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A snapshot of geriatric infections in Turkey: ratio of geriatric inpatients in hospitals and evaluation of their infectious diseases: A multicenter point prevalence study

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ABSTRACT

Introduction: The human population is aging at an astonishing rate. The aim of this study is to capture a situation snapshot revealing the proportion of individuals aged 65 years and over among inpatients in healthcare institutions in Turkey and the prevalence and type of infections in this patient group in order to draw a road map.
Materials and Methods: Hospitalized patients over 65 years at any of the 62 hospitals in 29 cities across Turkey on February 9, 2017 were included in the study. Web-based *SurveyMonkey* was used for data recording and evaluation system.
Results: Of 17,351 patients 5871 (33.8%) were ≥65 years old. The mean age was 75.1 ± 7.2 years; 3075 (52.4%) patients were male. Infection was reason for admission for 1556 (26.5%) patients. Pneumonia was the most common infection. The median length of hospital stay was 5 days (IQR: 2–11 days). The Antibiotic therapy was initiated for 2917 (49.7%) patients at the time of admission, and 23% of the antibiotics prescribed were inappropriate. Healthcare-associated infections developed in 1059 (18%) patients. Urinary catheters were placed in 2388 (40.7%) patients with 7.5% invalid indication.
Conclusion: This study used real data to reveal the proportion of elderly patients in hospital admissions. The interventions done, infections developed during hospitalization, length of hospital stay, and excessive drug load emphasize the significant impact on health costs and illustrate the importance of preventive medicine in this group of patients.

Introduction

Turkey is a developing country bridging the European and Asian continents, and the Turkish population features a broad sociocultural structure, including citizens of a wide range of races, languages, and religions. Worldwide, the human population is aging at an astonishing rate. While only 1% of the world population was over 65 years old in the 1900s, it is predicted that this rate will

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reach approximately 20% by 2050. The elderly population constituted 8.7% of the global population in 2016 (Sharifi-Mood and Metanat, 2007).

According to data from the Turkish Statistical Institute, Turkey is 66th among 167 countries ranked according to highest proportion of elderly in their population. The elderly (aged 65 years and over) population in Turkey was 5,682,003 in 2012 and increased by 17.1% over a period of five years, reaching 6,651,503 in 2016. The proportion of elderly within the total population was 7.5% in 2012 and rose to 8.3% in 2016. Within the elderly population, 43.9% were male and 56.1% were female (Türkiye İstatistik Kurumu Haber Bülteni, 2016). In this case there is a growing population of older adults and increasing healthcare needs.

Along with these changes in population distribution, age-related health problems have become more common and will undoubtedly continue to become increasingly prevalent. Impaired host defense and changes in lifestyle as potential changes in habits, like increased alcohol or tobacco using, limited ability to exercise, decreased income, combined with community and hospital-acquired infections contribute to morbidity and mortality among older adults (Castle, 2000). The healthcare needs of older adults in Turkey, specifically with regard to infection is not properly known. To date, there have been no comprehensive studies in Turkey on the prevalence of infections among hospitalized older adults and the features of infection, and we believe this prevents us from seeing the extent of the problem and understanding what steps are necessary.

When planning this study, our goal was to capture the current situation in order to draw a road map for geriatric patient care. We conducted a survey-based point-prevalence study to determine the number and reasons for admission of older adults hospitalized in Turkey and also, the prevalence and distribution of infections, the antimicrobial drug usage and, interventions performed (catheterization, mechanical ventilation, etc.) of these patients.

Materials and methods

Patients aged 65 years and older who were under inpatient care in one of 62 secondary and tertiary healthcare institutions in 29 cities across Turkey on February 9, 2017 were included in the study. The number of beds in all hospitals participating in the study was over 100.

The Geriatric Infections Study Group of the Infectious Diseases and Clinical Microbiology Specialty Society of Turkey (EKMUD) sent invitations to all members via e-mail. A separate mail group consisting of infectious diseases specialist (IDS) who wished to participate in the study was created and information regarding the study was shared via the group. Necessary permits and approvals were obtained from the managers of all hospitals and filed for the study. Ethics committee approval was also obtained from Cukurova University, the planning center. Participants were asked to record the number and age distribution of all inpatients on the date –October 9, 2017, specified for the study. A form consisting of 20 questions (shown in appendix) was prepared to be filled in for all individuals aged 65 years and over in the hospitals. This form was placed on the web-based *SurveyMonkey* data recording and evaluation system. The centers participating in the study entered the data pertaining to patients into the *SurveyMonkey* system using a one-page data entry form accessed via a link sent to them. All doctors who entered the data were IDS and answered the questions by assessing the patients' infection diagnoses, catheterization indications, and the appropriateness of antibiotics administered simultaneously. All were informed in order to make their diagnosis of healthcare and nosocomial infection appropriate antibiotic use and also asked if there is a valid reason for urinary catheter insertion adhering to the international guidelines that they follow. Experts filled out a separate form for each patient. In addition, the IDS were asked to report the total number of patients hospitalized in the inpatient clinics and intensive care units. An IDS from each hospital attended to the study. However, more than one willing physician were also allowed to enter data from the same hospital. However, in this case, they were asked to share the hospitalized patients with each other, so that they did not overlap. Survey questions were set so as not to switch from one to the other, thereby preventing the missing form from being saved in the system.

Statistical analysis of the acquired data was done after the completion of the entry procedure using the SPSS 20.0 (SPSS Inc., Chicago, IL, USA) software package. Categorical measurements were summarized as numbers and percentages, and numerical measurements as mean and standard deviation (with median and minimum-maximum where necessary). The Kolmogorov–Smirnov test was used to determine whether the continuous variables showed normal distribution; Student's *t*-test was used for normally distributed variables and the Mann–Whitney *U* test was used for non-normally distributed variables. A chi-square test was used in comparisons of categorical variables. The statistical significance level was accepted as 0.05 in all tests.

Results

The survey was recorded in the *SurveyMonkey* system for all patients over 65 years' old who were monitored in the intensive care and general medical and surgical units of the participating centers between 9 AM and 5 PM on February 9, 2017. The system was closed to data entry at the end of the working hour on the same day. The participants were asked to report the number of all hospitalized patients within 48 h that day and were recorded.

Of 17,351 patients staying in 62 hospitals in 29 cities, 5871 (33.8%) were aged 65 years or older. The mean age of these patients was 75.1 ±7.2 years; 3075 (52.4%) were male and 2796 (47.6%) were female. The types of hospitals from which data were collected are listed in Table 1 according to the proportion of inpatients aged 65 years and older. Table 1 also shows the patients' residential status, comorbidities, and the inpatient units where they were being treated. The patients' diagnoses at admission are presented in Table 2. No comorbid disease was recorded for 743 (12.7%) of the patients. The remaining patients had a history of at least one comorbid disease.

It was observed that 1768 (35%) of the patients were being treated in surgical units, 3127 (65%) were in internal medicine units, 4766 (81.2%) were in other inpatient units, and 1105 (18.8%) were in intensive care units.

Infection was the cause of hospitalization for 1556 (26.5%) of the patients. Pneumonia was the most common of these infections, with nearly half of the patients having a diagnosis of typical or atypical pneumonia. This was followed by urinary tract infections, acute cholecystitis, and diabetic foot infections (Table 3).

As of the day the study data were collected, the median length of hospital stay was 5 days (IQR: 211 days). Antimicrobial therapy was initiated for 2917 (49.7%) of the patients at the time of admission, and 23% of the antimicrobial agents given were inappropriate. The most commonly administered antibiotic classes were first and second generation cephalosporins (69.4%), beta-lactam/beta-lactamase inhibitors (35.8%), fluoroquinolones (32.8%), and carbapenems (14.7%). The list of antimicrobials administered is in Table 4. Antiviral and antifungal agents also initiated to 38 (%1.9) and 28 (%1.5) patients at admission, respectively.

Healthcare-associated infections developed in 1059 (18%) of the patients. Mean duration of hospitalization was 25 days among patients who developed infection and 6.7 days among those who

Table 1
Demographic data of the patients.

Demographic Data	Patient number (n=5871)	Percentage (%)
Sex		
Female	2796	47.6
Male	3075	52.4
Age Groups		
65–80 years	4440	75.6
81 and over	1431	24.4
Hospital Type		
University Hospital	2172	37
Training and Research Hospital	2645	45
State Hospital	767	13
Private Hospital	172	3
Private University Hospital	115	2
Residential Status		
Independent	3038	51.7
With family	2761	47
Nursing home	60	1
Other	12	0.2
Comorbidities*		
Hypertension	2948	50.2
Diabetes mellitus	1799	30.6
Congestive heart failure	1176	20.0
Chronic obstructive pulmonary disease	1143	19.5
Solid tumor	548	9.3
Chronic kidney disease	536	9.1
Cerebrovascular accident	527	9.0
Cerebrovascular accident	363	6.2
Alzheimer's/Dementia	308	5.2
Alzheimer's/Dementia	104	1.8
Chronic ischemic heart disease	1143	19.5
Leukemia/Lymphoma		
Other*		
Inpatient Units		
Medical Wards**	2529	41.7
Surgical Wards***	1629	27.8
Intensive Care Units		
Reanimation/Anesthesia Intensive Care	329	5.6
Internal Medicine Intensive Care	219	3.7
Surgical Intensive Care	139	2.4
Main Intensive Care	136	2.3
Emergency Intensive Care	12	0.2
Other**	878	15.0

* One patient may have more than one accompanying disease.
** Internal Medicine, Pulmonary Diseases, Cardiology, Neurology, Physical Therapy and Rehabilitation, Infectious Diseases, Dermatology.
*** General Surgery, Orthopedics and Traumatology, Urology, Cardiovascular Surgery, Neurosurgery, Ophthalmology, Plastic and Reconstructive Surgery, Otorhinolaryngology.
**** General services, Mixed services.

Table 2
Disease causing hospital admission.

Diseases*	Patient number (n=5871)	Percentage (%)
Infection	1556	26.5
Cerebrovascular disease	520	8.9
Cardiovascular disease	493	8.4
Solid malignancies	377	6.4
Orthopedic surgery	321	5.4
Chronic pulmonary diseases	293	5.0
Chronic kidney disease	245	4.2
Abdominal surgery	192	3.3
Gastrointestinal diseases	184	3.1
Urologic diseases	178	3.0
Neurosurgery	134	2.3
Kidney failure	180	3.0
Ocular surgery	108	1.8
Trauma	97	1.7
Diabetes mellitus	88	1.5
Rheumatologic diseases	64	1.1
Other	841	14.4

* One patient may have more than one disease for hospital admission.

Table 3
Infection diseases causing hospital admission.

Infection Diagnosis	Number (n = 1556)	Percentage (%)
Pneumonia*	820	52.6
Urinary tract infection**	198	12.8
bdominal infection***	124	7.9
Skin and soft tissue infection****	120	7.6
Sepsis with no identified source	60	3.8
Bone joint infection*****	52	3.3
Surgical site infection	33	2.1
Meningitis******	17	1.2
Ocular infections	7	0.5
Endocarditis	6	0.4
Upper respiratory tract infection	5	0.4
Tuberculosis	2	0.1
Other	112	7.2
TOTAL	1556	100

* typical pneumonia 651 (%41.8), Atypical pneumonia 141 (%9,1), Ventilator-associated pneumonia 18 (%1.1), Viral pneumonia 10 (%0,6).
** Pyelonephritis 166 (%10.7), Cystitis 32 (%2.1).
*** Acute cholecystitis/cholangitis 93 (%5.9), Intra-abdominal abscess 14 (%0.9), Acute gastroenteritis 11 (%0.7) Bowel infections 6 (%0.4).
**** Diabetic foot infection 65 (%4), Cellulitis 48 (%3.1), Necrotizing fasciitis/Fournier's gangrene 7 (%0.5).
***** Spondylodiscitis 8 (%0.6), Osteomyelitis 7 (%0.5) Prosthesis infection 37 (%2.2).
****** Bacterial meningitis 12 (%0.8) Viral meningoencephalitis 5 (%0.4).

Table 4
Antimicrobial drugs initiated at time of admission*.

Antimicrobial drug	N	%
1 st/2nd generation cephalosporins	1371	69.4
Beta-lactam/beta-lactamase inhibitors	709	35.8
Fluoroquinolones	648	32.8
Carbapenems	291	14.7
Macrolides	228	11.5
Nitroimidazoles	120	6.1
Glycopeptides	93	4.7
Aminoglycosides	37	1.9
Oxazolidinones	34	1.7
Sulfonamides	27	1.4
Expanded spectrum cephalosporins	24	1.3
Tigecycline	21	1.1
Daptomycin	20	1.0
Colistin	19	1.0
Clindamycin	7	0.4
Fusidic acid	6	0.3
Doxycycline	3	0.2

* One patient may have more than one antimicrobial use.

did not develop infections ($p < 0.0001$). The prevalence of nosocomial infection among patients in intensive care units was 44.9% (n = 475), while this rate was 12.3% (n = 584) for patients in other inpatient units ($p < 0.0001$).

Urinary catheters were placed in 40.7% of the patients (n = 2388), and 181 (7.5%) of these patients did not have a valid indication for catheterization. Mean duration of urinary catheter use was 13 days (1730 days). Indications for urinary catheterization are shown in Table 5.

Decubitus ulcers were present in 259 patients (4.4%) at admission and developed in 259 patients (4.4%) during inpatient treatment.

Discussion

Our point prevalence study has demonstrated that infection is the most common cause of hospitalization among geriatric patients in Turkey (26.5%) different from developed countries with higher rate (Russo and Elixhauser, 2003). This was followed by neurological diseases, cancers, heart diseases, and chronic

Table 5
Indications for urinary catheterization.

Indication	Number (n)	Percentage (%)
To monitor input/output	1646	68.9
To correct anatomic or functional obstruction	129	5.4
For preoperative urine drainage	65	2.7
For postoperative urine drainage	234	9.8
For neurogenic dysfunctions	106	4.4
For bladder irrigation	27	1.13
Not indicated	181	7.5
Total	2388	100

obstructive pulmonary disease (COPD). Epidemiological differences between populations are expected, but an excess of infectious diseases may indicate that a society does not have good infection control and that socioeconomic and cultural conditions are poor. Despite the rapid growth of the older population in our country, hospital units providing special services for geriatric patients are very few in number and limited to certain centers. According to listings of the Medical Specialist Examination, 13 universities in Turkey have a Department of Geriatrics (Tıpta Uzmanlık Kurulu, 2020).

Age-associated immune dysregulation, comorbid damage, and age-related functional limitations are also important factors in the high rate of infectious diseases (Castle, 2000, Loeb, 2003; High et al., 2005). Pneumonia, urinary system infections, soft tissue infections, gastroenteritis, and prosthesis infections are known to be common among geriatric patients. Accompanying problems such as diabetes, COPD, bronchiectasis, urinary obstruction, dysphagia, poor oral hygiene, cutaneous and mucosal barrier disruption, degenerative changes in bone and cartilage, and more frequent implantation of foreign bodies lead to a higher incidence of infectionnot only community-acquired infections, but also hospital-acquired infections such as pneumonia, urinary system infections, and cellulitis (Castle, 2000; Heppner et al., 2013; Rozzini et al., 2007; Juthani-Mehta and Quagliarello, 2010). The snapshot we have taken of the situation shows that pneumonia is the most common infection. It is reported that pneumonia is 10 times more common in elderly individuals. In addition, antibiotic use is common in this patient group, resulting in the issue of antibiotic resistance. Although this point prevalence study does not include resistance data, antibiotic resistance in Turkey is known to be high (Soyletir et al., 2016;Central Asian and Eastern European Surveillance of Antimicrobial Resistance (Central Asian and Eastern European Surveillance of Antimicrobial Resistance (CAESAR), 2016). The extensive use of antibiotics revealed in the present study is one of the major risk factors for resistance and antibiotic-related complications (High et al., 2009).

Compared to cases seen in younger patients, cases of pneumonia in the elderly last longer and result in higher mortality (14). It has been shown that in Turkey, where traditional family life is still preserved, most patients aged 65 years and over live with their family or in their own home; very few patients live in nursing homes (1%). Despite this low proportion of nursing home residents, the high rates of infection indicate that age-related factors are more influential than social conditions in determining susceptibility to infection.

Lower respiratory tract infections and pneumonia accounted for nearly half of all infection-related hospitalizations in elderly individuals (Millett et al., 2013; Curns et al., 2005, Kaplan et al., 2002). Our data also support the literature. However, despite a similar rate, there was a large number of patients hospitalized for pneumonia due to the high prevalence of infection in our study. This demonstrates the importance of preventive measures.

Appropriate and timely management of infections in the elderly requires experience and knowledge of the different signs and symptoms of infection in this patient group (van Duin, 2012). However, s who care for geriatric patients hold the opinion that it is better to monitor these patients carefully without giving antibiotics unless an infection is confirmed (Beckett et al., 2015). Unfortunately, our snapshot shows that this opinion was not practiced, as 49.7% (n = 2917) of the patients were started on antibiotics at time of admission. This issue should be addressed by providing more educational activities to raise physician awareness.

Urinary catheterization is performed frequently in the older population; its prevalence ranges between 6% and 40% depending on the study population (Wang et al., 2012). In our population, the rate of urinary catheterization was high, at 40.7%. Furthermore, the mean catheterization period was also high, at 13 days. Catheterization is the most important risk factor for nosocomial urinary infections, and longer catheter use is associated with higher infection rates. Urinary infection is the most common nosocomial infection in the elderly. Studies have shown that 60% of urinary tract infections are the result of unindicated urinary catheter use (Inelmen et al., 2007; Hazelett et al., 2006). The rate of unindicated use in our study was 7.5%.

It has been reported that geriatric hospitals have higher rates of nosocomial infections (Sax et al., 2001). In the present study, this rate was 18% overall and 44.9% for intensive care units. Moreover, because this is a point prevalence study, it does not include data on nosocomial infections developed by these patients during follow-up.

The management of infectious diseases in geriatric patients is challenging due to factors such as multiple comorbid diseases and polypharmacy, restrictive circumstances, and functional disorders (Heppner et al., 2013). Early initiation of appropriate antibiotics in patients with severe infections requiring monitoring in an intensive care unit has key importance in survival (Gaieski et al., 2010). However, the rapid and indiscriminate administration of broad-spectrum empirical antibiotics is an invitation for resistance (Carlet et al., 2011). In our population, the rate of antibiotic use was fairly high. Nearly half of the patients were started on antibiotics at the time of admission and the antibiotics used were inappropriate for a quarter of the patients. In addition, although the proportion of patients being treated in intensive care units was 14.2%, the high ratio of empirical and early treatment was striking.

Another issue requiring consideration is the use of vascular access devices and urinary catheters. These foreign bodies can act as foci of infection and must eventually be removed, and surgery is known to have a role in deep-seated infections. For this reason, it is crucial that Geriatrics departments be monitored closely by infection control specialists (van Duin, 2012; Esme et al., 2019; Letica-Kriegel et al., 2019)

Limitations

In this multi-center study, it was accepted that the information provided by the participating centers in the study was correct. However, there is a possibility that there may be data that is either due to lack of information or overlooked. Again, errors may have occurred during the survey response.

Various studies indicate that age is an important risk factor for multidrug-resistant microorganisms, independent of other factors. It is also established that infections have a more severe course and cause more morbidity and mortality in elderly patients. As mentioned earlier, resistance rates are not compared in the present study because we did not obtain resistance data.

Since the study was a point of prevalence study, information on prognostic findings such as mortality data and hospital stay was not obtained.

Infection diagnoses, appropriate antimicrobial therapy and interventional applications were determined by the evaluation of IDS. Qualification related to the field of expertise has been accepted. In order to avoid individual errors, the definitions of the disease and the criteria for treatment and urinary catheterization should have been defined.

Conclusion

Prior to our research, a comprehensive multicenter geriatric infection study had not been conducted in Turkey. This large-scale, multicenter study has revealed the proportion of elderly inpatients using actual data. The figures are quite dramatic, indicating that one-third of all hospital inpatients are over the age of 65 years. Infections account for one quarter of hospital admissions. These infection rates are significantly higher compared to those in developed countries. Pneumonia is the most common cause of hospitalization. The interventions performed, infections contracted during hospitalization, length of hospital stay, and excessive drug load emphasize the significant impact on health costs and illustrate the importance of preventive medicine in this group of patients.

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