Risk factors for mortality in elderly patients who live in nursing homes: 8-year follow-up period

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ABSTRACT

Background: In developed countries and our country, the ratio of the elderly to the total population is increasing due to the rise in worldwide medical care spendings and the medical workforce allocated for the treatment of the acute and chronic problems of the elderly. **Aims and Objectives:** The number of studies based on long-term observations of the risk factors that affect the survival and mortality rates of the elderly in nursing homes is quite rare. Currently, there are no studies concerning this issue in the country. The authors carried out an eight years prospective study to determine the risk factors for mortality in a private nursing home with a capacity of 150 beds located in Istanbul. **Materials and Methods:** From January 2007 to March 2015, we scanned the number of medications, comorbidities, nutritional status, age, mental score, number of falls and fractures, levels of hemoglobin, albumin, creatinine, and glucose parameters related with mortality in 612 patients admitted to the nursing home. **Results:** The median overall survival time was 34 months. A total of 240 (39%) residents died within eight years, 44% within two years and 55% within three years. The evaluation results shothat 360 (51%) of the 612 residents, were females and the mean age was 76.49 (± 11.36) years. Hazard ratios of the related parameters that related to mortality were respectively 1,3 for age, 1,5 for BMI less than 20kg/m2, 4,2 for more than six comorbidities, 7,01 for six to nine number of medications, 5 for dependency, 0,7 for one to three episodes of infection, 0,5 for falls, 1,3 for fracture, 3,1 for mental score of less than 18, 1,9 for hemoglobin less than 12gr/dl, 4,03 for creatinine higher than 1.5 mg/dl, 2,43 for glucose greater than 126 mg/dl, 4,8 for albumin less than 3 g/dl (95% CI). **Conclusion:** The risk factors causing mortality are; old age, BMI less than 20, more than six comorbidities, more than six medications, dependency, one to three episodes of infection, impaired mental score less than 18, anemia, hyperglycemia, kidney failure, hypoalbuminemia at the patients who admitted to nursing homes. Early optimal monitoring of these parameters can provide a positive contribution to the survival of elderly residents in nursing homes.

Key words: Nursing home; Mortality; Risk factors; Elderly patients

INTRODUCTION

In developed countries and our country, the ratio of the elderly to the total population is increasing due to the rise in worldwide medical care spendings and the medical workforce allocated for the treatment of the acute and chronic problems of the elderly.

Therefore, knowing the negative risk factors, which are affecting the health status of the elderly directly or indirectly, will help the health care staff to provide optimal follow-up standards as well as more realistic health policies aimed towards this population.

A significant number of people over the age of sixty-five, carry out their daily activities independently; others have

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children and/or other family members or a caregiver living with them in a home environment, while others are forced to live in public or institutional care centers because of financial reasons, desolation, increased dependency, and inability for physical self-maintenance.

The necessity for institutional care centers in our country is increasing every day. In the last ten years, the capacity of these institutions has increased by 400 % and has reached a 25,000-bed volume.

In nursing homes, cross-sectional studies are more likely to be conducted. Demographic characteristics, as well as baseline characteristics, are evaluated in these studies. Long-term survival studies based on observation of risk factors that affect the mortality rates are very few. Such studies are not done frequently in this country. Some small-scale and short-term follow-up studies show that advanced age,[1] gender,[1] low body mass index (BMI)[2], anemia,[3,4] albumin levels,[5] kidney failure,[3,6] low mental score,[7-9] strenuous activities of daily living (ADL), dependence[10] and frailty[8] affect mortality rates negatively while other studies indicate that factors such as anemia,[11] albumin levels,[2,12] renal failure[11] are not associated with high mortality rates. Knowledge is sparse on the factors that affect the mortality of nursing home residents. The survival span of these elders has been shortening due to more restrictive admission criteria. As there are varying opinions on this subject, long-term follow-up studies are still needed.

To determine the risk factors affecting the rate of mortality, we planned a prospective long-term study in a private nursing home with a 150-bed capacity located in Istanbul.

MATERIALS AND METHODS

The study was an eight-year long term observation of elderly patients selected by the Department of Internal Medicine at the Yeditepe University School of Medicine. Institutional Review Board has reviewed and approved the protocol. The authors have conducted all aspects of the research in this project under the principles of the Declaration of Helsinki.

The study has been carried out in Istanbul between January 2007- January 2015, in a private nursing home with a 150-bed capacity.

Study subjects
Inclusion criteria
We included all patients over the age of 65 on January 1st, 2007 in this study. All subjects were living in a nursing home for over a month. The same internal medicine physicians,

neurologists, and psychiatrists followed the patients. In cases of medical and surgical emergencies, we transferred the patients to various hospitals in the region.

Exclusion criteria
We excluded the patients under the age of 65 or less than one month follow-up period in a nursing home and also the patients who did not give consent for the analysis.

Data collection
The nursing home documented a detailed medical history of the patients within the first three days of their admission by recording their age, gender, weight, physical examination results, the number and type of medications used, concomitant diseases (hypertension, diabetes, arthritis, heart failure, dementia, renal failure), nutritional status, ADL, MMS score, and baseline laboratory results (complete blood count, levels of albumin, creatinine, glucose).

An internal medicine specialist, neurologist, and a psychiatrist examined the patients. Meanwhile, a psychologist conducted the MMT assessment. Daily care and treatments of the patients were performed by nurses and health care staff. Visits were conducted by an internal medicine specialist every week.

Any interventions needed in acute and chronic conditions were performed on site, while we transferred the patients in need of further assistance to hospitals.

With an interval of 3-6 months, we reevaluated the parameters and medical records and repeated the physical examinations of the patients. We updated the records in case of any deaths in the hospital or nursing home.

Anthropometric measurements: Body weight and height were carefully measured, respectively, to 0.1 kg and 0.1 cm accuracy; BMI was calculated in (kg/m2).

We performed MMT to evaluate cognitive function.[13] Cognitive impairment was measured on a scale of 30 points; 18 and under as severe, 19-23 as moderate, 24 and above as standard. To evaluate ADL, we used Katz and Stroud's scale. Bathing, getting dressed, eating, walking, and toilet activities were evaluated. We assigned each activity points between 0 and 2; 0: dependent activity, 1: semi-dependent activity, 2: independent activity. Body weight was evaluated in BMI to define nutritional status. Exton Smith scale was used to evaluate the risk of pressure ulcer.

Intervals: First time interval: 3-6 months; second time interval: 6-12 months; third time interval: 12-18 months; fourth time interval: 18-24 months; fifth time interval: 24-36 months.

Statistical analysis

The data collected were analyzed by using the SPSS 21.0 (Statistical Packages of Social Sciences) program. We assessed the compatibility of the normal distribution of data by Kolmogorov-Smirnov test. Descriptive statistics for continuous variables were shown as mean± standard deviation while frequencies and percentages were used to show the categorical variables. Two independent sample t-tests were used to compare the standard distribution data of two independent groups. We performed the Chi-Square analysis test to see the difference between the categorical variables. Using the log-rank test effects of the universe on survival was analyzed. To measure the effects of risk factors on patient survival, we used the hazard ratio and 95% confidence intervals and values below $p < 0.075$ were considered to be statistically significant. Finally, an eight-year survival curve was created using the Kaplan Meier method.

RESULTS

During this period 720 of the elderly patients had been accepted into the nursing home where only 612 were eligible for the study. During the eight years, 240 (39%) patients died, 372 (61%) survived. There is no difference in sex distribution between the groups (p 0.63). The mean age of the deceased group was 80.40 ± 10.54 years while the average age of the living was 73.97 ± 11.17 years (P <0.00). Results related to the deceased and the living are respectively: BMI 22.64 ± 5.33 vs. 24.21 ± 4.95 (p 0.000), BMI <20 kg/m2, 33% vs. 23% (p 0.017), more than six illnesses in 27% of the deceased and 8% of the living (p 0.000). The subjects suffering from cancer, represent 18% of the deceased and 5% of the living patients (p 0.000). 14% of the deceased and 3% in the living patient group use more than eight medications (p 0.000). Those completely dependent regarding ADL were 20% in the deceased group and 9% of the living (p 0.000). The average MMT score was 14.98 ± 6.8 in the deceased group and 18.54 ± 5.67 for the living (p 0.000). Table 1 shows baseline demographic characteristics based on survival of the elderly living in nursing homes.

Laboratory values of the deceased and living groups are; hemoglobin > 12 g/dl 32% vs 45% (p 0.026), albumin <3.0 g/dl, 36% vs. 16% (p 0.000), creatinine >0.9 mg/dl, 67% vs 49% (p 0.000), glucose> 126 mg/dl, 26% vs 15% (p 0.002) according to the table. Table 2 shows baseline assessments of the laboratory values of the deceased and living elderly.

Concomitant diseases in the deceased and the living groups were observed as dementia, 48% and 51% (p 0.000), malnutrition, 54% and 45% (p 0.000), pressure sores, 63% and 36% (p 0.000), heart failure, 57% and

Table 1: Baseline assessments of general population, living and deceased elderly

	General population	Deceased elderly	Living elderly	P value
Number	612	240(%39,2)	372 (%60,8)	
Mean Age, year±SD	76,49±11,36	80,40±10,54	73,97±11,17	0,000
Sex, Female n, %	360 (%58)	144(%40)	216(%60)	0,635
Weight kg±SD	61,67±12,24	58,91±12,83	63,45±11,52	0,000
BMI±SD (kg/m^2)	23,59±5,16	22,64±5,33	24,21±4,95	0,000
<20 kg/m^2, n%	166 (%27,5)	80(%33,5)	86(%23,6)	0,017
20-24.9 kg/m^2, n%	230(%38,1)	91(%38,1)	139(%38,1)	
25-29.9 kg/m^2, n%	141 (%23,3)	43(%18,0)	98(%26,8)	
>= 30 kg/m^2, n%	67 (%11,1)	25(%10,5)	42(%11,5)	
Number of diseases, n±SD	4,67±1,7	5,37±1,76	4,23±1,5	0,000
1-3, n%	154 (%25,6)	26(%11,2)	128(%34,6)	0,000
4-6, n%	353(%58,6)	143(%61,6)	210(%56,8)	
>6, n%	95(%15,8)	63(%27,2)	32(%8,6)	
Cancer n,%				
Non-existent n,%	547(%89,4)	196(%81,7)	351(%94,4)	0,000
Existing n,%	65(%10,6)	44(%18,3)	21(%5,6)	
Number of Medication±SD	5,34±2,17	6,04±2,34	4,9±1,94	0,000
1-3, n%	116 (%19,1)	25 (%10,5)	91 (%24,6)	0,000
4-8, n%	446(%73,5)	179(%75,5)	267(%72,2)	
>8. n%	45(%7,4)	33(%13,9)	17(%3,2)	
ADL, Dependency				
None, n %	141(%23)	31(%12,9)	110(%29,6)	0,000
Semi, n %	389(%63,8)	161(%67,1)	228(%61,3)	
Complete, n %	82(%13,4)	48(%20)	34(%9,1)	
MMT score±SD (0-30)	17,28±6,32	14,98±6,8	18,54±5,67	0,000
≤18 n,%	226(%54,5)	110(%75,3)	116(%43,1)	0.000
19-23 n,%	129(%31,1)	24(%16,4)	105(%39)	
≥24 n,%	60(%14,5)	12(%8,2)	48(%17,8)	

BMI: Body Mass Index, ADL: Activity of Daily Life, MMT: Mini Mental Test

42% (p 0.000), COPD, 45% and 54%, (p 0.216), paralysis 43% and 56% (p 0.265), diabetes, 36% and 63% (p 0.41), hypertension, 40% and 59% (p 0.348), kidney failure 52% and 48% (p 0.013) respectively. Baseline comorbidities of the elderly at their admission to the nursing home are shown in Table 3.

The mean follow-up period in the overall population was 18.6 ± 23.5 months, whereas the mean follow-up period in the deceased group was 14.3 ± 17.5 months and that in the living group was 21.4 ± 26.4 months (p = 0.000). The follow-up period less than one year was 63% among the deceased and 58% among the living group, respectively (p 0.004). A follow-up rate of more than five years is 4% in the deceased and 12% in the living group (p 0.004).

The percentages for the presence of infection in the follow-up period were as follows: In the deceased; no infection present: 2 %; 1-3 episodes of infection: 91% (p 0.000), and in the living; no infection present: 37 %; 1-3 infection episodes: 57%.

Fall rates are 27.9% in the deceased and 27.6% in the living (p 0.697), and the rate of fractures due to those falls are

13% and 11% (p 0.188), respectively. Table 4 shows some of the variables observed during the follow-up.

There is a statistically significant progressive decrease in the number of medications used, noted at six months intervals. The decrease is noted -2.810 (P <0.05) between the first and second time intervals and -4.766 (P <0.00) between first and third time intervals. The living group used more medications during the third time interval (P 0.021) (Graphic 1a).

Some diseases show a decrease (p 0,0019) in all study groups as time intervals progress. In the third time slot, there is a decrease (P 0.027) in the number of diseases for the living group (Graphic 1b). The body weight increases progressively in all the groups. The weight difference between the first and fourth time intervals (0.014) and second and fourth intervals (0.042) are statistically significant. Increase in weight is noted in the living group while there is a decrease in the deceased in all time intervals (Graphic 1c). MMT scores progressively decrease in all the groups. The values of the 4th time interval are lower than those in other values (p 0.000). The changes in MMT scores over time do not show a statistically significant difference between the deceased and the living groups (p> 0.05). (Graphic 1d). The

Table 2: Baseline assessments of the laboratory values in living deceased and the elderly

	General population	Deceased elderly	Living elderly	P value
Total	612	240 (%39,2)	372 (%60,8)	
Hemoglobin gr/dl, ± SD	11,75±1,72	11,47±1,68	11,95±1,72	0,004
< 9 gr/dl, n %	34(%7,4)	17(%9,1)	17(%6,2)	0,026
9-12 gr/dl, n %	242(%52,6)	109(%58,3)	133(%48,7)	
> 12 gr/dl , n %	184(%40)	61(%32,6)	123(%45,1)	
Albumin gr/dl±SD	3,51±0,53	3,37±0,56	3,61±0,49	0,000
< 3gr/dl n %	82(%24,5)	50(%36)	32(%16,3)	0,000
3.0 – 3.5 gr/dl n %	87(%26)	37(%26,6)	50(%25,5)	
> 3.5 gr/dl n %	166(%49,6)	52(%37,4)	114(%58,2)	
Creatinine mg/dl±SD	1,08±0,49	1,20±0,58	0,99±0,39	0,000
< 0.9 mg/dl, n %	191(%43,6)	57(%32,4)	134(%51,1)	0,000
0.9-1.5 mg/dl, n %	210(%47,9)	97(%55,1)	113(%43,1)	
> 1.5 mg/dl, n %	37(%8,4)	22(%12,5)	15(%5,7)	
Glucose mg/dl±SD	112,8±42,89	120,13±46,49	108,51±40,11	0,006
< 110 mg/dl n %	297(%68,1)	93(%57,8)	204(%74,2)	0,002
110-126 mg/dl n. %	55(%12,6)	26(%16,1)	29(%10,3)	
> 126 mg/dl n %	84(%9,3)	42(%26,1)	42(%15,3)	

Table 3: Baseline assesment of comoborbidity characteristics in the living and the deceased elderly

	General population	Deceased elderly	Living elderly	P value
Total	612	372(%39,2)	240(%60,8)	
Dementia, n %	256 (%41)	124(%48,4)	132(%51,6)	0,000
Malnutrition, n %	222 (% 36)	120(%54,1)	102(%45,9)	0,000
Pressure sores, n %	66 (% 10.7)	42(%63,6)	24(%36,4)	0,000
Heart Failure, n%	121 (%19.7)	70(%57,9)	51(%42,1)	0,000
COPD, n %	91 (%14)	41(%45,1)	50(%54,9)	0,216
Stroke, n%	119(%(%19,4)	52(%43,7)	67(%56,3)	0,265
Diabetes, n %	159 (% 25.9)	58(%36,5)	101(%63,5)	0,411
Hypertension, n %	389 (% 60)	158(%40,6)	231(%59,4)	0,348
Kidney Failure, n %	88 (% 14.3)	45(%51,1)	43(%48,9)	0,013

Table 4: The parameter comparison of infections, falls, and fractures in relation with follow-up for the deceased and living elderly

|	General population	Deceased elderly	Living elderly	P value
Total	612	372 (%39,2)	240 (%60,8)	
Follow up period, ay±SD	18,66±23,58	14,30±17,53	21,48±26,42	0,000
<=12 ay (n; %)	369(% 60,3)	153 (%63,8)	216 (%58,1)	0,004
13-24 ay (n; %)	86 (% 14,1)	42 (%17,5)	44 (%11,8)	
25-36 ay (n; %)	43/% 7,0)	19 (%7,9)	24 (%6,5)	
37-48 ay (n; %)	35(% 5,7)	10 (%4,2)	25 (%6,7)	
49-60 ay (n; %)	24(% 3,9)	6 (%2,5)	18(%4,8)	
>60 ay (n; %)	55(% 9,0)	10(%4,2)	45(%12,1)	
Number of Infections, n±SD	1,7±1,15	1,75±1,21	1,66±1,10	0,215
No Episodes, n %	142(%25,5)	4 (%2,2)	138(%37,1)	0,000
1-3 episodes , n %	382(%68,7)	168(%91,3)	214(%57,5)	
> 3 episodes, n %	32(%5,8)	12(%6,5)	20(%5,4)	
Falls				
No Falls , n %	442 (%72,2)	173 (%72)	269 (%72,3)	0,697
Fall 1 , n %	156 (%25,5)	60 (%25)	96 (%25,8)	
Falls >1 , n %	14 (%2,3)	7 (%2,9)	7 (%1,8)	
Fractures				
Non-existent , n %	538(%87,9)	207(%86,2)	331(%89)	0,188
Existing , n %	74(%12,1)	33(%13,8)	41(%11)	

Table 5: 8-year follow-up of risk ratios for all causes of mortality

Characteristics	Hazard Ratio	%95 CI	P value	Characteristics	Hazard Ratio	%95 CI	P value
Age, year	1,311	1,019-1,042	0,000	Mini Mental Test Score (0-30)			
Women, sex	1,022	0,789-1,323	0,869	≤18	3,170	1,743-5,768	0,000
Weight, kg	0,980	0,969-0,991	0,000	19-23	1,315	0,657-2,634	0,439
BMI (kg/m2)				≥24	Reference		
<20 kg/m2	1,519	1,124-2,053	0,007	Hemoglobin gr/dl			
20-24.9 kg/m2	Reference			< 9 gr/dl	1,445	0,760-2,747	0,261
25-29.9 kg/m2	0,863	0,606-1,229	0,414	9-12 gr/dl	1,949	1,424-2,667	0,000
>= 30 kg/m2	0,791	0,496-1,259	0,327	> 12 gr/dl	Referens		
Number of Patients, n				Albumin gr/dl			
1-3	Reference			< 3gr/dl	4,894	2,889-8,290	0,000
4-6	2,615	1,721-3,974	0,000	3.0 – 3.5 gr/dl	2,631	1,821-3,803	0,000
>6	4,279	2,704-6,771	0,000	> 3.5 gr/dl	Reference		
Number of Medication use				Creatinine mg/dl			
1-3	Reference			< 0.9 mg/dl	Reference		
3-6	4,404	1,623-11,947	0,004	0.9-1.5 mg/dl	2,788	1,914-4,062	0,000
6-9	7,007	2,577-19,053	0,000	> 1.5 mg/dl	4,033	2,368-6,867	0,000
>=10	10,610	3,561-31,617	0,000				
ADL Dependency				Glucose mg/dl			
None	referens			< 110 mg/dl	Reference		
Partial	3,023	2,052-4,545	0,000	110-126 mg/dl	2,192	1,522-3,159	0,000
Complete	5,246	3,325-8,275	0,000	> 126 mg/dl	2,431	1,652-3,577	0,000
Number of Infections							
No episodes	Reference			Malnutrition,	1,947	1,511-2,509	0,000
1-3 episodes	0,718	0,530-0,973	0,033	Pressure sore	1,948	1,396-2,720	0,000
> 3 episodes	0,289	0,153-0,546	0,000	Heart Failure	1,871	1,416-2,472	0,000
Falls				COPD	1,149	0,821-1,609	0,417
None	Reference			Stroke	1,421	1,044-1,933	0,026
Existing Falls	0,536	0,400-0,179	0,000	Diabetes	0,952	0,708-1,282	0,747
Falls>3	1,157	0,369-3,628	0,802	Hypertension	1,183	0,906-1,545	0,218
Fracture				Kidney failure	1,32	0,957-1,831	0,09
Existing	1,351	0,935-1,952	0,109	Dementia	1,306	1,014-1,683	0,039
None	Reference						

creatinine level progressively increases in all of the groups over time. There is a statistically significant difference between the first and second time intervals and first and third time intervals (p: 0.019, p0.028). There is, however, no statistically significant difference among the values of creatinine levels in the deceased and the living groups (p> 0.05) (Graphic 2a).

We did not find statistically significant changes in albumin levels in either group at successive time intervals. The level of
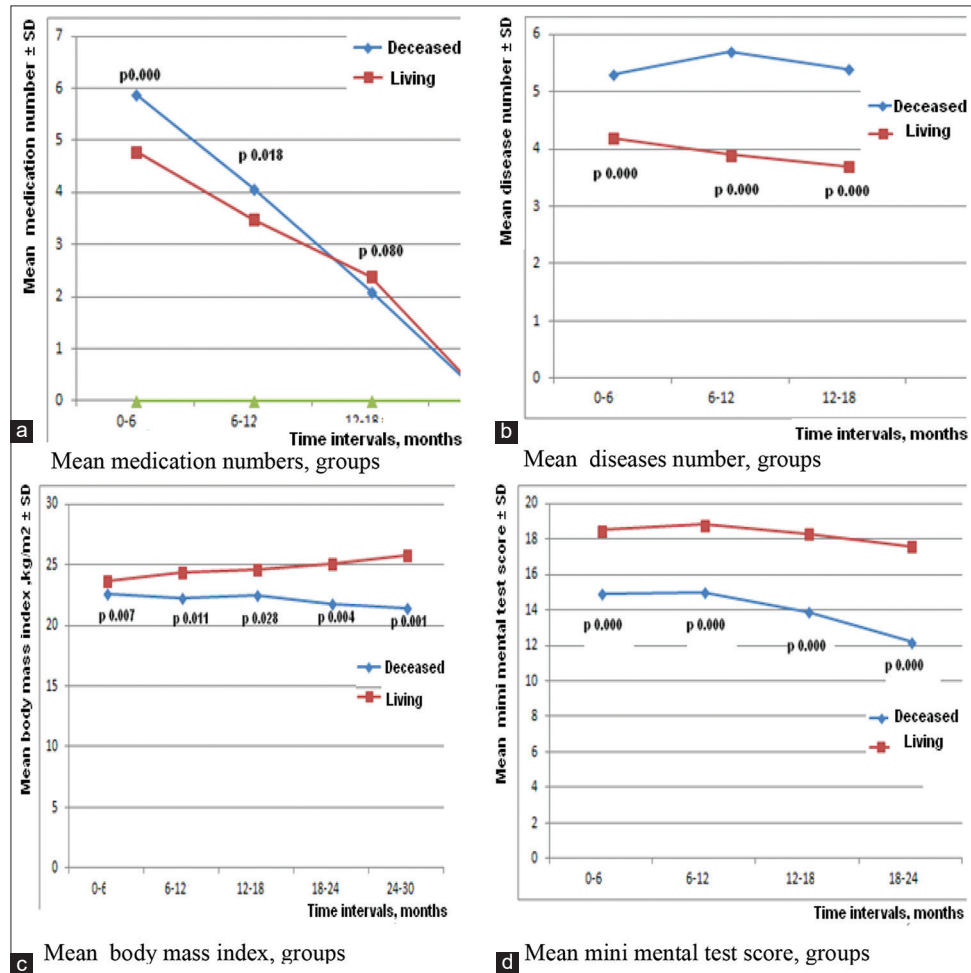
Graphic 1: Number of medication use, BMI and MMT parameters over a course of time in the deceased and living elderly.

albumin has decreased in the deceased group (p 0.015) (Graphic 2b). The average of glucose levels decreased progressively in the whole group (p 0.012), and the change is statistically significant. There was no statistically significant difference in glucose levels between the groups (Graphic 2c). At consecutive time intervals, changes in hemoglobin levels were not found to be statistically significant in either group. In the deceased group the hemoglobin level has decreased (p 0.005), while it has increased in the living group (p 0.011) (Graphic 2d).

Older age, BMI less than 20, more than four comorbidities, use of more than six medications, dependency, more than three infection episodes, falls, MMS less than 18, anemia, hypoalbuminemia, creatinine greater than 0.9 mg/dl, and hyperglycemia are all factors that carry high-risk ratio toward mortality (Table 5).

Graphic 3 shows the cumulative survival curve. The overall median survival time is 34 months. A total of 240 (39 %) residents died within eight years, 44% within two years and 55% of the residents within three years.

DISCUSSION

This study showed the median survival time of nursing home residents in Istanbul was 34 months (5.5 years) with a stable death rate over the whole period of the study. Almost 28% of the residents have died within a year of the admission date; a majority have died within three years, and less than half of the residents lived longer than three years. Out of the 612 elderly included in the study, 60% were followed-up for less than a year, and 10% of the patients were followed-up for more than five years. In this follow-up period, the all-cause mortality rate was found to be 40%. We have identified old age, BMI less than 20, more than four comorbidities, more than six medications, high dependency rate, three or more infection episodes, occurrence of falls, MMS less than eight, hemoglobin less than 12 g, albumin less than 3.5 g/dl, creatinine higher than 1 mg/dl, fasting blood glucose greater than 126 mg/dl as high-risk factors for mortality.

Gender did not seem to play a significant role in the mortality rate between the deceased and the living groups. Equal care and living conditions for both genders in the
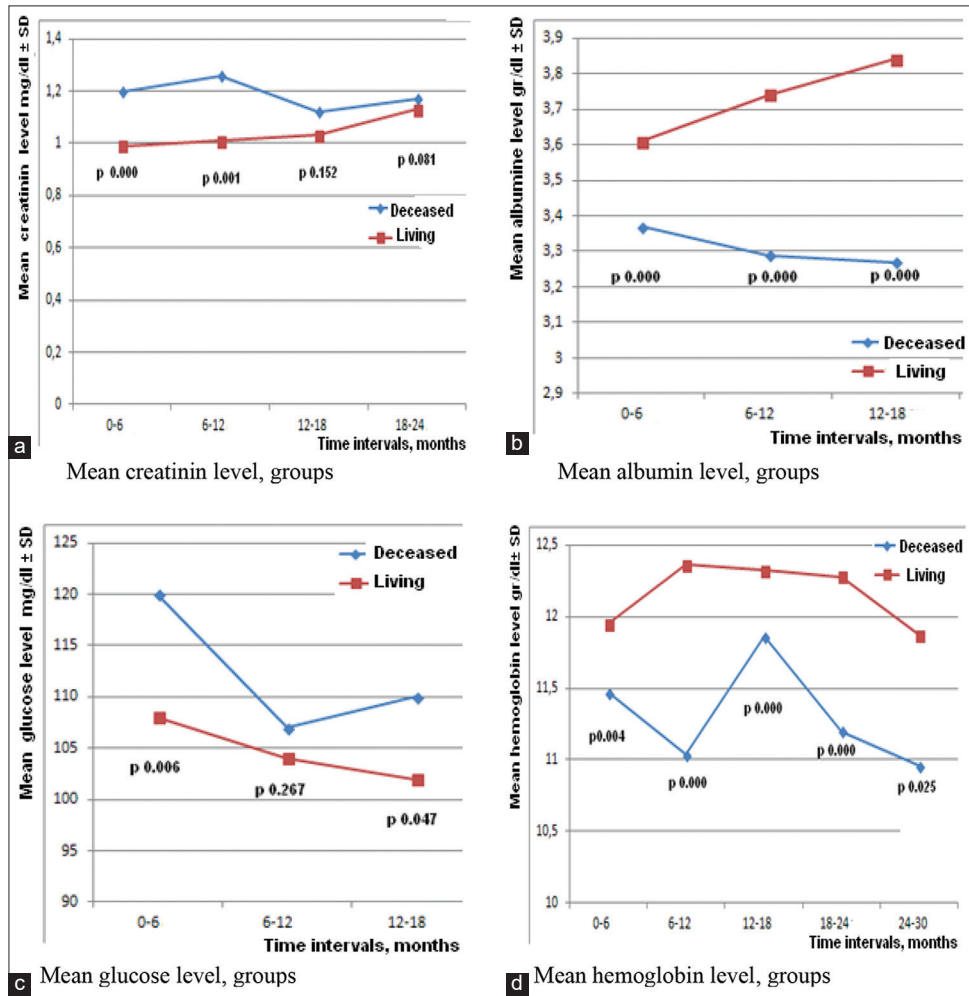
Graphic 2: Creatinine, albumin, glucose, hemoglobin changes in the two groups at progessive time intervals
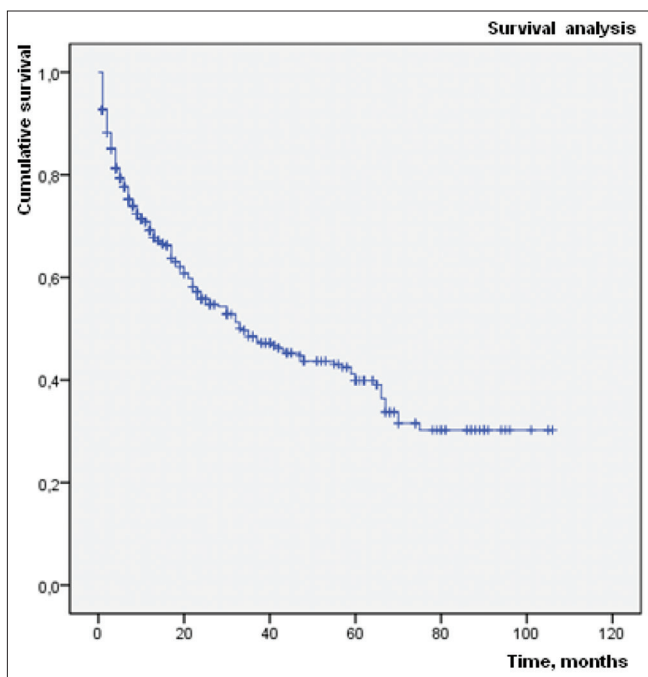
Graphic 3: Cumulative survival curve

nursing home may have played a significant role in this. Although there are some studies in Europe and USA showing the male gender as a cause for higher mortality rates among mixed dementia patients in nursing homes,[14-16] a study in China, however, states that mortality is not linked with either gender or race.[17]

Different elderly care units reported malnutrition at a rate of12-85%.[18] The average weight of the deceased group was 58 kg while it was 63 kg in the living group. At the end of the follow-up, these values have declined to 54 kg in the deceased and gone up to 69 kg in the living, making this 10% change statistically significant. The average BMI in the deceased group was 22 kg/m2, while it was 23 kg/m2 in the living group. At the end of follow-up, BMI has gone down to 21 kg/m2 in the deceased and up to 25 kg/m2 in the living. The initial rates of BMI under 20 kg/m2 was 33% for the deceased and has declined to 31% at the end of the follow-up. These rates have gone down to 13% from 23% in the living group. Especially early diagnosis and intervention in weight loss in the elderly would be

an important contribution to survival. In our study, the mean BMI was found to be 23.59 kg/m2 ± 5.16. In Chan's study in 2013, the average BMI was 18.8 ± 3.5 kg/m2 in a similar population, and 52% of the BMIs were under 18,5. According to our results, these rates seem quite high. In the same study, BMI less than 18.5 levels have been associated with a three-fold increase in mortality.[17]

Meanwhile, other studies show BMI less than 18.5 as a predictor of mortality.[19,20] In our study, BMI less than twenty was found to be a 1.5-fold increase in risk. In this country, a large-scale study has shown a 33.5% malnutrition risk and 13.5% actual malnutrition in patients residing in nursing homes;[21] which shows parallel results with our study.

The relationship between morbidity and mortality in elderly individuals with hypertension and other comorbidities are controversial. Studies are indicating no such relation[22] as well as studies showing an indirect relationship as well.[23] In our study, the baseline value for having more than six diseases was 27% in the deceased and 8% in the living group. Initially, the average comorbidity in the deceased was 5.3 and in the living 4.2 while the rates have increased in the deceased and decreased in the living (5.4 vs. 3.7) at the end of the follow-up. The elderly with more than six diseases had a 2.7-fold higher risk of mortality. Cancer is an important cause of mortality in the elderly. Initially, in our study, the cancer rate in the deceased was 18% while it was 5% in the living.

The rate of patients initially taking more than four medications was 90% in the deceased and 75 %in the living while the rate of those taking more than eight medications was 14% in the deceased and only 3% in the living group. Initially, the mean number of medications used was six in the deceased and five in the living group. At the end of the study, the number of medications used, stayed the same in the deceased group while average drug use had increased to six in the living. Having the option of palliative care, the number of medications used did not increase in the deceased group since the dependency rate was high in their comprehensive assessment. The Onder's Study 2013, shows 14% polypharmacy and an increase in mortality risk (HR 2,9).[24] In our study, polypharmacy was found to be 14% in the deceased and 4% in the living group, suggesting a higher mortality risk (HR 10).

Initially, full dependency rate involving ADL such as eating, dressing, toilet use, and walking in the deceased was 20% while it was 9% in the living group. However, at the end of the follow-up, these rates were 42% in both the dead and the living groups. Even with professional care support, after becoming entirely dependent, it is difficult to make the elderly semi-dependent and independent again. At the end of the follow-up period, the rate of the independent elderly was 3% in the deceased group and 41% in the living group. The living group had a better chance of rehabilitation as time progressed. In one study, ADL dependency at varying levels in nursing homes were 71%[25] while in our study, the ratio was 87% in deceased patients, and 70% in the living ones.

The rate of severe cognitive dysfunction (<18) was 75% in the deceased group (mean MMSE 14.9) and 43% in the living group (mean MMSE 18.5). Matusik's study 2012, of dementia and fragility in the elderly, separately does not show a significant difference in mortality but cognitive dysfunction was associated with mortality when evaluated together. Percentages of patients with severe cognitive dysfunction rate were 55.8%, and the standard mental score rate was 17%[26] in the Marusiki's study. Our study has similar results with 54% severe cognitive dysfunction and 15% average mental score. When evaluated individually, low performance and low scores on mental tests were found to be a risk factor for mortality. Another study reported that the rate of cognitive dysfunction was 67-72% in nursing homes.[27]

The baseline assessment showed that Hb levels were under 12g/dl in 60% of the overall group, 68% in the deceased and 55% in the living group. While hemoglobin levels have decreased in the deceased group, these levels have increased in the living group in time. Chronic diseases, nutritional deficiency, malignancy, iron deficiency, vitamin B12 deficiency anemia are the leading causes of anemia in nursing homes. In the Artzs study in 2004, the prevalence of anemia in the nursing home residents was 48%,[28] and 40% in another study.[29]

Deterioration of renal function can be a cause of higher incidence of anemia in the elderly, regardless of age. The incidences of chronic renal failure were 33% in the ages 65-74, 39% in the ages 75-84, and 49% in the ages 85 and above in the Robinsons study in 2007.[30] In Canada, a study in nursing home residents found CRF rates as 27% in men and 39% in women.[31] In our study, creatinine greater than 0.9 mg/dl was found to be 67% in the deceased group and 48% in the living group. Mortality was 2.3 times higher in those with creatinine over 1.5 mg/dl.

In the baseline assessment, 36% of the elderly in the deceased group had albumin levels of less than 3 grams, while this value was found in 16% in the living group. In time, the albumin level also decreased in the deceased group. In the deceased group, the average fasting blood glucose was 120 mg while the ratio of levels above 126 mg was 26%. In the living group, the average fasting blood

glucose was 108 mg, and the ratio above 126 mg was 15%. Later on, however, the fact that the progression of glycemia did not differ between these two groups, can be explained by careful and correct monitoring of glucose levels at the nursing home. In Lubarts study 2013, the diabetic rate was 36% while, average fasting blood glucose was 144 mg.[32] In our study, 26% of the total population had diabetes. Presence or absence of diabetes is not a risk factor for mortality, but glycemia above 126 mg is a variance for the 2.5-fold increase in the risk of mortality.

Ninety one percent of the deceased group experienced 1-3 episodes of infection during the study while this rate was 57% in the living group. When the Zorman's study in 2013 compared infections in the elderly living in nursing homes and the general population, they described greater mortality rate (23% vs. 10%) and greater functional loss (23% vs. 10%), respectively, in nursing home residents.[33]

During the follow-up period, we did not find a significant difference between falls and fractures. There were cases of falls in the 25 % and fractures in the 12 % of the groups. Schaller's study in 2012, did not find increased two-year mortality risk after a hip fracture as significant.[34]

We found several factors to predict mortality at admission to a nursing home.

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