# Characteristics and Outcomes of Ninth and Tenth Decade Patients Hospitalized in a Sub-Acute Geriatric Hospital

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## Abstract

**Background:** Population structures are changing across the western world, with particularly rapid growth in the number of very old people. Life expectancy has been increasing gradually over years, resulting in a larger subpopulation of people aged 90 and over.

**Objectives:** To describe the sociodemographic, medical and functional characteristics of people aged 80–90 and 90+ who were admitted to a sub-acute geriatric hospital and to compare the hospitalization outcomes between these subgroups.

**Methods:** We compared the demographic and clinical data (extracted by means of chart review) of two groups of elderly who were admitted to the Reuth Medical Center during 2001–2002: those aged 90+ and those 80–89. Among survivors, the main outcome measures at discharge were mortality rate, functional ability, and place of residence.

**Results:** The study included 108 patients who were admitted to different divisions of Reuth: 55 patients aged 90+ and 53 aged 80–90. The mortality rate was significantly elevated in the older age group (49.1% vs. 28.1% in the younger age group). On multivariate analysis, the most important prognostic factors for mortality were incontinence (odds ratio 3.45) and being dependent before admission (OR 4.76). Among survivors, an association was found between being incontinent and dependent before hospitalization, and being dependent on discharge.

**Conclusions:** The main prognostic factors for mortality and functional outcome in patients admitted to a non-acute geriatric hospital are incontinence and functional state prior to admission, and not age per se.

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Across the western world over the last century there has been a decrease in mortality rates in almost all age groups. The chances of surviving in those aged 60–80 have risen and mortality rates among people aged 85 and over have also decreased [1]. In Israel, as well, life expectancy increased by a mean of 18 years in the last 70 years. By the year 2000, life expectancy for males at birth was 76.7 years, and for females 80.9. At age 65, life expectancy averages 16.4 years for men and 18.7 years for women. The number of elderly people (aged 65+) in Israel has grown: since 1955 this population has increased 7.5 times [2].

These changes have led to a change in population structure, with a particularly rapid growth in the number of very old people [3]. Elderly people are at an increased risk of disease, disability and mortality; they are hospitalized more frequently than younger adults and display lower functional abilities at discharge. The existing literature regarding hospitalization outcome treat all those over 65 as a homogenous group, whereas others use different age strata but group the oldest old into one broad category (75+ or 85+). However, there is a profound difference between subgroups in this group with regard to hospitalization outcome; for example, there is a positive connection between age and disability [4] and between age and the incidence of dementia [5], with both disability and dementia known to be negatively and strongly connected to hospitalization outcome [6,7].

The aims of the present study were to describe the sociodemographic, medical and functional characteristics of people aged 80–90 and 90+ who were admitted to a rehabilitation geriatric hospital, and to describe and compare the hospitalization outcomes of those subgroups.

## Patients and Methods

### Patients

Reuth is a 300-bed non-acute hospital in Tel Aviv that provides medical, rehabilitative and nursing care to the elderly, adults, children and infants from all over Israel. Patients are referred to Reuth by all health management organizations in Israel. It is a non-profit hospital and is affiliated to Tel Aviv University's Sackler Faculty of Medicine.

Patients admitted to Reuth between January 2001 and December 2002 were eligible for the study. Included were all patients aged 90+ years (n=55) and a random sample of 53 patients aged 80–89 years (53 of 200 patients' files were drawn by random numbers).

### Data collection

During 2003 the charts of patients aged 80 and older were collected by one researcher (S.Y.K), using a data collection form and predetermined definitions for all variables. Patients were identified by a search of the hospital's central computer system and included patients who had been hospitalized for rehabilitation or nursing purposes. Various patient characteristics and known mortality risk factors were collected from the medical

OR = odds ratio

records. The independent variables that were explored in the study included:

- *Sociodemographic*: age, gender, origin, familial status, years of education and pre-hospitalization residence (home or nursing facility).
- *Pre-hospitalization medical and functional status*: preexisting co-morbidities before hospitalization were tabulated (e.g., heart disease, high blood pressure, diabetes, arthritis, cancer, lung disease, vision problem, hearing problem, orthopedic problem, psychiatric condition), each scored as 1 if present. The number of co-morbidities was calculated for each patient. Baseline walking and functional level was categorized as dependent, requires some assistance, or independent. Mobility was defined as impaired if the patient was unable to walk dependently outside. Continence was evaluated according to anamnesis.
- *Medical and functional status at admission*: The Functional Independence Measure™ scale was used to assess functional ability and progress during hospitalization. The scale ranges from 18 to 126 and is based on a score of 1–7 for each of 18 different items in accordance with the level of independence for each item. Using this scoring system, a patient with totally independent function would have a score of 126 points [8]. To estimate the cognitive state of patients, each patient underwent a mental evaluation with the Mini-Mental State Examination, a valuable diagnostic tool used to evaluate a patient's orientation, concentration and memory. The Mini-Mental exam is scored out of a total of 30 points: a score of 24 or higher is considered within normal range, and a score below 24 is suggestive of dementia [9]. The Norton Scale was also used; this is an additive scale to facilitate the prediction and prevention of pressure sore development. It is composed of five broad clinical categories: physical condition, mental state, activity, mobility, and incontinence, with a score of 16 or less indicating increased risk for development of pressure ulcer [10].
- There were three outcomes of interest in the study: mortality rate; and among survivors – post-hospitalization place of residence (institution or home) and functional status at discharge.

### Data analysis

Descriptive analyses of the demographic and medical characteristics are presented in Table 1 using frequency distribution for categorical data, and mean and statistical deviation for continuous variables. Differences between age groups (at admission, during hospitalization, and at discharge) and between those who survived and those who died were examined by *t*-test (for continuous variables) and $\chi^2$ test (for categorical variables). Logistic regression was performed for testing the combined effect of the independent variables on mortality. Results were considered statistically significant when the *P* value was <0.05.

## Results

Descriptive data of both age groups are displayed in Table 1. Altogether, the charts of 108 patients were reviewed. The sample consisted of 49 men and 59 women; a higher proportion of widows among the older group (67.3% vs. 42.7%) was statistically significant. Among the participants, 34 (31%) were functionally independent before admission, 45 (41.6%) were nursing home residents before admission, and 55 (51%) had impaired sphincter control. Sphincter control impairment was significantly lower in the younger age group. There were no other statistically significant differences in demographic or functional vari-

**Table 1.** Demographic, pre-hospitalization, hospitalization and outcome characteristic differences between age groups

| Characteristic | Variable | 80–90 yrs (n=53) | +90 yrs (n=55) | *P* |
|---|---|---|---|---|
| **Sociodemographic** | | | | |
| Age (yrs) | | 84 ± 3 | 93 ± 2 | <0.01 |
| Gender | Male | 26 (49.1) | 23 (41.8) | 0.45 |
| Family status | Married | 20 (37.7) | 18 (32.7) | 0.03 |
| | Widower | 25 (47.2) | 37 (67.3) | |
| | Other | 8 (15.1) | – | |
| Place of residence | Nursing home | 18 (34.0) | 27 (49.1) | 0.11 |
| **Functional abilities before hospitalization** | | | | |
| Function (ADL) | Dependent | 42 (79.2) | 32 (58.1) | 0.06 |
| Mobility | Impaired | 42 (79.2) | 32 (58.1) | 0.06 |
| Sphincter control | Impaired | 21 (39.6) | 34 (65.3) | 0.02 |
| Co-morbidity (number) | | 3.1 ± 3 | 3.0 ± 1.1 | 0.64 |
| Reason for hospitalization | Ventilation/ Nursing | 20 (37.7) | 22 (58.2) | 0.66 |
| **Functional and cognitive status at admission** | | | | |
| FIM | | 43.9 ± 25.0 | 50.3 ± 27.3 | 0.20 |
| Mini-mental | | 14.0 ± 10.7 | 14.7 ± 11.3 | 0.86 |
| **Mortality** | | 27 (49.1) | 15 (28.3) | 0.02 |

Values in the table are means ± SD, number (percentage), *P* value obtained by $\chi^2$ and *t*-test. ADL = Activities of Daily Living, FIM = Functional Independence Measure.

**Table 2.** Demographic, pre-hospitalization, hospitalization characteristic differences between survivors and non-survivors

| Variable | Category | Survivors (n=66) | Non-survivors (n=42) | *P* |
|---|---|---|---|---|
| **Demographic** | | | | |
| Gender | Male | 32 (65.3) | 17 (34.6) | 0.41 |
| Place of residence | Nursing home | 16 (24.2) | 29 (69) | <0.01 |
| | Home | 50 (75.7) | 13 (30) | |
| **Pre-hospitalization functional abilities** | | | | |
| Function (ADL) | Dependent | 11 (16.7) | 37 (88.1) | <0.01 |
| Sphincter control | Impaired | 18 (27.2) | 37 (88.1) | <0.01 |
| Mobility | Impaired | 7 (10.6) | 29 (69.0) | <0.01 |
| Co-morbidity (number) | | 2.8 ± 1.1 | 3.4 ± 1.3 | 0.01 |
| Hospitalization purpose | Ventilation/Nursing | 8 (12.1) | 35 (83.3) | <0.01 |
| **Functional and cognitive status at admission** | | | | |
| FIM | | 60.6 ± 23.5 | 25.8 ± 12.6 | <0.01 |
| Mini-mental | | 19.3 ± 8.5 | 5.0 ± 9.0 | <0.01 |

Values in the table are means ± SD, number (percentage), *P* value obtained by $\chi^2$ and *t*-test

**Table 3.** Mortality prediction, using logistic regression model

| Variable | OR | CI 95% |
|---|---|---|
| Incontinence | 3.44 | 1.69–7.14 |
| Pre-hospitalization: functionally dependent | 4.76 | 1.78–12.5 |

OR = odds ratio, CI 95% = confidence interval for the OR

ables between the two age groups. There were no statistically significant differences in functional status and cognitive status on admission between the two age groups [Table 1].

Forty-two patients (38%) died during hospitalization. There was a significant difference in mortality rate between the two age groups ($P = 0.02$), which was 28.3% (n=15) in the 80–90 age group and 49.1% (n=27) in the 90+ age group (mortality rate ratio of 1.73). Significant differences were found in all functional performance characteristics before and at admission between those who survived and those who died [Table 2]. Among all functional parameters, those who survived demonstrated a significantly higher performance. Almost half of the survivors were functionally independent before admission, compared to 4.8% among those who died. The mean FIM score was 34.9 points higher and the mean Mini-Mental score 14.3 points higher in those who survived compared to those who died. There was a significant difference in the incidence of complications; those who survived had significantly fewer complications, except for urinary tract infection which was not statistically different between groups.

A logistic regression model was used for multivariate analysis. Mortality was the independent variable. Age and functional parameters, which are strongly related to mortality, were also included in the model. Forward stepwise analysis was used to select variables that were independently related to the outcome measures. In the final step of the multivariate analysis [Table 3], incontinence and being functionally dependent before admission were the only significant predictors for mortality.

With regard to functional status and place of residence at discharge, incontinence and dependency prior to hospitalization was significantly higher among the dependent and nursing home residents at discharge [Table 4].

## Discussion

The aim of this study was to characterize people aged 80–90 and 90+ who were admitted to a non-acute geriatric hospital, to compare the outcomes, and to identify risk factors for mortality and disability in these age groups.

We found that the mortality rate was significantly higher in the older age group, and that the most important prognostic factors for mortality included incontinence and being dependent before hospital admission. Among survivors, being continent and functionally independent before admission related positively to functional outcome.

Previous studies have demonstrated the relationship between functional status and mortality among people aged 65 and over. In an Italian study that included 987 patients aged 70+, on multivariate analysis, dependency in activity of daily living was independently associated with mortality [11]. A prospective study that included 1,298 people aged 65+ concluded that mobility impairment is a risk factor for mortality [12]. A similar association was observed in the present study that investigated people over age 80.

There was a significant difference in the place of residence between survivors and non-survivors. Most of the non-survivors lived in a nursing home. A Canadian study that included patients aged 65 years and over exhibited higher mortality among nursing home residents compared to people who lived at home [13].

The number of underlying co-morbidities was significantly elevated among the non-survivors group. It must be stated that functional status is influenced by the basic morbidity. Among the survivors, functional status on admission was found to be associated with functional status at discharge. This relationship has been documented in previous studies, one of which showed that the most important prognostic factor for outcome in hospitalized patients aged 80 years and older is the performance of basic Activities of Daily Living 2 weeks before admission [14].

Another finding is that incontinence on admission is a prognostic factor for mortality. The relationship between urinary incontinence and mortality has been documented in several studies, with most of the literature on continence stating that incontinence is highly associated with mortality in older people, no matter where they live [15,16]. One study that examined the relationship between urinary/fecal incontinence and mortality in elderly people living at home demonstrated that the estimated survival rates decreased with a decline in continence in both the 65–74 and 75+ age groups. On multivariate analysis, severe incontinence was a significant prognostic factor for mortality [17].

FIM = Functional Independence Measure

**Table 4.** Functional status and place of resident at discharge: pre-hospitalization characteristics

| | Functionally dependent* | | | Place of residence | | |
|---|---|---|---|---|---|---|
| | Partial (n=36) | Fully (n=27) | *P* ** | Home (n=37) | Nursing home (n=29) | *P*** |
| Age 90+ | 15 (41.7) | 12 (44.4) | 0.82 | 13 (35.1) | 15 (51.7) | 0.17 |
| Prior hospitalization place of residence (nursing home) | 5 (13.5) | 10 (37.0) | 0.03 | 0 (0) | 16 (55.2) | <0.01 |
| Sphincter control (impaired) | 3 (8.1) | 14 (51.8) | <0.01 | 7 (18.9) | 12 (41.4) | 0.04 |
| Functionally dependent | 1 (2.8) | 9 (33.3) | <0.01 | 4 (10.8) | 7 (24.1) | 0.14 |

Values in the table are numbers (percentage)

* Three missing values.

** *P* value obtained by $\chi^2$

We also found that incontinence on admission was a prognostic factor for functional status at discharge. The literature shows that incontinence is highly associated with mortality, immobility and discharge to a nursing home. In patients with stroke, continence is correlated to the outcome of rehabilitation [15,16,18]. Wu et al. [14] showed that in patients aged 80+, incontinence is a predictive factor for poor functional status on discharge.

The association between increasing age and poor outcome can be explained by patient characteristics associated with age, such as additional disabilities or urinary incontinence – both of which were found to be strongly and significantly associated with mortality rate and functional outcomes. It is difficult to distinguish between age alone and such age-associated factors. Our findings support the approach that clinical decisions should be based on the functional state rather than on age per se. A similar conclusion was reached in a prospective Canadian study that followed patients who were referred to rehabilitation after stroke; the researchers found that age had no effect on the change in FIM score [19].

## Conclusions

Patients aged 90 and above exhibited inferior function and lower survival rates compared to patients aged 80–90. Yet the most significant finding is that the main prognostic factors for the outcome in patients admitted to this non-acute geriatric hospital are continence and functional state prior to admission, and not age per se.

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