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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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TRENDS IN EMERGENCY MEDICAL CALLS BEFORE AND AFTER COVID-19 IN KAZAKHSTAN

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Abstract.

This study analyzes Emergency Medical Services (EMS) call trends and demographic changes from 2020 to 2024. During this period, a total of 2,469,283 EMS calls were registered, with sharp increases in 2021 and subsequent stabilization in later years. The number of daily calls rose by 52% in 2021 compared to 2020, with smaller growth in 2022 and 2023. A notable decline of 12.7% was observed in the first half of 2024. Response times also lengthened across the study period, increasing from 15.05 minutes in 2020 to 16.56 minutes in 2024. Time spent from request to completion decreased initially in 2021 but increased again in 2023 and 2024, with the longest average time of 1:16:46 in 2024. The study also found that call patterns fluctuated by day of the week, with Mondays consistently showing the highest call volumes and Fridays the lowest. Gender analysis revealed that both the male and female populations grew, with men increasing by 80.6% and women by 61.1% between 2020 and 2023. Although women initially outnumbered men, the gender gap narrowed over time. The 7-18 age group saw the most significant growth, especially in 2021-2022. The findings highlight a significant strain on EMS services due to increasing demand and worsening response times, exacerbated by the COVID-19 pandemic. These insights can guide resource allocation and service improvements to meet the growing healthcare demands.

Key words. Emergency medical services, EMS call trends, response times, demographic changes, COVID-19 impact.

Introduction.

The COVID-19 pandemic caused a significant increase in Emergency Medical Services (EMS) calls globally [1-5]. Some regions, like Israel, reported an astronomical 1900% increase in EMS calls during the pandemic's peak months. This surge put immense pressure on EMS dispatch centers and led to delays in response times. For example, in NYC, EMS calls rose to more than 50% above normal levels [6], while in Northern Italy, EMS calls spiked by 440%. The call volumes overwhelmed dispatch centers and strained the system's ability to respond to all emergencies efficiently [7].

The increase in EMS call volumes caused significant delays in response times across several cities. Ambulance response times rose by several minutes in locations like Tijuana, Mexico, and New York City. In Copenhagen, EMS operators were overwhelmed, leading to a fivefold increase in the time taken to answer calls. This strained system resulted in increased mortality for time-sensitive cases, including stroke and cardiac arrest [6].

The elderly population, in particular, exhibited a marked shift in EMS call patterns, with impaired consciousness and respiratory

distress replacing cardiovascular issues as the most common reasons for EMS dispatches [8]. Older adults, particularly those aged 60 and above, were disproportionately affected by the pandemic. Several studies noted a marked increase in EMS calls related to respiratory issues, impaired consciousness, and other complications in elderly patients. For example, a study in Eastern Iran noted that during the pandemic, calls for cardiovascular emergencies among elderly patients were overtaken by COVID-19-related symptoms such as respiratory distress and loss of consciousness [9]. Several studies identified that men were more likely than women to be aware of and use EMS services during the pandemic. In Saudi Arabia, for example, 61.2% of EMS users were men, compared to 38.8% of women. This gender disparity could be influenced by various factors, including traditional gender roles, differences in health-seeking behaviors, and possibly greater occupational exposure to risks such as accidents or exposure to COVID-19 in certain male-dominated professions [10].

On 13 March 2020, Kazakhstan imposed its first state of emergency, restricting movement between cities, suspending public transportation, and closing non-essential businesses [11]. The emergency services in Kazakhstan played a crucial role in the country's response to the COVID-19 pandemic. They were involved in both direct medical response and broader logistical efforts to control the spread of the virus and mitigate its impact. Like many countries, Kazakhstan faced challenges with its emergency response capacity. Emergency services were at times overwhelmed by the surge in cases, particularly during the peak of the pandemic. Ambulance services faced delays, and hospitals had to cope with resource shortages. This study aimed to investigate the patterns of EMS call rates in Kazakhstan, Astana from 2020 to 2024, before and after COVID-19.

Materials and Methods.

Data was extracted from automated system used by the Astana ambulance station: ADIS information system. The primary data source for this analysis is EMS call records from March 2020 to 1st half of the year 2024. The data was categorized by year, day of the week, and time periods, with a focus on several key metrics: total calls, daily call averages, response time, and time to complete calls. Data points were collected across all days of the week to analyze patterns and trends specific to weekdays versus weekends. Special attention was given to changes before and after the height of the COVID-19 pandemic in 2021.

To analyse response time, we studied two indicators, where arrival at the scene: the time from the moment a call is received by the ambulance dispatch until the EMS team arrives at the casualty. Time from call arrival to hospitalization: the time from the moment the call is received by the ambulance dispatch

until the casualty is transported to an inpatient medical facility, which means call from the moment of request to the moment of its completion.

The analysis is based on demographic data. The data includes gender-specific population counts for males and females across different age groups. This data tracks growth rates, median age changes, and shifts within specific age categories (0-6, 7-18, 19-65, 65+).

We employed IBM SPSS Statistics 23 to analyze the data. Descriptive statistics, including frequency, percentages, means, and standard deviations, were used to characterize the call volume across the different time periods. To assess differences in call volume between groups, independent sample t-tests were conducted. A p-value of less than 0.05 was considered statistically significant.

Results and Discussion.

For the years 2020-2024, the following calls are registered at the SMP stations: 438,885 calls in 2020; 665,018 calls in 2021; 730,951 calls in 2022; 743,544 calls in 2023 and 329,770 calls in 2024 (1st half of the year) respectively. A total of 2,469,283 calls were received by the EMS service during the study period.

For the period in 2020, the number of daily calls was 1202, in 2021 the daily figure of calls was 1823 which is an increase of 52% compared to the period in 2020. As for the daily figure, in 2022 the daily figure was 2003, an increase of 9.9% compared to 2021. In 2023, the daily EMS was 2,037 times, which is a prevalence of 1.7% compared to 2022. The daily figure for 2024 is 1,807 which is 12.7% lower than 2023. In general, there is a trend of increasing number of EMS calls by year. A sharp increase in the number of calls occurred in 2021, then the daily call rate shows a decrease in the number of calls in 2024. At the time prior to 2020 the arrival time to the scene was 15.05 minutes, while in 2021 it was 15.35 minutes and in 2022 this figure is - 15.40 minutes. In 2023, the SMS response time was 16.12 minutes, while in 2024, the time of arrival at the scene of an accident increased by 16.56 minutes. There is a trend of increase in SMS response time by the years under study. The total increase was 01.85 minutes. The analysis of the time spent on the call from the moment of request to the moment of its completion showed that the average time spent on the call in 2020 was 1:03:33 minutes, in 2021 54:05 minutes, which is by 09:28 minutes less compared to 2020. In 2022, the figure is 51:08 minutes, a decrease of 03:03 minutes compared to 2021. In 2023, there is an increasing trend in the time per call from the time of contact to completion and was 56:38 minutes, which is 05:30 minutes more than 2022. In 2024, there is an increasing trend of 1:16:46 minutes. In general, at the beginning and at the end of the study period, the time spent on the call from the moment of contact to the moment of its completion showed the maximum data, in other years there is a decrease in this indicator.

By day of the week, the dynamics of SMS calls: Monday from 2020 to 2021 there is an increase of 48% (from 65,277 to 96,857). From 2021 to 2022 there is also an increase of 11.9% (from 96,857 to 108,423). From 2022 to 2023, 1.8% (from 108,423 to 110,410) more calls were made on a given day of the week. Tuesday from 2020 to 2021 there is a 53% increase

(from 61,725 to 94,708). From 2021 to 2022, there is also a 10.3% increase in calls (from 94.708 to 104.421). From 2022 to 2023, 0.6% (from 104.421 to 105.044) more calls were made on a given day of the week. Wednesday from 2020 to 2021 there is a 53% increase (from 62,827 to 96,260). From 2021 to 2022, there is also a 7.1% increase in calls (from 96,260 to 103,071). From 2022 to 2023, 2% (from 103,071 to 105,143) more calls were made on a given day of the week. Thursday from 2020 to 2021 shows a significant increase of 47.7% (from 63,168 to 93,300). From 2021 to 2022, there is also a 9.5% increase in calls (from 93,300 to 102,206). From 2022 to 2023, 1.8% (from 102,206 to 104,095) more calls were made on a given day of the week. On Friday in 2020 compared to 2021, 52.7% (from 61,552 to 93,971) more calls for EMS assistance were made on Friday. An 8.1% increase in calls (from 93,971 to 101,575) was also seen from 2021 to 2022). From 2022 to 2023, 0.6% (from 101.575 to 102.169) more calls were made on a given day of the week. Saturday From 2020 to 2021, there is a significant increase of 52.3% (from 61.043 to 92.959) more EMR calls. From 2021 to 2022, there is also a 12.4% increase in calls (from 92,959 to 104,513). From 2022 to 2023, 0.7% (from 104.513 to 103.809) more calls were made on a given day of the week. Sunday also shows an increasing trend in EMS calls across all years, so from 2020 to 2021 there is a significant 53.3% increase in EMS calls (from 63,289 to 97,016). From 2021 to 2022, there is also a 10% increase in calls (from 97.016 to 106.805). From 2022 to 2023, 5.8% (from 106.805 to 112.966) more calls were made. Overall, from 2020 to 2023 there was a steady increase on all days of the week.

The most frequent EMS occurred on Monday (65,277 cases) for 2020, with the lowest number of call-outs occurring on Saturday (61,043 cases). In 2021, EMS were more frequently sought on Sunday (97.016 calls) compared to Saturday where the number of calls was 92.959. 2022 the most frequent EMS cases occurred on Monday (108,423 cases) and the minimum number of calls occurred on Friday (101,575 cases). Sunday 2023 produced the maximum number of calls for EMS (112,966 cases) and the lowest number of calls occurred on Friday (102,169 cases). In 2024 (H1), the maximum calls are made on Monday (48.702 cases) and the minimum on Friday (46.075 cases). Analysing call trends by day of the week shows that Monday consistently has the highest values. Friday most often shows the lowest values, indicating that there are fewer calls on that day.

Key findings: Monday is the most active day in terms of referrals across all years. This may indicate that the beginning of the week is associated with higher levels of activity. Studies in various industries indicate that the beginning of the week is associated with higher levels of operational activity, which gradually decrease as the week progresses. This research highlights how call centers often experience higher call volumes at the start of the week, affecting workload and staffing considerations [12]. Systematic review article explores the effect of 'end of week' on patient outcomes in acute care services. The authors found that hospitalisations and related activity decrease towards the end of the week, particularly on Fridays, which may influence patient outcomes [13]. Trends show that activity is consistently higher at the beginning of the week and decreases markedly towards the end of the week (Table 1 and Figure 1).

Table 1. Call statistics.

Variable		2020	2021	Difference (%)	2022	Difference (%)	2023	Difference (%)	2024 (1st half of the year)
Number of calls	General	438 881	665 018	51.5%	730 951	9.9%	743 544	1.7%	329 770
	Daytime	1 202	1 823	51.5%	2 003	9.9%	2 037	1.7%	1 807
Arrival at the scene (min/s)		15:05	15:35	00:30	15:40	00:05	16:12	0:32	16:56
Time from call receipt to hospital admission to inpatient care		1:03:33	54:05	09:28	51:08	03:03	56:38	05:30	1:16:46
Day of the week									
Monday		65277	96857	48%	108423	11.9%	110410	1.8%	48702
Tuesday		61725	94708	53%	104421	10.3%	105044	0.6%	47062
Wednesday		62827	96260	53%	103071	7.1%	105143	2%	46718
Thursday		63168	93300	47.7%	102206	9.5%	104095	1.8%	46465
Friday		61552	93971	52.7%	101575	8.1%	102169	0.6%	46075
Saturday		61043	92959	52.3%	104513	12.4%	103809	0.7%	46127
Sunday		63289	97016	53.3%	106805	10%	112966	5.8%	48657

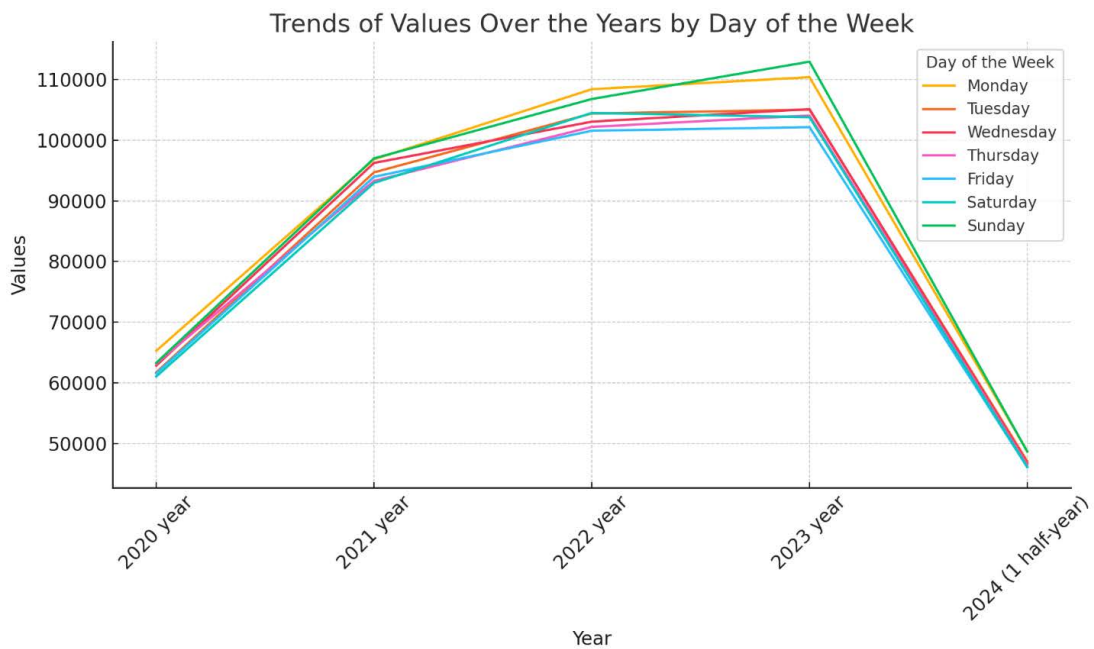


Figure 1. Graph of the dynamics of calls for EMS by days of the week.

Notably, there was a significant spike in EMS call volume in 2021, which was consistent with data showing how COVID-19 impacted EMS services globally [14-17]. Many agencies experienced unprecedented pressures with increased call volumes, reduced budgets, and strained personnel [18].

One notable trend is the significant increase in EMS call volumes during specific periods, particularly seen in 2021 compared to previous years. This mirrors global findings where EMS services experienced heightened demand, especially during and following the COVID-19 pandemic. For instance, a study in Saudi Arabia showed a sharp rise in emergency calls during the pandemic, further straining response times and system capacity [10]. Another study emphasized the geographical disparities in EMS response times, highlighting that urban areas typically experience shorter response times compared to rural regions, where delays can lead to worse patient outcomes [19].

Response times have been increasing globally, and this is consistent with the trend seen in our data. In several studies, response times were shown to correlate with worse outcomes, particularly in life-threatening emergencies such as cardiac arrest [20].

When analysing EMS call trends by day of the week, consistent patterns emerge across various studies and datasets. Mondays often show the highest volume of calls, which aligns with our observation that emergencies peak at the beginning of the week. This could be due to a variety of factors, including increased workplace activities or individuals seeking medical care after delaying non-emergent issues over the weekend.

In contrast, Fridays or weekends, particularly Saturdays, tend to show lower call volumes, as people are less likely to seek non-urgent medical assistance or as businesses and schools are closed, reducing accidents and other emergencies.

For example, a report from NEMSIS (the National EMS Information System) shows similar findings, highlighting peaks in emergency calls at the start of the week and fewer calls towards the end [21]. Moreover, other studies analysing EMS demand indicate that service needs fluctuate throughout the day and week, with certain days like Monday seeing higher call volumes [22]. This trend is consistent across different geographic regions and years, further supporting the notion of higher activity at the start of the week.

By understanding these patterns, EMS agencies can better allocate resources during peak demand times, such as Monday mornings, while adjusting staffing for slower periods like the weekends [23].

Patient demographics and referral patterns.

Analysis of the change in the number of men and women from 2020 to 2023 showed the following: the number of men increased by 80.6%, the number of women increased by 61.1%. The increase in the number of males was significantly higher than that of females during this period. The baseline values show that initially the number of women was greater than the number of men in all years. For example, in 2020, there were approximately 34% more females than males. An analysis of the change in the number of men and women by year shows the following key points: a sharp increase in 2020-2021, where the number of men increased by 59.7% and the number of women by 45.5%. There is further moderate growth in 2021-2022, with an increase of 11.6% for males and 8.5% for females. Between 2022 and 2023 there is a slowdown in growth, with males increasing by just 1.4% and females by 2%. The data shows that the median age of the population decreases from 35.4 years in 2020 to 29.5 years in 2022 and then begins to rise to 31.9 years in 2024. Analysis of the 0-6 years age group for males and females showed the following trends: from 2020 to 2021 there was a 76.8% increase in males and a 42.3% increase in females, from 2021 to 2022 there was a significant increase in both males (53.3%) and females (71.1%). Small decreases in males (-10.6%) and females (-2.4%) occurred from 2022 to 2023. In 2024 (1st half of the year), males were 34748 and females 23946. An analysis of the 7-18 age group for males and females showed the following trends: from 2020 to 2021 there was a significant decrease in males (-39.4%) and females (-57.8%). From 2021 to 2022, there was a rapid increase in both males (+358.9%) and females (+477.9%). From 2022 to 2023, the dynamics shows a slight increase in the number of men (+9.6%) and women (+15.4%). In 2024 (1st half of the year) men prevailed and made up 14319, women 11770. An analysis of the age group 19-65 for males and females showed the following trends: from 2020 to 2021, the number of males increased by 7.9 per cent and females by 24.3 per cent. There is an increase in both males (19.2%) and females (9.6%) from 2021 to 2022. From 2022 to 2023: The number of males increased by 14.3% and the number of females decreased slightly (-0.5%). In 2024 (H1), females (77949) predominate in this return group compared to males (41832). Analysing the 65+ age group for males and females showed the following trends: from 2020 to 2021, males increased sharply by 330.5% and females by 245.0%. From 2021 to 2022 there is a strong decline in both

males (-70.3%) and females (-60.4%). The trend shows a slight increase in males (+2.9%) and females (+1.7%) from 2022 to 2023. In 2024 (1H), the number of women (14578) in this return group has doubled compared to men (7517). In general, the data show that the age group 7-18 years showed the greatest increase in numbers for both males and females.

The analysis of gender trends from 2020 to 2023 shows significant growth in both male and female populations, with a faster increase among males. Specifically, the male population grew by 80.6%, while females increased by 61.1%. Despite this, women remained the larger group across all years, though the gender gap has been narrowing, especially in certain age groups.

This shift mirrors broader global and U.S. trends. For example, the U.S. Census Bureau reports similar changes, with males making up a larger share of younger age groups, while women predominate in older age groups due to their longer life expectancy. In the U.S., the sex ratio for children under 18 was 104 boys per 100 girls in 2020, while for adults over 65, the ratio dropped to 56 men per 100 women, largely because women tend to live longer than men [24].

In addition, the data shows the median age of the population has fluctuated. The U.S. population is generally getting older, with the median age rising due to a combination of lower fertility rates and increased life expectancy. The shifts in age distribution can have significant social and economic implications, particularly regarding healthcare, caregiving, and workforce demographics [25-27].

During the COVID-19 pandemic, EMS systems globally experienced significant changes in call volumes and patterns, including differences based on gender [28-30]. Studies have shown that the pandemic increased the demand for EMS services due to factors like respiratory distress and cardiac-related issues, but the impact varied across genders.

For instance, men were more likely to call EMS services during COVID-19 for severe health issues, such as cardiac arrests and respiratory distress. This aligns with higher rates of severe COVID-19 complications in men, who were more vulnerable to life-threatening symptoms. Men's risk factors, such as higher rates of smoking and cardiovascular issues, contributed to more frequent calls during this period [31].

Women, on the other hand, had a smaller but consistent increase in EMS calls, particularly related to non-COVID emergencies, mental health crises, and domestic issues, which escalated during lockdowns. The pandemic's indirect effects, like mental health stress and reduced access to regular healthcare, disproportionately affected women (Table 2 and Figure 2) [32].

Conclusion.

The results of the study have revealed significant differences in EMS trends, which are in line with numerous international studies. Monday is the most active day in terms of referrals across all years. This may indicate that the beginning of the week is associated with higher levels of activity. Friday shows the lowest number of referrals, this may be due to the end of the working week when activity is lower. Trends show that activity is consistently higher at the beginning of the week, with a noticeable decrease towards the end of the week. The analysis showed that the '19-65 years' age group had the highest number

Table 2. Demographic data.

Variable		2020	2021	Difference (%)	2022	Difference (%)	2023	Difference (%)	2024 (1 half).	P value.
Paul	Man	187 449 (43%)	299 290 (45%)	59.7%	334018 (46%)	12%	338541 (46%)	1.4%	98416 (43%)	<0,05
	Woman	251 408 (57%)	365 737 (55%)	45.5%	396997 (54%)	8.5%	405015 (55%)	2%	128243 (57%)	<0.05
Age Value ± SD	All of them	35.4±23.6	34.1±23.7		29.5±20		30.2±23.0		31.9±22.5	<0.05
	Man	32.2±25.2	30.0±24.3		24.8±23.0		26.4±22.8		29.8±23.8	<0.05
	Woman	37.7±22.2	37±22.8		33.2±23		33.4±22.6		33.8±21.3	<0.05
0-6 years.	Man	50 676	89 585	76.8%	137326	53%	122731	12%	34748	<0.05
	Woman	33 313	47 413	42%	81132	71%	79212	2.4%	23946	<0.05
7-18 years old	Man	16051	9728	39%	44640	359%	48918	10%	14319	<0.05
	Woman	14489	6117	58%	35352	478%	40783	15%	11770	<0.05
19-65 years old	Man	103329	111461	7.9%	132826	19%	151818	14%	41832	<0.05
	Woman	170622	212040	24%	232458	9.6%	231401	1%	77949	<0.05
65+ years	Man	17392	74872	330%	22229	70%	22884	3%	7517	<0.05
	Woman	32985	113811	245%	45051	60%	45809	2%	14578	<0.05

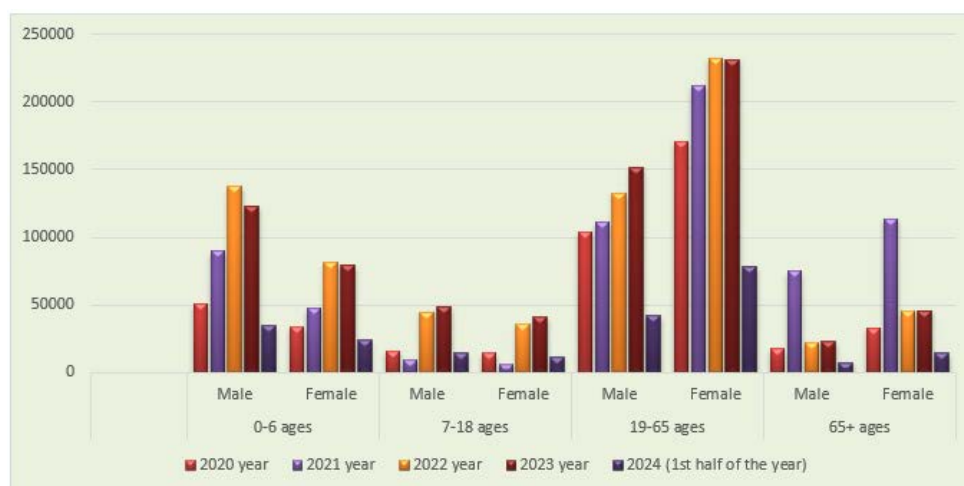


Figure 2. Frequency of visits to the emergency department by age.

of referrals in each of the years analyzed. This age group consistently had the highest number of referrals for all periods examined. In the older population of the 65+ age group, there was a sharp increase in 2021, followed by a decrease in 2022 and 2023. Overall, it can be observed that the youngest and oldest age groups underwent the largest changes in numbers, while the middle-aged group (19-65 years) showed more stable growth trends.

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РЕЗЮМЕ

Тенденции вызовов скорой медицинской помощи до и после COVID-19 в Казахстане

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В данном исследовании анализируются тенденции и демографические изменения в сфере вызовов скорой медицинской помощи (СМП) в период с 2020 по 2024 год. За этот период было зарегистрировано в общей сложности 2 469 283 вызова скорой помощи, с резким ростом в 2021 году и последующей стабилизацией в последующие годы. В 2021 году количество ежедневных вызовов выросло на 52 % по сравнению с 2020 годом, а в 2022 и 2023 годах рост был меньше. Заметное снижение на 12,7 % наблюдалось в первой половине 2024 года. Время ответа также увеличилось за исследуемый период: с 15,05 минуты в 2020 году до 16,56 минуты в 2024 году. Время, затраченное от запроса до завершения, сначала уменьшилось в 2021 году, но затем снова увеличилось в 2023 и 2024 годах, а самое продолжительное среднее время составило 1:16:46 в 2024 году. Исследование также показало, что количество звонков зависит от дня недели: по понедельникам наблюдается наибольшее количество звонков, а по пятницам - наименьшее. Гендерный анализ показал, что в период с 2020 по 2023 год численность мужского и женского населения увеличилась на 80,6 %, а женского - на 61,1 %. Хотя изначально женщин было больше, чем мужчин, со временем гендерный разрыв сократился. Наиболее значительный рост наблюдался в возрастной группе 7-18 лет, особенно в 2021-2022 годах. Полученные данные свидетельствуют о значительной нагрузке на службы скорой помощи в связи с ростом спроса и ухудшением времени реагирования, усугубляемым

пандемией COVID-19. Эти данные могут помочь в распределении ресурсов и совершенствовании услуг для удовлетворения растущего спроса на медицинские услуги.

Ключевые слова: службы скорой медицинской помощи, тенденции вызовов скорой помощи, время реагирования, демографические изменения, влияние COVID-19.

რეზიუმე
გადაუდებელი სამედიცინო ზარების ტენდენციები ყაზახეთში COVID-19-ის დაწყებამდე და მის შემდეგ

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ეს კვლევა აანალიზებს ტენდენციებს და დემოგრაფიულ ცვლილებებს სასწრაფო სამედიცინო დახმარების (EMS) ზარების სფეროში 2020 წლიდან 2024 წლამდე პერიოდში. ამ პერიოდის განმავლობაში, სულ 2,469,283 სასწრაფო დახმარების ზარი დარეგისტრირდა, 2021 წელს მკვეთრი ზრდა და შემდგომი სტაბილიზაცია მომდევნო წლებში. 2021 წელს ყოველდღიური ზარების რაოდენობა 2020 წელთან შედარებით 52% - ით გაიზარდა, ხოლო 2022 და 2023 წლებში ზრდა ნაკლები იყო. 2024 წლის პირველ ნახევარში 12.7% - იანი შესამჩნევი შემცირება დაფიქსირდა. კვლევის პერიოდში

ასევე გაიზარდა რეაგირების დრო: 2020 წელს 15.05 წუთიდან 2024 წელს 16.56 წუთამდე. მოთხოვნიდან დასრულებამდე აღებული დრო პირველად შემცირდა 2021 წელს, მაგრამ შემდეგ კვლავ გაიზარდა 2023 და 2024 წლებში, ყველაზე გრძელი საშუალო დრო კი 2024 წელს 1:16:46 იყო. კვლევამ ასევე აჩვენა, რომ ზარების რაოდენობა დამოკიდებულია კვირის დღეზე: ორშაბათს ყველაზე მეტი ზარი აქვს, პარასკევს კი ყველაზე ნაკლები. გენდერის ანალიზმა აჩვენა, რომ 2020-2023 წლებში მამაკაცთა და ქალთა პოპულაცია 80.6% - ით გაიზარდა, ხოლო ქალთა პოპულაცია 61.1% - ით. მიუხედავად იმისა, რომ თავდაპირველად უფრო მეტი ქალი იყო, ვიდრე მამაკაცი, გენდერული სხვაობა დროთა განმავლობაში შემცირდა. ყველაზე მნიშვნელოვანი ზრდა დაფიქსირდა 7-18 წლის ასაკობრივ ჯგუფში, განსაკუთრებით 2021-2022 წლებში. დასკვნები მიუთითებს სასწრაფო დახმარების სერვისებზე მნიშვნელოვან ტვირთზე მოთხოვნის გაზრდისა და რეაგირების დროის გაუარესების გამო, რაც გამწვავდა COVID-19 პანდემიით. ეს მონაცემები ხელს შეუწყობს რესურსების გამოყოფას და მომსახურების გაუმჯობესებას სამედიცინო მომსახურების მზარდი მოთხოვნის დასაკმაყოფილებლად.

საკვანძო სიტყვები: სასწრაფო სამედიცინო მომსახურება, სასწრაფო დახმარების გამოძახების ტენდენციები, რეაგირების დრო, დემოგრაფიული ცვლილებები, COVID-19-ის გავლენა.