Impaired Mobility and Urinary Incontinence in Nursing Home Residents

A Multicenter Study

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Impaired Mobility and Urinary Incontinence in Nursing Home Residents: A Multicenter Study

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ACKNOWLEDGEMENTS: The authors would like to express their gratefulness to the participating nursing homes who supported this study.

CONFLICTS OF INTEREST AND SOURCE OF FUNDING: The authors declare that they have no conflict of interest. This study was supported by the Department of Geriatric Medicine of the Charité – Universitätsmedizin in Berlin.

Abstract

Purpose: The purpose of this study was to evaluate associations among use of walking aids, mobility status and occurrence of urinary incontinence (UI) in geriatric patients residing in nursing homes, and to examine associations between UI severity (frequency and amount) and its impact on health related quality of life (QoL).

Design: Multi-center descriptive cross-sectional prevalence study.

Subjects and Setting: Two thousand forty four patients from nursing homes were included in the study. A majority were female (72.0%), the mean age was 82.1 years (SD 11.2), mean BMI was 26.1 (SD 5.4), and the mean Care Dependency Scale (CDS) score was 46.0 (SD 18.2) indicating a medium to high care dependency. The study setting was 30 nursing homes throughout Germany from 2014 to 2015.

Methods: Data were collected by trained nurses using a standardized data collection form to collect information about demographic characteristics, health conditions, mobility status measured according to the Elderly Mobility Scale (EMS), UI and QoL measured using the International Consultation of Incontinence Questionnaire Short Form (ICIQ-SF).

Results: The prevalence of UI was 69.7% (n=1804). Analysis of Variance (ANOVA) showed that in 1659 nursing home residents with information on the amount of leakage, 572 reported a medium amount of leakage with a mean impact on health related QoL of 2.2 (SD 2.2, $p<0.001$) on a scale from 0 (no impact) to 10 (very high impact). The mean of the impact on QoL in 235 residents who reported a large amount of leakage was 2.4 (SD 3.0, $p<0.001$). In 1741 residents with information on the frequency of UI, 637 reported being urinary incontinent more than once a day with a mean impact on QoL of 2.2 (SD 2.1, $p<0.001$) and 359 residents with permanent UI stated a mean impact on QoL of 2.1 (SD 2.8. $p<0.001$). According to the bivariate association of UI with use of walking aids, the highest prevalence of UI (61.2%) was in patients who did not use any walking aids. The Chi-square Automatic

Interaction Detector (CHAID) of the relation between mobility according to the EMS and UI results in 71.1% of all patients with UI who did not use any walking aids, although their mobility status had been reduced.

Conclusions: The prevalence of immobility in correlation with UI in nursing homes is high. Permanent and large amounts of urinary leakage have a high impact on health related QoL. Therefore, we recommend measures to preserve or regain mobility to minimize or prevent UI in geriatric residents and patients and thus, increase their health related QoL.

Keywords: mobility, Elderly Mobility Scale, epidemiology, prevalence, quality of life, urinary incontinence

Introduction

The prevalence of mobility limitations increases with age, and as the population ages, impaired mobility in the elderly and conditions associated with it such as urinary incontinence (UI) will be an even more significant public health issue. Experts in UI in nursing homes have long recognized the relationship between mobility and incontinence showing that the incidence of UI in cognitively impaired elderly nursing home residents was significantly decreased after a month of daily exercise regimen (1).

Multiple studies have classified immobility as one of the most common risk factors for geriatric syndromes such as pressure injuries, falls, and urinary incontinence (2). Moreover, intensive research supporting a relationship between UI and immobility indicating the need for further studies has been carried out by leading experts and investigators addressing the subject of incontinence in the frail elderly (3). Hence, preserving or regaining mobility in the elderly should be of highest priority in order to improve health related quality of life (QoL), and avoid occurrence of complications like incontinence-associated dermatitis (IAD) or pressure injury (4).

While research linking any impairment in mobility to UI is extensive, we found relatively few studies evaluating the link between reduced mobility status according to the Elderly Mobility Scale (EMS) and UI in nursing home patients. In 2014, the annual report on the prevalence of nursing care problems in Germany conducted by the Department of Geriatric Medicine of the Charité – Universitätsmedizin in Berlin reported a significant association between a reduced mobility status and the presence and severity of UI in general, indicating walking aids are a useful tool to support residents' mobility (5). The need for additional studies in the nursing home setting is also supported by the findings of Lahmann and colleagues identifying mobility as an important predictor for multiple other conditions prevalent in a context of care dependency seen in the nursing home. (6) Coll-Planas and associates also reported associations between UI and disability in late-life (7). Their findings illustrate clinical relevant relationships between mobility limitations and UI, a key nursing care issue in the aging population (8-10), and the positive influence of walking aids on the mobility status in geriatric residents and patients in nursing homes.

In the context of the nursing home, the definition of the term mobility is based on concepts of care dependency (11, 12). Mobility is defined as the physical ability to move independently over short distances (with walking aids if necessary) and to carry out autonomous changes in body position (13). Considering the development of correlated diseases such as frailty and fractures, reduced mobility influences the severity of UI in the elderly population (14).

The purpose of this study was to measure associations among use of walking aids, level of mobility and UI in geriatric nursing home residents, and to examine associations between UI severity (frequency and amount) and its impact on health related QoL. Our goal is to increase knowledge of associations between these prevalent geriatric syndromes by addressing the study aims as follows: 1) describe the prevalence, severity (frequency and amount), and QoL impact of UI; 2) examine associations between the UI severity and its impact on QoL; 3) describe mobility status; and 4) examine the association between UI and mobility characteristics in geriatric nursing home residents.

Methods

In 2014 and 2015 two multicenter descriptive cross-sectional prevalence studies were conducted in nursing homes in all 16 federal states of Germany. These prevalence studies are performed annually by the Department of Geriatric Medicine at the Charité – Universitätsmedizin Berlin and methods have been described in previous studies (15, 16).

Once a year, nursing homes and hospitals throughout Germany are asked to participate in the surveys. Facilities willing to participate receive standardized training materials, containing explanations of assessment scales, and information on how to fill in data collection forms. On the day of the survey, nurses trained by site coordinator perform a physical examination of residents after they or a proxy have given their informed consent. Inclusion criteria were: all residents who were present in the participating nursing homes at the day of the survey. Exclusion criteria were: residents ≤ 18 years of age and if informed consent had not been given. Study procedures were reviewed and approved by the Ethical Medical Committee of Berlin (consent no: Eth-837-262/00).

Instruments and Questionnaire

All items in the questionnaire were collected via patient interview by nurse data collectors trained by the site coordinator. Questionnaire items that queried demographics and comorbid conditions were: gender, weight, height, year of birth, level of care (according to German SGB XI), and possible comorbid diseases such as diabetes, apoplexy, oncological illness, psychiatric disorder, diseases of the cardiovascular system, diseases of the musculoskeletal system, and dementia. Items addressing care dependency, mobility, UI, and health related QoL were measured as follows:

Care dependency was measured by using the Care Dependency Scale (CDS), which has been tested for reliability, validity and utilization in various settings (17-19). The CDS ranges from 15 (completely care dependent) to 75 points (completely independent), and compromises 15 items: eating and drinking, continence, body posture, mobility, day/night pattern, getting dressed and undressed, body temperature, hygiene, avoidance of danger, communications, contact with others, sense of rules and values, daily activities, recreational activities, and learning ability. In our study, each of the 15 CDS items has been assessed by trained nurses, and points have been given for each resident in accordance with the 5-point Likert-type scale relating to the aspect of dependency being rated from 1pt. (completely care dependent) to 5pts. (completely independent). According to Dijkstra et al. the recommended cut-off score for care dependency is ≤68 points (18). However, cut-off scores may vary between different investigations based on sample size, setting and dependency status as well as the diagnostic criteria used. For our study, the measured mean care dependency of 46 points indicates that the participating residents were from partially to a great extent care dependent.

The level of mobility was measured using the Elderly Mobility Scale (EMS) (20). The EMS is a 7-item validated tool designed to assess of mobility in frail elders. Items use an ordinal scale to measure assistance required to move from: 1) lying to sitting position, 2) sitting to lying position, and 3) sitting to standing position. The EMS also assesses assistance needed during walking, timed required to walk 6 meters; and functional reach. Total scores ranged from 0 to 20 with higher scores representing a higher level of independence in relation to mobility. EMS scores >14 indicate a high level of mobility and independence; scores between 10 and 14 indicate a borderline in terms of safe mobility and independence in activities of daily living, and scores <10 indicate a high level of help with mobility. In addition, nurse data collectors were asked if the patient used a wheelchair or walking aids (i.e., cane, walker or wheeled walker).

Urinary incontinence was defined as any involuntary loss of urine (21). Based on this definition and for the calculation of the prevalence of UI, nurse data collectors recorded presence and severity of UI, and its impact on health related QoL. We used the International Consultation of Incontinence Questionnaire Short Form (ICIQ-SF) (22-24) to determine the severity and characteristics of UI. In our questionnaire the presence of UI was operationally defined by the frequency divided in 6 categories: never, 1x week or less, 2-3x week, 1x daily, permanent; with daily and permanent frequency indicating severe forms of UI. The severity of UI was operationally defined by the amount of leakage divided in 4 categories: none, little, medium, large; with medium and large amount of leakage indicating severe forms of UI. The

ICIQ-SF is a 4-item questionnaire that asks how often urinary leakage occurs (possible score: 0-5), how much the individual usually leaks (possible score: 0-6), and how much urinary leakage interferes with daily life (possible score: 0-10). The fourth item asks when leaking occurs. The first three items (frequency of leaking, amount of leakage, and the impact on QoL (scored from 0 to 10 with higher scores indicating greater impact) are summed to yield an overall score. The cumulative score ranges from 0 to 21, with higher values indicating more severe forms of UI.

Study Procedures

Researchers trained the coordinators of all participating nursing homes. The coordinator then trained the nurses responsible for data collection. These nurses assessed and interviewed participating patients. Data were collected by fully trained nurses by site coordinator only. The standardized data collection form contained items querying patient demographics, comorbid health conditions, mobility status, and UI. The completed data forms were sent to the Department of Geriatrics at the Charité – Universitätsmedizin Berlin, where they were prepared for data analysis.

Data Analysis

Data were screened prior to analysis for any anomalies (e.g. missing data, univariate and multivariate outliers, non-normality, non-independence, etc.) that could invalidate the results obtained from the analyses performed. For descriptive statistics, bivariate and multivariate analysis we used the available case approach. Data were analyzed using SPSS Statistics for Windows Version 24 (Statistical Package for the Social Sciences, Chicago IL). For bivariate analysis of categorical data, we used the chi-squared test of independence; we used ANOVA for evaluation of categorical and metric data. The ANOVA test was used to calculate the overall impact on health related QoL depending on frequency and amount of UI. We considered the health related QoL scale as psychometric. The chi-squared test was used in order to compare residents' mobility status according to EMS items and the use of wheelchair and walking aids in association with the presence of UI. For all statistical tests, an $\alpha = 0.05$ two-sided was considered to be statistically significant. Variables from the bivariate analysis that were significantly associated with mobility and UI were entered into a Chi-square Automatic Interaction Detector (CHAID) multivariate tree diagram to analyze the relation between highly significantly EMS items and UI. CHAID is a technique created by Gordon V. Kass in 1980 (25). It is a tool used to discover the relationship between variables. CHAID analysis builds a predictive tree to help determine variables best merge to explain the outcome in the given dependent variable. In CHAID analysis, nominal, ordinal, and continuous data can be used, where continuous predictors are split into categories with approximately equal number of observations. CHAID creates all possible cross tabulations for each categorical predictor until the best outcome is achieved and no further splitting can be performed. Unlike in regression analysis, the CHAID technique does not require the data to be normally distributed. As a result of the bivariate analysis, the independent EMS items *sit to stand*, *sitting to lying* and *stand*, and the two additional independent variables *wheelchair* and *walking aid stick, frame and rollator* were included in CHAID analysis in order to calculate their impact on the dependent variable (UI).

Results

Two thousand forty four patients from nursing homes were included in the study. As in some cases information on gender, age, BMI and care dependency were missing, the total n for the different variables differed. Regarding gender, most were women, 72.0% (total n=1951); the mean age of n=2025 residents was 82.1 years (SD 11.2); mean BMI of n=1988 was 26.1 (SD 5.4); and the mean CDS score of n=1906 was 46.0 (SD 18.2) indicating a medium to high care dependency.

Prevalence of UI

Presence or absence (less than once a week) of UI was measured in 1925 patients. The prevalence of UI was 70.3 %. The frequency of UI differed. 5.5% (n=106) indicated UI twice or three times a week, 10.6% (n=204) indicated UI once daily, 34.6% (n=666) indicated UI more than once daily, and continuous UI was reported in 19.6% (n=378). Out of a total of n=1832 residents with information on the amount of UI 31.7% (n=581) were affected by a small amount of leakage, while 33% (n=604) stated a medium amount. For 13.3% (n=243) a large amount of leakage was reported.

Health Related QoL and UI

The overall impact of UI on QoL was evaluated in 1292 urinary incontinent participants, for which the level of impact has been indicated on a scale from 0 (no impact) to 10 (high impact). Most reported a rather small impact: 33.0% (n=427) “zero”, 18.1% (n=234) “1” and 17.5% (n=226) “2”, while a high impact on QoL was only reported by 3.6% (n=46) (2.1% (n=27) “8”, 0.5% (n=6) “9” and 1% (n=13) “10”).

Table 1 shows the associations between frequency and the amount of unintended urine loss (independent variables) and their associations with health related QoL (dependent variable) calculated by using analysis of variance (ANOVA). The total number of participants for the intersection of frequency of UI and health related QoL was n=1741 and for the intersection of amount of UI and health related QoL n=1659. There were significant differences in the QoL impact scores based on both the frequency and amount of urine leakage ($p<0.001$). ANOVA showed that the impact on QoL was medium, if urinary leakage occurred between once daily and twice to three times a week (mean 1.4; 1.5). If leakage occurred more than once daily or permanently, the impact on QoL was high (mean 2.2; 2.1). Considering the amount of leakage, little amount had a medium impact on QoL (mean 1.5), while for medium and large amounts of urinary leakage the impact on QoL was high (mean 2.2; 2.4).

Mobility

Table 2 summarizes the level of mobility according to the seven EMS items. Most patients were able to move independently from lying to sitting (53.7%; n=1029) and from sitting to lying (55.8%; n=1060). One-quarter (n=437) needed physical help to stand and 25.6% (n=401) to walk. 31.9% (n=578) needed more than 30s and 20.1% (n=364) were unable to complete a 6m walk. 35.3% (n=576) were unable to reach more than 10cm.

Bivariate Association between mobility and UI

Table 3 shows the prevalence of UI in association with mobility according to the EMS items and two additional walking aid items. The highest prevalence of 61.2% was in patients who did not use any walking aids.

Multivariate CHAID Analysis regarding UI

The results of patients with UI (yes/no) per item and category according to the EMS are displayed in the multivariate classification tree in Fig. 2, controlled for care dependency. The overall prevalence was 69.7%. Of the seven EMS items, completed by two walking aid items, that were entered in CHAID analysis, three EMS items and the two walking aid items were selected by the CHAID routine for the classification tree for UI. Tree analysis in Fig. 2 shows on the first level, that the strongest predictor for UI was “sit to stand”. On the second level the strongest predictors were “sitting to lying” and “wheelchair”. On the third and final level “stand” and “walking aid stick, frame, rollator” were the strongest predictors. A total of 11 nodes could be detected. Of these, 11 final nodes were calculated, which stand for 11 statistically significant different levels of mobility in geriatric residents and patients regarding UI risk characteristics. Fig. 2 shows that the higher the use of wheelchair and walking aids by (partly) immobile patients, the lower the risk for UI.

Discussion

Results of our multi-center descriptive cross-sectional prevalence study indicate that UI occurs in 69.7% of all patients in German nursing homes. The prevalence of UI in our study corresponds to available figures in nursing homes of up to 77% (26). Considering the frequency of UI, the prevalence of those who are incontinent more than once daily was about 34%, and regarding those with an at least medium amount of leakage, the prevalence was 33%. Because reported prevalence rates depend to a high degree on the applied definition (11, 14), descriptive results were used for analysis in this study in order to enable comparison to other study results.

The bivariate analysis of the overall impact of the frequency and amount of UI on health related QoL in this study indicates a low impact of UI occurring once a week or less, and a medium impact of occurrences of 2–7 times a week. In contrast to the study by Suhr and Lahmann (27), who conducted prevalence of UI in home care patients resulting in a high impact on health related QoL of UI occurring more than once per day or permanently, the impact on QoL of nursing home residents experiencing UI more than daily or permanently is medium. The medium impact on QoL of more than daily occurrences of UI corresponds to the impact of medium amount of unintended urine loss. The lower frequency and amount of unintended urine loss in nursing home residents compared to home care patients might result from a possibly higher mobility support in nursing homes since supporting nurses are available more frequently than in temporary home care rounds (28). Moreover, Bliss and colleagues point out that QoL is positively correlated with social engagement which, in return, means that low social engagement may not only reduce QoL but also worsening UI (29). DuBeau and colleagues have shown in their study that even in frail, functionally and cognitively impaired nursing home residents worsening UI decreases QoL (9). Thus, to offer nursing home residents the possibility to engage in social activities and to improve continence care and quality in nursing homes at the same time may also be of high importance in order to maintain or increase health related QoL.

The level of mobility according to the EMS scores in our study indicated that approximately one in four nursing home patients was unable to stand and walk independently. The bivariate analysis of the level of mobility and diagnosis of UI supports the strong associations between mobility and UI reported by others (30-32). Nevertheless, we found that in 2 out of 7 EMS items (partly) immobile patients in need of help by other persons were less urinary incontinent than residents who were able to move independently; e.g. 11.9% of patients in need of help from two or more people when moving from lying to sitting experienced unintended urine loss, while urine leakage was reported to occur by 41.9% patients able to move independently. A possible explanation for these results might be that (partly) immobile patients are necessarily looked after and cared for more frequently than independent residents, including support when going to the toilet. Hence, the opportunity to use walking aids in certain situations, e.g. when going to the toilet, in order to support faster movement could be advantageous even for residents who usually move independently. These findings correspond to the highest UI prevalence of 61.2% in partly immobile patients who did not use any walking aids. As a consequence, patients with impaired mobility who may not use any walking aids might not be able to reach the sanitary installations in time and thus, will be affected by UI more often. The CHAID tree analysis of the relation between EMS items and UI confirms these findings, concluding that the higher the use of wheelchair and walking aids by (partly) immobile patients, the lower the risk for UI.

Findings from this study suggest that interventions to maintain or improve mobility in nursing home patients may alleviate the frequency and severity of UI. Sackley and colleagues carried out an exploratory cluster study and found out that group mobility training to promote urinary continence is feasible for use with nursing home residents resulting in a decrease of urinary leakage in the intervention group from 12 residents out of 17 to 7 out of 16 after the intervention at six weeks (33). Furthermore, these mobility trainings can also be performed by cognitively impaired residents, especially persons with dementia, since several studies have revealed correlations between the occurrence and severity of UI and dementia (32-34). In addition to a recommended subsequent use of walking aids for residents with a reduced mobility status, the chance is, that ongoing research on technical assisted living systems might support the level of mobility for nursing home residents and patients in the near future (35). Kumari and colleagues point out possible transformations of the healthcare system in their recently published review on wearable monitoring technologies by introducing wearable wireless sensors for continuous monitoring of patients for inpatient as well as for outpatient settings (36).

Strengths and Limitations

We analyzed findings from adult patients in 40 nursing homes located throughout Germany. Data were acquired from a wide variety of facilities of varying sizes and community settings. Due to the voluntary participation for institutions, residents and patients a selection bias might be present. In addition, due to the cross-sectional study design no statements about causal relationships can be made. However, the strong association between impaired mobility and UI indicates that if mobility is supported, the risk for UI may be minimized at the same time. We were unable to differentiate urge, stress, or mixed incontinence and to determine the influence of mobility aids on specific types of incontinence. Moreover, the presence of dual (urinary and fecal) incontinence and other associated factors with UI like cognitive impairment and/or dementia were not included in the analysis and may affect results.

Conclusions

We analyzed data in 2044 adults cared for in nursing homes in Germany and found high prevalence rates of UI and impaired mobility. We also found an association between UI and mobility based on EMS scores. Therefore, we recommend interventions to preserve or regaining residents’ mobility in order to minimize UI.

References

1. Jirovec MM. The impact of daily exercise on the mobility, balance and urine control of cognitively impaired nursing home residents. Int J Nurs Stud. 1991;28(2):145-51.
2. Inouye SK, Studenski S, Tinetti ME, Kuchel GA. Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. J Am Geriatr Soc. 2007;55(5):780-91.
3. DuBeau CE, Kuchel GA, Johnson T, 2nd, Palmer MH, Wagg A, Fourth International Consultation on I. Incontinence in the frail elderly: report from the 4th International Consultation on Incontinence. Neurourol Urodyn. 2010;29(1):165-78.
4. Gray M, Giuliano KK. Incontinence-Associated Dermatitis, Characteristics and Relationship to Pressure Injury: A Multisite Epidemiologic Analysis. J Wound Ostomy Continence Nurs. 2018;45(1):63-7.
5. Lahmann N, Dassen T, Tannen A, Kottner J, Schmitz G, Kuntz S, et al. Pflegeprobleme in Deutschland. Ergebnisse von 14 Jahren Forschung in Pflegeheimen und Kliniken 2001-2014. Schwerpunkt: Mobilität. Berlin: Charité - Universitätsmedizin Berlin, Institut für Gesundheits- und Pflegewissenschaft; 2014.
6. Lahmann NA, Tannen A, Kuntz S, Raeder K, Schmitz G, Dassen T, et al. Mobility is the key! Trends and associations of common care problems in German long-term care facilities from 2008 to 2012. Int J Nurs Stud. 2015;52(1):167-74.
7. Coll-Planas L, Denkinger MD, Nikolaus T. Relationship of urinary incontinence and late-life disability: implications for clinical work and research in geriatrics. Z Gerontol Geriatr. 2008;41(4):283-90.
8. Jenkins KR, Fultz NH. Functional impairment as a risk factor for urinary incontinence among older Americans. Neurourol Urodyn. 2005;24(1):51-5.
9. Dubeau CE, Simon SE, Morris JN. The effect of urinary incontinence on quality of life in older nursing home residents. J Am Geriatr Soc. 2006;54(9):1325-33.
10. Silay K, Akinci S, Ulas A, Yalcin A, Silay YS, Akinci MB, et al. Occult urinary incontinence in elderly women and its association with geriatric condition. Eur Rev Med Pharmacol Sci. 2016;20(3):447-51.
11. WHO. International Classification of Functioning, Disability and Health (ICF). Geneva: WHO - World Health Organization; 2016.
12. DNQP. Entwuf: Expertenstandard nach § 113a SGB XI Erhaltung und Förderung der Mobilität in der Pflege Deutsches Netzwerk für Qualitätsentwicklung in der Pflege (DNQP) 2014.
13. Wingenfeld K, Büscher A, Gansweid B. Das neue Begutachtungsassessment zur Feststellung von Pflegebedürftigkeit. Projektbericht. 2008.
14. Kirschner-Hermanns R, Anding R. [Characteristic Features of Urinary Incontinence--Diagnostic Investigation in Geriatric Patients]. Aktuelle Urol. 2016;47(1):60-4.
15. Lahmann NA, Halfens RJ, Dassen T. Pressure ulcers in German nursing homes and acute care hospitals: prevalence, frequency, and ulcer characteristics. Ostomy Wound Manage. 2006;52(2):20-33.
16. Lahmann NA, Dassen T, Poehler A, Kottner J. Pressure ulcer prevalence rates from 2002 to 2008 in German long-term care facilities. Aging Clin Exp Res. 2010;22(2):152-6.
17. Dijkstra A, Buist G, Moorer P, Dassen T. A reliability and utility study of the care dependency scale. Scand J Caring Sci. 2000;14(3):155-61.
18. Dijkstra A, Tiesinga LJ, Plantinga L, Veltman G, Dassen TW. Diagnostic accuracy of the care dependency scale. J Adv Nurs. 2005;50(4):410-6.
19. Lohrmann C, Dijkstra A, Dassen T. Care dependency: testing the German version of the Care Dependency Scale in nursing homes and on geriatric wards. Scand J Caring Sci. 2003;17(1):51-6.
20. Smith R. Validation and Reliability of the Elderly Mobility Scale. Physiotherapy. 1994;80(11):744-7.

21. Blaivas JG, Appell RA, Fantl JA, Leach G, McGuire EJ, Resnick NM, et al. Definition and classification of urinary incontinence: recommendations of the Urodynamic Society. Neurourol Urodyn. 1997;16(3):149-51.
22. Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M, Abrams P. ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. Neurourol Urodyn. 2004;23(4):322-30.
23. Abrams P, Avery K, Gardener N, Donovan J, Board IA. The International Consultation on Incontinence Modular Questionnaire: www.iciq.net. J Urol. 2006;175(3 Pt 1):1063-6; discussion 6.
24. Klovning A, Avery K, Sandvik H, Hunskaar S. Comparison of two questionnaires for assessing the severity of urinary incontinence: The ICIQ-UI SF versus the incontinence severity index. Neurourol Urodyn. 2009;28(5):411-5.
25. Kass GV. An Exploratory Technique for Investigating Large Quantities of Categorical Data. Journal of the Royal Statistical Society Series C (Applied Statistics). 1980;29(2):119-27.
26. Halfens RJ, Meesterberends E, van Nie-Visser NC, Lohrmann C, Schonherr S, Meijers JM, et al. International prevalence measurement of care problems: results. J Adv Nurs. 2013;69(9):e5-17.
27. Suhr R, Lahmann NA. Urinary incontinence in home care: a representative multicenter study on prevalence, severity, impact on quality of life, and risk factors. Aging Clin Exp Res. 2017.
28. Popejoy LL, Galambos C, Stetzer F, Popescu M, Hicks L, Khalilia MA, et al. Comparing Aging in Place to Home Health Care: Impact of Nurse Care Coordination On Utilization and Costs. Nurs Econ. 2015;33(6):306-13.
29. Bliss D, Harms S, Eberly LE, Savik K, Gurvich O, Mueller C, et al. Social Engagement After Nursing Home Admission: Racial and Ethnic Disparities and Risk Factors. J Appl Gerontol. 2017;36(11):1306-26.
30. Roe B, Flanagan L, Maden M. Systematic review of systematic reviews for the management of urinary incontinence and promotion of continence using conservative behavioural approaches in older people in care homes. J Adv Nurs. 2015;71(7):1464-83.
31. Jerez-Roig J, Santos MM, Souza DL, Amaral FL, Lima KC. Prevalence of urinary incontinence and associated factors in nursing home residents. Neurourol Urodyn. 2016;35(1):102-7.
32. Rose A, Thimme A, Halfar C, Nehen HG, Rubben H. Severity of urinary incontinence of nursing home residents correlates with malnutrition, dementia and loss of mobility. Urol Int. 2013;91(2):165-9.
33. Sackley CM, Rodriguez NA, van den Berg M, Badger F, Wright C, Besemer J, et al. A phase II exploratory cluster randomized controlled trial of a group mobility training and staff education intervention to promote urinary continence in UK care homes. Clin Rehabil. 2008;22(8):714-21.
34. Valk M, Moons KG, Cools HJ, Schrijvers AJ. Classifying the probability of urinary incontinence in psychogeriatric nursing home patients. Arch Gerontol Geriatr. 2002;34(1):79-91.
35. Klingelhofer-Noe J, Dassen T, Lahmann NA. [Nursing homes versus assisted living facilities: Outcome quality regarding pressure ulcers, falls and malnutrition]. Z Gerontol Geriatr. 2015;48(3):263-9.
36. Kumari P, Mathew L, Syal P. Increasing trend of wearables and multimodal interface for human activity monitoring: A review. Biosens Bioelectron. 2017;90:298-307.

FIGURES

Fig. 1 Overall impact on QoL, if UI is present (*n* = 1292)

Fig. 2 Multivariate tree diagram of relation between EMS items and UI

TABLES

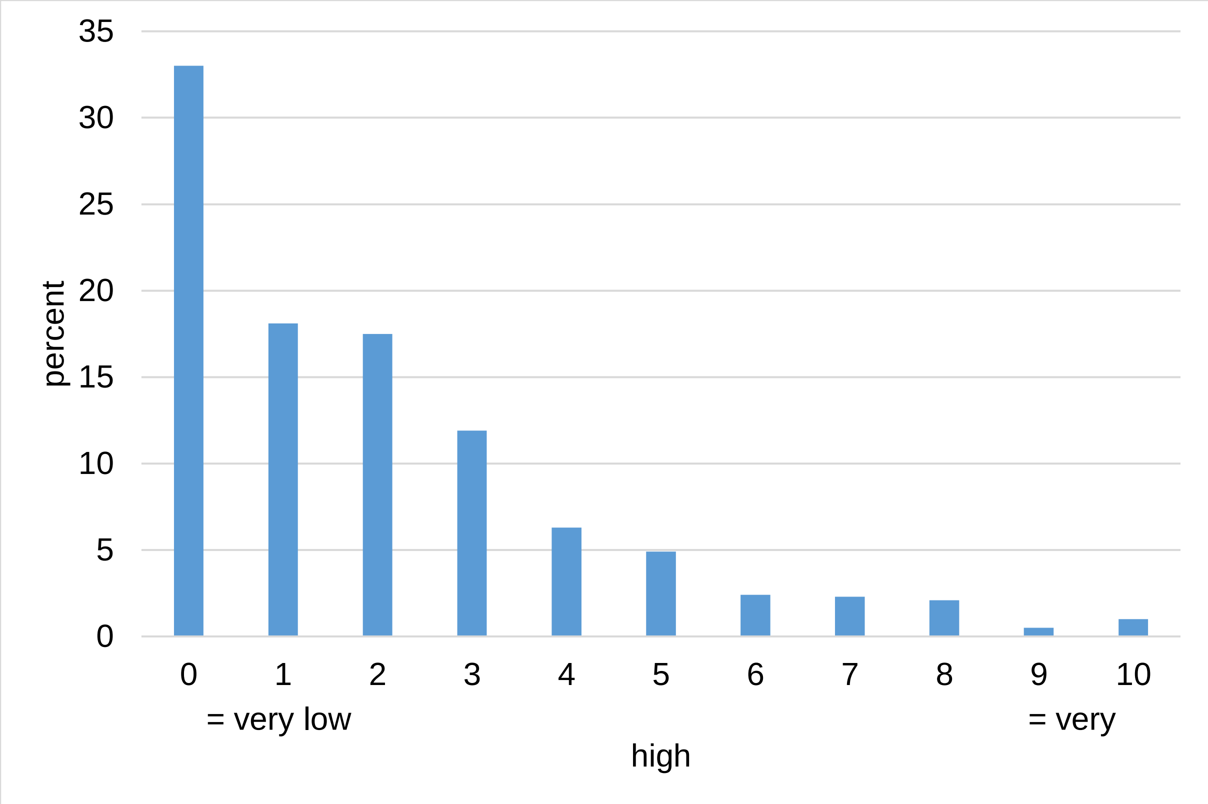

Figure 1. Overall impact on QoL, if UI is present (n=1292)

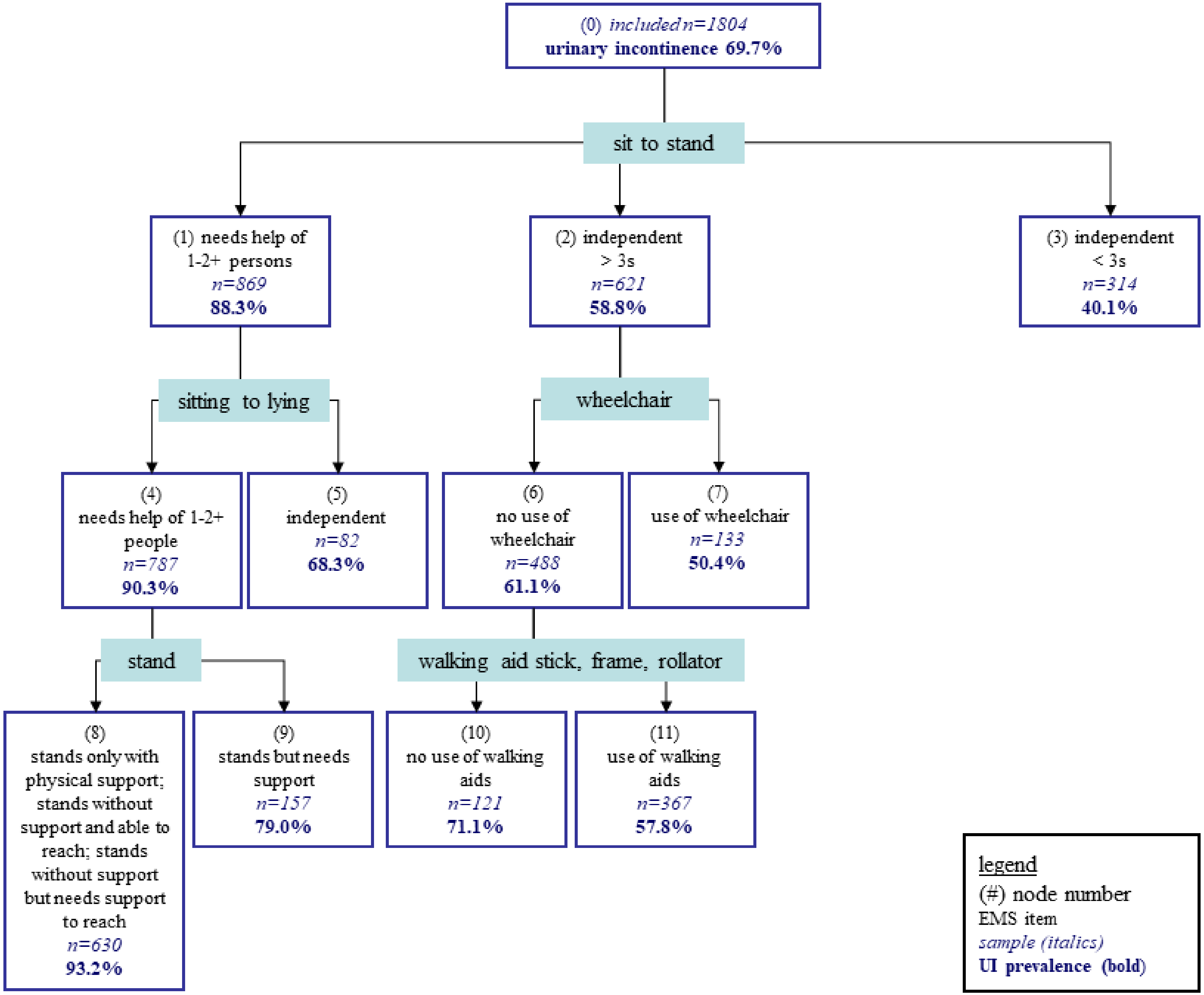

Figure 2. Multivariate tree diagram of relation between EMS items and urinary incontinence

Table 1 Overall impact on QoL of frequency and amount of UI

Overall impact on QoL				
	n	Mean	SD	*p* value (ANOVA)
Frequency				
Never	305	0.0	0.3	<0.001
1x week or less	144	1.0	1.2	
2-3x week	97	1.5	1.2	
1x daily	199	1.4	1.5	
> 1 daily	637	2.2	2.1	
Permanent	359	2.1	2.8	
Amount				
None	293	0.0	0.3	<0.001
Little	559	1.5	1.5	
Medium	572	2.2	2.2	
Large	235	2.4	3.0	

Table 2 Level of mobility according to EMS item response categories

<table>
<tr><th>EMS items</th><th colspan="4">EMS response categories in % (n)</th></tr>
<tr><td rowspan="2">Lying to sitting (n=1916)</td><td colspan="2">0 Needs help of 2+ people</td><td>1 Needs help of 1 person</td><td>2 Independent</td></tr>
<tr><td colspan="2">8.9 (171)</td><td>(37.4 (716)</td><td>53.7 (1029)</td></tr>
<tr><td rowspan="2">Sitting to lying (n=1899)</td><td colspan="2">0 Needs help of 2+ people</td><td>1 Needs help of 1 person</td><td>2 Independent</td></tr>
<tr><td colspan="2">8.5 (161)</td><td>35.7 (678)</td><td>55.8 (1060)</td></tr>
<tr><td rowspan="2">Sit to stand (n=1824)</td><td>0 Needs help of 2+ people</td><td>1 Needs help of 1 person</td><td>2 Independent > 3s</td><td>3 Independent < 3s</td></tr>
<tr><td>10.8 (197)</td><td>31.9 (581)</td><td>38.2 (697)</td><td>19.1 (349)</td></tr>
<tr><td rowspan="2">Stand (n=1783)</td><td>0 Stands only with physical support (help of another person)</td><td>1 Stands but needs support [a]</td><td>2 Stands without support [a] but needs support to reach</td><td>3 Stands without support [a] and able to reach</td></tr>
<tr><td>24.5 (437)</td><td>14.9 (265)</td><td>19.2 (343)</td><td>41.4 (738)</td></tr>
<tr><td rowspan="2">Gait (n=1568)</td><td>0 Needs physical help to walk or constant supervision</td><td>1 Mobile with walking aid but erratic/unsafe turning (needs occasional supervision)</td><td>2 Independent with frame</td><td>3 Independent</td></tr>
<tr><td>25.6 (401)</td><td>32.9 (516)</td><td>16.2 (254)</td><td>25.3 (397)</td></tr>
<tr><td rowspan="2">Timed 6m walk (n=1814)</td><td>0 unable to cover 6m</td><td>1 over 30s</td><td>2 16-30s</td><td>3 under 15s</td></tr>
<tr><td>20.1 (364)</td><td>31.9 (578)</td><td>29.7 (538)</td><td>18.4 (334)</td></tr>
<tr><td rowspan="2">Functional reach (n=1630)</td><td colspan="2">0 under 10cm or unable</td><td>2 10-20cm</td><td>4 over 20cm</td></tr>
<tr><td colspan="2">35.3 (576)</td><td>39.6 (646)</td><td>25.0 (408)</td></tr>
</table>

[a] Support means needs to use upper limbs to steady self.

Table 3 Bivariate association of UI

EMS items		% UI	
		No	**Yes**
Lying to sitting	Needs help of 2+ people	2.0	11.9
	Needs help of 1 person	18.3	46.2
	Independent	79.8	41.9
	n	564	1241
	Chi²	<0,001	
Sitting to lying	Needs help of 2+ people	1.8	11.3
	Needs help of 1 person	16.4	44.8
	Independent	81.8	43.9
	n	560	1230
	Chi²	<0,001	
Sit to stand	Needs help of 2+ people	3.6	13.6
	Needs help of 1 person	13.2	41.3
	Independent > 3s	48.5	33.4
	Independent < 3s	34.7	11.7
	n	559	1163
	Chi²	<0,001	
Stand	Stands only with physical support (help of another person)	7.5	32.8
	Stands but needs support	13.3	16.0
	Stands without support but needs support to reach	20.1	19.5
	Stands without support and able to reach	59.1	31.6
	n	557	1128
	Chi²	<0,001	
Gait	Needs physical help to walk or constant supervision	10.1	34.6
	Mobile with walking aid but erratic/unsafe turning (needs occasional supervision)	36.7	31.2
	Independent with frame	15.6	16.2
	Independent	37.6	17.9
	n	526	967
	Chi²	<0,001	
Timed 6m walk	unable to cover 6m	4.0	26.8
	over 30s	24.9	35.4
	16-30s	38.9	25.8
	under 15s	32.3	12.1
	n	527	1188
	Chi²	<0,001	
Functional reach	under 10cm or unable	17.5	44.4
	10-20cm	47.0	36.5
	over 20cm	35.4	19.2
	n	525	1023
	Chi²	<0,001	
Walking aids (additional items)			
Wheelchair	No use of wheelchair	72.0	49.6
	Use of wheelchair	28.0	50.4
	n	571	1354
	Chi²	<0,001	
Walking aid stick, frame, rollator	No use of walking aids	40.6	61.2
	Use of walking aids	59.4	38.8
	n	525	1023
	Chi²	<0,001	