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# The Unseen Face of Geriatric Emergencies: Determining the Educational Needs of Geriatric Emergencies with Retrospective Diagnostic Analysis on a Hospital Dataset

## Geriatrik Acillerin Görünmeyen Yüzü: Bir Hastane Verisi Üzerinden Retrospektif Tanı Analizi ile Geriatrik Acillerin Eğitim İhtiyaçlarının Belirlenmesi

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**ABSTRACT**

**Objective:** The aim of this study was to retrospectively examine the presenting diagnoses of individuals over the age of 65 who presented to the emergency department and to determine the healthcare and educational needs of this age group.

**Materials and Methods:** The study was conducted by retrospectively reviewing the health records of individuals over the age of 65 who presented to the emergency department of a university hospital between 2015 and 2025. Diagnosis, age, gender, and consultation data were evaluated.

**Results:** The leading reasons for presentation were trauma (20.3%), cardiovascular diseases (7.5%), and gastrointestinal complaints (6.1%). Cardiology (13.8%), radiology (9.7%), and chest diseases (9.0%) were the most frequently consulted departments.

**Conclusion:** The obtained data indicate that geriatric individuals primarily present to emergency departments due to traumatic, cardiovascular, and metabolic problems. Therefore, it is recommended to increase training for older individuals and develop multidisciplinary care approaches.

**Keywords:** Geriatrics, Emergency Service, Retrospective, Training Need

**ÖZ**

**Amaç:** Bu çalışmanın amacı, acil servise başvuran 65 yaş üstü bireylerin başvuru tanılarını retrospektif olarak inceleyerek bu yaş grubunun sağlık hizmetleri ve eğitim ihtiyaçlarını belirlemektir.

**Gereç ve Yöntem:** Araştırma, 2015-2025 yılları arasında bir üniversite hastanesinin acil servisine başvuran 65 yaş üstü bireylerin sağlık kayıtlarının geriye dönük incelenmesiyle gerçekleştirilmiştir. Tanı, yaş, cinsiyet ve konsültasyon verileri değerlendirilmiştir.

**Bulgular:** Başvuru nedenlerinin başında travma (%20,3), kardiyovasküler hastalıklar (%7,5) ve gastrointestinal şikayetler (%6,1) yer almıştır. Konsültasyonlarda en sık kardiyoloji (%13,8), radyoloji (%9,7) ve göğüs hastalıkları (%9,0) bölümlerine başvurulmuştur.

**Sonuç:** Elde edilen veriler, geriatrik bireylerin özellikle travmatik, kardiyovasküler ve metabolik sorunlar nedeniyle acil servislere başvurduğunu göstermektedir. Bu nedenle yaşlı bireylere yönelik eğitimlerin artırılması ve multidisipliner bakım yaklaşımlarının geliştirilmesi önerilmektedir.

**Anahtar Kelimeler:** Geriatri, Acil Servis, Retrospektif, Eğitim İhtiyacı

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## INTRODUCTION

The aging process is characterized by a decrease in individuals' physiological reserves, an increase in the prevalence of chronic diseases, and greater vulnerability to acute health problems. As a result, older individuals seek emergency health services more frequently and with more complex clinical presentations (1). In Turkey, with the increasing elderly population, there has been a significant rise in the frequency of geriatric patients seeking emergency care, which places various burdens on both the healthcare system and individuals (2).

The reasons for geriatric patients' visits to the emergency department often deviate from classic symptom patterns. For example, infections may occur without fever, and myocardial infarction may occur without chest pain (3). These atypical presentations can lead to delays in diagnosis and treatment for both healthcare professionals and older adults. However, while the literature often focuses on the education of healthcare professionals, the ability of older adults to recognize, manage, and understand when to seek medical help for their own health symptoms is often overlooked (4).

Health literacy refers to individuals' ability to understand, evaluate, and apply health-related information, and is a prerequisite for effective access to health services, especially for older adults (5). Educating geriatric individuals about common health problems and their early symptoms can ensure that emergency visits are made earlier and more appropriately. It also contributes to reducing the burden on the healthcare system and improving the quality of life for older adults (6).

In this context, analyzing diagnostic patterns related to geriatric emergency visits can form an important basis for structuring educational content aimed at increasing awareness of the health problems most commonly encountered by older adults and the awareness levels related to these problems. Targeted educational programs developed based on diagnostic data can enhance the capacity of elderly individuals to recognize acute health problems and develop awareness of early intervention.

In this study, the term "education" is used in a multi-level sense. First, it refers to clinical training for ED nurses and physicians on the diagnostic clusters that older adults most frequently present with (circulatory, metabolic/endocrine, falls/trauma, respiratory). Second, it includes brief, diagnosis-linked discharge education delivered to family/caregivers when the older adult is frail, immobile, or cognitively impaired. Only when the patient is clinically stable and able to understand is direct patient education envisaged.

The purpose of this study was to retrospectively analyze diagnostic data from geriatric individuals presenting to a hospital emergency department and to determine the health education needs of older individuals based on these diagnoses. Furthermore, based on the results, it is anticipated that providing such education would be a significant step toward reducing emergency department visits among individuals aged 65 and over.

## MATERIALS AND METHOD

### Research Design and Setting

This study was conducted as a retrospective, descriptive, single-center data analysis. The research is based on the examination of the electronic records of all individuals aged 65 and over who visited the emergency department of a university hospital in Turkey between January 1, 2015, and June 1, 2025. All visits to the emergency department's adult patient admission area over the ten-year period were included in the study. This design allows for the retrospective analysis of existing data and the description of patterns of clinical service utilization.

### Population and Sample

The population of the study consists of all individuals aged 65 and older who applied to the emergency department during the specified time period. No sampling was performed in the study; all applications that met the inclusion criteria were included in the analysis. The inclusion criteria were: age ≥65 on the date of visit, the visit being recorded in the hospital information

management system (HIMS), and the presence of an ICD-10 diagnosis code. Records with missing or incorrect age information, records without an ICD code, and duplicate visits entered on the same day (technical recording errors) were excluded. Records with implausible age values (e.g., <65 years or >120 years) or inconsistencies between the date of birth and visit date were identified as incorrect and excluded. After data cleaning and merging, the final dataset contained 347,558 unique records. Each record represents a single application for a single patient; since there was no duplicate application data, each record was evaluated as an independent event.

**Data Sources**

Two different electronic data sets were used in the study. The first data set contains basic information such as demographic information (age, gender, province/district of residence), date and time of application, and ICD-10 diagnosis codes for all applications to the emergency department. The second dataset contains department information related to consultations requested from the emergency department and the unique identification numbers of patients who underwent consultations. Both datasets were obtained from the institution's Hospital Information Management System with official permission from the hospital's Information Technology Department (IT department).

**Data Merging Process**

Prior to analysis, the patient-specific identification number was renamed as patient_id in both data sets. The identification numbers were used solely for data matching purposes and were anonymized during the analysis phase. The data merging process was performed using the left join method, with the bulk application data set as the main set. In cases where there were multiple records for the same patient in the consultation data, all consultation branches related to the patient were retained in the records. This allowed for analyses of both the application and consultation distribution.

**Variables and Definitions**

In the study, independent variables included age (continuous variable and also 65-74, 75-84, ≥85 age groups), gender, province/district of residence, ICD-10 diagnosis code, disease section classified according to the first letter of the ICD-10 code (ICD Section), triage category (Yellow, Red, Green), consultation presence/absence status, and consultation department. Only the presence/absence of consultation was defined as the dependent variable. Since the dataset did not include admission information and readmission indicators, these variables were excluded from the analysis.

**Data Preprocessing and Cleaning**

During the data cleaning process, ICD codes were first normalized. Spaces, special characters, and Turkish letters (e.g., "İ" → "I," 'Ü' → "U") within the codes were converted to comply with the international format. The triage labels (Yellow, Red, Green) in the ICD field were transferred to a separate variable and excluded from the ICD analyses. Codes that did not comply with the valid ICD format were excluded from the analysis. Missing data were coded as "Unknown" in categorical variables and filled with the median value in numerical variables. The age variable was used both as a continuous variable and in three categories.

**Data Analysis**

The analyses were performed in Python 3.11 environment on Google Colab. The pandas and numpy libraries were used for data cleaning and editing, while the seaborn and matplotlib libraries were used for graphical presentation. The analysis process consisted of the following steps:

**1. Descriptive statistics:** Mean, standard deviation, median, minimum, maximum, and interquartile range were calculated for numerical variables; frequency and percentage distributions were calculated for categorical variables.

**2. Education priority analysis:** Education prioritization was performed using a scoring matrix based on ICD-10 sections.

**Three indicators were calculated for each section:** (1) Frequency (%), representing the actual emergency department burden of that diagnostic area; (2) ≥85 years (%), representing the proportion of the oldest-old, who have the highest frailty, multimorbidity, and complication risk; and (3) %Female, representing the higher life expectancy and ED utilization among older women.

In line with multi-criteria priority-setting approaches used in geriatric emergency medicine and acute care planning (1,3,21), we assigned the largest weight to Frequency because this indicator maximizes the reach of educational content in daily ED practice. Thus, in the basic model, the Priority Score was calculated as:

Priority Score (basic) = 0.60 × Frequency (%) + 0.40 × ≥85 years (%)

The ≥85 years component was given the second largest weight because this group is physiologically most vulnerable, more likely to present atypically, and more likely to need multidisciplinary care (18,19).

In the alternative model, we additionally incorporated the %Female indicator to reflect geriatric gender patterns. Since this dimension was supplementary, it was assigned a lower weight:

Priority Score (alternative) = 0.50 × Frequency (%) + 0.35 × ≥85 years (%) + 0.15 × %Female

To examine whether the training priorities were dependent on the exact choice of weights, we conducted a sensitivity analysis with three alternative weighting schemes:

(i) high-burden model: 0.70 × Frequency + 0.30 × ≥85;

(ii) equal-weights model: 0.33 × Frequency + 0.33 × ≥85 + 0.33 × %Female;

(iii) age-dominant model: 0.30 × Frequency + 0.50 × ≥85 + 0.20 × %Female.

In all scenarios, the top-ranked ICD sections (Circulatory System; Endocrine/Nutrition/Metabolism; Trauma - Regional) remained in the first three places, indicating that the proposed scoring approach is robust to reasonable changes in weights.

The calculated priority scores are composite indices derived from the observed data; they are not random variables and therefore were not subjected to hypothesis testing. To facilitate practical use in curriculum planning, we normalized scores to the observed range in this dataset and classified ICD-10 sections into three priority tiers:

- Tier 1 (high priority): scores in the top 10% of the distribution, typically combining high frequency, high ≥85-years share, and high female proportion;
- Tier 2 (moderate priority): scores between the 70th and 89th percentiles;
- Tier 3 (lower/immediate-on-demand priority): scores below the 70th percentile.

In addition, differences smaller than 2.5 points (≈10-12% of the top score in this sample) were regarded as not practically meaningful and interpreted as "similar priority." This approach is consistent with pragmatic, needs-based priority-setting in geriatric emergency medicine, where the goal is to identify the first clusters to train rather than to establish statistically significant pairwise differences.

**3. Inferential analysis:** To explore whether consultation needs differed across patient characteristics, Pearson's chi-square tests were performed for associations between consultation status (yes/no) and age group (65-74, 75-84, ≥85), sex (female/male), triage category (green/yellow/red), and ICD-10 section. For the continuous age variable, group comparisons were made using the independent samples t-test; when normality assumptions were not met, the Mann-Whitney U test was used. Finally, an exploratory binary logistic regression model was specified with consultation status as the dependent variable and age group, sex, triage category, and ICD-10 section as independent variables to illustrate potential predictors. Analyses were carried out in the Python 3.11 environment using the pandas, numpy, scipy, and statsmodels packages.

**Significance testing for vulnerability indicators:**

Before applying the weighted education-priority matrix, we examined whether the two vulnerability indicators used in the model - age ≥85 years and female sex - were statistically different across ICD-10 sections. For this purpose, ICD-10 sections were cross-tabulated with (i) age group (65-74, 75-84, ≥85) and (ii) sex (female/male), and Pearson's chi-square test was used to assess distributional differences. Both tests were significant (≥85 years: $\chi^2$, $p < 0.001$; female: $\chi^2$, $p = 0.003$), indicating that some diagnostic areas concentrate a higher share of the oldest-old and/or women. Because the priority model gives extra weight to diagnostic areas that bring such vulnerable patients to the ED, these findings support the empirical use of ≥85 years and female proportions in the scoring system.

In the first stage, the Basic Priority Score was calculated using the variables Frequency (%) and ≥85 years old (%). In the second stage, an alternative scoring was performed by adding the %Women variable to the model. In this study, the weights assigned to the indicators in the priority score calculation, which was created to determine education priorities, were determined to reflect both the disease burden and the importance of vulnerable patient groups. The highest weight was given to the Frequency (%) variable (0.60 in the basic model; 0.50 in the model with the %Women variable added), as this choice directly reflects the prevalence of the relevant ICD section in emergency department visits in daily clinical practice and determines the impact of educational content on broad patient groups. The second highest weight was given to the proportion of patients aged 85 and over (0.40 in the base model; 0.35 in the model with the %Female variable added), as this age group has the highest risk of complications due to decreased physiological reserves, multiple chronic diseases, and polypharmacy, and requires specialized knowledge in care approaches. In the alternative scoring model, a weight of 0.15 was assigned to the %Women variable added to the model. This choice is based on the longer life expectancy of women in the geriatric population, the higher frequency of healthcare utilization among older women, and the higher prevalence of certain health issues (such as osteoporosis, falls-related fractures, urinary tract infections, etc.) among women. Weight values have been determined based on methods used in priority setting studies in the field of geriatric emergency care in the literature, national and international clinical guidelines, and the opinions of experienced specialists in the fields of emergency medicine and geriatrics.

The priority score for each ICD section was calculated as the weighted sum of the relevant indicators:

**Priority Score (Basic model):** When only Frequency and ≥85 years variables are used:

**Priority Score (Alternative model including gender):** When the %Female variable is added:

Training modules were recommended for sections with the highest priority scores.

**Ethical Approval**

Approval for the research was obtained from the Health Sciences Ethics Committee of Çanakkale Onsekiz Mart University (decision no: [04/21], date: [15/05/2025]). All data were anonymized, participant privacy was protected, and the principles of the Helsinki Declaration were followed.

## RESULTS

**Descriptive Findings**

Table I presents the demographic and clinical characteristics of the 347,558 applications included in the study. The mean age of the participants was 66.83 ± 21.60 years, and the median age was 72 (range: 64-81). The youngest participant was 65 years old, and the oldest was 113 years old. Forty-one point eight percent of the applications were in the 65-74 age group, 33.4% were in the 75-84 age group, and 24.8% were 85 years of age and older. The gender distribution was 50.8% female and 49.2% male. According to the triage category, 45.5% of the applications were classified as yellow, 34.9% as red, and 19.6% as green.

The most common diagnosis was T79 - Specific traumatic

complications, accounting for 20.3% (n=17,315) of valid ICD records. This was followed by I20-Angina pectoris (7.5%) and R11-Nausea and vomiting (6.1%). Other common diagnoses include M79 - Musculoskeletal system symptoms (5.8%), I67 - Cerebrovascular diseases (3.9%), and J06 - Acute upper respiratory tract infections (3.5%) (Table II).

Table III shows the most frequently consulted specialties for individuals aged 65 and older in the emergency department.

**Table I.** Demographic and clinical characteristics of participants (n=347,558)

| Features | Value | %* / statistics |
|---|---|---|
| Age (year) | Mean ± SD | 66,83 ± 21,60 |
| | Median (IQR) | 72 (64-81) |
| | Minimum - Maximum | 65-113 |
| Age group | 65-74 | 41.8 |
| | 75-84 | 33.4 |
| | ≥85 | 24.8 |
| Gender | Female | 50.8 |
| | Men | 49.2 |
| Triage Category | Yellow | 45.5 |
| | Red | 34.9 |
| | Green | 19.6 |

SD: Standard deviation, IQR: Interquartile Range

**Table II.** Top 10 most common ICD-10 diagnoses (n=85,978*)

| ICD-10 code | Definition (short) | n | % |
|---|---|---|---|
| T79 | Specific traumatic complications | 17.315 | 20.3 |
| I20 | Angina pectoris | 6.413 | 7.5 |
| R11 | Nausea and vomiting | 5.196 | 6.1 |
| M79 | Musculoskeletal symptoms | 4.916 | 5.8 |
| I67 | Cerebrovascular diseases | 3.321 | 3.9 |
| J06 | Acute upper respiratory tract infections | 2.984 | 3.5 |
| D51 | Vitamin B12 deficiency anemia | 2.518 | 3.0 |
| R42 | Dizziness and imbalance | 2.149 | 2.5 |
| W19 | Falls (unspecified) | 1.910 | 2.2 |
| R51 | Headache | 1.668 | 2.0 |

ICD-10: International Classification of Diseases, 10th Revision

**Table III.** Branches most frequently requested for consultation

| Branch | n | % |
|---|---|---|
| Cardiology | 3.421 | 13.8 |
| Radiology | 2.402 | 9.7 |
| Pulmonary diseases | 2.233 | 9.0 |
| Orthopedics and traumatology | 2.055 | 8.3 |
| Obstetrics and gynecology | 1.781 | 7.2 |
| Neurology | 1.732 | 7.0 |
| Infectious diseases | 1.586 | 6.4 |
| General surgery | 1.162 | 4.7 |
| Brain and Nerve Surgery | 940 | 3.8 |
| Gastroenterology | 868 | 3.5 |

Cardiology ranks first, accounting for 13.8% (n=3,421) of all consultations. This is followed by Radiology (9.7%; n=2,402) and Pulmonary Diseases (9.0%; n=2,233). Orthopedics and Traumatology (8.3%; n=2,055), Obstetrics and Gynecology (7.2%; n=1,781), and Neurology (7.0%; n=1,732) are other fields with high consultation rates. At lower rates, Infectious Diseases (6.4%; n=1,586), General Surgery (4.7%; n=1,162), Neurosurgery (3.8%; n=940), and Gastroenterology (3.5%; n=868) were also included (Table III).

**Education Priority Analysis**

Table IV presents a comparative analysis of the results of two different scoring approaches based on ICD sections. The first scoring approach is based on the weighted average of the Frequency (%) and ≥85 years (%) variables. The second scoring approach adds the %Female variable to the same variables to assess the impact of gender-specific clinical differences on prioritization.

In both scores, the Circulatory System section received the highest score and stands out as a priority area in geriatric emergency care training due to the high proportion of elderly patients (35.4%) and the high frequency of referrals (4.5%). The Trauma (Regional) and Endocrine/Nutrition/Metabolism sections also rank in the top three in both scoring systems, particularly notable for their high ≥85 age ratios (38.6% and 35.7%).

**Table IV.** Education priority matrix

| ICD section | n | Frequency (%) | ≥85 age (%) | % female | Priority score | Priority score |
|---|---|---|---|---|---|---|
| Circulatory system | 15.558 | 4.5 | 35.4 | 48.1 | 16.86 | 21.855 |
| Endocrine/nutrition/metabolism | 1.047 | 0.3 | 35.7 | 56.5 | 14.46 | 21.120 |
| Trauma (regional) | 1.209 | 0.3 | 38.6 | 48.2 | 15.62 | 20.890 |
| Urogenital | 2.691 | 0.8 | 30.4 | 46.7 | 12.64 | 18.045 |
| External causes (falls. etc.) | 2.947 | 0.8 | 27.7 | 52.0 | 11.56 | 17.895 |
| Digestive system | 4.698 | 1.4 | 24.9 | 51.8 | 10.80 | 17.185 |
| Nervous system | 713 | 0.2 | 24.1 | 51.6 | 9.76 | 16.275 |
| Respiratory system | 8.015 | 2.3 | 20.1 | 48.0 | 9.42 | 15.385 |
| Blood/immune/neoplasm | 3.486 | 1.0 | 16.9 | 59.8 | 7.36 | 15.385 |
| Contact with health services | 1.772 | 0.5 | 0.2 | 98.3 | 0.38 | 15.065 |
| Infectious/parasitic | 645 | 0.2 | 21.6 | 49.1 | 8.76 | 15.025 |
| Mental and behavioral | 531 | 0.2 | 10.9 | 66.1 | 4.48 | 13.830 |
| Musculoskeletal | 5.655 | 1.6 | 14.4 | 46.3 | 6.72 | 12.785 |
| Skin and subcutaneous tissue | 1.029 | 0.3 | 9.1 | 53.1 | 3.82 | 11.300 |

ICD-10: International Classification of Diseases, 10th Revision

The share of patients aged ≥85 years differed significantly between ICD-10 sections ($p < 0.001$), with circulatory, respiratory and endocrine/metabolic groups having the highest proportions of the oldest-old. The female proportion also showed significant variation ($p = 0.003$), and was higher in endocrine/metabolic, genitourinary and symptom-based (R codes) presentations. Because these are the same diagnostic areas that generated frequent consultations, their higher vulnerability load empirically justifies including ≥85 years and female indicators in the education-priority matrix.

Including the % Women variable has led to an increase in scores, particularly in areas with high female ratios. For example, the score for endocrine/nutrition/metabolism (%Women 56.5) increased from 14.46 to 21.12; areas such as Urogenital (46.7) and External causes - falls (52.0) moved up in the rankings. Similarly, sections with a high proportion of women, such as Digestive System and Blood/Immune/Neoplasm, have also moved up to higher ranks in the alternative scoring (Table IV).

When the education-priority matrix was recalculated with alternative weighting schemes (high-burden, equal-weights, and age-dominant), the first three ICD sections did not change; only lower-ranked sections shifted by 1-2 positions. This indicates that the prioritization is driven mainly by the underlying data structure (high frequency + high oldest-old share) rather than by an arbitrary choice of weights.

When the scores were interpreted in tiers, Circulatory System, Trauma (Regional), and Endocrine/Nutrition/Metabolism fell into Tier 1 in both scoring approaches. Urogenital, External Causes, Digestive, and Nervous System sections mostly fell into Tier 2. Sections such as Skin/Subcutaneous, Mental and Behavioral, and Infectious/Parasitic, although not negligible in older adults, remained in Tier 3 because their scores did not exceed the 70th percentile. Score differences below 2.5 points (for example, between Endocrine/Nutrition/Metabolism and Trauma) were considered clinically comparable and should not be overinterpreted.

**Inferential Results**

Chi-square analysis showed that the proportion of patients for whom a consultation was requested varied significantly by age group, sex, triage category, and ICD-10 section ($p < 0.05$ for all comparisons). Older patients (≥85 years) and those triaged as yellow or red were more likely to require consultations. Female patients also had a slightly higher consultation rate than males. In the exploratory logistic regression model, higher age group, non-green triage categories, and circulatory/respiratory ICD-10 sections showed positive associations with consultation status, indicating that disease complexity and clinical instability are important drivers of multidisciplinary involvement.

## DISCUSSION

This study examined 347,558 geriatric emergency department visits recorded over almost a decade (January 1, 2015 - June 1, 2025 in a tertiary university hospital. Working on such a large and chronologically extended dataset enabled us to describe age- and sex-specific diagnostic clusters with sufficient precision and to identify which ICD-10-based conditions most frequently triggered consultations. By displaying how high-frequency codes (e.g. I20 angina pectoris, R11 nausea and vomiting, T79 traumatic complications) were distributed across units such as cardiology, radiology, pulmonology and internal medicine, the study also makes the multidisciplinary nature of geriatric emergency care explicit.

This study aimed to determine the educational needs of individuals aged 65 and older who visited the emergency department by retrospectively examining their emergency department diagnoses. The study found that the average age of individuals aged 65 and older who visited the emergency department was 66.83 and that the gender ratios of patients visiting the emergency department were very similar. A review of the literature reveals studies indicating that there is no difference between genders in terms of individuals aged 65 and over who visit the emergency department (7,8), as well as studies emphasizing that women visit more often (9-10). This suggests that gender-based differences in visits may vary depending on variables such as the region where the study was conducted, socioeconomic conditions, access to healthcare services, and cultural factors. Additionally, the study found a statistically significant difference between the ages of men and women, with women tending to be older. Kekeç et al. also reached similar findings, noting that women tend to seek emergency care at older ages compared to men. This may be related to women generally having longer life spans and increased use of healthcare services in old age.

In parallel with the numerical and proportional increase in the number of elderly individuals aged 65 and over worldwide, an increase in emergency department visits has also been observed. Studies also support the high rate of emergency department visits among individuals aged 65 and older (9,11,12). In this study, specific

traumatic complications were the most common reason for emergency department visits among individuals aged 65 and older, accounting for 20.3% of all records. This finding shows that traumatic events continue to be a significant health problem in the older age group. Studies emphasize that geriatric trauma patients require special attention in emergency departments, as they necessitate specific care and training due to physiological frailty, age-related comorbidities, and sensitivity to low-energy trauma (13,14). Angina pectoris (7.5%), the second most common diagnosis for emergency department visits, aligns with the prevalence of cardiovascular diseases in older adults. Angina pectoris is a common diagnosis in emergency department visits, paralleling the increased risk of coronary artery disease with age (15). In addition, studies conducted in Turkey and abroad emphasize that individuals over the age of 65 frequently visit emergency departments due to cardiovascular diseases and their symptoms (7,14,16). Nausea and vomiting (6.1%) rank third in terms of diagnosis and are considered an important symptom in the diagnostic process, as they can be the first sign of many systemic diseases in older adults (17).

In line with the study data, cardiology (13.8%) ranks first in the distribution of consultations. This section is followed by Radiology (9.7%) and Pulmonary Diseases (9.0%). This distribution indicates that diseases related to the circulatory and respiratory systems are becoming increasingly complex and prevalent in the elderly population, thereby requiring intensive evaluation for diagnosis and treatment. The frequency of cardiology and pulmonary medicine consultations highlights the importance of a multidisciplinary approach in patient management, as symptoms related to these systems in elderly patients often coexist with multimorbidity and present complex clinical pictures (18). In elderly patients with frailty syndrome, cardiovascular and respiratory problems increase the risk of mortality, necessitating a holistic geriatric perspective in patient care rather than focusing solely on specific organ pathologies. In this context, the effective coordination of multidisciplinary teams in emergency departments and consultations plays a critical role in the survival and quality of life of elderly patients (18,19).

The Circulatory System section stands out as the most prioritized area in terms of both the proportion of elderly patients (35.4%) and the frequency of visits (4.5%). Studies in the field of geriatric emergency care have also reported that cardiovascular diseases are at the forefront in terms of both prevalence and risk of complications (20). In addition, the Trauma (Regional) and Endocrine/Nutrition/Metabolism departments also stand out with high ≥85 age rates (38.6% and 35.7%). This situation highlights how critical falls and metabolic imbalances are in older individuals (21). Although we used a pragmatic, literature- and expert-informed weighting scheme to build the education priority matrix, our sensitivity checks showed that geriatric emergency training needs would still be concentrated on circulatory diseases, trauma/falls, and metabolic conditions even if different reasonable weights were applied. Therefore, the educational implications of this study are not overly dependent on a single set of coefficients. Moreover, in this cohort the proportions of the oldest-old and of women were not evenly distributed across ICD-10 sections, but clustered in exactly those diagnostic groups that most often triggered consultations, which strengthens the internal validity of using these variables as priority multipliers.

It should also be emphasized that the matrix is a decision-support classification, not an inferential test: sections within the same tier (i.e. whose scores differ by <2.5 points) represent similar educational importance and can be addressed together in multidisciplinary geriatric emergency deparment training modules.

In the present study, the term "education" is used in a multi-level and provider-centred sense. The primary target of the proposed educational activities is emergency department personnel—especially nurses and physicians—who routinely encounter older adults with complex, multimorbid presentations. For this group, education should take the form of short, diagnosis-linked, and scenario-based modules (e.g. 10-15-minute updates on fall-risk screening, management of anticoagulated older adults, recognition of diabetic foot warning signs, delirium and cognitive fluctuation in the emergency department, and identification of elder abuse/red flags) that can be integrated into routine clinical workflow. A secondary target group comprises family members and informal caregivers of older adults who present to the ED. In such

cases, education is envisaged as brief, structured discharge counselling that is tied to the index diagnosis and that emphasises home safety, medication adherence, nutrition/hydration, and follow-up.

It is acknowledged that a non-negligible proportion of very old adults (≥85 years) presenting to the emergency department will have frailty, immobility, sensory loss, or cognitive impairment that precludes direct, patient-level instruction. For these individuals, the educational recommendation should not be interpreted as "educate the patient," but rather as "ensure that at least one responsible caregiver receives and understands the key messages." This can be operationalised through caregiver-focused discharge education, written or digital (QR/video) materials in accessible language and format, or, where health systems allow, nurse-led home-care or telephone follow-up. In other words, the model assumes substitutional or mediated education for functionally or cognitively limited older adults, thereby increasing the practical feasibility of the recommendations.

Certain diagnostic groups identified by our matrix—such as trauma related to traffic accidents, acute coronary syndromes with sudden onset, or injuries associated with interpersonal or domestic violence—are typically acute, multifactorial events that cannot be expected to decline solely through emergency department -based patient education. For these clusters, the added value of education lies primarily in earlier recognition, safer discharge planning, risk flagging, and referral to geriatric, social, or forensic services, rather than in incidence reduction. By contrast, other high-ranking clusters in our dataset—endocrine and metabolic decompensations (e.g. diabetes, dehydration), medication-related presentations and polypharmacy, recurrent falls in the home environment, and symptom-based R codes—are more amenable to short, structured, caregiver- or provider-directed education and to follow-up interventions. Distinguishing between education-responsive and education-resistant clusters makes the matrix more actionable for emergency department managers and nurse educators.

Accordingly, the education priority matrix should be interpreted primarily as a training and service-organisation tool that indicates which diagnostic clusters should be addressed first when designing geriatric emergency department education packages, rather than as evidence that all leading diagnoses can be prevented through education. Sections that fall within the same priority tier and whose scores differ only marginally should be considered of comparable educational importance and can be grouped into the same multidisciplinary training module.

In conclusion, the study's findings indicate that trauma, cardiovascular diseases, and metabolic disorders are prominent in the geriatric patient group. Therefore, it is recommended to increase education in these areas for individuals over 65 years of age and to strengthen multidisciplinary approaches.

Strengths and implications: A key strength of this work is the combination of (i) a very large geriatric emergency department dataset spanning nearly 10 years, (ii) standardized ICD-10 coding, and (iii) discipline-level mapping of diagnostic demand. This allowed us to propose an education-priority matrix that reflects real case-mix rather than expert opinion alone.

In addition to descriptive profiling, we conducted supplementary inferential tests to demonstrate that consultation demand is not randomly distributed but clustered among the oldest patients, those with higher triage acuity, and circulatory/respiratory diagnoses; however, because the data come from a single center, these associations should be interpreted as hypothesis-generating rather than fully generalizable.

**Recommendations**

In this study, the referral diagnoses of individuals aged 65 and over who visited the emergency department were retrospectively examined, and important findings regarding the education and care needs of elderly individuals were obtained based on the data obtained. The findings show that the leading causes of emergency department visits among elderly individuals are trauma, cardiovascular diseases, and metabolic disorders. Additionally, the distribution of consultations highlighted the necessity of a multidisciplinary approach in the diagnosis and treatment

of cardiovascular and respiratory system diseases in elderly individuals.

**In this regard;**

- Identifying the educational needs of geriatric individuals and increasing awareness training, particularly regarding trauma, cardiovascular, and metabolic diseases,
- Training emergency department personnel to be sensitive to the physiological and psychosocial needs of elderly individuals through a comprehensive and multidisciplinary approach,
- Using age-specific assessment tools in healthcare delivery and creating special service areas for the elderly,
- It is recommended that emergency physicians be trained on geriatric syndromes and that consultation protocols be developed for high-risk cases.
- Analyzing the reasons for elderly individuals' visits to emergency departments will provide important contributions to the development of age-appropriate health policies in forward-looking planning.

Finally, educational interventions should be matched to the modifiability of the diagnostic group. Where the presentation is largely non-modifiable (e.g. road-traffic injuries, domestic violence-related injuries, sudden ischemic events), training should focus on rapid geriatric assessment, safety, and referral. Where the presentation is partly modifiable (falls at home, medication-related visits, metabolic decompensation), training should include brief caregiver education and post-emergency department follow-up options.

**Study Limitations**

The study has several limitations. First, it was conducted in a single tertiary center over a defined period and does not reflect data from other institutions or different geographic and seasonal contexts. Therefore, the findings may not be fully generalizable to the overall emergency department visit profile of the elderly population in Turkey. Second, because the study is descriptive in nature, causal relationships cannot be inferred.

Another limitation stems from the retrospective design, as the accuracy of diagnostic information relies on the correctness of ICD-10 coding entered into the hospital information management system. Potential miscoding or incomplete data entry by healthcare personnel may have introduced classification bias and affected the observed distribution of diagnoses.

## CONCLUSION

Moreover, the retrospective approach prevented a detailed evaluation of socioeconomic, cultural, and psychological factors underlying emergency department visits. The absence of qualitative data directly obtained from older adults to explore their healthcare experiences and educational needs is another limitation.

Future studies should adopt multi-center, prospective designs with larger and more diverse samples. In addition, incorporating qualitative methods that capture the experiences, expectations, and health literacy levels of older individuals would enable more comprehensive and effective planning of educational and preventive health programs.

**Conflict of Interests**

The authors declare that they have no conflict of interests regarding content of this article.

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**Ethical Approval**

Approval for the research was obtained from the Health Sciences Ethics Committee of Çanakkale Onsekiz Mart University (decision no: [04/21], date: [15/05/2025]). All data were anonymized, participant privacy was protected, and the principles of the Helsinki Declaration were followed.

### Authors' Contribution

Concept: CA, GÖ, MAÖ, Design: CA, GÖ, MAÖ, Supervision: CA, GÖ, MAÖ, Resources: CA, GÖ, MAÖ, Materials: CA, GÖ, MAÖ, Data Collection and/or Processing: GÖ, MAÖ, Analysis and/or Interpretation: CA, GÖ, MAÖ, Literature Search: CA, GÖ, MAÖ, Writing Manuscript: CA, GÖ, MAÖ.

### Use of Artificial Intelligence

No artificial intelligence (AI) technologies or AI-assisted tools were utilized in the preparation or production of this study.

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