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Original Article

Gender-differences in disease distribution and outcome in hospitalized elderly: Data from the REPOSI study

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ABSTRACT

Background and purpose: Women live longer and outnumber men. On the other hand, older women develop more chronic diseases and conditions such as arthritis, osteoporosis and depression, leading to a greater number of years of living with disabilities. The aim of this study was to describe whether or not there are gender differences in the demographic profile, disease distribution and outcome in a population of hospitalized elderly people.

Methods: Retrospective observational study including all patients recruited for the REPOSI study in the year 2010. Analyses are referred to the whole group and gender categorization was applied.

Results: A total of 1380 hospitalized elderly subjects, 50.5% women and 49.5% men, were considered. Women were older than men, more often widow and living alone or in nursing homes. Disease distribution showed that malignancy, diabetes, coronary artery disease, chronic kidney disease and chronic obstructive pulmonary disease were more frequent in men, but hypertension, osteoarthritis, anemia and depression were more frequent in women. Severity and comorbidity indexes according to the Cumulative Illness Rating Scale (CIRS-s and CIRS-c) were higher in men, while cognitive impairment evaluated by the Short Blessed Test (SBT), mood disorders by the Geriatric Depression Scale (GDS) and disability in daily life measured by Barthel Index (BI) were worse in women. In-hospital and 3-month mortality rates were higher in men.

Conclusions: Our study showed a gender dimorphism in the demographic and morbidity profiles of hospitalized elderly people, emphasizing once more the need for a personalized process of healthcare.

1. Introduction

The percentage of people aged 60 years and over has gradually increased during the last decades due to the improvements in healthcare [1,2] and is expected to further increase up to nearly 30% of the European population by the year 2050. Women are the largest portion of elderly people reaching 64% of those 80 years or older [3]. Aging is associated with multiple chronic conditions [4], ranging in prevalence between 55% and 98% in people over 65 years of age [5]. Female sex along with old age and low socio-economic level is associated with multi-morbidity and an increased risk of hospitalization [5–8].

In the general population, gender differences are known for cardiovascular disease in terms of age distribution and impact of risk factors, clinical presentation and outcome [9,10]. Moreover, in the aging population the female sex is more frequently associated with depression [11,12] and cognitive disorders [13], that are likely to be responsible for physical function decline and poor quality of life [14,15]. However, only few data are available on gender differences in terms of disease distribution and outcome in elderly subjects admitted to hospital.

Hence, the Registro Politerapie SIMI (REPOSI) project [16], that was designed to investigate the impact of multi-morbidity and related polypharmacy in the elderly population admitted to internal medicine and geriatric wards in Italy, was thought to be an appropriate setting

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in order to investigate whether or not there is any gender difference in socio-demographic profile, clinical characteristics, disease distribution and outcome in the hospitalized elderly.

2. Methods

All patients recruited for the REPOSI study during the year 2010 have been included in this analysis and the available information were analyzed on the basis of a gender perspective. Socio-demographic variables such as age classes, education, marital status, work occupation, living arrangement and need for assistance in daily living, were all considered along with laboratory and clinical characteristics.

Disease distribution at hospital admission, including frequency of diagnoses higher than 10% was taken into account. The International Classification of Diseases-Ninth Revision (ICD-9) was used for disease classification [17]. Cognitive status and mood disorders, tested by the Short Blessed Test (SBT) [18] and Geriatric Depression Scale (GDS) [19], were considered. Functional status at hospital admission was measured by means of the Barthel Index (BI) [20] and classified as mild (BI 75–90), moderate (BI 50–74), severe (BI 25–49) and total dependence (BI 0–24). The severity and comorbidity indexes, evaluated respectively by the Cumulative Illness rating Scale (CIRS-s and CIRS-c) [21], were also included in the gender analysis. Finally gender-differences in outcome measures, such as length of hospital stay, destination at hospital discharge and in-hospital and 3 month-mortality rates were also considered.

3. Statistical analysis

Data are reported as percentages for categorical variables and as means (95% confidence intervals) for quantitative variables. Analyses are referred to the whole group and gender categorization was applied. A Barthel Index score ≤ 40 was used to select patients with significant disability according to our population characteristics. The comparison between groups was made using the exact Fisher test for contingency tables and the z test for the comparison of proportions. The non-parametric Mann–Whitney *U* test was used for the comparison of quantitative variables. Multivariate logistic analysis was used to explore the relationship between variables and outcomes (in-hospital and 3-month follow-up mortalities). Odds ratios (ORs) and 95% confidence intervals (95% CIs) were computed. The choice of variables was performed according to the Hosmer–Lemeshow methodology [24]: after univariate analysis, only variables with a $p < 0.20$ were included in the final model; then, through a backward process, variables were excluded until a significance level of $p < 0.20$ was reached for each variable. A two-tailed $p < 0.05$ was considered statistically significant. Stata (StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP) was used for database management and analysis.

4. Results

We analyzed data on 1380 hospitalized patients aged 65 years or older enrolled in the REPOSI study during the year 2010, both sexes being equally represented. Women were slightly older than men, more frequently widow and living alone or in nursing homes (Table 1).

The analyses of the clinical characteristics categorized by gender (Table 2) showed that systolic blood pressure, body temperature, leucocytes, platelets and serum cholesterol were higher in women, but hemoglobin, fasting glucose level and serum creatinine were higher in men. Men were more often overweight (41.8% vs 30.5%), although visceral obesity (>102 cm in men and >88 cm in women) was more prevalent in women (62.2% vs 29.6%).

The cumulative illness rating scale for the evaluation of severity and comorbidity indexes (CIRS-s and CIRS-c) were more frequently abnormal in men, while the SBT, GDS and BI were worse in women (Table 2). Disease distribution showed that malignancy, diabetes, coronary artery disease, chronic kidney disease and chronic obstructive pulmonary disease were more frequent in men, while hypertension, osteoarthritis, anemia and depression were so in women (Table 3). Table 4 shows that in women there was a trend for a longer hospital stay than in men, however men had a higher in-hospital and 3-month mortalities. At multivariate analysis, both in-hospital and 3-month mortalities, the latter being statistically significant, were higher in men (Tables 5 and 6).

5. Discussion

This study from the REPOSI cohort of hospitalized elderly patients admitted acutely to internal or geriatric wards has shown the existence of gender differences in terms of demographic profile, clinical characteristics and outcomes. Although the attention of the scientific community on gender-related issues is high [22], there is little evidence specifically stemming from hospitalized patients with multiple diseases admitted to internal medicine and geriatric wards. Our observation that clinical profiles and disease distributions varied according to gender would support the existence of a gender dimorphism in the elderly. Women were older than men, consistently with epidemiological data on aging population [3], they were more often living alone due to their widowhood and longer life expectancy [23]. In REPOSI, women had a worse GDS score than men, confirming that there is a gender difference in the self-reporting assessment of symptoms related to depression.

Living alone is likely to be strictly related to depression that has been linked to several adverse health outcomes [25]. For instance, feeling lonely has been associated with higher age-related increases of systolic blood pressure [26] and an increased risk of incident coronary heart disease [27]. Attention has been recently devoted to the burden of mood disorders such as depression on cardiovascular disease [28–31], diabetes [32], hypertension [26] and stroke [33–35]. Furthermore, data from the Nurses Health Study showed an association between depression and cardiac events in women, namely sudden cardiac death and coronary artery disease [36]. A further investigation on the same cohort of 80,574 women aged between 54 and 79 years showed that a history of depression and the use of antidepressant drugs were associated with an increased risk for stroke [33]. Finally, INTERSTROKE showed that self-reported depression is associated with an increased risk of stroke (OR 1.35; 99% CI 1.10–1.66) in 3000 cases and 3000 matched controls from 22 countries [37]. In elderly women the finding of a high prevalence of depression is often regarded as a marker of subclinical cerebrovascular disease [38], making them unsuitable for anti-depressant medication (particularly for selective serotonin reuptake inhibitors), that is associated with an increased risk of sudden death [39] and stroke [40].

Cognitive impairment tends to be more pronounced in elderly women than men [13], as also confirmed by the present analysis that showed that women scored worse at the SBT. Nahid and colleagues [41] found an increased risk of cognitive impairment and Alzheimer's disease in the female gender. Moreover, the PLUPAR study [42] showed that permanent cognitive impairment was more frequent in women.

Both depression and cognitive impairment may contribute to limitations in daily life activities, leading to a progressive deterioration of functional ability [43]. Our analysis showed that women had a worse functional status than men according to BI, that would be certainly related to the aging itself and therefore to the older age of women than men in our cohort, however it could also be the effect of a possible link between daily living activities, psychological and cognitive statuses. Data from the Women's Health Initiative Observational Study, conducted on a population of 61,609 women aged 50–79 years at baseline and followed up for 12 years, showed that those with a more sedentary life style reported a greater overall number of chronic diseases, a higher frequency of falls and disability in the activities of daily living, and that

Table 1
Socio-demographic characteristics and risk factors of the REPOSI population.

Variables	All patients	Women	Men	p
N of subjects	1380	697 (50.5%)	683 (49.5%)	
Age[a]	79 (78.1–79.4)	80.1 (79.6–80.7)	77.8 (77.3–78.4)	<0.0001
Marital status (%)				<0.001
Married	53.4	33.3	74.0	
Widow	37.6	57.6	17.2	
Separated	0.8	0.7	0.8	
Divorced	0.9	0.7	1.1	
Single	7.3	7.7	6.9	
Profession (%)				<0.001
Businessman	1.9	0.4	3.5	
Manager	12.7	9.8	15.8	
Tradesman	5.4	5.1	5.8	
Other	80.0	84.7	74.9	
Living arrangement (%)				<0.001
Alone	23.5	32.7	14.3	
Spouse	42.3	24.3	60.3	
Sons	16.0	25.0	7.0	
Spouse and sons	9.3	6.1	12.6	
Other	8.9	11.9	5.8	
Institutionalized (%)	7.2	7.5	7.0	0.68
Caregiver (%)	56.5	59.2	53.7	0.03
Spouse	31.5	11.6	53.7	<0.001
Son	51.4	67.0	34.0	
Other	17.1	21.4	12.3	
Smoking habits (%)				
Smokers	40.1	17.8	62.8	<0.001
Former smokers	8.9	5.2	12.8	
No smokers	51.0	77.0	24.4	
Alcohol (%)	42.3	26.4	58.6	<0.001
Need for urinary catheter (%)	23.3	23.7	23.0	0.75
Previous hospital admissions (%)				
No previous admission	61.5	63.8	59.1	0.10
One previous admission	25.7	23.7	27.8	
>1 previous admission	12.8	12.5	13.1	
N° previous admissions[a]	5.7 (5.3–6.2)	5.4 (4.8–6)	6 (5.4–6.8)	0.11

[a] Data are reported as mean (confidence interval 95%).

they were more likely to live alone [44]. On the other hand, the present data show that men were more impaired than women in terms of cumulative illness burden with respect to severity and comorbidity (CIRS-s and CIRS-c).

Disease distribution favored a profile of a male subject that in his old age is affected more frequently than women by chronic obstructive pulmonary and coronary artery diseases and malignancies that are likely to be responsible for recurrent hospital admissions and higher in-hospital and short-term mortalities following hospitalization, yet without impairing their ability in daily life. Disease frequency, on the male side, is obviously associated to the gender differences in risk factor distribution, indeed men are more often smokers and former smokers, where tobacco smoke plays a well recognized role in determining each one of the mentioned diseases. On the female side, disease distribution showed a prevalence of such chronic conditions as osteoarthritis and anemia that are responsible for sedentary life and discomfort [45] and contribute to the identification of a female profile that in her old age is characterized by impairment in daily life activities even if without dominant severe diseases.

All in all, our findings are consistent with previous epidemiological studies pertaining to gender differences in terms of cognitive impairment, depression, quality of life and disability [44]. The greatest agreement with the literature concerns the demographic profile of the elderly according to gender [46], so that a higher percentage of men than women live with their spouse, who take on the role of caregiver despite their old ages. On the other hand, elderly women are more likely to rely for support upon non-spousal caregivers, such as their children or non-family members. Recently the PROFUND project has shown that having a caregiver different of spouse is a prognostic factor for increase of mortality [47]. In our cohort there isn't a statistical association between the caregiver and in-hospital or 3-month mortality Another major issue for elderly people is quality of life, that is worse in women than in men, perhaps owing to gender differences in living conditions, higher prevalence of chronic inflammatory diseases, pain and depression [14], conditions that usually deteriorate following an acute event causing hospitalization [48].

Our study has limitations. It is based upon data stemming from a general clinical evaluation for cognitive and affective disorders, based upon tools that are reliable for disease screening but not diagnostically conclusive. The study also lacks a lot of clinical information that was not collected by the minimum dataset of the REPOSI study; nor did we investigate whether or not there is an association between depression and cognitive impairment and specific medical therapies prescribed in hospital. However, in comparison to previous data on gender differences regarding risk factors and disease distribution that did mainly stem from population-based observational studies, this study should be considered an accurate picture of the situation of the elderly acutely hospitalized in internal medicine and geriatric wards. It also represents a reliable sample of the condition of elderly people with multi-morbidity that could be translated to a gender-difference analysis.

In conclusion, this study clearly shows a gender dimorphism in the demographic and morbidity profiles of hospitalized elderly people, women being older than men and more often affected by chronic conditions impairing their ability of daily life, while men did show more multimorbidity and higher short-term mortality after

Table 2
Clinical characteristics of the REPOSI population at hospital admission.

	All patients (n = 1380)	Women (n = 697)	Men (n = 683)	p
Systolic blood pressure (mm Hg)[a]	133 (132–134)	134 (133–136)	132 (131–134)	0.04
Diastolic blood pressure (mm Hg)[a]	75.4 (74.8–76)	75.8 (74.9–76.7)	75 (74–76)	0.32
Heart rate (bpm)[a]	80 (79–81)	83 (81.5–84)	79 (77.6–80)	<0.0001
Body temperature (mm Hg)[a]	36.8 (36.3–37.2)	37 (36–37.9)	36.4 (36.4–36.5)	0.03
Fasting glucose (mg/dL)[a]	128 (124–132)	126 (121–131)	129 (123–135)	0.78
Creatinine (mg/dL)[a]	1.2 (1.2–1.3)	1.12 (1–1.18)	1.38 (1.3–1.46)	<0.0001
Hemoglobin (mg/dL)[a]	11.9 (11.8–12)	11.6 (11.5–11.8)	12.2 (12–12.4)	<0.0001
Leucocytes (cells per microliter)[a]	9155 (8750–9561)	9300 (8640–9950)	9000 (8533–9482)	0.55
Platelets (cells per microliter)[a]	228,000 (223,000–233,000)	242,500 (235,000–250,000)	214,000 (206,000–221,000)	<0.0001
Cholesterol (mg/dL)[a]	163 (160–167)	171 (167–175)	154 (151–158)	<0.0001
BMI[a]	25.9 (25.7–26.3)	26.4 (26–26.8)	25.6 (25.2–26)	0.06
Waist circumference (cm)[a]	93.7 (92.8–94.6)	91.7 (90.4–93)	95.6 (94.5–96.8)	<0.0001
Visceral obesity (%)	45.9	62.2	29.6	<0.0001
Underweight patients (%)	3.9	4.6	3.1	0.17
Optimal weight patients (%)	43.3	41.7	43	0.64
Overweight patients (%)	36.1	30.5	41.8	<0.0001
Obesity I (%)	12.3	15.6	9.0	0.0002
Obesity II (%)	3.6	5.2	1.9	0.0015
Obesity III (%)	1.8	2.4	1.2	0.10
Short Blessed Test score [a]	9.8 (9.5–10.3)	10.8 (10.2–11.4)	8.9 (8.3–9.5)	0.0001
Short Blessed Test score ≥ 10 (%)	47.6	51.8	43.2	0.01
Barthel Index [a]	76.7 (75.1–78.4)	72.9 (70.4–75.4)	80.7 (78.6–82.8)	<0.0001
Barthel Index ≤ 40 (%)	16	20	12	0.0001
Geriatric depression scale[a]	1.3 (1.2–1.4)	1.4 (1.3–1.5)	1.2 (1.1–1.3)	0.002
N° of drugs at hospital admission[a]	5.4 (5.3–5.6)	5.2 (5–5.4)	5.6 (5.4–5.9)	0.01
N° of in-hospital drugs[a]	4.0 (3.9–4.4)	4.0 (3.7–4.3)	4.2 (3.9–4.5)	0.38
N° of drugs at hospital discharge[a]	6.4 (6.2–6.6)	6.3 (6–6.5)	6.6 (6.3–6.8)	0.08
Severity index (CIRS) [a]	1.6 (1.63–1.66)	1.61 (1.6–1.7)	1.7 (1.6–1.7)	0.0002
Comorbidity index (CIRS) [a]	2.9 (2.8–3)	2.7 (2.6–2.9)	3.0 (2.9–3.2)	0.0012
Comorbidity index (CIRS) < 3	44.1%	48.1%	40%	0.002
Comorbidity index (CIRS) ≥ 3	55.9%	51.9%	60%	

[a] Data are reported as means (95% confidence interval). BMI = Body Mass Index; underweight: BMI < 18.5; optimal weight: BMI: 18.5 to 24.9; overweight: BMI: 25 to 29.9; obesity I: BMI: 30 to 34.9; obesity II: BMI: 35 to 39.9 and obesity III: BMI ≥ 40. CIRS = cumulative illness rating scale.

hospitalization. The awareness of a gender dualism in living conditions and disease distribution in the elderly may explain gender differences in outcomes and represent a starting point for a process of personalized care to elderly people in order to improve their quality of life.

Learning points

- Hospitalized elderly people show a gender dimorphism in the demographic and morbidity profiles.
- Disease distribution in hospitalized elderly shows that men are more frequently affected by COPD and CHD, while women present more often chronic conditions such as ostheoarthritis and anemia.
- Depression and cognitive impairment along with an impaired functional ability in daily life are more frequent in women and old women

Conflict of interest statement

All the authors have no conflicts of interest to declare.

Table 3
Most frequent diagnoses (frequency more than 10%) in the REPOSI population and according to gender at hospital admission.

	All patients (n = 1380)	Women (n = 697)	Men (n = 683)	p
Hypertension (%)	78.7	80.7	76.8	0.05
Malignancy (%)	29.0	21.0	37.2	<0.0001
Peripheral vascular disease (%)	28.7	28.7	28.8	0.19
Diabetes mellitus (%)	28.6	24.2	32.8	0.0004
Coronary artery disease (%)	24.7	19.3	30.1	<0.0001
Heart failure (%)	22.0	21.0	23.0	0.39
Chronic kidney disease (%)	21.6	15.7	27.6	<0.0001
Atrial fibrillation (%)	21.0	21.2	20.7	0.83
Chronic obstructive pulmonary disease (%)	20.2	16.0	24.4	0.0001
Gastric disease (%)	17.7	18.2	17.2	0.64
Hypertensive cardiopathy (%)	15.0	15.7	14.3	0.45
Osteoarthritis (%)	13.5	18.4	8.5	<0.0001
Depression (%)	12.6	14.7	10.4	0.01
Anemia (%)	12.1	13.8	10.4	0.05
Cardiac valvulopathy (%)	10.0	11.2	8.7	0.11
Diverticular disease (%)	10.0	9.1	11.0	0.25
Diverticular disease (%)	10.0	9.1	11.0	0.25

Table 4
Length of hospital stay, destination at hospital discharge, in-hospital and 3-month mortalities of the whole REPOSI population according to gender.

	All patients (n = 1380)	Women (n = 697)	Men (n = 683)	p
Length of hospital stay[a] (days)	11.2 (10.5–11.8)	11.5 (10.5–12.5)	10.8 (9.9–11.9)	0.37
In hospital mortality (%)	5.0	4.4	5.6	0.34
3-Month mortality (%)	5.0	6.8	11.5	0.01
Destination at discharge				0.14
Home (%)	89.6	25.9	26.8	
Home care (%)	3.2	0.6	1.3	
Institution (%)	3.7	0.8	1.37	

[a] Data are reported as means (95% confidence interval).

Appendix A

Investigators and co-authors of the REPOSI (REgistro POliterapie SIMI, Società Italiana di Medicina Interna) Study Group are as follows:

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Table 5
Multivariate analysis of the association between variables and in-hospital mortality.

	Odds ratio (95% C.I.)	p
Age	1.03 (0.99–1.07)	0.07
Male gender	1.68 (0.95–2.97)	0.07
Barthel Index ≤ 40	5.20 (2.96–9.11)	<0.0001
Severity index (CIRS)	2.54 (1.45–4.4)	0.001
Fasting blood glucose	0.99 (0.996–0.999)	0.01
Systolic blood pressure	0.97 (0.96–0.98)	<0.0001
Malignancy	1.46 (0.83–2.57)	0.18

The model reports only variables with p < 0.2; see Statistical analysis Section.

Table 6
Multivariate analysis of the association between variables and 3-month mortality.

	Odds ratio (C.I. 95%)	p
Age	1.05 (1.01–1.09)	0.004
Male gender	2.12 (1.23–3.60)	0.006
Barthel Index ≤ 40	4.98 (2.70–8.90)	<0.0001
Systolic blood pressure	0.98 (0.97–0.99)	0.01
Chronic kidney disease	1.49 (0.87–2.60)	0.14
Malignancy	3.58 (1.28–4.11)	<0.0001

The model reports only variables with p < 0.2; see Statistical analysis Section.

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