Emergency Medical Service in the Elderly Population in Iran: A Cross-sectional Study Before and During the COVID-19 Pandemic

Mohammadreza Sabbaghi, MS[1], Kheizaran Miri, PhD[2], and Mohammad Namazinia, MS[2] (iD)

Abstract

This research examines the impact of an aging population in Eastern Iran on prehospital emergency medical services (EMS), with a focus on changes before and during the COVID-19 pandemic. A descriptive cross-sectional analysis was performed on data from 10,264 elderly individuals using EMS in Torbat-e Heydarieh County from March 2019 to March 2022. Statistical analyses, including t-tests and Chi-square tests, were conducted using SPSS software. Findings indicate that 30% of the 33,847 EMS calls received were from older adults. The nature of emergencies evolved from cardiovascular issues pre-pandemic to predominantly impaired consciousness during COVID-19, a statistically significant shift ($p < .001$). The study concludes with a call for research targeted at this demographic and suggests setting up dedicated EMS response units to cater to the elderly, responding to the increase in elderly-related EMS needs.

What this paper adds

- This study highlights the impact of the aging population on prehospital EMS in Eastern Iran, particularly during the COVID-19 pandemic.
- It reveals a significant shift in the primary reason for EMS calls among the elderly population, from cardiovascular issues to impaired consciousness, during the study period.

Applications of study findings

- The study's findings suggest the need for adapting EMS to cater to the elderly population, considering their distinct health concerns and challenges.
- The results can inform the development of age-friendly EMS response units and tailored prehospital care for the elderly population.
- The insights gained from this study can guide policymakers and healthcare providers in optimizing EMS services to address the growing elderly-related EMS needs in Eastern Iran.

Introduction

The global population aging is on the rise (Maestas et al., 2023). In this context, Iran has been ranked among the speedily developing countries, and the home to one of the oldest populations in 2050, all the more so higher than the global norm in Asia as well as North and Latin America (Mehri et al., 2020) (Miri et al., 2023).

This demographic transition is particularly pronounced in counties like Torbat-e Heydarieh in Eastern Iran, where the elderly population is growing at a faster rate compared to metropolitan areas (Bagheri & Soltani, 2023). Torbat-e Heydarieh

[1]Msc student of Emergency Nursing, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran
[2]Department of Nursing, School of Nursing and Midwifery, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran

Corresponding Author:
Mohammad Namazinia, Department of Nursing, School of Nursing and Midwifery, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh 95169-1516, Iran.
Email: Mnamazi99@gmail.com

County, located in a mountainous region, faces unique challenges in providing healthcare services to its aging population due to its geographical terrain and limited healthcare infrastructure.

Considering the significantly growing demand for urgent prehospital care in the elderly populations, emergency medical services (EMS) might be critically affected, as evidenced in previous surveys (Bhattarai et al., 2023; Magnusson et al., 2020; Rhee et al., 2020). Besides, it has been anticipated that roughly half of the EMS missions are to deliver services to this age group by 2030 (Ordoobadi et al., 2022).

To this point, a few studies have shed light on aging populations receiving prehospital care-EMS (Berkowitz et al., 2023; Borský et al., 2022). As the physiological and socioeconomic characteristics of younger and older populations are not the same (Guo et al., 2020; Johnson et al., 2019), prehospital care-EMS missions in response to the elderly people might be challenged by some risks of falls, treatment non-compliance, communication problems, and other common health concerns (Berkowitz et al., 2023; Puchongmart et al., 2023).

The outbreak of some pandemics, above all the coronavirus disease 2019 (COVID-19), has further altered the provision of prehospital care-EMS to the elderly (Coughlin et al., 2021; Jaffe et al., 2021).

The COVID-19 pandemic has altered the pattern of reasons for elderly individuals to contact prehospital emergency services. Studies have shown that during the pandemic, symptoms such as impaired consciousness, weakness, and lethargy, which are consequences of COVID-19 infection in the elderly, have been among the most common reasons for requesting emergency services in this age group (Carfi et al., 2020; Rubin & Wessely, 2020). This is in contrast to the pre-pandemic period, where cardiovascular emergencies were the leading cause of EMS missions for the elderly. Moreover, respiratory emergencies have gained greater importance during the COVID-19 era, as respiratory symptoms, including cough and dyspnea, have been reported as the most common clinical manifestations of COVID-19 in the elderly (C. Huang et al., 2020).

The Iranian healthcare system is a combination of public and private sectors, with the government providing primary healthcare services through a network of health centers and hospitals (Mehrdad, 2009) (Alizadeh-Taghiabad et al., 2023). Notably, prehospital emergency medical services (EMS) in Iran are provided free of charge to all citizens, which may influence the utilization of these services by the elderly (Azami-Aghdash et al., 2017).

As investigated, the leading causes of EMS missions during the COVID-19 pandemic have been different from those before this serious condition in this age group (Carfi et al., 2020; Rubin & Wessely, 2020). Given the rapidly increasing demand for urgent prehospital care among elderly populations, emergency medical services (EMS) are likely to be severely impacted. Notably, no study has investigated this issue in Eastern Iran, either

before or during the COVID-19 pandemic, highlighting a significant knowledge gap. To address this, the present study aimed to explore the epidemiology of prehospital care-EMS in elderly populations in Eastern Iran, thereby contributing to the existing literature.

Methods

Study Setting and Design

This study with a descriptive cross-sectional design was conducted in Torbat-e Heydarieh County, Eastern Iran, having a population of about 1 million.

Population and Inclusion/Exclusion Criteria

The statistical population examined here comprised of 10,264 elderly people contacting the EMS centers in Torbat-e Heydarieh County, Iran, from March 2018 to March 2022 via phone or in person, selected through census sampling.

Measurement Tools

The data collection tool was a researcher-made checklist, reflecting on the epidemiological indicators in the elderly population, which consisted of two parts. Part A was about the individual characteristics, namely, gender, age, place of living, etc., and Part B was associated with EMS mission time, main complaints, mission outcomes, and type of contact.

This tool had been previously applied in some studies in Iran to understand the foremost causes of EMS calls (Jalalvandi et al., 2015; Seyyednozadi et al., 2017). In view of that, content validity index (CVI = 0.9) was utilized to obtain the validity of this tool for this study. To this end, it was given to the faculty members of nursing and medical emergency ($n = 10$) for further evaluations, and then its final version was administered with regard to their comments and revisions. Upon completing the given tool in terms of time indices by 30 samples, its reliability was correspondingly established, with the Cronbach's alpha coefficient of .81, based on the internal consistency method.

Sampling

Given the retrospective nature of the study, the Research Ethics Committees authorized the researchers to do it with no informed consent. All the study procedures were also fulfilled in line with the Declaration of Helsinki.

After obtaining the code of ethics, the first author referred to the EMS centers in Torbat-e Heydarieh County, Iran, and retrieved the raw data from the ASAYAR Automation System. Of note, this software program could aid manage and control the delivery of services by the EMS centers in Iran, from client call to mission accomplishment. It was also being operated

Table 1. Characteristics of the Elderly Receiving Prehospital Care-EMS Before and During the COVID-19 Pandemic.

Variables	Before COVID-19	During COVID-19	
	$n = 2964$	$n = 7300$	*p*-Value
Age, year (mean ± SD)	75.22 ± 9.9	75.04 ± 10.0	.399
Gender, *n* (%)			
Male	1,652 (55.7)	3,970 (54.4)	.215
Female	1,312 (44.3)	3,329 (45.6)	
Mission time, *n* (%)			
Morning	980 (33.1)	2,481 (34.0)	.666
Evening	852 (28.7)	2,076 (28.4)	
Night	1,132 (38.2)	2,743 (37.6)	
Diagnosis, *n* (%)			
Impaired consciousness	618 (20.9)	2,538 (34.8)	<.001
Respiratory emergencies	52 (1.8)	1,487 (20.4)	
Cardiovascular emergencies	830 (28.0)	1,548 (21.2)	
Organ trauma	330 (11.1)	734 (10.1)	
Neurological emergencies	180 (6.1)	474 (6.5)	
Internal emergencies	572 (19.3)	513 (7.0)	
Other	382 (12.9)	6 (.1)	
Mission outcome, *n* (%)			
Transfer	2,130 (71.9)	4,391 (60.2)	<.001
Primary measures but no transfer	834 (28.1)	2,909 (39.8)	
Type of contact, n (%)			
In person	422 (14.2)	408 (5.6)	<.001
Via phone	2,542 (85.8)	6,892 (94.4)	

since March 2019 in the EMS centers in Torbat-e Heydarieh County, Iran.

Statistical Analysis

The survey data were subsequently analyzed using the SPSS Statistics (v.25) software package. To categorize them, descriptive statistics, that is, frequency distribution, mean, and standard deviation (SD) were initially exploited. Additionally, independent-samples *t*-test, Chi-square test, and Fisher's exact test were employed to compare the study variables before and during the COVID-19 pandemic. The normality of the quantitative variables was further checked by the Kolmogorov-Smirnov (K-S) test. Notably, the confidence interval (CI) of 95% and the significance level of .05 were considered for all tests.

Results

The characteristics of the elderly receiving prehospital care-EMS before and during the COVID-19 pandemic are presented in Table 1. The mean age of the elderly individuals was 75.04 ± 10.0 years during the pandemic and 75.22 ± 9.9 years before the pandemic, with no significant difference (p = .399). The majority of the elderly individuals were male, with 54.4% during the pandemic and 55.7% before the pandemic (p = .215).

In terms of mission time, the largest proportion of missions occurred at night, with 37.6% during the pandemic and 38.2% before the pandemic (p = .666). The morning and evening missions accounted for 34.0% and 28.4% during the pandemic, and 33.1% and 28.7% before the pandemic, respectively.

The primary diagnoses of the elderly individuals differed significantly before and during the pandemic (p < .001). Impaired consciousness was the leading cause of EMS missions during the pandemic, accounting for 34.8% of cases, whereas cardiovascular emergencies were the leading cause before the pandemic, accounting for 28.0% of cases. Respiratory emergencies were the second most common diagnosis during the pandemic, accounting for 20.4% of cases, while internal emergencies were the second most common diagnosis before the pandemic, accounting for 19.3% of cases.

The mission outcomes also differed significantly before and during the pandemic (p < .001). During the pandemic, 60.2% of missions resulted in transfer to a healthcare facility, compared to 71.9% before the pandemic. Primary measures but no transfer accounted for 39.8% of missions during the pandemic and 28.1% before the pandemic.

Finally, the type of contact used to request EMS services differed significantly before and during the pandemic (p < .001). During the pandemic, 94.4% of requests were made via phone, compared to 85.8% before the pandemic. In-person requests accounted for 5.6% of cases during the pandemic and 14.2% before the pandemic (Table 1).

Discussion

This study aimed to reflect on the epidemiology of the prehospital-EMS delivered to the elderly population before and during COVID-19 in Eastern Iran. In this respect, the study findings demonstrated a significant difference in the main complaints, missions, and type of contact before and during the pandemic.

In addition, about 30% of the EMS missions in this study were related to the elderly people, which were in agreement with the reports in the surveys by Krammel et al. (2023) and C.-C. Huang et al. (2016). In this line, Krammel et al. (2023), investigating the epidemiology of EMS missions in Vienna, Austria, had analogously discovered that 43% of such missions had been accomplished following calls by the aging population (Krammel et al., 2023). This value had been also equal to 30% in the study by C.-C. Huang et al. (2016) in Taipei, Taiwan (C.-C. Huang et al., 2016). In view of that, the given findings established that the elderly were at the risk of some common chronic diseases, and EMS calls could uplift with age in this age group (Bouzid et al., 2022; Xu et al., 2022). In this way, adjusting EMS to make the urgent prehospital care treatment more appropriate for the global elderly population was of highest importance.

In the present study, the leading cause of the EMS missions (28.0%) before the COVID-19 pandemic was cardiovascular emergencies in the elderly, which was in harmony with the results reported in C.-C. Huang et al. (2016). Thus, the aging population was assumed much more vulnerable to cardiovascular diseases, because age could critically contribute to the disturbed functions of the cardiovascular system, thereby compounding the prevalence rate of such health-related concerns with age (Wyper et al., 2020) (Akar et al., 2023). The second cause of the EMS missions (20.9%) before the COVID-19 pandemic in this study was impaired consciousness, stemming from common drug side effects, metabolic disorders, some chronic diseases, depression, as well as dementia (Sabbaghi et al., 2023), which confirmed the findings in Goldstein et al. (2015). Moreover, the third cause of the EMS missions (19.3%) before the COVID-19 pandemic was internal emergencies. Some studies had accordingly indicated that 80% of the elderly people were undergoing at least one type of internal diseases, making them experience the risks of disabilities, emergency conditions, and even death more than other age groups (Costa et al., 2021). Henceforth, the results of the present study were consistent with the findings in Wang et al. (2019).

Notably, the main causes of the EMS missions to provide the elderly population with prehospital care-EMS during the COVID-19 pandemic were not the same as those before this serious condition. The most common cause of the EMS missions (34.8%) during the pandemic was impaired consciousness, along with complaints of weakness and lethargy, already reported as the persistent symptoms following COVID-19 in the elderly (Carfi et al., 2020; Rudroff et al., 2020). In fact, this infection could cause catabolic reactions in this age group, predisposing them to weight loss and muscle wasting, which could then result in impaired consciousness, weakness, and lethargy in this population (Bauer & Morley, 2021). In this line, fatigue, impaired consciousness, as well as weakness and lethargy had been so far presented as the foremost complaints in the elderly with COVID-19 in domestic and international studies, which verified the results of the present study (Azzolino et al., 2023; Sagarra-Romero & Viñas-Barros, 2020; Shariyate & Kachooei, 2020). Here, the second cause of the EMS missions (21.2%) during the COVID-19 pandemic was cardiovascular emergencies. The results of some surveys had further shown that COVID-19 could impair both respiratory and cardiovascular systems (DeFilippis et al., 2020; Gerc et al., 2020). On the other hand, cardiovascular diseases could be deteriorated, and the elderly mortality rates could alarmingly escalate if they had a history of such diseases once being infected with COVID-19 (Chen et al., 2020). This age group were similarly more susceptible to cardiovascular diseases because age could disrupt the optimal functioning of the cardiovascular system, so the prevalence rate of these diseases could ascend with age (Shao et al., 2020). In this way, the results of the present study were in accordance with the findings in Omura et al. (2020) and Gori et al. (2020). In the present study, the third cause of the EMS missions (20.4%) during the COVID-19 pandemic was respiratory emergencies. Based on previous research, the most common symptoms in the aging population with COVID-19 were respiratory symptoms, including cough and dyspnea (Kim et al., 2020; Wang et al., 2020), which could vary from very mild to severe (Ward et al., 2020). Therefore, the results of the present study were coherent with the reports in Jannat (2020) and (McManamny et al. (2022).

In relation to the study findings, the EMS mission outcomes during the COVID-19 pandemic were different from those before this condition in the elderly. The majority of the EMS missions (71.9%) before COVID-19 had thus led to being transferred to healthcare facilities, in accord with the reports in Forsgärde et al. (2020), but transfer and hospitalization during the COVID-19 pandemic had been at lower rates as compared with those before COVID-19. Among the reasons for these findings were the fear and anxiety induced by the infection of the elderly with COVID-19 in case of being transferred to healthcare facilities (Krammel et al., 2023).

The results of the present study as well demonstrated that the largest part of the EMS missions before and during the COVID-19 pandemic had been accomplished following the EMS calls, which was harmonious with

the findings in the surveys by McManamny et al. (2022), Forsgärde et al. (2020), and Krammel et al. (2023). Since EMS in Iran is with no charge to all, the elderly people are assured to even call the EMS centers for their non-emergency complaints.

The main strength of the present study was its population-based and descriptive cross-sectional nature, as it was conducted with a population of about 1 million people from March 2019 to March 2022. To the best of the authors' knowledge, it was the first attempt to explain the characteristics of the EMS calls before and during the COVID-19 pandemic by the aging population in Eastern Iran.

This study has several limitations that should be acknowledged. First, the data were obtained from Eastern Iran, which may limit the generalizability of the findings to other populations in Iran or other countries. Second, the data relied on demographic and clinical information collected by EMS responders, which may be subject to clinical, temporal, and administrative biases. Third, it was not possible to identify repeated calls made by the same individuals, which may have impacted the analysis. Fourth, the study lacked information on the type of care and treatment provided by physicians in healthcare facilities, as well as admission and discharge times, and other diagnoses. Fifth, the fact that EMS services are free of charge in Iran may have encouraged elderly individuals to call for non-emergency complaints, which may have influenced the results. Additionally, a key limitation of the study is the restriction of single complaint data, as the ASAYAR system only allows for the recording of a single primary complaint per EMS mission.

Conclusion

The study findings revealed the high rate of EMS calls by the elderly and the following missions, in which the main complaints were impaired consciousness as well as respiratory and cardiovascular emergencies. To effectively address the increasing demand for prehospital EMS services among older adults, we recommend that policymakers and healthcare providers take concrete steps to create age-friendly healthcare systems. Specifically, this can be achieved by designing physical spaces that accommodate the needs of older adults, developing care protocols that account for age-related health conditions, and providing training for healthcare professionals on geriatric care. By implementing these measures, healthcare systems can better respond to the needs of older adults and improve health outcomes in this population.

ORCID iD

Mohammad Namazinia https://orcid.org/0000-0003-2198-7556

Supplemental Material

Supplemental material for this article is available online.

References

Akar M, Miri K, Mazloum SR, et al. (2023). The impact of cardiopulmonary rehabilitation in phase II cardiac rehabilitation program on the health-related quality of life of patients undergoing coronary artery bypass graft Surgery. *Current Problems in Cardiology*, 102221.

Alizadeh-Taghiabad B, Mazloum R, Miri K, et al. (2023). Determining the frequency of burn wound dressing for clinically competent nursing students: establishing standards based on learning curves. *BMC Medical Education 23*, 678.

Azami-Aghdash S, Sadeghi-Bazargani H, Shabaninejad H, et al. (2017). Injury epidemiology in Iran: a systematic review. *Journal of Injury and Violence Research 9*, 27.

Azzolino, D., Coelho-Junior, H. J., Proietti, M., Manzini, V. M., & Cesari, M. (2023). Fatigue in older persons: The

role of nutrition. *Proceedings of the Nutrition Society, 82,* 39–46.

Bagheri, B., & Soltani, A. (2023). The spatio-temporal dynamics of urban growth and population in metropolitan regions of Iran. *Habitat International, 136,* 102797.

Bauer, J. M., & Morley, J. E. (2021). Editorial: COVID-19 in older persons: The role of nutrition. *Current Opinion in Clinical Nutrition and Metabolic Care, 24,* 1–3.

Berkowitz, J., Cotarelo, A., Washko, J*., et al.* (2023). *Emergency Medical Services and the elderly patient: Prehospital Management. Acute Care Surgery in Geriatric Patients* (pp. 107–113). Springer.

Bhattarai, H. K., Bhusal, S., Barone-Adesi, F., & Hubloue, I. (2023). Prehospital emergency care in low- and middle-income countries: A systematic review. *Prehospital and Disaster Medicine, 38,* 495–512.

Borský, P., Holmannová, D., Fiala, Z., Borská, L., Hruška, L., & Kučera, O. (2022). Physiology of ageing. *Casopis Lekaru Ceskych, 161,* 11–16.

Bouzid, W., Tavassoli, N., Berbon, C., Qassemi, S., Bounes, V., Azema, O., Shourick, J., & Nourhashémi, F. (2022). Impact of a personalised care plan for the elderly calling emergency medical services after a fall at home: The RISING-DOM multi-centre randomised controlled trial protocol. *BMC Geriatrics, 22,* 182.

Carfì, A., Bernabei, R., & Landi, F. (2020). Persistent symptoms in patients after acute COVID-19. *JAMA: the Journal of the American Medical Association, 324,* 603–605.

Chen, T., Wu, D., Chen, H., Yan, W., Yang, D., Chen, G., Ma, K., Xu, D., Yu, H., Wang, H., Wang, T., Guo, W., Chen, J., Ding, C., Zhang, X., Huang, J., Han, M., Li, S., Luo, X., . . . Ning, Q. (2020). Clinical characteristics of 113 deceased patients with coronavirus disease 2019: Retrospective study. *BMJ, 368,* 368.

Costa, G., Bersigotti, L., Massa, G., Lepre, L., Fransvea, P., Lucarini, A., Mercantini, P., Balducci, G., Sganga, G., & Crucitti, A. (2021). The Emergency Surgery Frailty Index (EmSFI): Development and internal validation of a novel simple bedside risk score for elderly patients undergoing emergency surgery. *Aging Clinical and Experimental Research, 33,* 2191–2201.

Coughlin, S. S., Yiğiter, A., Xu, H., Berman, A. E., & Chen, J. (2021). Early detection of change patterns in COVID-19 incidence and the implementation of public health policies: A multi-national study. *Public Health in Practice, 2,* 100064.

DeFilippis, E. M., Reza, N., Donald, E., Givertz, M. M., Lindenfeld, J., & Jessup, M. (2020). Considerations for heart failure care during the COVID-19 pandemic. *Heart Failure, 8,* 681–691.

Forsgärde, E.-S., Elmqvist, C., Fridlund, B., Svensson, A., Andersson, R., & Rööst, M. (2020). Patients' aged ≥65 years dispositions during ambulance assignments, including factors associated with non-conveyance to hospital: A longitudinal and comparative study. *BMJ Open, 10,* 038885.

Gerc, V., Masic, I., Salihefendic, N., & Zildzic, M. (2020). Cardiovascular diseases (CVDs) in COVID-19 pandemic era. *Materia Socio Medica, 32,* 158–164.

Goldstein, J., Jensen, J. L., Carter, A. J. E., Travers, A. H., & Rockwood, K. (2015). The epidemiology of prehospital emergency responses for older adults in a provincial

EMS system. *Indian Journal of Emergency Medicine, 17,* 491–496.

Gori, T., Lelieveld, J., & Münzel, T. (2020). Perspective: Cardiovascular disease and the covid-19 pandemic. *Basic Research in Cardiology, 115,* 32–34.

Guo, J., Liao, L., Wang, B*., et al.* (2020). Psychological effects of COVID-19 on hospital staff: A national cross-sectional survey of China mainland.

Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., Zhang, L., Fan, G., Xu, J., Gu, X., Cheng, Z., Yu, T., Xia, J., Wei, Y., Wu, W., Xie, X., Yin, W., Li, H., Liu, M., . . . Cao, B. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet, 395,* 497–506.

Huang, C.-C., Chen, W.-L., Hsu, C.-C., Lin, H. J., Su, S. B., Guo, H. R., Huang, C. C., & Chen, P. C. (2016). Elderly and nonelderly use of a dedicated ambulance corps' emergency medical services in Taiwan. *BioMed Research International, 2016,* 1506436.

Jaffe, E., Sonkin, R., Strugo, R., & Zerath, E. (2021). Evolution of emergency medical calls during a pandemic - An emergency medical service during the COVID-19 outbreak. *American Journal of Emergency Medicine, 43,* 260–266.

Jalalvandi, F., Esmaeilivand, M., & Safari Faramani, R. (2015). Assessing frequency of trauma among elderly attending to Taleghani Hospital in Kermanshah during the first six months of. *Journal of Geriatric Nursing, 1,* 47–54.

Jannat, Z. (2020). COVID-19 and the elderly with chronic diseases: Narrative review. *Journal of Military Medicine, 22,* 632–640.

Johnson, R., Harmon, R., Klammer, C., Kumar, A., Greer, C., Beasley, K., Wigstadt, S., Ambrose, L., VanDePol, E., & Jones, J. (2019). Cost-related medication nonadherence among elderly emergency department patients. *American Journal of Emergency Medicine, 37,* 2255–2256.

Kim, J., Gosnell, J. E., & Roman, S. A. (2020). Geographic influences in the global rise of thyroid cancer. *Nature Reviews Endocrinology, 16,* 17–29.

Krammel, M., Drahohs, V., Hamp, T., Lemoyne, S., Grassmann, D., Schreiber, W., Sulzgruber, P., & Schnaubelt, S. (2023). The epidemiology of pre-hospital EMS treatment of geriatric patients in the City of Vienna-an overview. *Journal of Clinical Medicine, 12,* 643.

Maestas, N., Mullen, K. J., & Powell, D. (2023). The effect of population aging on economic growth, the labor force, and productivity. *American Economic Journal Macroeconomics, 15,* 306–332.

Magnusson, C., Herlitz, J., & Axelsson, C. (2020). Patient characteristics, triage utilisation, level of care, and outcomes in an unselected adult patient population seen by the emergency medical services: A prospective observational study. *BMC Emergency Medicine, 20*(1), 19.

McManamny, T. E., Dwyer, R., Cantwell, K., Boyd, L., Sheen, J., Smith, K., & Lowthian, J. A. (2022). Emergency ambulance demand by older adults from rural and regional Victoria, Australia. *Australasian Journal on Ageing, 41,* e74–e81.

Mehrdad, R. (2009). Health System in Iran. *JMAJ 52:* 69.

Mehri, N., Messkoub, M., & Kunkel, S. (2020). Trends, determinants and the implications of population aging in Iran. *Ageing International, 45,* 327–343.

Miri K, Sabbaghi M, Mazlum SR, et al. (2023) The trend of change in the role of pre-hospital emergency medical ser-

vices in Iran's healthcare system: a situational analysis. *BMC emergency medicine* 23: 99.

Omura, T., Araki, A., Shigemoto, K., & Toba, K. (2020). Geriatric practice during and after the COVID-19 pandemic. *Geriatrics and Gerontology International*, *20*, 735–737.

Ordoobadi, A. J., Peters, G. A., Westfal, M. L., Kelleher, C. M., & Chang, D. C. (2022). Disparity in prehospital scene time for geriatric trauma patients. *American Journal of Surgery*, *223*, 1200–1205.

Puchongmart, C., Boonmee, P., Jirathanavichai, S., Phanprasert, N., Thirawattanasoot, N., Dorongthom, T., Monsomboon, A., Praphruetkit, N., & Ruangsomboon, O. (2023). Clinical factors associated with adverse clinical outcomes in elderly versus non-elderly COVID-19 emergency patients: A multi-center observational study. *International Journal of Emergency Medicine*, *16*, 11.

Rhee, B. Y., Kim, B., & Lee, Y. H. (2020). Effects of prehospital factors on survival of out-of-hospital cardiac arrest patients: Age-dependent patterns. *International Journal of Environmental Research and Public Health*, *17*, 5481.

Rubin, G. J., & Wessely, S. (2020). The psychological effects of quarantining a city. *BMJ*, *368*, 368.

Rudroff, T., Fietsam, A. C., Deters, J. R., Bryant, A. D., & Kamholz, J. (2020). Post-COVID-19 fatigue: potential contributing factors. *Brain Sciences*, *10*, 1012.

Sabbaghi, M., Namazinia, M., & Miri, K. (2023). Time indices of pre-hospital EMS missions before and during the COVID-19 pandemic: A cross-sectional study in Iran. *BMC Emergency Medicine*, *23*, 9.

Sagarra-Romero, L., & Viñas-Barros, A. (2020). COVID-19: Short and long-term effects of hospitalization on muscular weakness in the elderly. *International Journal of Environmental Research and Public Health*, *17*, 8715.

Seyyednozadi, M., Jarahi, L., Erfanian, M*., et al*. (2017). Pre-hospital emergency medical services: An epidemiological survey in Mashhad, Iran. *Journal of Patient Safety and Quality Improvement*, *5*, 572–576.

Shao, C., Wang, J., Tian, J*., et al*. (2020). Coronary artery disease: From mechanism to clinical practice. *Coronary Artery Disease*, 1177, 1–36.

Shariyate, M. J., & Kachooei, A. R. (2020). Association of new coronavirus disease with fragility hip and lower limb fractures in elderly patients. The *Archives of Bone and Joint Surgery*, *8*, 297–301.

Wang, L., Chen, Z., Zhang, M*., et al*. (2019). Study of the prevalence and disease burden of chronic disease in the elderly in China. *Zhonghua liu xing bing xue za zhi= Zhonghua liuxingbingxue zazhi*, *40*, 277–283.

Wang, L., He, W., Yu, X., Hu, D., Bao, M., Liu, H., Zhou, J., & Jiang, H. (2020). Coronavirus disease 2019 in elderly patients: Characteristics and prognostic factors based on 4-week follow-up. *Journal Infectology*, *80*, 639–645.

Ward, C. F., Figiel, G. S., & McDonald, W. M. (2020). Altered mental status as a novel initial clinical presentation for COVID-19 infection in the elderly. *American Journal of Geriatric Psychiatry*, *28*, 808–811.

Wyper, G. M. A., Assunção, R., Cuschieri, S., Devleeschauwer, B., Fletcher, E., Haagsma, J. A., Hilderink, H. B. M., Idavain, J., Lesnik, T., Von der Lippe, E., Majdan, M., Milicevic, M. S., Pallari, E., Peñalvo, J. L., Pires, S. M., Plaß, D., Santos, J. V., Stockton, D. L., Thomsen, S. T., . . . Grant, I. (2020). Population vulnerability to COVID-19 in Europe: A burden of disease analysis. Archives of Public Health, *78*, 47–48.

Xu, B., Guo, Z., Jiang, B., Zhang, K., Zhu, W., Lian, X., Xu, Y., Zhao, Z., & Liu, L. (2022). Factors affecting sarcopenia in older patients with chronic diseases. *Annals of Palliative Medicine*, *11*, 972–983.