled up, elective activities were canceled, and infection control measures were implemented throughout the care pathway. Several studies have documented a sharp initial reduction in ED attendances during the first COVID-19 wave [9,10], followed by a gradual recovery and, in some centers, a rebound in demand during subsequent waves in 2021–2022.

However, the specific effect of the pandemic on PC-to-ED referral behavior, in terms of both volume and clinical complexity, remains poorly characterized, particularly for the post-confinement recovery period. Existing Spanish literature has primarily focused on within-hospital or within-ED impact [10], without explicitly examining the interface between PC and secondary care. Understanding how the pandemic reshaped this interface is crucial for informing future resource planning and for identifying whether pandemic-era improvements in communication and clinical resolution may be sustained.

The study hospital is a first-level referral university hospital affiliated with a Spanish public university, serving a catchment area of approximately 200,000 inhabitants through eight main PC centers in its reference health district. In 2019, the ED received approximately 150 patients per day, of whom an estimated 7-8% were referred from PC. This setting therefore represents a suitable single-center model for studying the PC-ED interface.

The objectives of this study were: (1) to compare the volume and characteristics of -ED referrals between the pre-pandemic and post-pandemic periods; (2) to evaluate the quality of referral documentation; and (3) to compare in-ED resource utilization and patient outcomes between the two periods.

2. Materials and Methods

2.1. Study Design and Setting

A descriptive, retrospective, longitudinal comparative study was conducted at the Emergency Department of a first-level referral university hospital serving a mixed urban-rural area in southern Spain, affiliated with a national public university.

2.2. Study Periods and Population

Two non-overlapping observation windows were selected (Figure 1):

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- **Pre-pandemic period**: 1 June - 31 December 2019 (7 months), preceding the onset of the COVID-19 pandemic in Spain.
- **Post-pandemic period**: 1 January - 30 June 2022 (6 months), after the main pandemic waves had subsided but while the healthcare system was still operating under the influence of pandemic-related structural changes.

All consecutive referrals from PC centers to the ED received during regular working hours (Monday to Friday, 08:00–21:00; morning shift 08:00–15:00 and afternoon shift 15:00-21:00) were included. Referrals originating from PC urgent-care services, specialist outpatient clinics, or external specialists were excluded.

Figure 1. Study flowchart

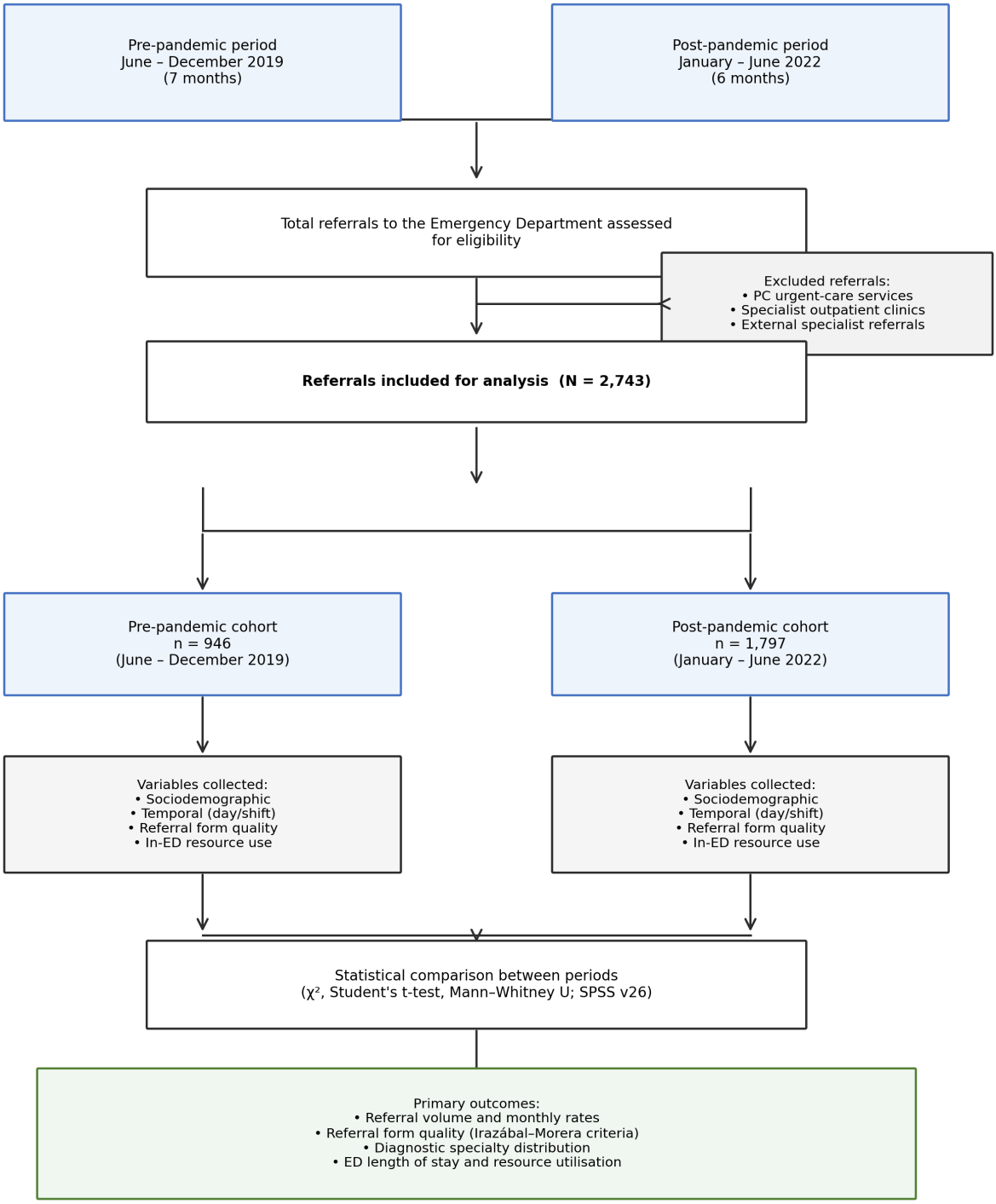

Figure 1. Flowchart of the study population. PC: primary care; ED: emergency department.

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2.3. Variables

The following variables were collected from anonymized referral forms and the electronic medical record:

Sociodemographic variables: age (years, continuous); sex (male/female); PC center of origin (eight centers, identified as PC Centers 1-8 in order of referral volume).

Temporal variables: day of the week (Monday to Friday); work shift (morning or afternoon).

Referral form quality variables, assessed using the validated quality criteria of Irazábal and Gutiérrez [11] as modified by Morera et al. [12]: presence of clinical history (yes/no); physical examination findings (yes/no); diagnostic impression or clinical judgment (yes/no); and reason for referral (specialist assessment; request for complementary test; request for admission; appointment request).

Clinical specialty: diagnoses classified into Cardiology, Hematology, Infectious Diseases, Dermatology, Neurology, Gastroenterology, Pulmonology (including COVID-19), Orthopedics, ENT (Otorhinolaryngology), Nephrology, Urology, Gynecology, Ophthalmology, Psychiatry, General Surgery, Endocrinology, Rheumatology, Maxillofacial Surgery, Allergology, and Vascular Surgery.

In-ED resource utilization and outcome variables: need for urgent blood tests (yes/no); plain radiography (yes/no); advanced imaging (urgent ultrasound or CT scan) (yes/no); urgent specialist consultation (yes/no); intravenous treatment or plaster cast (yes/no); ED length of stay (<3 h; 3–6 h; 6–12 h; >12 h); need for ED observation (yes/no); hospital admission (yes/no); and referral to another center (yes/no).

2.4. Data Collection and Ethics

All data were extracted from a password-protected database specifically designed for this study and accessible only to the principal investigators. The study was approved by the Ethics and Research Committee of Hospital Universitario Puerta de Hierro (Approval No. ACT 151/22) and conducted in accordance with the principles of the Declaration of Helsinki, the Spanish Data Protection Act (BOE-A-2018) and the European General Data Protection Regulation (EU 2016/679).

2.5. Statistical Analysis

Categorical variables were described as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation (SD). Between-group comparisons used the χ^2 test for categorical variables, Student's *t*-test for normally distributed continuous variables, and the Mann-Whitney U test for non-normally distributed variables; ANOVA and Kruskal-Wallis tests were applied for comparisons involving more than two groups. Statistical significance was set at $p < 0.05$. All analyzes were performed with IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Referral Volume and Sociodemographic Characteristics

A total of 2743 PC-to-ED referrals were analyzed: 946 (34.5%) in the pre-pandemic period (June-December 2019) and 1797 (65.5%) in the post-pandemic period (January-June 2022). Adjusting for the different observation lengths (7 vs. 6 months), the monthly referral rate increased from approximately 135 to 300 referrals per month, a 122% increase.

The mean age of patients was similar between periods (53.1 ± 18.3 years in 2019 vs. 54.9 ± 19.0 years in 2022; $p = 0.015$), with no clinically meaningful difference. No significant sex differences were observed: 431 males (45.6%) and 515 females (54.4%) in 2019 vs. 829 males (46.1%) and 968 females (53.9%) in 2022 ($p = 0.775$).

Referral distribution by day of the week showed significant differences ($p = 0.026$);Wednesday was consistently the day with the highest number of referrals in both periods (223, 23.6% in 2019; 401, 22.3% in 2022). No significant shift differences were observed ($p = 0.283$). Referral volume varied significantly by PC center ($p = 0.001$): PC Centre 1 generated the most referrals in both periods (255 in

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2019; 428 in 2022), followed by PC Centre 2 (180; 214), PC Centre 3 (159; 278), and PC Centre 4 (158; 350). Full data are presented in Table 1.

Table 1. Sociodemographic characteristics, referral origin by PC centre, and temporal distribution of referrals in the pre-pandemic (2019) and post-pandemic (2022) periods. PC centres are numbered in descending order of referral volume in 2019.

Variable	2019 (n = 946) N (%)	2022 (n = 1,797) N (%)	p-value
Sex			
Female	515 (54.4)	968 (53.9)	0.775
Male	431 (45.6)	829 (46.1)	
PC centre of origin			
PC Centre 1	255 (27.0)	428 (23.8)	<0.001
PC Centre 2	180 (19.0)	214 (11.9)	
PC Centre 3	159 (16.8)	278 (15.5)	
PC Centre 4	158 (16.7)	350 (19.5)	
PC Centre 5	71 (7.5)	96 (5.3)	
PC Centre 6	33 (3.5)	196 (10.9)	
PC Centre 7	23 (2.4)	107 (6.0)	
PC Centre 8	9 (1.0)	49 (2.7)	
Other centres	58 (6.1)	79 (4.4)	
Day of the week			
Monday	214 (22.6)	360 (20.0)	0.026
Tuesday	161 (17.0)	390 (21.7)	
Wednesday	223 (23.6)	401 (22.3)	
Thursday	168 (17.8)	340 (18.9)	
Friday	180 (19.0)	306 (17.0)	
Work shift			
Morning (08:00–15:00)	543 (57.4)	993 (55.3)	0.283
Afternoon (15:00–21:00)	403 (42.6)	804 (44.7)	

3.2. Referral Form Quality

Completion of the clinical history section improved significantly (94.5% in 2019 vs. 98.2% in 2022; $p < 0.001$). The presence of a diagnostic impression also increased significantly (44.7% vs. 50.1%; $p = 0.008$). No significant change was found for the physical examination section (81.2% vs. 83.7%; $p = 0.097$).The most frequent reason for referral was specialist assessment in both periods (92.8% vs. 92.9%; $p = 0.282$). Data are summarized in Table 2.

Table 2. Reason for referral and quality of referral form completion in the pre-pandemic (2019) and post-pandemic (2022) periods. Quality criteria assessed per Irazábal–Gutiérrez/Morera methodology.

Variable	2019 (n = 946) N (%)	2022 (n = 1,797) N (%)	p-value
Reason for referral			
Specialist assessment	878 (92.8)	1,668 (92.9)	0.282
Request for complementary test	68 (7.0)	128 (7.1)	
Request for admission	1 (0.1)	0 (0.0)	
Appointment request	1 (0.1)	0 (0.0)	
Referral form completeness			
Clinical history present	894 (94.5)	1,765 (98.2)	<0.001
Physical examination present	768 (81.2)	1,504 (83.7)	0.097
Diagnostic impression present	423 (44.7)	899 (50.1)	0.008

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3.3. Diagnostic Specialty Distribution

The distribution of referrals by specialty changed significantly ($p < 0.001$; Table 3). The most notable shifts were:

- **Orthopedics**: increased from 5.8% to 18.4%, nearly tripling, consistent with a surge in physical activity after the end of confinement.
- **Pulmonology + COVID-19**: 12.9% in 2019, rising to 22.0% in 2022 when COVID-19-specific referrals (7.7%) are combined with pulmonology (14.3%).
- **Gastroenterology**: decreased from 17.2% to 9.1%.
- **Hematology**: decreased from 7.1% to 2.7%.
- **Infectious Diseases**: decreased markedly from 5.7% to 0.5%.
- **Ophthalmology**: increased from 3.0% to 6.1%.
- **Vascular Surgery**: appeared as a new category in 2022 (1.1%).

Table 3. Distribution of referrals by diagnostic specialty in the pre-pandemic (2019) and post-pandemic (2022) periods ($p < 0.001$ for overall between-period comparison).

Specialty	2019 ($n = 946$) N (%)	2022 ($n = 1,797$) N (%)	p-value
Gastroenterology	163 (17.2)	164 (9.1)	<0.001
Cardiology	147 (15.5)	248 (13.8)	
Pulmonology	122 (12.9)	257 (14.3)	
COVID-19	0 (—)	139 (7.7)	
Neurology	98 (10.4)	104 (5.8)	
Hematology	67 (7.1)	48 (2.7)	
ENT (Otorhinolaryngology)	61 (6.4)	75 (4.2)	
Orthopedics	55 (5.8)	330 (18.4)	
Infectious Diseases	54 (5.7)	9 (0.5)	
Urology	51 (5.4)	83 (4.6)	
Ophthalmology	28 (3.0)	109 (6.1)	
Dermatology	38 (4.0)	36 (2.0)	
Endocrinology	17 (1.8)	21 (1.2)	
Maxillofacial Surgery	15 (1.6)	0 (0.0)	
Nephrology	5 (0.5)	35 (1.1)	
Psychiatry	8 (0.8)	22 (1.2)	
General Surgery	7 (0.7)	62 (3.5)	
Gynecology	3 (0.3)	12 (0.7)	
Rheumatology	3 (0.3)	15 (0.8)	
Allergology	0 (0.0)	8 (0.4)	
Vascular Surgery	0 (0.0)	21 (1.1)	
Social Work	2 (0.2)	0 (0.0)	

3.4. Emergency Department Length of Stay

The distribution of ED length of stay changed substantially ($p < 0.001$; Table 4). Stays of less than 3 hours decreased from 67.9% to 32.7%, while stays of 3–6 hours increased from 13.0% to 42.8%. Stays of 6–12 hours increased from 1.9% to 10.9%, and stays exceeding 12 hours decreased slightly from 17.2% to 13.6%.

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Table 4. Emergency department length of stay, complementary investigations, treatments, and patient outcomes in the pre-pandemic (2019) and post-pandemic (2022) periods.

Variable	2019 (n = 946) N (%)	2022 (n = 1,797) N (%)	p-value
ED length of stay			
<3 hours	642 (67.9)	588 (32.7)	<0.001
3–6 hours	123 (13.0)	769 (42.8)	
6–12 hours	18 (1.9)	195 (10.9)	
>12 hours	163 (17.2)	245 (13.6)	
Complementary investigations and treatments			
Urgent blood tests	652 (68.9)	1,011 (56.0)	<0.001
Plain radiography	539 (57.0)	1,043 (58.0)	0.597
Advanced imaging (US or CT)	173 (18.3)	273 (15.2)	0.037
Urgent specialist consultation	172 (18.2)	384 (21.4)	0.048
IV treatment or plaster cast	419 (44.3)	573 (31.9)	<0.001
Outcomes			
ED observation area admission	120 (12.7)	157 (8.7)	<0.001
Hospital admission	647 (68.4)	196 (10.9)	<0.001
Referral to another centre	116 (12.3)	16 (0.9)	<0.001

US: ultrasound; CT: computed tomography; IV: intravenous; ED: emergency department.

3.5. In-ED Resource Utilisation and Outcomes

Compared with the pre-pandemic period, significant decreases were observed across multiple resource utilization variables (Table 4):

- **Urgent blood tests**: 68.9% vs. 56.0%; $p < 0.001$.
- **Advanced imaging** (ultrasound or CT): 18.3% vs. 15.2%; $p = 0.037$.
- **Intravenous treatment or plaster cast**: 44.3% vs. 31.9%; $p < 0.001$.
- **ED observation**: 12.7% vs. 8.7%; $p < 0.001$.
- **Hospital admission**: 68.4% vs. 10.9%; $p < 0.001$.
- **Referral to another centre**: 12.3% vs. 0.9%; $p < 0.001$.

Conversely, urgent specialist consultation increased (18.2% vs. 21.4%; $p = 0.048$), and plain radiography use remained stable (57.0% vs. 58.0%; $p = 0.597$).

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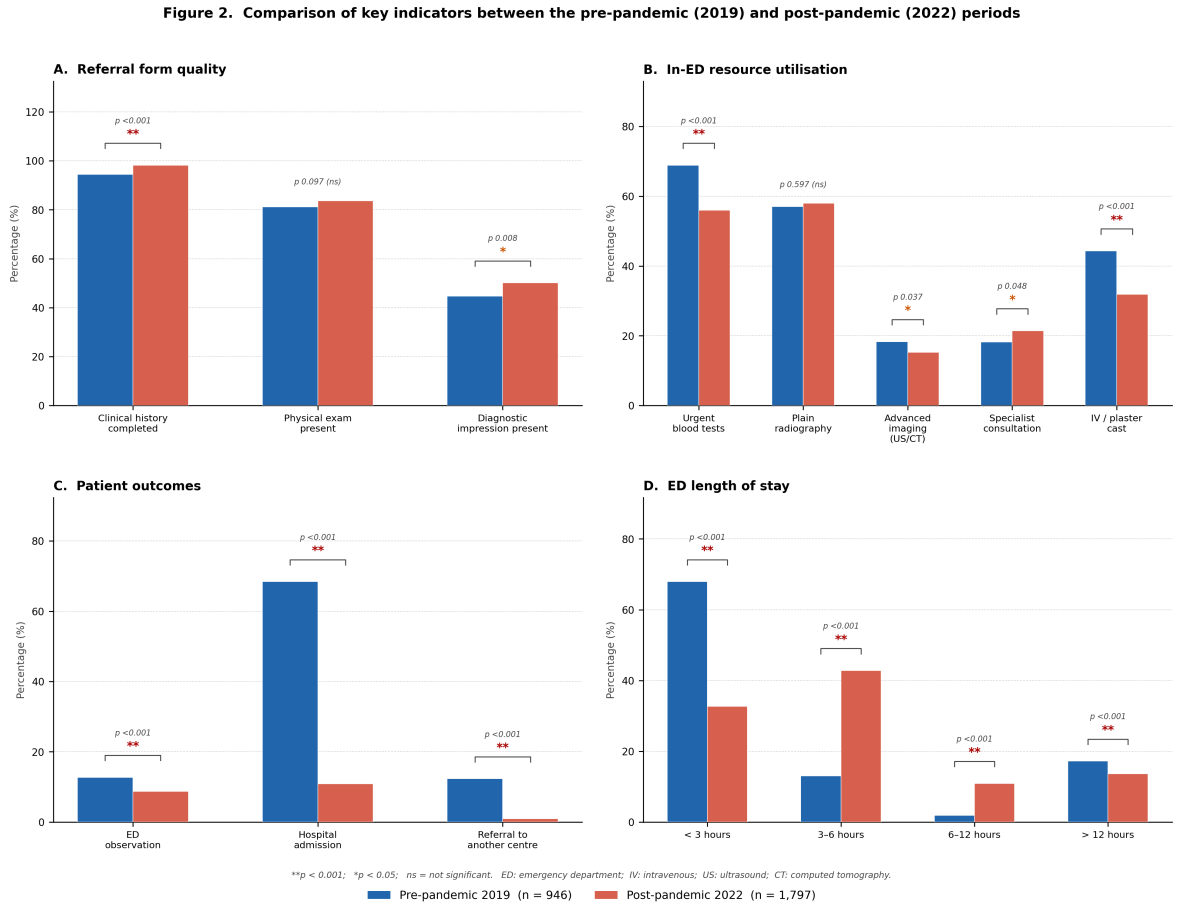

Figure 2. Comparison of key performance indicators between the pre-pandemic (2019) and post-pandemic (2022) periods. (A) Monthly referral rates. (B) ED length of stay distribution. (C) Resource utilization rates. (D) Patient outcome rates. Data are expressed as percentages. $^{*}p < 0.05$; $^{**}p < 0.001$.

4. Discussion

This study provides a comprehensive comparison of PC-to-ED referral patterns and in-ED resource utilization between the pre-pandemic (2019) and post-pandemic (2022) periods at a first-level referral university hospital. The principal finding is a substantial increase in referral volume following the COVID-19 pandemic, paradoxically accompanied by a reduction in in-ED resource consumption and hospital admission rates, suggesting an overall improvement in the clinical appropriateness of referrals.

4.1. Increase in Referral Volume

The monthly referral rate approximately doubled between the two study periods. This contrasts with the sharp initial decline in ED attendances documented during the first COVID-19 wave, attributed to patient avoidance of healthcare facilities, lockdown restrictions, and the repurposing of hospitals for COVID-19 management [9,10]. Our post-confinement data from 2022 capture a different dynamic: the pent-up demand accumulated during the pandemic, combined with a sustained rise in baseline PC caseload and the addition of COVID-19-related referrals, resulted in a substantially higher referral volume. Similar rebounds in emergency activity during 2021-2022 have been described by other Spanish authors [10,13].

The near-tripling of traumatology referrals (5.8% to 18.4%) is particularly noteworthy. This finding aligns with the widely reported surge in physical and sports-related injuries following the lifting of movement restrictions in 2021 [9], and may also partly reflect patients with accumulated musculoskeletal pathology that had gone unattended during the pandemic. By contrast, the sharp fall

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in infectious disease referrals (5.7% to 0.5%) likely reflects both improved telemedicine management of infectious episodes at PC level and the diversion of COVID-19 cases to dedicated care pathways.

4.2. Improvement in Referral Form Quality

The improvement in clinical history completion (94.5% to 98.2%; $p < 0.001$) and diagnostic impression documentation (44.7% to 50.1%; $p = 0.008$) is a clinically relevant finding. High-quality referral documentation reduces iatrogenic errors, facilitates ED triage, and enables more efficient clinical assessment[14]. It is plausible that the pandemic-driven shift towards structured electronic referral platforms and telemedicine contributed to this improvement. However, the absence of a diagnostic impression in almost half of referrals in 2022 (49.9%) remains a meaningful gap, and targeted training programs for PC physicians may be warranted. The validated quality framework of Irazábal and Gutiérrez [11] as modified by Morera et al. [12] provided a robust instrument for this assessment.

4.3. Changes in ED Resource Utilization

The dramatic fall in hospital admission rates from 68.4% in 2019 to 10.9% in 2022 ($p < 0.001$) is the most striking finding of this study. Although the pre-pandemic figure may partly reflect complex or semi-urgent cases that were channeled through the ED, the post-pandemic figure suggests that a greater proportion of 2022 referrals were of lower acuity or were resolved definitively within the ED. The concurrent increase in ED stays of 3-6 hours (13.0% to 42.8%) is consistent with this interpretation: patients required greater observation time within the ED but were ultimately discharged.

The reductions in urgent blood test requests (68.9% to 56.0%) and advanced imaging use (18.3% to 15.2%) likely reflect both a shift in case mix towards more musculoskeletal and respiratory presentations requiring fewer laboratory investigations and an enhanced clinical resolution capacity within the PC setting, where general practitioners may have gained confidence in managing borderline cases through the pandemic experience. The increased use of telephone consultations between PC and hospital specialists during the pandemic[6] may also have enabled a more appropriate pre-referral work-up.

The increase in urgent specialist consultations within the ED (18.2% to 21.4%; $p = 0.048$) may reflect a more selective referral process, with PC physicians retaining simpler cases and referring only those genuinely requiring specialist assessment, thereby increasing the average acuity of the referred population.

4.4. Temporal Patterns

The consistent predominance of Wednesday as the peak referral day in both periods aligns with previously reported patterns[2] and may reflect the accumulation of clinical decisions across the first half of the working week. The absence of significant differences by work shift suggests that PC-to-ED referral activity is relatively evenly distributed across morning and afternoon hours, which has implications for ED staffing planning.

4.5. Strengths and Limitations

Strengths of this study include the large consecutive sample from a real-world secondary care setting, the coverage of two epidemiologically distinct periods, and the use of validated quality criteria for referral form assessment. The retrospective design enabled complete data capture without participant drop-out.

Limitations include the single-center design, which restricts generalizability to other health districts with different demographic compositions or healthcare organizational models. The observation windows differ in duration (7 vs. 6 months), which was addressed by converting raw counts to monthly rates. Unmeasured confounders such as changes in GP workforce, adoption of new telemedicine platforms, or shifts in the catchment population during the pandemic may have contributed to the observed differences and cannot be disentangled from the pandemic effect itself.

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The retrospective design precludes causal inference, and outcomes beyond the ED encounter were not available.

5. Conclusions

Following the initial waves of the COVID-19 pandemic, PC-to-ED referrals increased substantially in volume, with a monthly rate approximately twice that of the pre-pandemic period. Despite this increase, referred patients required fewer complementary investigations, were significantly less frequently hospitalized, and were rarely transferred to other centers, while the quality of referral forms improved significantly. These findings suggest that the pandemic period fostered enhanced coordination between PC and the ED and led to more appropriate patient selection for secondary care referral. Future multi-center studies with longer follow-up are needed to determine whether these improvements are sustained and whether targeted interventions, particularly around referral form completion and telemedicine integration, can further optimize the PC-to-ED interface in the post-pandemic era.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Hospital Universitario Puerta de Hierro (PI 151/22 of 18 of july 2022).

Informed Consent Statement: Patient consent was waived due to the retrospective nature of the study and the complete anonymization of all data, as approved by the Ethics Committee.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request, subject to data protection regulations.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

COVID-19	Coronavirus Disease 2019
CT	Computed Tomography
ED	Emergency Department
ENT	Ear, Nose and Throat (Otorhinolaryngology)
EU	European Union
GP	General Practitioner
IV	Intravenous
NHS	National Health System
PC	Primary Care
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
US	Ultrasound
WHO	World Health Organization

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