

# Non-hierarchical loss of basic activities of daily living in geriatric inpatients with dementia

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## Summary

**Objective:** The present study attempts to investigate the hierarchical loss of independence in basic activities of daily living (ADL) in patients with dementia in a geriatric hospital.

**Method:** In this two-year retrospective study on dementia, medical records of the clinical setting of the EGZB were reviewed. A total of 871 cases met ICD-10-GM diagnostic criteria for dementia, in which 673 cases (77.3%) had valid Mini Mental Status Examination Scores (MMSE) and 829 cases (95.2%) were assessed by basic ADL in terms of Barthel Index (BI).

**Results:** The average age of this sample was  $82.0 \pm 8.2$  years. 70.4% cases were women. The mean MMSE score was  $16.8 \pm 5.5$ , mean BI score was  $45.5 \pm 31.2$ , and the mean number of coexisting medical conditions was  $11.5 \pm 4.2$ . Across the different levels of cognitive impairment, the four leading basic ADL task losses were bathing, climbing stairs, bladder control and bowel control. Accordingly, basic ADL independence was more frequently preserved for transfer and feeding. No consistent order of losses in mobility, toilet use, grooming, and dressing was found across the different levels of cognitive impairment.

**Conclusion:** Present results indicate that this specific sample deviated from the hierarchical pattern of ADL loss as predicted by Katz et al. as well as others. Further studies are needed to investigate the hierarchical loss of basic ADL of patients with dementia in geriatric hospitals.

**Key words:** Activities of Daily Living (ADL), ADL-hierarchy, dementia, geriatric hospital

## Nicht-hierarchischer Verlust von Basisaktivitäten des täglichen Lebens (ADL) bei Patienten mit Demenz in einem geriatrischen Krankenhaus

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## Zusammenfassung

Die vorliegende Studie untersucht die Hierarchie des Verlusts von Basisaktivitäten des täglichen Lebens (ADL) bei Patienten mit Demenz in einem geriatrischen Krankenhaus. Dazu wurde eine retrospektive Fallanalyse von Patientenakten für einen Zwei-Jahres-Zeitraum durchgeführt. Es wurden 871 Fälle identifiziert, bei denen eine Demenz nach ICD-10 kodiert wurde. Für 673 Fälle (77,3%) lag ein MMSE-Testergebnis vor und in 829 Fällen (95,2%) wurden die Basisaktivitäten (ADL) über den Barthel-Index (BI) ermittelt. Das durchschnittliche Alter betrug  $82,0 \pm 8,2$  Jahre. 70,4% der untersuchten Fälle waren weiblich. Der durchschnittliche MMSE betrug  $16,8 \pm 5,5$ ; der durchschnittliche BI betrug  $45,5 \pm 31,2$  und die Anzahl der durchschnittlichen Begleiterkrankungen betrug  $11,5 \pm 4,2$ . Aufgrund der unterschiedlich stark ausgeprägten kognitiven Einschränkungen waren die vier häufigsten Funktionsverluste bei den ADL-Fähigkeiten die Unfähigkeit zu Baden, Treppen zu steigen und der Verlust der Harn- und Stuhlkontrolle. Die Fähigkeiten zum Selbsttransfer und die Unabhängigkeit der Nahrungsaufnahme waren seltener beeinträchtigt. Die vorliegenden Ergebnisse werden als ein Hinweis darauf interpretiert, dass diese spezifische Personengruppe von dem u. a. von Katz et al. beschriebenen Muster an ADL-Fähigkeitsverlusten abweicht. Es bedarf weiterer Studien, die unterschiedliche Muster des Verlustes von Basisaktivitäten bei dementen Patienten in der Geriatrie untersuchen.

**Schlüsselwörter:** Basisaktivitäten des täglichen Lebens (ADL), ADL-Hierarchie, Demenz, Geriatrisches Krankenhaus

## Introduction

The impact of cognitive impairment on activities of daily living (ADL) in patients with dementia has been well documented. It is consistently agreed that cognitive impairment is an important risk factor for developing functional disabilities in patients with dementia [4–5, 10]. However, in most studies functional disability was cumulatively defined, i. e. as need for help in one or more ADL tasks or as low sum scores of ADL assessments etc. Few studies investigated the hierarchical loss of basic ADL tasks such as eating, dressing, grooming, transfer, and toilet use. Some previously conducted population-based studies have demonstrated that the hierarchical functional loss in the cognitively impaired elderly was associated with cognitive decline [5–6, 8, 10, 13, 15–16, 19]. Katz and his colleagues hypothesized that there is a hierarchical structure to the specific functional tasks, the hierarchical pattern of ADL loss would be as follows: bathing, dressing, toileting, transfer, continence, and feeding [11–12, 18]. The Berlin Aging Study reported that the four most prevalent losses of basic ADL tasks in a locally representative sample of community-dwelling and institutionalized elders are bladder control, bathing, climbing stairs and bowel control [19]. Few studies investigated the hierarchical loss of basic ADL tasks in patients with dementia in geriatric hospitals. Even fewer studies investigated prospectively how this hierarchy of functional loss proceeds as the cognitive decline proceeds as well. Dementia patients in geriatric hospitals are a specific subgroup of the older population. They suffer from advanced cognitive impairment as well as from multiple physical illnesses. Most of them belong to the very old. Hence, these patients represent the frailest part of the older population. Basic ADL have been regarded as self-care competency, which is fundamental for elderly people to maintain independency in daily living which does have a positive correlation with the quality of life [2]. Knowing the hierarchical loss of basic ADL tasks within this specific group of patients will help to predict the form of functional decline and subsequent care needs, which will benefit to the management of these patients.

## Method

### Data collection

This is a two-year retrospective study by reviewing medical records of the clinical setting of the EGZB. Out of the total number of 4.592 patients treated at the EGZB from January 2003 to December 2004, 871 cases met the ICD-10-GM criteria for the clinical diagnosis of dementia [20]. All of these 871 medical records were reviewed systematically. The socio-demographic data, clinical features, cognitive assessment and basic ADL were abstracted for the present study by using a structured research protocol.

	Mean/n	SD/%
<b>Age (mean ± SD)</b>	82.0	8.2
< 65	32	3.7
65 – 74	117	13.4
75 – 84	379	43.5
≥ 85	343	39.4
<b>Gender, female</b>	613	70.4
Female aged (mean ± SD)	83.6	7.4
Male aged (mean ± SD)	78.1	8.6
<b>Institutionalized</b>	107	12.3
<b>Living alone</b>	411	47.2
<b>Spouseless</b>	397	45.6
<b>Alzheimer's disease</b>	229	26.3
<b>Vascular dementia</b>	296	34.0
<b>Dementia syndrome</b>	346	39.7
<b>MMSE Score (mean ± SD)</b>	16.8	5.5
MMSE > 24	44	6.5
MMSE 18 – 24	250	37.1
MMSE 11 – 17	227	33.7
MMSE < 11	152	22.6
<b>Barthel Index (mean ± SD)</b>	45.5	31.2
0 – 55	507	59.1
60 – 80	218	25.4
85 – 95	126	14.7
100	7	0.8
<b>Coexisting medical conditions (mean±SD)</b>	11.5	4.2
> 5	831	96.1
> 10	466	53.5

**Tab 1:** Socio-demographic data, clinical features and functional measures of this sample (n=871)

### Basic activities of daily living (ADL)

The basic ADL was measured by the Barthel Index, which covers ten different self-care domains of daily living including feeding, transfers, grooming, toilet use, bathing, mobility, climbing stairs, dressing, bowel control, and bladder control. Each domain is rated on a scale of 0/5 or 0/5/10 or 0/5/10/15 with the highest value indicating independency and the lowest value indicating complete dependency. The maximum sum score is 100 points [3]. The Barthel Index is a performance-based assessment. In the present study the Barthel Index was assessed by experienced nurses according to the observed situation rather than using self-reports or proxy-reports. In order to reduce the impact of acute medical conditions on basic ADL and BI scores, the present study used the scores of BI at the time of discharge. From the total of 871 diagnosed dementia cases, 829 (95.2%) cases have had a recorded Barthel Index assessment closely before discharge.

### Cognitive function

Cognitive function was measured by the Mini Mental State Examination (MMSE) as a standardized and most widely used cognitive screening instrument. It served as a brief glo-

Score:	0	5	10	15
<b>BI Tasks: (n /%1)</b>				
Bathing	794 (95.8%)	35 (4.2%)	N/A	N/A
Climbing stairs	491 (59.2%)	277 (33.4%)	61 (7.4%)	N/A
Bladder control	378 (45.6%)	173 (20.9%)	278 (33.5%)	N/A
Bowels control	339 (40.9%)	125 (15.1%)	365 (44.0%)	N/A
Mobility	295 (35.6%)	108 (13.0%)	285 (34.4%)	141 (17.0%)
Toilet use	294 (35.5%)	301 (36.3%)	234 (28.2%)	N/A
Dressing	283 (34.1%)	329 (39.7%)	217 (26.2%)	N/A
Grooming	283 (34.1%)	546 (65.9%)	N/A	N/A
Transfers	173 (20.9%)	197 (23.8%)	270(32.6%)	189 (22.8%)
Eating	157 (18.9%)	335 (40.4%)	337 (40.7%)	N/A

Tab. 2: Distribution of scores in basic ADL tasks (Barthel Index Items) n=829, <sup>1</sup> Because of rounding, percentages do not always sum to 100

bal cognitive measurement. Quantitative estimates of presence and severity of cognitive impairments were made by screening seven domains of cognitive functions: time orientation (5 points), spatial orientation (5 points), registration of three words (3 points), attention and calculation (5 points), recall of the three words (3 points), language (8 points), and visual construction (1 point). The sum score ranges from 0 to 30. Lower scores indicate more severe cognitive impairment. In the present study cognitive impairment was classified according to the MMSE scores in four different levels of cognitive impairment: very mild (>24 MMSE-points), mild (18–24), moderate (11–17) and severe cognitive impairment (<11) [3, 9]. Of the 871 clinically confirmed dementia cases, 673 (77.3%) cases had the valid MMSE scores. The remainder of 198 (22.7%) cases could not be assessed due to critical and/or poor medical conditions.

Comorbidity

Comorbidity was measured by counting the total number of coexisting medical conditions according to the German modification of the ICD-10 (ICD-10-GM), which included both medical diseases and medical conditions.

Results

The average age of this sample was 82.0±8.2 years, and 70.4% cases were female. The mean MMSE score was 16.8±5.5 points and the mean BI score was 45.5±31.2 points. Socio-demographic data, clinical features and functional measures are summarized in Table 1. 59% of the total dementia cases were severely dependent in basic ADL with a summed BI score less than 55 [3], 56% cases showed an advanced stage of dementia with a MMSE score less than 18 points. 68% were aged 80 years and older, 96% suffered from more than five coexisting medical conditions and 54% of these suffered from more than ten coexisting medical conditions.

The distribution of the basic ADL task scores of the entire sample is shown in Table 2 and Figure 1. 794 (95.8%)

cases were completely dependent in bathing, 491 (59.2%) in climbing stairs, 378 (45.6%) in bladder control and 339 (40.9%) in bowel control.

The distributions of losses in basic ADL tasks across the different levels of cognitive impairment are presented in Figures 2–5. The results show that with the decline of MMSE score the mean task scores of basic ADL (BI) decreased sharply (Table 3). Across the different levels of cognitive impairment, the four most prevalent losses of basic ADL

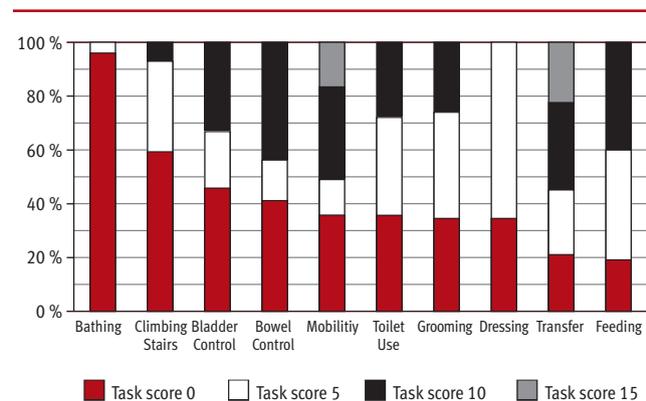


Figure 1: Distribution of scores in basic ADL tasks (entire sample, n=829)

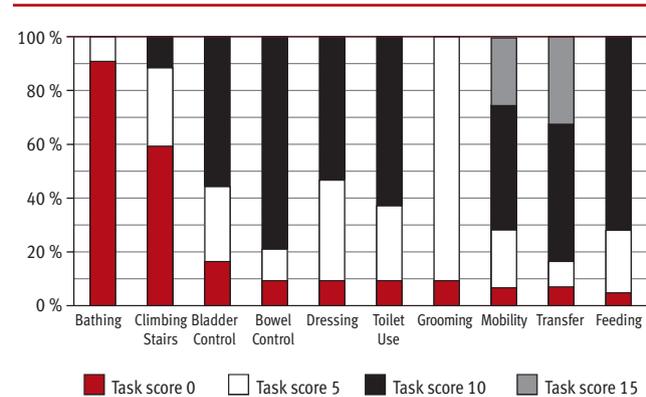
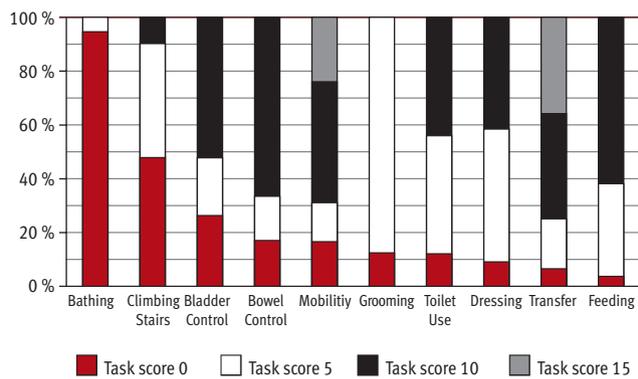
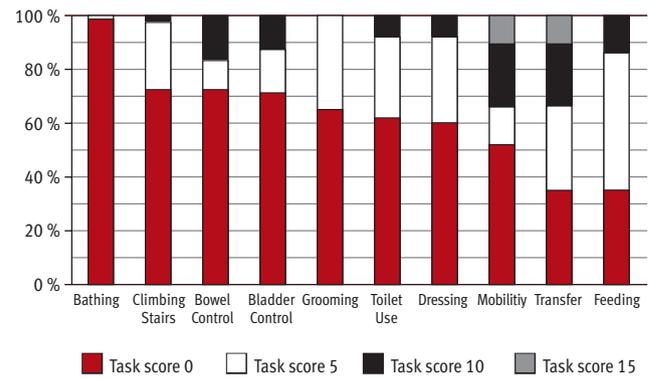


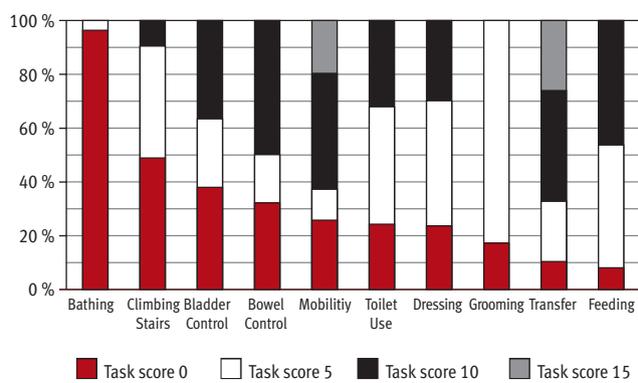
Figure 2: Distribution of scores in basic ADL tasks (subgroup MMSE > 24, n=43)



Figur 3: Distribution of scores in basic ADL tasks (subgroup MMSE 18–24, n=238)



Figur 5: Distribution of scores in basic ADL tasks (subgroup MMSE < 11, n=149)



Figur 4: Distribution of scores in basic ADL tasks (subgroup MMSE 11–17, n=217)

task domains are bathing, climbing stairs, bladder control and bowel control. Accordingly, basic ADL independence was more frequently preserved for transfer and feeding. No consistent order of losses in mobility, toilet use, grooming, and dressing was found across the different levels of cognitive impairment.

Discussion

The main purpose of the present study was to investigate the pattern of loss in basic ADL tasks among patients with dementia in a geriatric hospital. The results showed that the four most prevalent losses in basic ADL tasks were bathing, climbing stairs, bladder control and bowel control in this sample of demented geriatric inpatients, and the independence with the tasks of transfer and feeding were more frequently preserved. But no consistent overall pattern of ADL-losses was found across all different levels of cognitive impairment in this sample, despite the finding that the prevalence of dependence in each task increased with the decline of cognitive function. With regard to previous studies, Katz and his colleagues suggested that the hierarchical pattern of function loss would be: bathing, dressing, toileting, transferring, continence, and feeding, which reversed the order they acquired these abilities in childhood [11–12, 18]. However, most previous population-based studies which explicitly focus on cognitive impairment showed that some basic ADL tasks such as bathing, walking, toileting and dressing were the most vulnerable [5–6, 8, 10, 13, 15–16, 19], whereas

MMSE category Cases (%)	MMSE > 24 43 (6.7%)	MMSE 18–24 238 (36.8%)	MMSE 1–17 217 (33.5%)	MMSE < 11 149 (23.0%)	Total 647 (100%)	P value <sup>1</sup>
<b>ADL-tasks:</b>						
Bathing	0.5 ± 1.5	0.3 ± 1.2	0.2 ± 1.0	0.1 ± 0.6	0.2 ± 1.0	0.075
Stairs	3.6 ± 3.3	3.1 ± 3.3	3.1 ± 3.3	1.5 ± 2.6	2.8 ± 3.2	0.000
Bladder	7.0 ± 3.8	6.3 ± 4.2	5.0 ± 4.3	2.1 ± 3.5	4.9 ± 4.4	0.000
Bowels	8.5 ± 3.2	7.5 ± 3.8	5.9 ± 4.4	2.2 ± 3.8	5.8 ± 4.5	0.000
Mobility	9.5 ± 4.3	8.9 ± 5.0	7.9 ± 5.4	4.6 ± 5.4	7.6 ± 5.4	0.000
Toilet Use	7.7 ± 3.3	6.6 ± 3.4	5.4 ± 3.7	2.3 ± 3.2	5.3 ± 3.9	0.000
Grooming	4.5 ± 1.5	4.4 ± 1.6	4.2 ± 1.9	1.7 ± 2.4	3.7 ± 2.2	0.000
Dressing	7.2 ± 3.3	6.7 ± 3.2	5.3 ± 3.7	2.4 ± 3.2	5.3 ± 3.7	0.000
Transfers	10.5 ± 4.2	10.3 ± 4.5	9.2 ± 4.7	5.5 ± 5.0	8.8 ± 5.0	0.000
Feeding	8.4 ± 2.8	7.9 ± 2.8	6.9 ± 3.1	4.0 ± 3.4	6.7 ± 3.4	0.000

Tab. 3: Mean scores of ADL-tasks (BI-items) across the different levels of cognitive impairment (n=647), <sup>1</sup> One way ANOVA (mean ± SD)

no any consistent hierarchy pattern of ADL-losses has been found across all these studies. The possible reasons for this inconsistency could be: 1) Different samples of elderly were examined. 2) Different scale items were used. 3) Disability was defined at different levels. 4) Different data sources were used such as professional assessments, self-reports and proxy-reports. 5) Different mechanisms of disability were involved. 6) Other potential influencing factors. However cognitive impairment should be regarded as a main component involved in this deviation, since dementia as pathology affects physical functions in various ways. On the other hand the present study is based on a sample of hospitalized geriatric patients with dementia. As the results showed, the majority of patients in this sample not only suffered from advanced dementia but also from multiple coexisting acute or chronic medical conditions. Therefore, this is a highly selected sample derived from a geriatric hospital, which covered the three main risk factors for functional disability: cognitive impairment, multiple coexisting medical conditions and very old age [1, 7, 14, 17]. These characteristics of this sample might be the prevailing reasons that the present results deviated sharply from the hierarchical pattern of ADL loss as suggested by Katz et al. as well as others. We assume however that the observed non-hierarchical loss of basic ADL tasks of patients with dementia is supposedly affected by several factors such as age and coexisting medical conditions beyond cognitive function. Further studies are needed to prospectively investigate the pattern of losses in basic ADL among patients with dementia in geriatric hospitals.

## Conclusion

The non-hierarchical pattern of ADL-losses among hospitalized geriatric patients with dementia deviated from previous findings of population based studies. The basic ADL tasks of bathing, climbing stairs, bladder control and bowel control seem to be more vulnerable in this specific subgroup of geriatric patients. The non-hierarchical pattern of ADL-losses in patients with dementia is supposed to be attributable to several factors; cognitive impairment, however, may play the dominant role. Further prospective studies are needed to investigate the pattern of loss in basic ADL among geriatric patients with dementia in more detail.

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