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The impact of the COVID-19 pandemic on the use of Emergency Departments in Italy

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Key words: COVID-19, Emergency department, Italy, Age-class, Educational level, Gender
Parole chiave: COVID-19, Pronto Soccorso, Italia, Classi di età, Livello di educazione, Genere

Abstract

Background. *During 2020, COVID-19 had a diversified distribution in Italy, the first nation in Europe to experience the outbreak of the epidemic. This was linked to geographical differences in population density and distribution of healthcare facilities, including Emergency Departments (EDs). This study aims to assess the impact of the pandemic on ED utilization in 2020 across different subpopulations and geographical locations in Italy.*

Methods. *We used anonymized data from a survey conducted by the Italian National Institute of Statistics on 25,000 families to analyze the yearly rate of people who used EDs from 2015 to 2020. The rate of persons who accessed ED services in 2020 per 1,000 population was compared with those of the previous non-pandemic years.*

Results. *The number of people accessing EDs in 2020 was 32.3% lower, although this reduction was not uniform across the 21 regions / autonomous provinces. People aged 0–14 years experienced the highest reduction in ED visits. In 2020, low educational level people exhibited a steeper reduction in the use of EDs.*

Conclusions. *This study shows a significant drop in EDs use especially by children; the population section mostly affected by the effects of the pandemic. This study also confirms that education and socio-economic status are important determinants of ED use. The heterogeneous reduction in ED use across the regions of Italy highlights the need to further investigate the impact of this pattern on the health of the population, as well as to define adequate preparedness strategies to face future emergencies.*

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Introduction

As the COVID-19 pandemic rampaged throughout the World causing an immense number of deaths in 2020 and 2021 (1-3), the Italian Government and the National Healthcare Service (SSN) enacted a range of non-pharmaceutical interventions and organizational strategies to mitigate the effect of the health crisis (4-7). Initial public health strategies consisted in deferring non-urgent patients' visits to avoid postponable healthcare services utilization and to reallocate resources to COVID-19 management (8, 9). Moreover, the Italian Government enforced national and subnational lockdown measures from March to May 2020 (10, 11).

These non-pharmaceutical measures not only helped to contain the spread of the virus (12), but they also affected the patterns of Emergency Departments (ED) visits and their overall utilization by citizens (13, 14). Specifically, the Italian SSN reported a reduction in ED visits for acute care unrelated to COVID-19, as underlined by many authors (13, 15, 16). On the one hand, this reduction in ED use reflects the lower need of visits for specific conditions (e.g., trauma, road and work accidents (17, 18)) as a result of the lockdown measures, while, on the other hand, it shows how, net of the COVID-19-related accesses, many of the ED visits are not real emergencies. In the worst-case scenario, this drop in ED visits may mean unmet health needs.

Notably, the vast majority of studies on ED visits' patterns during the pandemic focused on specific pandemic waves (19), conditions (20), and subpopulations (21, 22). Few studies investigated ED use by age, gender and educational level. Plenty of literature reported higher prevalence of inappropriate ED use among people with lower socioeconomic status (23) and children (24). The pandemic may have affected these utilization patterns offering new insights on the issue of ED overburden. This information could reveal unique subpopulations defined by a larger variation in ED use compared with the pre-pandemic period and, conceivably, would allow researchers to understand the reasons behind these changes. This key information for policymakers and health systems would make it possible to implement specific analyses aimed at assessing the health needs resulting from a reduced use of the ED service, and at evaluating the appropriateness of the health conditions that prompted patients to seek urgent medical assistance.

During the first months of 2020, COVID-19 had an extremely varied distribution in Italy, being the first nation in Europe to experience the outbreak of the epidemic. This heterogeneity was also linked to geographical differences in population density, distribution of healthcare facilities, and local strategies to contain or mitigate the virus. As a matter of fact, the 21 regions and autonomous provinces of Italy must provide the so called "Essential Levels of Care" (i.e., the core benefit package and standard of health services), set by the central government, through the Regional Health Services, but are responsible and autonomous for the local organization and delivery of healthcare (25). By definition, regional differences that may result in different ED utilization cannot be investigated in studies that focus on single subnational jurisdictions (19-22). Therefore, a broader vision is needed to appreciate the effect of the pandemic on the whole country and not only at the local level.

For all these reasons, this study aims to assess the impact of the COVID-19 pandemic on ED utilization in 2020 across different subpopulations and geographical locations in Italy.

Methods

1. Data sources

In this descriptive time-trend analysis, we used anonymized data from the survey "Aspects of daily life" conducted by the Italian National Institute of Statistics (Istat) (26). This survey is part of an integrated system of social surveys - the Multi-Purpose Surveys on Families - that investigates the daily life of individuals and families in Italy. The survey is carried out on a sample of about 25,000 families equally distributed in about 800 Italian municipalities of different demographic sizes. Families are randomly extracted according to a sampling strategy aimed at building a statistically representative sample of the resident population in Italy. The survey takes place every year in the period between March and May. We analyzed the yearly rate of people who used ED in the three months prior to the interview per 1,000 population, from 2015 to 2020. This information was extracted from a single question of the survey (Have you visited an ED in the last three months? Yes/No). The original survey is available in the supplementary material.

2. Data analysis

The rate of persons who accessed ED services in 2020 per 1,000 population was compared with a historical baseline from previous years in a period which was not affected by the pandemic. The baseline consisted of the weighted average of annual rates observed between 2015 and 2019, using the triangle number $(5\times(5+1))/2=15$ as the denominator of the formula to give increasing prominence to recent years (i.e., 1/15 in 2015 to 5/15 in 2019).

Differences in ED utilization were stratified by region, sex, age group, and educational level. Age was subdivided into 11 classes (i.e., 0-5, 6-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-79, and ≥80 years), while educational level was subdivided into 4 classes (i.e., primary school or lower, middle school, high school, and university degree or higher).

All analyses were performed using R version 4.2.0 (R Project for Statistical Computing) (27).

Results

The number of people accessing ED in the first months of 2020 was 32.3% lower as compared with the 2015–2019 reference period (50.5 versus 74.6 per 1,000 population) (Figure 1). This pattern was not uniform across the 21 regions and autonomous provinces of Italy. Specifically, the reduction was more pronounced in the northwest (Lombardy: −36.7%; Piedmont: −34.5%; Aosta Valley: −39.5%; Liguria: −38.8%) and the south (Calabria: −41.7%; Basilicata: −39.4%), whereas the northeastern and central regions reported a lower decline, the lowest being in the autonomous province of Trento (−9.0%) (Figures 2 and 3).

People aged 0–5 years (females: −59.1%; males: −54.1%) and 6–14 years (females: −42.5%; males: −52.3%) experienced the highest reduction in ED visits (Figure 4). In the other age-by-gender subgroups the reduction was still noticeable, but less marked. The two age groups with the strongest difference between males and females were 45–54 years, where it was more evident for females, and 70–74 years, where it was more evident for males.

Figure 5 shows differences in ED use across educational levels. The 2015–2019 weighted average shows higher use among people with lower educational levels, this pattern being more pronounced in males than in females. In 2020, lower educational levels exhibited a steeper reduction in ED services use; more specifically, the highest percentage reduction was found among people with a middle school diploma (−33.4%) and a primary school certificate or lower (−32.1%).

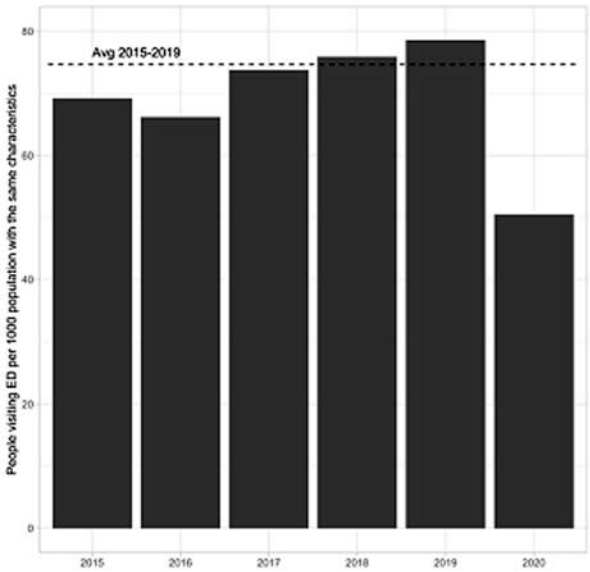

Figure 1. People accessing Emergency Departments per 1,000 population from 2015 to 2020. Dashed line (- -) indicates the weighted average of annual rates between 2015 and 2019.

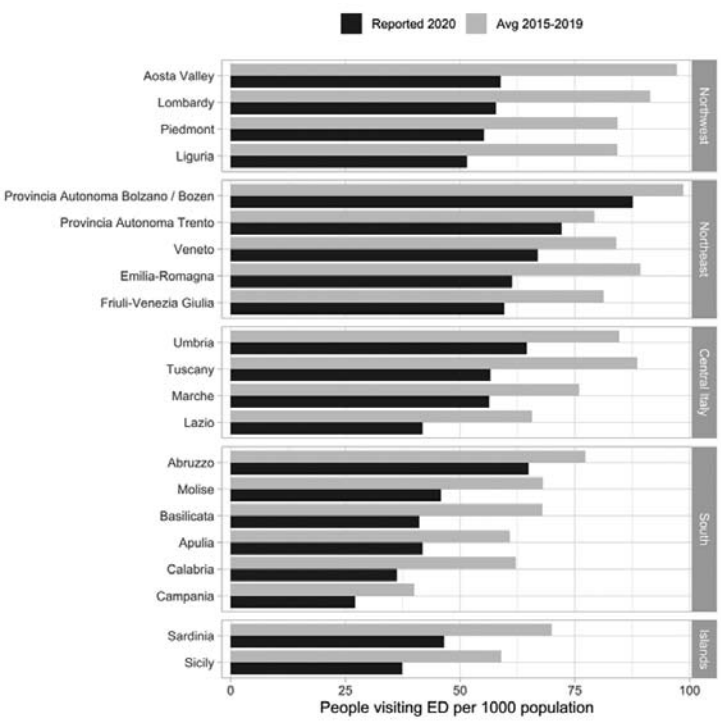

Figure 2 - People accessing Emergency Departments per 1,000 population by geographical region. Weighted average of annual rates (2015–2019) vs 2020.

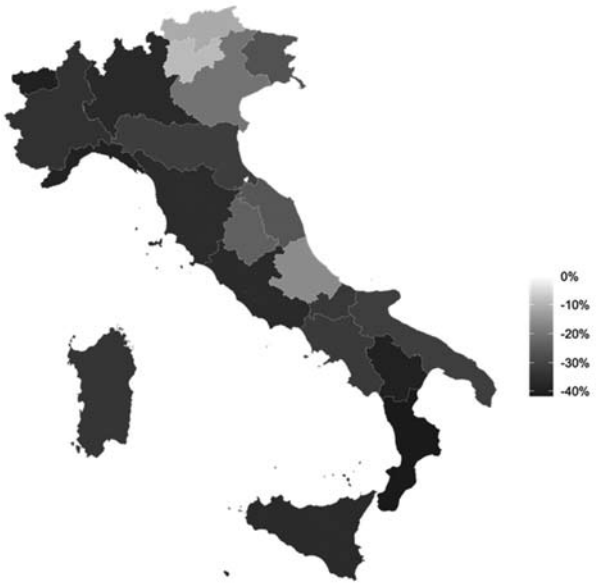

Figure 3 - Percentage reduction in people accessing Emergency Departments per 1000 population. Weighted average of annual rates (2015–2019) vs 2020.

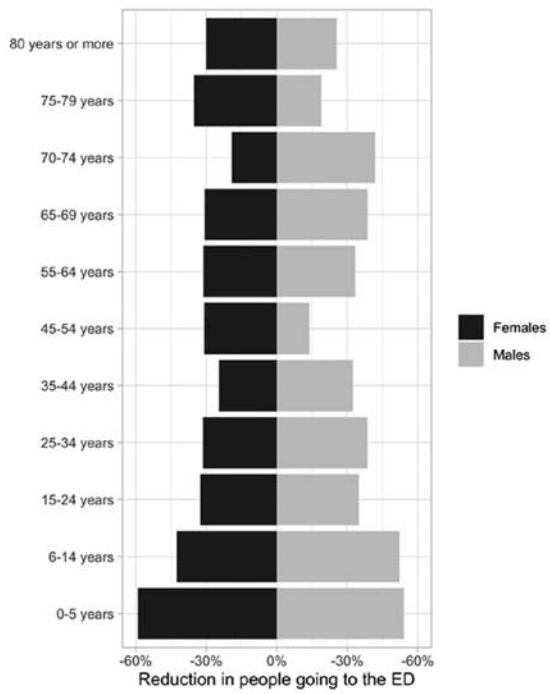

Figure 4 - Percentage reduction in people accessing Emergency Departments per 1,000 population by sex. Weighted average of annual rates (2015–2019) vs 2020.

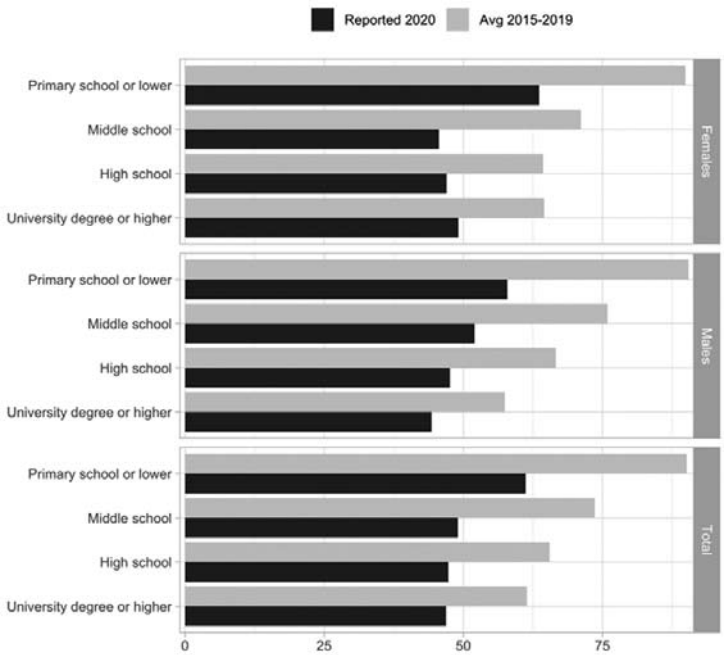

Figure 5 - People accessing Emergency Departments per 1,000 population by sex and educational level. Weighted average of annual rates (2015–2019) vs 2020.

Discussion

In this study we investigated the impact of the COVID-19 pandemic on the healthcare services use in the Italian population. Specifically, we analyzed the differences in ED use in 2020 compared with previous years, using data from a national survey conducted by Istat on a sample of 25,000 Italian families, representative of the entire Italian population. Data were aggregated by geographical region, sex, age class, and educational level.

Although it was not possible to exclude individuals who sought emergency services for COVID-19-related conditions, in the first five months of 2020, the number of people who used emergency services was lower than the weighted average of previous years. This evidence confirms what has already been reported by other studies that analyzed how the patterns of access to ED changed during the pandemic. Indeed, plenty of literature reported a higher reduction in ED visits during the first pandemic wave in many countries (28-32). This study confirms this trend at the subnational level and shows that the reduction in ED use was not homogeneous across the Italian regions. Specifically, the greatest reduction in absolute numbers occurred in the northwestern regions, which correspond to the area of Italy that was first hit by the pandemic (33, 34). Conceivably, it can be assumed that local restrictions, combined with a greater fear of the population of contracting the virus in healthcare facilities, led to a reduction in ED use. This hypothesis is supported by other authors, such as Herranz-Larrañeta et al, who analyzed the variations in access to EDs in Spain during the first pandemic wave (35).

We also identified non-homogeneous patterns of ED use by age class. Notably, the age classes that reported the greatest reduction in the use of EDs were 0–5 and 6–14 years. This important reduction

may be linked to the high proportion of inappropriate access to the ED typical of the younger population (36). This high proportion could be related to the fact that ED visits for people under 18 years of age do not require copayment even for conditions which are not of emergency or urgent nature (37), and to parent's need for reassurance and misperception of urgency (38-41). During the pandemic period, the fear of contagion may have overcome this need for reassurance and contributed to a reduction of inappropriate accesses. Furthermore, the reduction in the use of EDs during the pandemic period could also be attributed to the lower number of traumas and injuries that have affected children and adolescents due to the closure of recreational and sporting activities (42-46).

Acknowledging these drastic changes in pediatric ED use should prompt us to consider possible solutions to mitigate inappropriate pediatric ED visits (30, 47, 48). First, we should aim at improving parents' health literacy and awareness of their children's health status. Moreover, in Italy, pediatric primary care is not available during the night and on weekends, leading parents to seek hospital assistance. A possible solution to this problem could be strengthening pediatric primary healthcare services to meet the health needs of the population. With this in mind, telemedicine services could be implemented to provide medical consultations when the outpatient clinic is closed.

The reduction in the use of emergency services was more homogeneous in the remaining age groups. The analysis of ED utilization by educational level showed that there was a noticeable gradient between populations with different educational status in the years preceding the pandemic (i.e., 2015–2019). Specifically, higher levels of use have been reported in subpopulations with low levels of education. This result confirms what has already been reported in the literature, namely that lower education is associated with lower health literacy and, therefore, with a greater consumption of health resources and emergency services (49, 50). The same patterns observed in our analysis, however, add an important piece to the knowledge of this phenomenon. Indeed, during the first months of the pandemic, marked by draconian measures for limiting social and work interaction, these sections of the population were those that reduced the use of services the most. As a result, differences in EDs use across educational levels were less evident during the pandemic, although persons with the lowest education (primary school or lower) still "outdistanced" the other population subgroups (middle school or higher). Notably, the male population maintained a higher utilization gradient than the female population. These differences point to strong health inequalities closely related to the social determinants of health. Specifically, it has been widely demonstrated that better health outcomes are associated with higher socioeconomic status (51) and this was confirmed to be true even during the pandemic (52). This result supports current evidence that reports an overuse of emergency services for nonurgent conditions in subpopulation with low socioeconomic status (53, 54).

All the above considered, the COVID-19 pandemic showed that effective communication plays a crucial role in determining people's behaviors. This concept remains valid even in the post-pandemic period. Communication between health professionals and patients (including families with children) should therefore be improved. This would make it possible to improve the level of awareness of individuals regarding their own health and the health of their children, avoiding misperception of urgency, and, therefore, unnecessary ED usage.

This study has several limitations. First, it relies on self-reported data and does not

investigate the actual number of ED accesses in Italy. Second, the data are limited to the first 5 months of 2020, restricting the analysis to the first pandemic wave only. Third, the lack of individual data prevents us from conducting more in-depth analyses, such as investigating frequent users' behaviors or the reason behind ED access. Lastly, having no access to the number of respondents to the survey, makes it impossible to build confidence intervals around point estimates and to detect significant decreases or increases over time using statistical tests.

Conclusions

In this study, we described the impact of the COVID-19 pandemic on ED use patterns in Italy elaborating anonymized data from a survey of about 25,000 Italian families (26). EDs' use has been widely studied both before and during the COVID-19 pandemic. This study shows a significant drop in ED use during the first pandemic wave. The reduction was particularly marked in the pediatric population, one of the most affected by the direct and indirect effects of the pandemic. Moreover, we report a marked reduction in ED use in the subpopulation with the lowest educational level, confirming that education and socio-economic status are important determinants of healthcare services' use, even during a health crisis. Lastly, our results show a heterogeneous reduction in ED use across the regions of Italy, highlighting the need for future studies investigating the impact of this pattern on the health inequalities and wellbeing of the Italian population, as well as for adequate preparedness strategies to face future emergencies.

Author Contributions: FS and DG conceived the study. FS and JL contributed to the study design. FS, JL, DG and RG drafted the manuscript, which was integrated with important intellectual enrichments by all authors. FS and JL performed the statistical analysis. RG supervised the study. The final manuscript was read and approved by all the authors. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: This study involved aggregate data that exist in the public domain, where it is not possible to identify individuals from the information provided. For this reason, ethical approval is not required

Data Availability Statement: The data further elaborated in the present study are available at the following URL: http://dati.istat.it/

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

Riassunto

L'impatto della pandemia di COVID-19 sull'utilizzo del Pronto Soccorso in Italia

Premessa. Nel corso del 2020 l impatto del COVID-19 è stato eterogeneo in Italia, prima nazione in Europa a sperimentare l outbreak dell'epidemia. Ciò è stato dovuto alle differenze geografiche nella densità di popolazione e nella distribuzione delle strutture sanitarie, compresi i dipartimenti di emergenza e i pronto soccorso (PS). Questo studio ha come obiettivo valutare l'impatto della pandemia sull'utilizzo dei PS nel 2020 in diverse sottopopolazioni e località geografiche in Italia.
Metodi. Abbiamo utilizzato i dati anonimizzati di un'indagine condotta dall'Istituto Nazionale di Statistica (Istat) su 25.000 famiglie per analizzare il tasso annuo di individui che hanno utilizzato i PS dal 2015 al 2020. Il tasso di accesso ai PS nel 2020 è stato confrontato con quello dei precedenti anni non pandemici.

Risultati. Il numero di persone che hanno acceduto ai PS nel 2020 è stato del 32,3% inferiore rispetto agli anni precedenti, sebbene questa riduzione non sia stata uniforme nelle 21 regioni e province autonome italiane. Le persone di età compresa tra 0 e 14 anni hanno sperimentato la più alta riduzione delle visite al PS. Nel 2020, gli individui con bassi livelli di istruzione hanno mostrato una riduzione più marcata dell'utilizzo dei PS.

Conclusioni. Questo studio mostra un calo significativo nell'uso dei PS soprattutto nei bambini, la popolazione maggiormente colpita dagli effetti della pandemia nelle prime ondate. Questo studio conferma anche che l'istruzione e lo stato socio-economico sono importanti determinanti dell'uso dei PS. La riduzione eterogenea dell'utilizzo di PS nelle regioni italiane evidenzia la necessità di approfondire l'impatto di questo setting di cura della popolazione, nonché di definire strategie di preparedness adeguate per affrontare future emergenze.

References

1. COVID-19 Excess Mortality Collaborators. Estimating excess mortality due to the COVID-19 pandemic: a systematic analysis of COVID-19-related mortality, 2020-21. Lancet. 2022 Apr 16; **399**(10334):1513-36. doi: 10.1016/S0140-6736-(21)02796-3. Epub 2022 Mar 10. Erratum in: Lancet. 2022 Apr 16; 399(10334): 1468. PMID: 35279232; PMCID: PMC8912932.
2. Signorelli C, Odone A, Gianfredi V, et al. COVID-19 mortality rate in nine high-income metropolitan regions. Acta Biomed. 2020 Jul 20; **91**(9-S): 7-18. doi: 10.23750/abm.v91i9-S.10134. PMID: 32701911; PMCID: PMC8023097.
3. Sanmarchi F, Golinelli D, Lenzi J, et al. Exploring the Gap Between Excess Mortality and COVID-19 Deaths in 67 Countries. JAMA Netw Open. 2021; **4**(7): e2117359. doi:10.1001/jamanetworkopen.2021.17359. PMID: 34269809; PMCID: PMC8285734
4. Odone A, Vitale M, Signorelli C. The identity of public health in COVID-19 times. Acta Biomed. 2020 2020; **91**(9-S): 5-6. doi: 10.23750/abm.v91i9-S.10200. PMID: 32701910; PMCID: PMC8023088.
5. Reno C, Sanmarchi F, Stoto MA, Fantini MP, Lenzi J, Golinelli. The impact of health policies and vaccine rollout on the COVID-19 pandemic waves in Italy. Health Policy Technol. 2022 Jun; **11**(2): 100604. Epub 2022 Feb 15. doi: 10.1016/j.hlpt.2022.100604. PMID: 35186670; PMCID: PMC8843325.
6. Manica M, Guzzetta G, Riccardo F, et al. Impact of tiered restrictions on human activities and the epidemiology of the second wave of COVID-19 in Italy. Nat Commun. 2021 Jul 27; **12**(1): 4570. doi:10.1038/s41467-021-24832-z.
7. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next?. Lancet. 2020 Apr 11; 395(10231): 1225-8. doi:10.1016/S0140-6736(20)30627-9. Epub 2020 Mar 13. PMID: 32178769; PMCID: PMC7102589.
8. Berardi C, Antonini M, Genie MG, et al. The COVID-19 pandemic in Italy: Policy and technology impact on health and non-health outcomes. Health Policy Technol. 2020 Dec; **9**(4): 454-87. doi: 10.1016/j.hlpt.2020.08.019. Epub 2020 Sep 3. PMID: 32895626; PMCID: PMC7467905.
9. Odone A, Delmonte D, Gaetti G, Signorelli C. Doubled mortality rate during the COVID-19 pandemic in Italy: quantifying what is not captured by surveillance. Public Health. 2021 Jan; **190**: 108-15. doi: 10.1016/j.puhe.2020.11.016. Epub 2020 Nov 30. PMID: 33412438; PMCID: PMC7703200.
10. Torri E, Sbrogiò LG, Rosa ED, CF, Cinquetti S, Francia F, Ferro A. Italian Public Health Response to the COVID-19 Pandemic: Case Report from the Field, Insights and Challenges for the Department of Prevention. Int J Environ Res Public Health. 2020 May 22; **17**(10): 3666. doi: 10.3390/ijerph17103666. PMID: 32456072; PMCID: PMC7277676.
11. Gibertoni D, Adja KYC, Golinelli D, et al. Patterns of COVID-19 related excess mortality in the municipalities of Northern Italy during the first wave of the pandemic. Health Place. 2021 Jan; **67**: 102508. doi: 10.1016/j.healthplace.2021.102508. Epub 2021 Jan 11. PMID: 33476843; PMCID: PMC7834600.
12. Panarello D, Tassinari G. One year of COVID-19 in Italy: are containment policies enough to shape the pandemic pattern?. Socioecon Plann Sci. 2022 Feb; **79**: 101120. doi: 10.1016/j.seps.2021.101120. Epub 2021 Jul 3. PMID: 34248212; PMCID: PMC8253667.
13. Santi L, Golinelli D, Tampieri A, et al. Non-COVID-19 patients in times of pandemic: Emergency department visits, hospitalizations and cause-specific mortality in Northern Italy. PLoS One. 2021 Mar 22; **16**(3): e0248995. Published 2021 Mar 22. doi: 10.1371/journal.pone.0248995. PMID: 33750990; PMCID: PMC7984614.
14. Perlini S, Canevari F, Cortesi S, et al. Emergency Department and Out-of-Hospital Emergency System (112-AREU 118) integrated response to Coronavirus Disease 2019 in a Northern Italy centre. Intern Emerg Med. 2020 Aug; **15**(5): 825-33. doi: 10.1007/s11739-020-02390-4. Epub 2020 Jun 8. PMID: 32507926; PMCID: PMC7276336.
15. Raffaldi I, Castagno E, Fumi I, et al. Pediatric admissions to emergency departments of North-Western Italy during COVID-19 pandemic: A retrospective observational study. Lancet Reg Health Eur. 2021 Jun; **5**: 100081. doi: 10.1016/j.lanepe.2021.100081. Epub 2021 Mar 18. PMID: 34104902; PMCID: PMC7969147.
16. Poletto M, Perri G, Malacarne F, et al. Effect of COVID-19 outbreak on emergency department

attendances in an Italian academic hospital. Eur J Public Health. 2020 Sep; **30**(Suppl 5): ckaa165.207. doi: 10.1093/eurpub/ckaa165.207. PMCID: PMC7543584.
17. Yasin YJ, Grivna M, Abu-Zidan FM. Global impact of COVID-19 pandemic on road traffic collisions. World J Emerg Surg. 2021 Sep 28; 16(1): 51. doi: 10.1186/s13017-021-00395-8. PMID: 34583713; PMCID: PMC8478263.
18. Sekadakis M, Katrakazas C, Michelaraki E, Kehagia F, Yannis G. Analysis of the impact of COVID-19 on collisions, fatalities and injuries using time series forecasting: The case of Greece. Accid Anal Prev. 2021 Nov; **162**: 106391. doi: 10.1016/j.aap.2021.106391. Epub 2021 Sep 4. PMID: 34525414; PMCID: PMC8426576.
19. Golinelli D, Campinoti F, Sanmarchi F, et al. Patterns of Emergency Department visits for acute and chronic diseases during the two pandemic waves in Italy. Am J Emerg Med. 2021 Dec; **50**: 22-6. doi: 10.1016/j.ajem.2021.07.010. Epub 2021 Jul 9. PMID: 34271231.
20. Venkatesh AK, Janke AT, Shu-Xia L, et al. Emergency Department Utilization for Emergency Conditions During COVID-19. Ann Emerg Med. 2021 Jul; **78**(1): 84-91. doi: 10.1016/j.annemergmed.2021.01.011. Epub 2021 Jan 13. PMID: 33840512; PMCID: PMC7805390.
21. Bardin A, Buja A, Barbiellini Amidei C, et al. Elderly People's Access to Emergency Departments during the COVID-19 Pandemic: Results from a Large Population-Based Study in Italy. J Clin Med. 2021 Nov 26; **10**(23): 5563. doi: 10.3390/jcm10235563. PMID: 34884265; PMCID: PMC8658732.
22. Misra S, Barron E, Vamos E, et al. Temporal trends in emergency admissions for diabetic ketoacidosis in people with diabetes in England before and during the COVID-19 pandemic: a population-based study. Lancet Diabetes Endocrinol. 2021 Oct; **9**(10): 671-80. doi: 10.1016/S2213-8587(21)00208-4. Epub 2021 Sep 2. PMID: 34481558.
23. Naouri D, Ranchon G, Vuagnat A, et al. French Society of Emergency Medicine. Factors associated with inappropriate use of emergency departments: findings from a cross-sectional national study in France. BMJ Qual Saf. 2020 Jun; **29**(6): 449-64. doi: 10.1136/bmjqs-2019-009396. Epub 2019 Oct 30. PMID: 31666304; PMCID: PMC7323738.
24. Riva B, Clavenna A, Cartabia M, et al. Emergency department use by paediatric patients in Lombardy Region, Italy: a population study. BMJ Paediatr Open. 2018 May 30; **2**(1): e000247. doi: 10.1136/bmjpo-2017-000247. PMID: 29942865; PMCID: PMC6014225.
25. Lenzi J, Rucci P, Franchino G, et al. Regional and gender variation in mortality amenable to health care services in Italy. J Hosp Adm. 2013; **2**(3): 28-37. doi: 10.5430/jha.v2n3p28.
26. Istituto Nazionale di Statistica (ISTAT). Indagine multiscopo sulle famiglie: aspetti della vita quotidiana. 2022. Available on: https://www.istat.it/it/archivio/91926 [Last accessed: 2022 August 21].
27. R Core Team. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2021. Available on: https://www.R-project.org/ [Last accessed: 2022 August 21].
28. Siegel DA, Reses HE, Cool AJ, et al. Trends in COVID-19 Cases, Emergency Department Visits, and Hospital Admissions Among Children and Adolescents Aged 0-17 Years - United States, August 2020-August 2021. Morb Mortal Wkly Rep. MMWR Morb Mortal Wkly Rep. 2021 Sep 10; **70**(36): 1249-54. doi:10.15585/mmwr.mm7036e1. Erratum in: MMWR Morb Mortal Wkly Rep. 2021 Sep 24; **70**(38):1355. PMID: 34499628; PMCID: PMC8437056.
29. Ghaderi H, Stowell JR, Akhter M, Norquist C, Pugsley P, Subbian V. Impact of COVID-19 Pandemic on Emergency Department Visits: A Regional Case Study of Informatics Challenges and Opportunities. AMIA Annu Symp Proc. 2022 Feb 21; 2021: 496-505. PMID: 35308996; PMCID: PMC8861727.
30. Pines JM, Zocchi MS, Black BS, et al. The effect of the COVID-19 pandemic on emergency department visits for serious cardiovascular conditions. Am J Emerg Med. 2021 Sep; **47**: 42-51. doi: 10.1016/j.ajem.2021.03.004. Epub 2021 Mar 9. PMID: 33770713; PMCID: PMC7939976.
31. Çıkrıkçı I ık G, Çevik Y. Impact of COVID-19 pandemic on visits of an urban emergency department. Am J Emerg Med. 2021 Apr; **42**: 78-82. doi: 10.1016/j.ajem.2021.01.011. Epub 2021 Jan 14. PMID: 33493832; PMCID: PMC7807170.
32. Boserup B, McKenney M, Elkbuli A. The impact of the COVID-19 pandemic on emergency department visits and patient safety in

the United States. Am J Emerg Med. 2020 Sep; **38**(9): 1732-6. doi: 10.1016/j.ajem.2020.06.007. Epub 2020 Jun 6. PMID: 32738468; PMCID: PMC7274994.
33. Alicandro G, Remuzzi G, La Vecchia C. Italy's first wave of the COVID-19 pandemic has ended: no excess mortality in May, 2020. Lancet. 2020 Sep 12; **396**(10253): e27-e28. doi: 10.1016/S0140-6736(20)31865-1. Epub 2020 Sep 3. PMID: 32891216; PMCID: PMC7470816.
34. Odone A, Delmonte D, Scognamiglio T, Signorelli C. COVID-19 deaths in Lombardy, Italy: data in context. Lancet Public Health. 2020 Jun; **5**(6): e310. doi: 10.1016/S2468-2667-(20)30099-2. Epub 2020 Apr 25. Erratum in: Lancet Public Health. 2020 Jun; **5**(6): e315. PMID: 32339478; PMCID: PMC7182509.
35. Herranz-Larrañeta J, Klein-Rodríguez A, Menéndez-Riera M, et al. ENT emergencies during the first wave of COVID-19 pandemic in Spain: Our experience. Am J Otolaryngol. 2021 Mar-Apr; **42**(2): 102865. doi: 10.1016/j.amjoto.2020.102865. Epub 2021 Jan 9. PMID: 33450479; PMCID: PMC7794058.
36. Vedovetto A, Soriani N, Merlo E, Gregori D. The burden of inappropriate emergency department pediatric visits: why Italy needs an urgent reform. Health Serv Res. 2014 Aug; **49**(4): 1290-305. doi:10.1111/1475-6773.12161. Epub 2014 Feb 5. PMID: 24495258; PMCID: PMC4239850.
37. Terraneo M, Sarti S, Tognetti Bordogna M. Social inequalities and pharmaceutical cost sharing in Italian regions. Int J Health Serv. 2014; **44**(4): 761-85. doi: 10.2190/HS.44.4.e. PMID: 25626227.
38. Berry A, Brousseau D, Brotanek JM, Tomany-Korman S, Flores G. Why Do Parents Bring Children to the Emergency Department for Nonurgent Conditions? A Qualitative Study. Ambul Pediatr. 2008 Nov-Dec; **8**(6): 360-7. Epub 2008 Oct 5. PMID: 19084785.
39. Carret ML, Fassa AC. Domingues MR. Inappropriate Use of Emergency Services: A Systematic Review of Prevalence and Associated Factors. Cad Saude Publica. 2009 Jan; **25**(1): 7-28. doi: 10.1590/s0102-311x2009000100002. PMID: 19180283.
40. Stockwell MS, Findley SE, Irigoyen M, Martinez RA, Sonnett M. Change in Parental Reasons for Use of an Urban Pediatric Emergency Department in the Past Decade. Pediatr Emerg Care. 2010 Mar; **26**(3): 181-5. doi: 10.1097/PEC.0b013e3181d1dfc7. PMID: 20179661.
41. Fieldston ES, Alpern ER, Nadel FM, Alessandrini EA. A Qualitative Assessment of Reasons for Nonurgent Visits to the Emergency Department: Parent and Health Professional Opinions. Pediatr Emerg Care. 2012 Mar; **28**(3): 220-5. doi: 10.1097/PEC.0b013e318248b431. PMID: 22344210.
42. Iozzi L, Brambilla I, Foiadelli T, Marseglia GL, Ciprandi G. Paediatric emergency department visits fell by more than 70% during the COVID-19 lockdown in Northern Italy. Acta Paediatr. 2020 Oct;**109**(10): 2137-8. doi: 10.1111/apa.15458. Epub 2020 Jul 22. PMID: 32623774; PMCID: PMC7361573.
43. Hamill JK, Sawyer MC. Reduction of childhood trauma during the COVID-19 Level 4 lockdown in New Zealand. ANZ J Surg. 2020 Jul; **90**(7-8): 1242-3. doi: 10.1111/ans.16108. Epub 2020 Jun 26. PMID: 32536014; PMCID: PMC7323325.
44. Malige A, Deemer A, Sobel AD. The Effect of COVID-19 on Pediatric Traumatic Orthopaedic Injuries: A Database Study. J Am Acad Orthop Surg Glob Res Rev. 2022 Feb 11; **6**(2): e22.00012. doi: 10.5435/JAAOSGlobal-D-22-00012. PMID: 35148285; PMCID: PMC8843388.
45. Raitio A, Ahonen M, Jääskelä M, et al. Reduced Number of Pediatric Orthopedic Trauma Requiring Operative Treatment during COVID-19 Restrictions: A Nationwide Cohort Study. Scand J Surg. 2021 Jun; **110**(2): 254-7. doi:10.1177/1457496920968014. Epub 2020 Oct 26. PMID: 33100133; PMCID: PMC8258724.
46. Shi Y, Kvasnovsky C, Khan S, et al. Impact of the COVID-19 pandemic on trauma activations at a pediatric level 1 trauma center in New York. Pediatr Surg Int. 2021 Oct; **37**(10): 1409-14. doi: 10.1007/s00383-021-04962-7. Epub 2021 Jul 15. PMID: 34264357; PMCID: PMC8280274.
47. McDermott KW, Stocks C, Freeman WJ. Overview of Pediatric Emergency Department Visits, 2015: Statistical Brief #242. 2018 Aug 7. In: Healthcare Cost and Utilization Project (HCUP) Statistical Briefs (Internet). Rockville (MD): Agency for Healthcare Research and Quality (US); 2006 Feb-. Available on: https://www.ncbi.nlm.nih.gov/books/NBK526418/ [Last accessed: 2022 August 21].
48. Barbiellini Amidei C, Buja A, Bardin A, et al. Pediatric emergency department visits during the

COVID-19 pandemic: a large retrospective population-based study. Ital J Pediatr. 2021 Nov 4; **47**(1): 218. doi: 10.1186/s13052-021-01168-4. PMID: 34736514; PMCID: PMC8567132.

49. Kurt F, Be de F, O uz S, Suskan E. How Important Are Parental Age and Educational Level in Nonurgent Admissions to the Pediatric Emergency Department?. Pediatr Emerg Care. 2020 Sep; **36**(9): 414-8. doi: 10.1097/PEC.0000000000001886. PMID: 31464877.
50. Pianori D, Maietti E, Lenzi J, et al. Sociodemographic and health service organizational factors associated with the choice of the private versus public sector for specialty visits: Evidence from a national survey in Italy. PLoS One. 2020 May 7; **15**(5): e0232827. doi: 10.1371/journal.pone.0232827. PMID: 32379839; PMCID: PMC7205245.
51. Marmot M. Health equity in England: the Marmot review 10 years on. BMJ. 2020 Feb 24; **368**: m693. doi: 10.1136/bmj.m693. PMID: 32094110.
52. Nana-Sinkam P, Kraschnewski J, Sacco R, et al. Health disparities and equity in the era of COVID-19. J Clin Transl Sci. 2021 Mar 16; **5**(1): e99. doi: 10.1017/cts.2021.23. PMID: 34192054; PMCID: PMC8167251.
53. Frølich A, Ghith N, Schiøtz M, Jacobsen R, Stockmarr A. Multimorbidity, healthcare utilization and socioeconomic status: A register-based study in Denmark. PLoS One. 2019 Aug 1; **14**(8): e0214183. doi: 10.1371/journal.pone.0214183. PMID: 31369580; PMCID: PMC6675513.
54. Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care services in a single-payer universal health care system?. Int J Equity Health. 2014 Nov 28; **13**: 115. doi: 10.1186/s12939-014-0115-1. PMID: 25431139; PMCID: PMC4260253.

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