

## Hospitalization and Mortality Rates in Patients with Respiratory Diseases in the Very Elderly Population

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### Abstract

**Background:** Advanced technologies and treatments continue to increase life expectancy, however, the hospital mortality rate of elderly patients with respiratory diseases remains unclear. In this study, we aimed to demonstrate the changing frequencies of hospitalized elderly patients with respiratory diseases and their mortality rates over time.

**Methods:** A retrospective observational cohort study was performed in a tertiary training hospital using data from a 7-year period (2008-2014). The characteristics and hospital outcomes of patients  $\geq 80$  years old was collected from an electronic hospital database system. The frequency of elderly patients with respiratory diseases and their mortality rates for each year were assessed. Results Overall, 9.6% (10,782) of patients were  $\geq 80$  years old. Their mean age was 84 (80- 114) years with a slight male predominance (52.6%). The median length of hospital stay was 8 (5-11) days. The frequency of elderly patients gradually increased: 6.5%, 6.0%, 7.2%, 8.5%, 10.9%, 13.6%, and 15.5% for 2008 to 2014, respectively. Importantly, mortality rates did not significantly increase over time (7.4%, 6.9%, 7.7%, 8.3%, 7.6%, 8.3%, and 8.0% respectively). The mean mortality rate for all 7 years was 7.8% (n = 843), and the mean age of non-survivors was 84 ( $\pm 4$ ) years.

**Conclusion:** The frequency of hospitalized elderly patients has increased, but mortality rates have remained flat. The Ministry of Health and hospital directors should consider planning palliative care through special hospital units to improve the quality of life of elderly patients.

**Keywords:** Elderly; Rehabilitation; Mortality; Respiratory diseases

### Methods

This single center observational cohort study was performed in a large tertiary training and research hospital for respiratory diseases and thoracic surgery with (605 beds, 23 level III ICU beds, and 14 Level II ICU beds). Medical records of patients admitted between 2008 and 2014 were evaluated. The study was approved by our local ethical committee (Sureyyapaşa Chest Diseases and Thoracic Surgery Teaching Hospital-Istanbul, Turkey 22.01.2015) and conducted in accordance with the ethical principles stated in the Declaration of Helsinki. Informed consent was not obtained from patients due to retrospective design.

### Patients

All consecutive hospitalized patients between 2008 and 2014 who were aged  $\geq 80$  were enrolled in the study. Clinical information and annual hospitalization frequencies were obtained from the hospital's electronic database system.

### Definitions

Patients  $\geq 65$  and  $\geq 80$  years old were defined as elderly, and as very elderly, respectively (2-4). We recorded the number of hospitalizations of elderly patients per year, length of stay (LOS) in hospital as days, hospitalization reasons, and hospitalization outcomes (discharge to home or death). Costs, readmission rates, utilization, rehabilitation,

### Introduction

The elderly population continues to grow thanks to new medical technologies and treatments. According to a Union report, those over 80 years old accounted for 14% of the population of 2013; this is expected to reach 19% in 2050, corresponding to nearly 400 million people worldwide [1]. Elderly is defined as over 65 to 80 years, and very elderly is over 80 [2-4]. The latter group has a higher prevalence of comorbidities and functional impairment and is admitted to hospitals and intensive care units (ICUs) more frequently than younger patients [5,6].

Physicians refrain from admitting elderly patients because of comorbid diseases and poor prognoses. However, this population needs more frequent hospitalization because of cardiovascular, respiratory, urinary system, and musculoskeletal diseases [7-10]. Respiratory diseases such as influenza increase seasonally, and respiratory system anatomical changes such as reduced mucociliary clearance and weakened coughing reflex can increase the risk of infection [11,12].

The current literature is limited to yearly hospitalization results and mainly describes ICU outcomes for elderly patients [2,3,5]. In the present study, we aimed to demonstrate the frequency of very elderly patients ( $\geq 80$  years) with respiratory diseases and the mortality rates.

cognition, function, and patient/staff satisfaction were not recorded. Polypharmacy and the presence of delirium were not analyzed.

### Statistical analysis

Data are expressed as median, interquartile range (25-75%), and percentage (%), where appropriate. Mann-Whitney U and chi-square tests were used for non-parametric and dichotomous data, respectively. A p-value <0.05 was considered significant. Descriptive analyses with SPSS statistical software (SPSS version portable 16.0; SPSS, Chicago, IL, USA) were used to evaluate the data.

### Results

During the study period, 112,418 patients were hospitalized and 10,782 (9.6%) were very elderly with a slight male predominance (52.6%). The median length of hospital stay was 7 (4-12) days in the ICU, and 8 (5-11) days of overall hospitalization. The mean age of all elderly patients was 84 (80-114). From 2008 to year 2014, the frequency of elderly patients gradually increased year by year (6.5%, 6.0%, 7.2%, 8.5%, 10.9%, 13.6%, and 15.5%, respectively) (Table 1). Interestingly, mortality rates did not significantly increase (7.4%, 6.9%, 7.7%, 8.3%, 7.6%, 8.3%, and 8.0% respectively). The overall mean mortality rate was 7.8% (n=843), and the mean ICU mortality rate was 27.8%.

Figure 1 shows the mortality and hospitalization rates of very elderly patients. The reasons that 5754 patients were hospitalized were electronically accessible and are shown in Table 2. The majority were admitted for chronic obstructive pulmonary diseases, asthma, bronchiectasis, pneumonia, hypertension, and cardiac diseases including congestive heart failure, and ischemic and valvular heart diseases. Hospitalization reasons were summarized in Table 2.

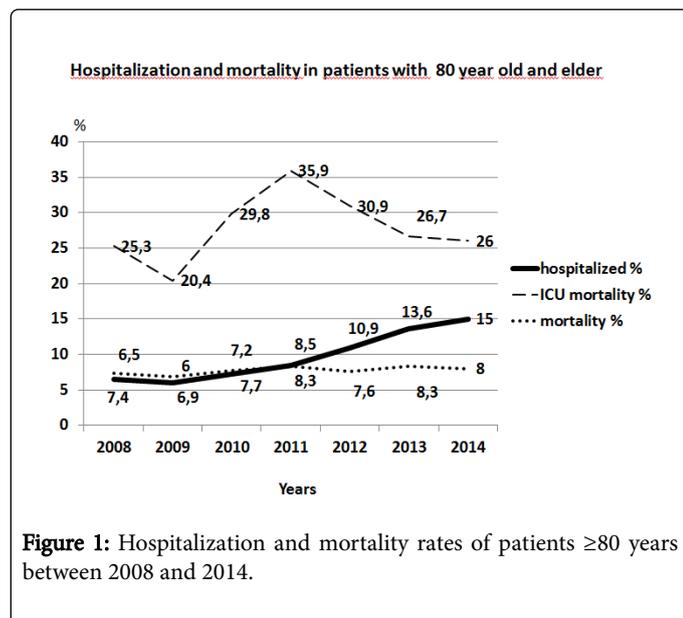


Figure 1: Hospitalization and mortality rates of patients ≥80 years between 2008 and 2014.

The mean age of patients who died in the hospital was 84 (±4) years. The percentages of patients discharged home with a cure of their underlying disease or without improvement were 27.6% and 63.9%, respectively. The outcomes of very elderly hospitalized patients between 2008 and 2014 are shown in Table 3.

### Discussion

The rate of elderly hospitalized patients increased over the 7-year study period, but there was no significant change in hospitalization outcomes including mortality.

The world's population is rapidly aging, and the elderly population will be at least two-fold greater by 2050 [1,4]. Among hospitalized subjects, the number of elderly patients may be much higher. In a large multicenter cohort study, Bangshaw et al. reported a 6% annual increase in the number of elderly patient admissions between 2000 and 2005, and very elderly patients accounted for approximately 14% of all ICU admissions in 2005 [13]. We found that that hospitalized patients aged ≥80 (including ICU admissions) increased 2.5 times over 7 years.

Heyland et al. [3] recently reported on 1671 patients aged ≥80 years that were hospitalized in ICU, and determined the median LOS as 17 (8-33) days with 35% hospital mortality. Nearly two decades ago, Montuclard et al. [6] showed higher rates of hospital mortality (53%) in patients aged ≥70 years. In the present study, the mean mortality rate of all patients over 7 years was 7.8% (n=843), while it was 27.8% in the ICU. The mean age of non-survivors was 84 (±4) years.

Montuclard et al. grouped elderly patients according to a 30-day LOS; among the 613 (age ≥70) who stayed less than 30 days, the mean was 7.2 days (range, 1-29), while 75 who were admitted for more than 30 days stayed for a mean of 52.5 days (range, 31-139) [6]. In our study, the median LOS was 8 days (interquartile range, 5-11).

Age is one of the independent variables in two commonly used prognostic scoring systems: the acute physiology and chronic health evaluation (APACHE) II [14] and APACHE III [15]. Advanced age is an obvious risk factor for mortality [16-18]. However, advanced age alone is not a risk factor for hospital mortality, and underlying, pre-existing factors play a greater role in the long-term outcome of these patients [19-23]. Using the APACHE III score, Knaus et al. [24] showed that 73.1% of the mortality prediction power was due to physiological conditions, with the 'admitting' disease and age contributing to 13.6% and 7.3%, respectively. Meanwhile, physicians generally prefer to admit younger patients to older patients.

Nguyen et al. recently investigated the impact of frailty on mortality, length of stay, and re-hospitalization in hospitalized patients with atrial fibrillation who were older than 65 [4]. There were 302 patients aged ≥85 who were divided into groups according to the presence of frailty. In both groups, the three most common cardiovascular conditions were hypertension, ischemic heart disease, and congestive heart failure, and the top three comorbidities were chronic pulmonary disease, cancer, and dementia [4].

Year	All hospitalized patients, n	Patients aged ≥80 years, n	%
2008	14,688	951	6.5

2009	16,801	1016	6.0
2010	17,134	1235	7.2
2011	18,922	1603	8.5
2012	17,813	1937	10.9
2013	13,811	1882	13.6
2014	13,249	2050	15.5
<b>Total</b>	<b>112,418</b>	<b>10,782</b>	<b>9.6</b>

**Table 1:** Patients treated between 2008 and 2014.

Disease	n
Respiratory diseases*	1771
Pneumonia	514
Hypertension	461
Respiratory Failure	270
Malignancy	267
Heart failure	240
Metabolic diseases**	240
Pleural diseases	208
Neurological diseases	143
Psychiatric diseases (delirium included)	138
Pulmonary embolism	122
Ischemic heart diseases	97
Tuberculosis	56
Hematologic diseases	42
Interstitial lung diseases	30
Extremity vascular problem	28
Viral/fungal diseases	23
Cerebrovascular diseases	22
Thoracic trauma	15
Secondary pulmonary hypertension	7
Orthopedic, infectious disease, and others	1060
Data not available	5028
*Chronic obstructive pulmonary disease/asthma/bronchitis/bronchiectasis	
**Diabetes mellitus and thyroid diseases	

**Table 2:** Hospitalization reasons for elderly patients.

The authors reported that the major reasons for admission were shortness of breath, falls, infections, delirium, or chest pain/discomfort [4]. Overall, the median LOS was 10 days (2-47), the median length of

prolonged hospitalization (defined as LOS  $\geq$ 75th percentile) was 17 days, and overall mortality was 4.3% [4]. We evaluated nearly 30 times more elderly hospitalized patients than Nguyen et al. found similar cardiac comorbidities and major reasons of hospital admission.

However, our 75th percentile LOS was shorter (11 versus 17 days, respectively). Meanwhile, our mortality rate was nearly two times greater, which may be because Nguyen et al. excluded elder patients who were about to die, under intensive care, or identified as “blind” or “deaf” and therefore unable to see or hear the investigators [23]. We included all of the patients recorded in our database. The largest studies reported hospital mortality rates of 25.9% in the ICU [14] and 30.8% [24] for patients  $\geq$ 75; similar to the 27.8% mortality rate we observed in the ICU.

There are some limitations in our investigation. Firstly, some data were missing given that it was a single-center retrospective study. However, we were able to assess a large elderly patient sample, which yielded important results on this issue. Secondly, our findings cannot be generalized to all elderly hospitalized patients admitted with conditions other than pulmonary diseases.

In addition, our subjects had various comorbid diseases and were treated for complex multisystem diseases. Finally, we lacked data on patient quality of life in the hospital and after discharge. Short- and long-term survival outcomes were not recorded. However, the main focus of this study was the rate of elderly hospitalization and patient outcome.

The major strength of this investigation is the very large number of elderly patients hospitalized for pulmonary reasons.

## Conclusion

Our results show that despite an increase in the elderly population, mortality is not significantly greater in this population of hospitalized patients. The major reasons that elderly patients were admitted to the hospital with respiratory symptoms were chronic obstructive pulmonary disease, pneumonia, hypertension, congestive heart failure, and pleural effusion. These patients had good outcomes when admitted with pulmonary diseases.

Despite cardiopulmonary comorbidities, elderly patients’ diseases are treatable. These patients and their families requested minimally invasive treatments. The Ministry of Health and hospital directors must consider these variables when developing protocols to treat very elderly with life-threatening diseases.

Year	2008	2009	2010	2011	2012	2013	2014
Very elderly patients, n	951	1016	1235	1603	1937	1887	2050
Discharged home with cure for underlying diseases, n (%)	239 (25.1)	352 (34.6)	400 (32.4)	493 (30.8)	408 (21.1)	414 (21.9)	567 (27.7)
Discharged home without improvement, n (%)	639 (67.2)	579 (57)	727 (58.9)	967 (60.3)	1371 (70.7)	1293 (68.5)	1325 (64.6)
Sent to other centers, n (%)	3 (0.3)	13 (1.2)	11 (8.9)	6 (0.4)	10 (0.5)	22 (11)	8 (0.4)
Mortality, n (%)	70 (7.4)	72 (6.8)	97 (7.8)	137 (8.5)	148 (7.6)	158 (8.4)	150 (7.3)

**Table 3:** Outcomes of very elderly hospitalized patients between 2008 and 2014.

Ideally, they should be admitted to specialized palliative care units for elderly patients that provides close follow-up with minimally invasive techniques such as noninvasive mechanical ventilation and monitorization.

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