

Gender-related ADL performance of old people recently admitted to a Swiss nursing home

A cross-sectional study

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Summary

QUESTIONS UNDER STUDY: The aim of this paper was to establish gender-specific associations between the characteristics of residents recently admitted to Swiss nursing homes (NH) and their activities of daily living (ADL) performance.

METHODS: A sample of 17'331 NH residents living in 90 Swiss NHs received a Resident Assessment Instrument Minimum Data Set (RAI-MDS) shortly after NH entry, in the period from 1997 to 2007. ADL performance was assessed using the MDS-ADL long-form scale that measures self-performance in the seven following tasks: bed mobility, transfer, locomotion, dressing, eating, toilet use and personal hygiene. Associations between ADL performance and health and personal characteristics of the residents were then investigated using bivariate and multivariate analyses.

RESULTS: A total of 40% of the residents recently admitted to Swiss NHs were completely dependent for ADL. Absence of physical activity and having been admitted to a NH before 2003 were gender-specific variables associated with poorer ADL. Incontinence, poor balance, impaired cognition and vision as well as low BMI were important factors associated with poorer ADL performance in both genders.

CONCLUSION: The general scheme of ADL impairment was quite similar for both genders, but females tended to do slightly but significantly better than males. Overall, strategies improving balance, continence, cognition and sensory function including treatment of vision impairment,

promoting healthy nutrition as well as physical activity – particularly among elderly women with musculoskeletal conditions – may facilitate care in recently admitted residents and/or delay NH admission.

Key words: ADL; nursing home admission; elderly; continence; balance; gender

Introduction

Loss of functional independence is a common reason why older people move into a nursing home (NH) [1, 2]. After entry into residential care at least 30% of older people experience a decrease in their physical activity level [3]. Limitations in activities of daily living (ADL) not only augment caregiver burden [4] but are also strongly correlated with increasing nursing costs among NH residents [5].

Gender-related differences in ADL performance of the elderly can be partially explained by physiological factors. Independent elderly men aged between 60 and 80 years preserve good strength of their lower extremity for longer explaining their better performance in ADLs requiring lower limb strength than age-matched women [6]. Similarly, dependent elderly men maintained better performance in activities that require the use of the upper extremity. Huang et al. detected a significant decrease in grip strength in older women accompanied by an increase of dependence in ADL which could explain the observed difference [7].

In Switzerland, most elderly people live at home. Care for the elderly is organised at a cantonal and community level. Although based on the Swiss health insurance law, this level of organisation allows a substantial degree of heterogeneity between NHs [8]. Insurance aspects are ruled nationally [9]. Non-governmental organisations, relatives and informal networks provide care for the dependent elderly at home [10]. NH entry is, as far as possible, a personal decision although it is often taken together with or by the patient's relatives following medical advice or as a consequence of overburden of relatives [9]. Thus, elderly subjects admitted to a Swiss NH may be functionally quite

independent or severely dependent. Objective as well as subjective factors determine entry to a NH [16]. Swiss NHs offer supervision and assistance in activities of daily living as well as medical and nursing services. Registered nurses, nurse assistants or auxiliary nurses deliver care [11]. For all situations, emerging costs in relation to nursing or medical care are covered by the compulsory health insurance. Nursing costs exceeding the allowance as well as further services are covered by the NH residents themselves; under defined conditions, the canton and the resident's community contribute, and if required the elderly can receive additional subsidies [9].

Functional independence can be evaluated through an assessment of ADL. Different causes threaten functional independence in basic ADL like dressing, eating or transferring. Among personal characteristics, advanced age [12], female gender [13, 14], either increased or decreased body mass index (BMI) [15, 16], lower functional status [12] or lower extremity functional limitations [16], pre-admission disability in instrumental activities of daily living (IADL), and length of hospital stay [12] have been identified as factors threatening independence. In addition, Stuck et al. discovered evidence for an increased risk in functional status decline for the elderly with a low frequency of social contacts, a low level of physical activity, no alcohol use compared to moderate use, poor self-perceived health, smoking and vision impairment [16]. Visual impairment [17] and depression [18], highly prevalent in newly admitted residents [19], are more frequently observed among older women and influence ADL performance negatively. In addition, co-existing visual and cognitive impairment demonstrated an increased risk to develop ADL disability among community dwelling elderly [20, 21].

Recent investigations show that there are gender specific profiles at risk for NH admission and that gender specific interventions may be needed to prevent institutionalisation [22]. The Leipzig longitudinal study found that the following characteristics: cognitive impairment, poor self-rated health status, and less than two specialist's visits in the preceding 12 months, were associated with a shorter time to NH admission for women. For men, risk factors for NH admission were being unmarried, with moderate educational status, and hospitalisation in the preceding 12 months [22]. Gender-specific findings as to urinary incontinence remain controversial [8, 22, 23]. However, a former systematic review could not confirm gender-specific risk factors for NH admission. Their findings suggested that cognitive and/or functional impairment, associated lack of support and assistance in daily living led to NH placement independently of gender.

Social status (widowed, divorced or single) was a significant predictor of accelerated NH admission only among elderly men [22]. Katz observed gender specific differences in the care of disabled elderly people. If an elderly married man was disabled, he received more informal care than a disabled woman. Disabled women lived more frequently alone and received less informal care independent of if they lived alone or were married [24]. ADL dependence in this context could lead to NH admission in women more easily. On the basis of a large sample of over 17'000 people, we looked for possible associations between ADL perform-

ance and resident characteristics and whether or not these characteristics were gender-specific. A better knowledge of gender-specific ADL profiles of persons newly admitted to a NH may help to develop more efficient resident support through early implementation of strategies aiming at the maintenance or improvement of ADL performance. According to current knowledge, we hypothesised that elderly women recently admitted to a NH may show an association between reduced ADL performance with cognitive and visual impairments as well as depressive symptoms, a low BMI, poor balance and little practice of exercise or sport. Hypothesised associations for men were advanced age and single as civil status. For incontinence, we did not define gender specificity as the literature was controversial; neither did we for types of health conditions which may give further explanations for ADL dependence.

Methods

Subjects

Data were collected in the three Swiss cantons of Aargau, Basel-City and Solothurn, corresponding to 13.5% of the total Swiss population [25]. A total of 90 NHs out of the 160 contacted NHs agreed to take part in the study. A majority of the total sample size comprising of 21'821 residents living in the 90 NHs received a Resident Assessment Instrument Minimum Data Set (RAI-MDS) shortly after entry [26], in the period from 1997 to 2007. Only these residents were considered in the current paper. The exact gap between the entry and the assessment was not recorded but on the basis of available information, this time was estimated to have a median value lower than or equal to three months. After cleaning the database for duplicate cases and incorrect coding of important information such as date of admission in the NH, we were able to include 17'331 residents in the present study.

The Qualitäts-Systeme Aktiengesellschaft (Q-Sys AG; Systeme zur Qualitäts- und Kostensteuerung im Gesundheitswesen), that pools all RAI-data, as well as all directors of the NHs involved in this study, authorised the use of these data for research purposes. The data included in this analysis were anonymised. They did not allow any connection to a particular person in a specific NH and therefore submission to a research ethics committee was not required.

Measures

ADL scales derived from the RAI-MDS have been shown to be valid measures for both the community dwelling elderly and NH residents [27, 28]. Several MDS-ADL scales are available; a long-form, a short-form scale and a hierarchical scale. The MDS-ADL long-form scale is based on self-performance in the seven following tasks: bed mobility, transfer (mobility from/to bed/chair), locomotion on unit, dressing, eating, toilet use and personal hygiene [28]. Each task is independently coded from 0 (independent) to 4 (totally dependent). A person is considered as dependent in an activity of daily living as soon as the code for the corresponding item is above zero. The sum of the seven task scores constitutes the MDS-ADL score ranging from 0

(maximal independence) to 28 (maximal dependence). An activity that did not occur during the last seven days was re-coded as 4 according to Morris et al. [28]. The long-form MDS-ADL items permits researchers to distinguish between early loss ADLs (dressing and personal hygiene), middle loss (toilet use, transfer and locomotion) and late loss (bed mobility and eating).

In addition to the 7-item long-form version of the MDS-ADL scale, Morris et al. also defined a short form using only four items as well as a hierarchical measurement system based on the same items: one from early loss (personal hygiene), two from middle loss (use of toilet and locomotion), and one from late loss (eating) [28]. The MDS-ADL short-form scale is defined as the sum of these four items and it has values ranging from 0 to 16.

Furthermore, the MDS-ADL hierarchical scale was derived from the 4-item MDS-ADL short-form scale. It ranges from 0 (independent residents) to 6 (completely dependent residents with maximum need for support) [28]. Complete independence in the four ADLs corresponds to the "independent category". Residents with a MDS-ADL short-form score >0 and all 4 ADLs <2 are classified in the "supervision category", while all four ADLs <3 and one or more of the four ADLs equalling 2, define those who need "limited support". The remaining categories represent residents who need increasingly more help. If both eating and locomotion are <3 and either or both personal hygiene and toilet >2 , this corresponds to the "extensive support 1" category. If either eating or locomotion equal 3 and neither of these two ADLs equal 4, the patient is defined in the "extensive support 2" category. If eating and/or locomotion equal 4, the patient is considered as "dependent" while all four ADLs equalling 4 define the "total dependence category".

According to Morris et al., the different ADL scales are highly reliable and valid. For this study, both the MDS-ADL long-form and the MDS-ADL hierarchical scale were used as outcome measures [28]. The MDS-ADL long-form scale is useful to detect ADL changes over time while the MDS-ADL hierarchical scale provides a more intuitive meaning of the ADL performance of the subjects. However, given the strong association between the two scales most computations were done using only the long-form MDS-ADL.

The following possible risk factors for impaired ADL were included in the study:

- 1) Gender (female, male)
- 2) Age - 4 categories (≤ 64 , 65–79, 80–90, >90):
- 3) Civil status (single: including divorced and widowed/married)
- 4) Year of NH entry
- 5) Eye sight - 4 categories (sees well, slight difficulties, moderate difficulties, severe difficulties – blind).
- 6) Cognitive performance scale (CPS) ranging from 1 to 6 [29]
- 7) Body Mass Index (BMI) - 4 categories (<19 , 19–24.9, 25–29.9, ≥ 30)
- 8) Continence - 2 categories (continence versus any incontinence, urinary or fecal)

- 9) Balance - 4 categories (maintained position, unsteady, partial physical support, not able to attempt test alone)
- 10) Exercise or sport activity (yes/ no)
- 11) Outdoor walking or wheeling (yes/no)
- 12) MDS-Depression score based on a rating scale for use in NH, score ranging from 0 to 14 [30].
- 13) Types of health conditions (yes/no): vascular cerebral diseases, Parkinson's disease, psychiatric diseases, cardiovascular diseases, endocrinopathies, musculoskeletal diseases, lung disease, neoplasias.

Analyses

In a first step, the distribution of both the outcome variables (MDS-ADL long-form scale and hierarchical ADL scale) and the different factors were independently analysed. We tested for a significant difference between males and females using either the chi-square test (categorical variables) or the Wilcoxon rank-sum test (scales). We also measured the degree of association between the two ADL scales using the Spearman correlation. Finally, we analysed the distribution of the number of dependencies among NH residents and we looked at the relationship between the different domains of independencies in a way similar to that of Morris et al. (1999).

In a second step, the long-form MDS-ADL score was compared with each factor. For categorical factors, the median of the MDS-ADL score within each category is reported and for continuous factors the value of the Spearman correlation is reported. We also tested for associations between the MDS-ADL score and each factor categories using the Wilcoxon rank-sum test (binary factors), the Kruskal-Wallis test (multinomial factors) or the test of the Spearman correlation (continuous factors).

Finally, factors significant at the bivariate level were introduced in a linear regression, with the dependent variable being the MDS-ADL long-form scale. We report the adjusted R^2 measure, the value of the regression coefficients and their associated p -values. All analyses were performed for both the whole sample and then separately by gender, in order to detect gender specificity of the examined variables. Although 17'331 NH residents were included in the study, most analyses were performed on less data points due to missing data. Non-parametric methods such as the Spearman correlation, the Wilcoxon rank-sum test and the Kruskal-Wallis test were used because of the non-normality of the continuous variables involved in the statistical analysis. As the sample size was very large, we fixed the degree of significance of all statistical tests at 0.001 in order to avoid Type I errors.

Results

Subject characteristics

All considered characteristics were significantly different between males and females, except walking or wheeling outdoors (table 1).

Females were much more numerous than males. Only a small percentage of admissions concerned persons under the age of 65 and nearly half of the sample were 80–90

years old. About a quarter of the sample had a very low or high BMI. Exercise or sport activity was rare. Poor balance represented the most frequent impairment and incontinence was present in nearly half of the sample. Visual impairment was found in about 40% of the participants. Cardiovascular and musculoskeletal diseases were the most prevalent conditions, followed by endocrinopathies, psychiatric diseases and vascular cerebral diseases, while neoplasias, lung and Parkinson's diseases were much less frequent.

Gender specific ADL performance

The most frequently observed value on the MDS-ADL long-form scale (range 0-28) was zero (20.69% of the

sample, males 19.93%, females 21.06%) indicating no ADL-dependence, the mean score was 9.78 (sd = 8.63) and the median was 8. The distributions for males and females were very similar, even though there was a small tendency towards lower values (better performance) in the female subsample with the mean score being equal to 9.52 (8.56) and the median being equal to 8, compared to 10.30 (8.76) and 9 for males (detailed data not shown).

According to the hierarchical ADL scale, "Independent" and "Extensive support 1" were the two most represented categories in the sample, both overall and separately for each gender, while "Total dependence" was rare (table 2). Despite an apparent similarity between males and females,

Table 1: Main characteristics of nursing home residents after admission.

Variable	Categories	Overall %	Males %	Females %	p
Gender	Male	32.67			
	Female	67.33			
Age (n = 17281)	≤64	3.91	6.49	2.66	<0.001
	65–79	22.88	27.80	20.50	
	80–90	48.28	46.12	49.33	
	>90	24.92	19.59	27.51	
Civil status (n = 16220)	Single	72.37	50.38	82.90	<0.001
	Married	27.63	49.62	17.10	
Admission year *		2004 (2.60)	2004	2004	<0.001
Eye sight	Sees well	61.29	62.22	60.84	0.013
	Slight difficulties	26.63	26.83	26.53	
	Moderate difficulties	7.24	6.71	7.50	
	Severe difficulties – blind	4.84	4.24	5.12	
Cognitive Performance Scale* (n = 16930)		2	2	2	<0.001
BMI (n = 16082)	<19	13.37	9.84	15.06	<0.001
	19–24.9	50.59	51.96	49.94	
	25–29.9	25.74	28.91	24.22	
	≥ 30	10.30	9.28	10.79	
Continence (urine and faeces)	Yes	46.72	44.14	47.97	<0.001
	No	53.28	55.86	52.03	
Balance	Maintained position	25.01	25.79	24.64	<0.001
	Unsteady	24.40	22.31	25.42	
	Partial physical support	14.84	13.79	15.35	
	Not able to attempt test alone	35.75	38.11	34.60	
Exercise or sport activity	No	88.50	90.37	87.59	<0.001
	Yes	11.50	9.63	12.41	
Walking or wheeling outdoors	No	57.48	56.92	57.75	0.301
	Yes	42.52	43.08	42.25	
MDS-Depression scale *		1	1	1	<0.001
Vascular cerebral disease	No	84.93	81.12	86.79	<0.001
	Yes	15.07	18.88	13.21	
Parkinson's disease	No	94.21	91.50	95.53	<0.001
	Yes	5.79	8.50	4.47	
Psychiatric diseases	No	77.22	82.02	74.89	<0.001
	Yes	22.78	17.98	25.11	
Cardiovascular diseases	No	33.02	35.62	31.76	<0.001
	Yes	66.98	64.38	68.24	
Endocrinopathies	No	62.08	59.98	63.10	<0.001
	Yes	37.92	40.02	36.90	
Musculoskeletal diseases	No	55.74	64.82	51.33	<0.001
	Yes	44.26	35.18	48.67	
Lung disease	No	93.60	94.54	93.14	<0.001
	Yes	6.40	5.46	6.86	
Neoplasias	No	90.54	87.65	91.94	<0.001
	Yes	9.46	12.35	8.06	

For each categorical variable, the overall total frequency and percentage distribution as well as the percentage distributions by gender has been provided. The last column provides the *p*-value of the chi-2 test between males and females. For scales (indicated by *), the median value is provided, both globally and by gender, and the last column gives the *p*-value of the Wilcoxon rank sum test between males and females. Except when otherwise mentioned, the sample size for each variable is *n* = 17331.

the distributions of the seven levels of the MDS-ADL hierarchical scale were statistically different, with the largest difference being observed in the two most frequent categories, “Independent” and “Extensive support 1”. The association between the MDS-ADL long-form scale and the hierarchical ADL scale was very strong (Spearman correlation = 0.94; $p < 0.001$). The same result was obtained independently among males and females.

Table 3 indicates that 28.62% of the persons admitted in a NH are dependent to some degree in all the seven categories of the long-form MDS-ADL scale. The second most current situation was no dependency at all (19.30%) while six dependencies came third (14.03%). The general scheme was quite similar for both genders. However, females tended to do slightly, but significantly, better than males with a median of 4 dependencies (5 for the males) and a mean value of 3.92 (4.09 for the males).

Table 4 describes the relationship between the total number of ADL for which a person was still totally independent and the percentage of independence in each of the seven ADLs taken separately. For instance, among persons with only one remaining independent ADL, this ADL was “eating” in 69.10% of the cases at the overall level (males: 62.17%; females: 72.17%), “bed mobility” in 18.65% of the cases at the overall level (males: 19.79%; females: 18.14%), and so on. On average, males lost “locomotion” later in the ageing process than females. Therefore, the percentage of males remaining independent in “locomotion”, whatever their total number of ADL independencies, was always larger than the corresponding value for females. Conversely, females remained independent for “toilet use”, “hygiene” or “eating” for longer periods than males.

Table 2: Distribution of the hierarchical ADL scale.

Category	Overall (n = 16435)	Males (n = 5399)	Females (n = 11036)
Independent	23.62	22.06	24.38
Supervision	11.86	10.85	12.35
Limited support	14.18	12.72	14.89
Extensive support 1	23.87	27.32	22.18
Extensive support 2	9.11	9.56	8.90
Dependent	14.08	13.98	14.13
Total dependence	3.28	3.50	3.17
Total	100%	100%	100%

We report the percentage distribution of the seven categories of the hierarchical scale, both overall and separately by gender. The distribution is significantly different between males and females ($\chi^2 = 70.18$, $p < 0.001$).

Table 3: Distribution of the number of dependencies.

Number of dependencies	Overall	Males	Females
0	19.30	18.76	19.56
1	7.80	6.76	8.30
2	7.99	7.65	8.15
3	7.88	8.19	7.72
4	6.73	6.87	6.66
5	7.66	7.44	7.77
6	14.03	13.02	14.53
7	28.62	31.31	27.31
Total	100%	100%	100%

The percentage of persons with 0, 1, ..., 7 domains of dependencies are provided according to the long-form MDS-ADL shortly after their admission in a nursing home.

Table 4: Percentage of independent persons in each of the seven activities in function of the total number of independent activities.

	Number of independent ADLs:					
	Overall (Males; Females)					
Still independent ADL area:	1	2	3	4	5	6
Hygiene	0.05 (0.00; 0.07)	0.90 (0.76; 0.97)	3.29 (1.41; 4.22)	4.62 (3.43; 5.23)	13.79 (9.38; 15.82)	51.97 (44.18; 55.10)
Dressing	0.27 (0.15; 0.33)	0.74 (0.25; 0.97)	2.44 (1.98; 2.67)	6.49 (3.89; 7.85)	19.39 (18.75; 19.69)	65.68 (70.11; 63.91)
Toilet use	0.90 (0.73; 0.98)	5.25 (4.29; 5.72)	17.84 (12.99; 20.25)	39.36 (35.01; 41.62)	86.52 (86.06; 86.73)	95.08 (93.39; 95.75)
Transfer	1.13 (0.88; 1.24)	19.46 (21.21; 18.61)	65.63 (66.67; 65.12)	88.97 (92.68; 87.04)	97.05 (98.32; 96.46)	98.94 (99.21; 98.83)
Locomotion	9.91 (16.28; 7.09)	40.23 (48.74; 36.13)	58.97 (66.67; 55.13)	80.20 (86.50; 76.93)	92.12 (94.95; 90.82)	93.26 (96.83; 91.83)
Bed mobility	18.65 (19.79; 18.14)	58.62 (53.28; 61.19)	80.85 (84.18; 79.18)	93.04 (93.36; 92.87)	98.11 (99.28; 97.57)	99.24 (99.74; 99.04)
Eating	69.10 (62.17; 72.17)	74.79 (71.46; 76.40)	70.99 (66.10; 73.42)	87.32 (85.13; 88.47)	93.03 (93.27; 92.92)	95.83 (96.56; 95.54)

Data provided both at the overall level and separately by gender.

Factors associated with ADL

In most cases, the relationship between each factor and the MDS-ADL long-form scale was highly significant, both overall and for each gender separately (table 5). There were however exceptions: age and exercise or sport activity were related to ADL among females but not among males. Walking or wheeling outdoors, psychiatric diseases and lung disease were never significant. As expected, increased levels of significant factors were related to higher levels of ADL dependence. Females younger than 65 had surprisingly high ADL values compared to older females and to males. Moreover, a very low BMI (<19) was related to a worse ADL performance in both genders, but this was not true for very high BMI (≥ 30). Married residents performed notably worse on ADL than singles.

The 17 factors which were significantly associated with ADL in males, females or both, were included in linear regression analyses (table 6). For instance, at the overall level, single residents had an MDS-ADL value 1.35 points lower on average than married residents, and being incontinent led to an average value 3.81 points higher than continent persons. Compared to the bivariate analyses, 3 factors become totally non-significant for both genders: cardiovascular diseases, endocrinopathies and depression. Admission year and no exercise or sport activity were significant for females but not for males. All remaining factors were significant for both genders. As noted before at the bivariate level, the higher levels of factors were generally related to impaired ADL performance. Exceptions were age lower than 65 years and BMI under 19.

Discussion

The main findings of this study showed that 1) important gender-specific variables associated with poorer ADL performance comprised of no physical activity practice and being admitted to a NH before 2003; 2) important factors associated with poorer ADL performance for both genders were: incontinence, poor balance, cognitive as well as visual impairment and low BMI; and 3) 40% of residents recently admitted to Swiss NHs were completely dependent for ADL.

Gender-specific associations with ADL performance

A number of associations with ADL performance were clearly different between the genders. Male residents preserved better locomotion than women for a given ADL performance level, while women remained independent for longer for hygiene and toilet use. Regarding locomotion, this observation was in line with the profile of newly admitted residents to an American NH. Among the eight investigated ADL items, women had lower functioning than men for grooming, dressing, feeding, ambulating, transferring and defecating [31].

The hypothesis that absence of exercise among elderly women is associated with lower ADL performance was confirmed in our sample. Absence of exercise is frequent and in line with epidemiological data as only 21% of Swiss citizens over 70 years perform exercise once or twice per week [32]. Dunlop et al.'s study identified the lack of physical activity as the strongest predictive factor for ADL de-

cline in the elderly with musculoskeletal conditions [33]. This finding might explain the significant relationship between musculoskeletal conditions and ADL dependence in our population. Clearly, regular physical activity reduces the risk for ADL decrease [34, 35] and may delay NH admission in elderly community dwelling women.

Women admitted to NHs between 2004 and 2007 were significantly less ADL dependent than those admitted between 1997 and 2003. Recent widowhood, improvement of overall health status, or reduction of available social networks in the past decade as cohort effects are possible explanations.

Associations with ADL performance specific for both genders

The most important factors related to ADL performance were incontinence and poor balance. Very poor balance concerned more than a third of our sample and was the factor most strongly related with lower levels of ADL performance. In a NH population, balance in standing is one of the most important independent predictive factors to be targeted by interventions aiming at maintaining or improving ADL performance [36]. Incontinence was also a factor with a strong relationship with a lower level of ADL-independence. Wang et al. [37] identified a significant association between incontinence and impaired balance function at admission, with an increase in ADL dependence at follow-up which is in keeping with the current results.

Pathologically low BMI was significantly associated with impaired ADL performance. The relationship between poor nutrition status and lower ADL performance among elderly is well documented [38, 39].

Cognitive impairment is a significant factor for ADL dependency and was the only factor predicting functional incapacity for ADL in a Brazilian NH population [40]. Among community dwelling, elderly people, cognitive impairment had the highest strength of evidence for an increased risk for functional status decline [16].

Among residents newly admitted to a NH, those aged 64 or less had on average poorer ADL functioning compared to all other age groups. This association was different from what was expected. This suggests that residents with an early degradation of their ADL performance are frequently transferred to a NH in order to receive care. This could especially be true for chronic disabling diseases like multiple sclerosis. Indeed, in our sample, residents with multiple sclerosis were younger on average (data not shown) which is in keeping with Buchanan et al.'s findings [41]. Another population prone to early NH placement may be patients with cerebral vascular insult. The probability that the discharge destination is a NH is high for those who remain dependent for ADL or exhibit disruptive behaviours [42]. This could also be the case for persons with severe traumatic brain injury [43].

The fact that single residents are less ADL-dependent than married residents despite their older mean age, is not entirely in keeping with the current literature as it suggests that age combined with single status represents a risk factor for institutionalisation [13, 44]. The interpretation of our results must be cautious. The data do not specify if the elderly residents are widowed or not. In that case, the loss

of one's spouse could precipitate a widow's NH admission despite preserved ADL capacities relative to those of married residents who received support from their spouses before NH admission. In line with this interpretation, Kesselring et al. observed a higher risk for institutionalisation among the Swiss elderly care-dependent population if the caregiver was not the partner [10].

Prevalence of ADL dependence and NH admission

Nearly 80% of all residents recently admitted to a NH are to some extent dependent for basic ADLs and about 40%

need extensive care or complete support. A Swiss urban inquiry from 1986 previously stated that about 40% of the elderly require daily nursing assistance and that this could lead to NH admission [45]. Our results also imply that 60% of the residents could – regarding their ADL capacities – stay at home. Considerations of Thygesen et al. [46] and Luppá et al. [47] may shed light on this fact. The former conclude that the patients' subjective evaluations of both their health and perceived social support were important predictors of future NH admission. Luppá et al. [47] claimed that further investigation are

Table 5: Association between explanatory factors and the MDS-ADL long-form scale.

Variable	Categories	Overall		Males		Females	
		Median	p	Median (SD)	p	Median (SD)	p
Gender	Male	9	<0.001	–	–	–	–
	Female	8		–		–	
Age	≤64	9	<0.001	7	0.877	11	<0.001
	65–79	8		9		8	
	80–90	7		9		7	
	>90	9		10		9	
Civil status	Single	8	<0.001	7	<0.001	8	<0.001
	Married	13		13		13	
Admission year*		–0.0982	<0.001	–0.0974	<0.001	–0.0997	<0.001
Eye sight	Sees well	6	<0.001	6	<0.001	5	<0.001
	Slight difficulties	11		13		11	
	Moderate difficulties	16		17		15	
	Severe difficulties – blind	17		19		16	
Cognitive Performance Scale*		0.5165	<0.001	0.5564	<0.001	0.4930	<0.001
BMI	<19	12	<0.001	15	<0.001	12	<0.001
	19–24.9	9		11		8	
	25–29.9	8		9		7	
	≥ 30	9		6		10	
Continence (urine and faeces)	Yes	2	<0.001	2	<0.001	2	<0.001
	No	15		16		14	
Balance	Maintained position	0	<0.001	0	<0.001	0	<0.001
	Unsteady	5		6		5	
	Partial physical support	10		12		10	
	Not able to attempt test alone	18		18		18	
Exercise or sport activity	No	9	<0.001	9	0.004	8	<0.001
	yes	4		8		4	
Walking or wheeling outdoors	No	8	0.453	9	0.564	8	0.162
	yes	8		9		7	
MDS-Depression scale*		0.2390	<0.001	0.2566	<0.001	0.2340	<0.001
Vascular cerebral disease	No	7	<0.001	8	<0.001	7	<0.001
	Yes	15		16		14	
Parkinson's disease	No	8	<0.001	8	<0.001	7	<0.001
	Yes	15		16		13	
Psychiatric diseases	No	8	0.039	9	0.446	7	0.014
	Yes	8		9		8	
Cardiovascular diseases	No	6	<0.001	6	<0.001	6	<0.001
	Yes	9		10		8	
Endocrinopathies	No	7	<0.001	8	<0.001	7	<0.001
	Yes	9		10		9	
Musculoskeletal diseases	No	6	<0.001	7	<0.001	6	<0.001
	Yes	11		13		10	
Lung disease	No	8	0.959	9	0.720	8	0.928
	Yes	7		8		7	
Neoplasias	No	8	<0.001	9	<0.001	7	<0.001
	Yes	12		12		11	

The median value of the MDS-ADL scale is reported for each category of explanatory factors, both overall and by gender. In the case of continuous variables (indicated by *), the Spearman correlation with the MDS-ADL scale is provided instead of the median. Association is evaluated using the Kruskal-Wallis test for multinomial variables and the test of the Spearman correlation for continuous variables.

needed to understand the complex relationships leading to the use of NHs [47]. For example, in the Leipziger study, elderly women who estimated their health condition worse, were more frequently admitted to NHs [22].

A Dutch experience with small-scale homelike facilities versus psycho-geriatric NHs showed that residents in the homelike environment had higher functional and cognitive levels [48]. In 2007 in Switzerland, a pilot phase permitting disabled elderly to receive nursing care during 24 hours, and if necessary to be temporarily transferred to a NH continuing with the same caring staff, was successful. It is now part of the offer for disabled elderly people. This opportunity may delay or avoid permanent NH for disabled elderly [49].

Although we do not know the reasons for NH admissions in our sample, associations between ADL dependency and other clinical variables may partly explain why patients have been admitted to Swiss NHs. Fjelltnun et al. [50] suggest that older people waiting for NH placement are as equally frail, physically and psychologically, as those recently admitted. Thus, recently admitted residents with low ADL performance relative to those with higher ADL performance have different characteristics. For instance, in our sample, very poor balance, incontinence, impaired cognition and vision as well as a low BMI were strongly related to poor ADL performance.

Few studies report on what specific ADL domains NH residents are preferentially affected upon admission. Thus, Gaugler et al.'s meta-analysis [51] identified dependency in at least three ADL domains as the most important pre-

dictive factor for NH admission but did not order them according to their importance. In our study, late loss ADL domains, as defined by Morris et al. [28], were less frequent compared to early loss ADL items. In particular, the low observed percentage in our large sample of participants who were independent for bed mobility suggests that this ADL item could be classified in the middle loss rather than in the late loss category.

Limitations

The most important limitation was that data collection was completed before realisation of the present study. Therefore, research specific standardisation of assessment and reporting was impossible. It is possible that ADL performance was underestimated in our study as the data were collected for clinical purposes by nurses not specifically trained in research methods. Indeed, Bates-Jensen et al. [52] discovered discrepant scores regarding bed mobility when comparing scores obtained by trained researchers with those from nurses, who tended to overestimate the need for help of NH residents. Overestimation of dependence might also be an issue for self care items such as transfer or locomotion [52]. The same is true for the date of assessment which was not always exactly reported. Examination of the data set permitted deduction that most of the data was gathered during the first three months of NH stay. We therefore used the term of "recently admitted elderly to a NH". We were also primarily interested in the relationship between ADL performance and NH residents' charac-

Table 6: Linear regression for the MDS-ADL long-form scale.

Variables	Categories	Whole sample		Males only		Females only	
		N = 14831, R ² = 0.55		N = 4838, R ² = 0.57		N = 9993, R ² = 0.55	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
Gender (ref: Male)	Female	0.32	0.003	–	–	–	–
Age category (ref: 80–90)	≤64	1.31	<0.001	1.12	<0.001	1.69	<0.001
	65–79	0.41	<0.001	0.39	0.047	0.47	0.002
	>90	0.40	<0.001	0.35	0.117	0.43	0.002
Civil status (ref: Married)	Single	–1.35	<0.001	–1.48	<0.001	–1.15	<0.001
Admission year		–0.08	<0.001	–0.06	0.088	–0.09	<0.001
Eye sight (ref: Sees well)	Slight difficulties	0.59	<0.001	0.67	<0.001	0.55	<0.001
	Moderate difficulties	1.57	<0.001	1.80	<0.001	1.46	<0.001
	Severe difficulties – blind	2.78	<0.001	3.00	<0.001	2.67	<0.001
Cognitive Performance Scale		1.13	<0.001	1.15	<0.001	1.13	<0.001
BMI categories (ref: 19–24.9)	<19	0.90	<0.001	1.40	<0.001	0.75	<0.001
	25–29.9	–0.29	0.011	–0.42	0.025	–0.23	0.099
	≥30	0.30	0.068	–0.52	0.079	0.63	0.001
Continence (urine and faeces) (ref: Yes)	No	3.81	<0.001	4.22	<0.001	3.58	<0.001
Balance (ref: Maintained position)	Unsteady	1.55	<0.001	1.52	<0.001	1.54	<0.001
	Partial physical support	4.18	<0.001	4.38	<0.001	4.09	<0.001
	Not able to attempt test alone	8.99	<0.001	8.44	<0.001	9.24	<0.001
Exercise or sport activity (ref: No)	Yes	–1.28	<0.001	–0.43	0.110	–1.63	<0.001
MDS-Depression scale		0.02	0.240	0.09	0.014	–0.00	0.893
Vascular cerebral diseases (ref: No)	Yes	1.58	<0.001	1.64	<0.001	1.53	<0.001
Parkinson's disease (ref: No)	Yes	1.75	<0.001	2.07	<0.001	1.41	<0.001
Cardiovascular diseases (ref: No)	Yes	–0.10	0.364	–0.03	0.873	–0.15	0.291
Endocrinopathies (ref: No)	Yes	0.20	0.052	–0.01	0.960	0.31	0.012
Musculoskeletal diseases (ref: No)	Yes	0.73	<0.001	0.73	<0.001	0.75	<0.001
Neoplasias (ref: No)	Yes	1.55	<0.001	1.47	<0.001	1.52	<0.001

Results are provided overall and separately by gender. The degree of significance is fixed to 0.001. Variables in bold are significant both overall and for each gender separately. Variables in italic are significant both overall and among females, but not among males. Variables in white are never significant

teristics which we assumed did not change in a significant manner throughout the first months of NH stay.

Given the large sample size, generalisation of our results to Switzerland may be appropriate. However, differences due to the specificity of the different linguistic regions cannot be excluded as our data were derived exclusively from the German part of Switzerland. Replication of the study in the French and Italian regions might be of interest.

Gender-specific results in our study should be considered with the high female proportion in mind, although the huge sample size is likely to attenuate this potential bias. The socio-economic status of the residents was not known and we could therefore not account for it even though its impact on ADL performance and NH admission is known [45, 53].

Conclusion

Gender specific factors were relevant and for females poor ADL performance was associated with no physical activity and being admitted to a NH before 2003. Targeted interventions to increase physical activity levels could prevent NH admission. At the same time, such interventions could also have an impact on poor balance and incontinence which are very relevant factors. In addition, visual impairment deserves appropriate care as our results demonstrate a strong relationship between visual impairment and ADL performance.

The profile of people recently admitted to a NH at risk for lower ADL performance level can serve as an indicator for ADL performance promotion to prevent NH admission. As an example, community dwelling elderly people, particularly women presenting a musculoskeletal, neurological or visual impairment, should be monitored as to their ADL performance and encouraged to participate in programs promoting balance, continence, cognition and healthy nutrition. ADL-preserving interventions are also important as the association between ADL dependence and the risk of developing delirium is high in recently admitted NH residents [54].

The first months spent in a NH may be a destabilising period for the elderly. Feelings of being a burden and helplessness increase [55]. Immediate instauration of an appropriate caring approach promoting ADL performance could facilitate the transition from living at home to being a NH resident.

Longitudinal observations will provide a deeper understanding of ADL performance and associated factors, as well as their gender-specificity. It will allow estimation of whether the factors identified as important and/or gender-specific during the first months of NH stay remain critical, or if other factors take over as time passes. The identification of these factors will improve appropriate care and further therapeutic and preventative strategies and permit their gender specificity. This is the subject of ongoing research.

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