

AperTO - Archivio Istituzionale Open Access dell'Università di Torino

The association of indwelling urinary catheter with delirium in hospitalized patients and nursing home residents: an explorative analysis from the “Delirium Day 2015”

This is the author's manuscript

Original Citation:

Availability:

This version is available <http://hdl.handle.net/2318/1669581> since 2018-10-16T08:30:26Z

Published version:

DOI:10.1007/s40520-018-0974-1

Terms of use:

Open Access

Anyone can freely access the full text of works made available as "Open Access". Works made available under a Creative Commons license can be used according to the terms and conditions of said license. Use of all other works requires consent of the right holder (author or publisher) if not exempted from copyright protection by the applicable law.

(Article begins on next page)

The association of indwelling urinary catheter with delirium in hospitalized patients and nursing home residents: an explorative analysis from the “Delirium Day 2015”

Mario Bo, Paola Porrino, Simona G. Di Santo, Andrea Mazzone, Antonio Cherubini, Enrico Mossello, Angelo Bianchetti, Massimo Musicco, Alberto Ferrari, Nicola Ferrara, Claudia Filippini, Marco Trabucchi, Alessandro Morandi, Giuseppe Bellelli, on behalf of the Italian Study Group on Delirium (ISGoD)

Abstract

Background

Use of indwelling urinary catheter (IUC) in older adults has negative consequences, including delirium.

Aim

This analysis, from the “Delirium Day 2015”, a nationwide multicenter prevalence study, aim to evaluate the association of IUC with delirium in hospitalized and Nursing Homes (NHs) patients.

Methods

Patients underwent a comprehensive geriatric assessment, including the presence of IUC; inclusion criteria were age > 65 years, being Italian speaker and providing informed consent; exclusion criteria were coma, aphasia, end-of-life status. Delirium was assessed using the 4AT test (score ≥ 4 : possible delirium; scores 1–3: possible cognitive impairment).

Results

Among 1867 hospitalized patients (mean age 82.0 ± 7.5 years, 58% female), 539 (28.9%) had IUC, 429 (22.9%) delirium and 675 (36.1%) cognitive impairment. IUC was significantly associated with cognitive impairment (OR 1.60, 95% CI 1.19–2.16) and delirium (2.45, 95% CI 1.73–3.47), this latter being significant also in the subset of patients without dementia (OR 2.28, 95% CI 1.52–3.43). Inattention and impaired alertness were also independently associated with IUC. Among 1454 NHs residents (mean age 84.4 ± 7.4 years, 70.% female), 63 (4.3%) had IUC, 535 (36.8%) a 4AT score ≥ 4 , and 653 (44.9%) a 4AT score 1–3. The multivariate logistic regression analysis did not show a significant association between 4AT test or its specific items with IUC, neither in the subset of patients without dementia.

Discussion

We confirmed a significant association between IUC and delirium in hospitalized patients but not in NHs residents.

Conclusion

Environmental and clinical factors of acute setting might contribute to IUC-associated delirium occurrence.

Introduction

The indwelling urinary catheter (IUC) has a wide, and sometimes inappropriate, use among older patients, especially in the acute setting [1, 2, 3, 4, 5]. In European hospitals, prevalence of IUC is reported to be 17.5%, with even higher prevalence (24.6%) in geriatric setting [1, 2, 3] while prevalence in United States (US) hospital is 23.6% [4]. A wide cross-sectional study among US acute wards shows that approximately 30–40% of IUC are placed without an appropriate indication [5].

The indwelling urinary catheter has several well-known negative effects: up to 67% of urinary tract infection in all hospital patients are catheter associated and IUC use can result in increased risk of sepsis, mortality, longer hospital stay and higher care cost [6, 7].

Delirium itself can lead to negative outcomes, such as poor quality of life, longer length of hospital stay, increased mortality, long-term cognitive and functional impairment, institutional placement, distress for family members and national health expenditure [8, 9, 10, 11].

Several studies, conducted mainly in small and selected cohorts of hospitalized patients, suggest an association between IUC and delirium (Table 1) [12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27].

Table 1 Studies examining association between delirium and indwelling urinary catheter (IUC)

Author (year)	N	Age	Setting	Delirium assessment	Association IUC—delirium
Solà-Miravete (2017) [12]	454	65+	Hospital wards	CAM	OR 3.90 (95% CI 1.85–8.62)
Tomlinson (2016) [13]	482	65+	Int. Med	Discharge summary	OR 2.00 (95% CI 1.27–3.15)
Linpawattana (2016) [14]	99	65+	ICU	CAM-ICU	OR 2.03 (95% CI 0.49–8.39)
Pendlebury (2015) [15]	503	65+	Int. Med	CAM/ DSM4	OR 5.50 (95% CI 2.27–13.34)
Noriega (2015) [16]	203	75+	Cardiology	CAM	$p = 0.004$ (univariate analysis)
De Castro (2014) [17]	209	60+	Surgery	DSM4	OR 3.7 (95% CI 1.1–11.4)
Diez-Manglano (2013) [18]	744	–	Int. Med	Database	OR 2.00 (1.19–3.68)

Author (year)	N	Age	Setting	Delirium assessment	Association IUC—delirium
Liv (2013) [19]	331	65+	Orthogeriatrics	RAI-AC	$p < 0.000$ (univariate analysis)
Gutiérrez-Rodríguez (2013) [32]	505	65+	NHs	CAM	OR 5.33 (1.46–19.49)
Martinez et al. (2012) [20]	397	18+	Int. Med	CAM	No association (univariate analysis)
Van Rompaey (2009) [21]	523	18+	ICU	Neecham Conf. Scale	OR 5.37 (2.09–13.8)
McAlpine (2008) [22]	103	60+	Gynecology	CAM	No association
Inouye (2007) [23]	952	70+	Int. Med	CAM	Yes (univariate analysis)
Ranhoff (2006) [24]	401	60+	SICU	CAM	OR 2.7 (1.4–4.9)
Inouye (2003) [25]	422	70+	Int. Med	CAM	Lower occurrence of delirium associated to reduction of IUC
Inouye (1999) [26]	852	70+	Int. Med	CAM	Lower occurrence of delirium associated to reduction of IUC
Inouye and Charpentier (1996) [27]	508	70+	Int. Med	CAM	RR 2.4 (1.2–4.7)

CAM confusion assessment method, *Int. Med* Internal Medicine, *ICU* intensive care unit, *CAM-ICU* Confusion Assessment Method-intensive care unit, *DSM4* diagnostic and statistical manual of mental disorders 4, *RAI-AC* resident assessment instrument for acute care, *NHs* nursing homes, *Neecham Conf. Scale* Neelon and Champagne confusion scale, *SICU* subintensive care unit, *OR* odd-ratio, *RR* relative risk

The Italian “Delirium Day 2015”, a nationwide multicenter study to assess the point-prevalence of delirium over a single-day across various settings of care, showed that 22.9% of hospitalized patients had delirium, which was significantly associated with IUC use among several other variables (age, functional dependence, dementia, malnutrition, use of antipsychotics, feeding tubes, peripheral venous catheters, physical restraints and admission to Neurology wards) [28].

Use of IUC in nursing homes (NHs) is reported to be lower than in hospital setting: a large-scale prospective project show that prevalence in 568 US community-based NHs is 4.9% [29], while in Germany ranges between 5 and 15% [30]. IUC may also cause discomfort and mobility impairment [31], thereby increasing the risk of delirium occurrence, mainly in vulnerable patients [27]. However, the association of IUC with delirium was rarely investigated in NHs settings (Table 1) [32].

The present study, an explorative analysis from the “Delirium Day 2015”, has three goals: (1) to compare the prevalence of IUC use among two cohorts of hospitalized and NHs patients; (2) to provide a more in-depth evaluation of the demonstrated association between IUC and delirium in patients admitted to acute and rehabilitation hospital wards [28], (3) to evaluate, among NHs residents, whether the use of IUC is associated with the 4AT test (a screening instrument for cognitive impairment and delirium) total score or specific 4AT items.

Methods

Methods of the present study, which was a predefined objective of the “Delirium Day 2015”, have been extensively described in details elsewhere [28].

Briefly, this study was conducted on a single day (September 30th, 2015), among acute and rehabilitation hospital wards and NHs that agreed to participate. All patients admitted to the participating centers were considered potentially eligible if they were aged 65 years and older, were native Italian speakers, and if they or a proxy provided a written informed consent. Exclusion criteria were coma, aphasia and end-of-life status, as defined by clinical judgment. Informed consent was obtained from all participants or from their proxy when the participants had delirium or severe cognitive impairment. Patients underwent a standardized comprehensive geriatric assessment including functional status (ADL, Activities of Daily Living score) [33], nutritional and health status, presence of dementia, medications, use of IUC, feeding tubes, peripheral venous catheters and physical restraints [28].

The 4AT test was used to detect delirium and cognitive impairment in all participants. The 4AT is a brief and rapid tool (not requiring specific training), which has been validated for delirium screening in hospitalized older patients, showing a sensitivity of 89.7% and a specificity of 84.1% [34]. It comprises four items: item 1 assesses level of alertness; item 2 and 3 are brief cognitive screening tests (the Abbreviated Mental Test—4 and attention testing with Months Backwards); item 4 assesses acute change or fluctuation in mental status. A score of 0 suggests neither delirium nor cognitive impairment, scores between 1 and 3 suggest possible cognitive impairment (that is, corresponding to moderate to severe impairment on standard dementia screening tools), while a score of 4 or above suggests the presence of delirium and/or delirium superimposed on dementia [34].

In the present study, we explored the association of IUC with global 4AT scores (0, 1–3, and ≥ 4) and 4AT items suggesting delirium among hospitalized patients and NH residents.

The Ethical Committee of the IRCCS Fondazione Santa Lucia, Rome (Prot CE/PROG.500) approved the study protocol.

The descriptive analysis for quantitative variables was based on calculation of the mean and standard deviation (SD) while qualitative variables were reported as frequencies and percentages. Univariate analyses were performed using the Wilcoxon Mann–Whitney test for continuous variables; categorical variables were analysed by the Chi-square or Fisher's exact test as appropriate. Multivariable logistic regression analyses were used to identify variables independently associated with IUC, including 4AT scores and 4AT items. All statistical tests were two-sided. *P* values of 0.05 or less were considered statistically significant. The analysis were conducted using the SAS (SAS Institute, Cary, NC) software package, ver.9.3 for Windows.

Results

Data were collected from 120 acute hospital wards and 71 NHs. Demographic and clinical characteristics of the two cohorts studied according to the presence of IUC are reported in Table 2. Among 1867 hospitalized patients (mean age 82.0 ± 7.5 years, 58% females), IUC was present in 539 patients (28.9%), while delirium and cognitive impairment were detected in 429 patients (22.9%) and in 675 patients (36.1%), respectively. Among 1454 NHs participants who were eligible for the study (mean age 84.4 ± 7.4 years, 70% female), IUC was present in 63 patients (4.3%), while a 4AT score ≥ 4 was detected in 535 patients (36.8%) and a 4AT score ranging from 1 to 3 in 653 patients (44.9%).

Table 2 Demographic and clinical characteristics of patients in acute and rehabilitation hospital wards and in nursing homes according to the presence of indwelling urinary catheter (IUC)

	Acute and rehabilitation hospital wards			Nursing homes		
	IUC (<i>n</i> = 539, 28.9%)	No IUC (<i>n</i> = 1328, 71.1%)	<i>P</i> value	IUC (<i>n</i> = 64, 4.3%)	No IUC (<i>n</i> = 1391, 95.7%)	<i>P</i> value
Age, mean (SD)	83.57 (7.2)	81.33 (7.6)	< 0.001	86.35 (7.8)	84.31 (7.5)	0.015
Female sex, <i>n</i> (%)	311 (57.7)	771 (58.1)	0.887	28 (44.4)	989 (71.1)	< 0.001
Education, mean (SD)	6.30 (3.8)	6.81 (3.8)	< 0.001	5.45 (3.9)	5.82 (4.0)	0.206
ADL (functions lost), mean (SD)	3.35 (2.4)	2.10 (2.3)	< 0.001	4.83 (1.5)	4.11 (1.9)	0.003
Dementia, <i>n</i> (%)	163 (30.2)	286 (21.5)	< 0.001	34 (54.0)	709 (51.0)	0.646
Malnutrition, <i>n</i> (%)	50 (9.3)	83 (6.3)	0.021	9 (14.3)	62 (4.5)	< 0.001
No. of medications, mean (SD)	5.21 (2.2)	5.04 (2.1)	0.106	5.57 (2.0)	5.37 (2.2)	0.370
Antihypertensive drugs, <i>n</i> (%) ^a	323 (60.0)	854 (64.5)	0.073	38 (60.3)	733 (53.4)	0.278
Statin/lipid lowering drugs, <i>n</i> (%)	58 (10.8)	284 (21.4)	< 0.001	8 (12.7)	240 (17.3)	0.346
Antiarrhythmic drugs, <i>n</i> (%)	65 (12.1)	147 (11.1)	0.541	9 (14.3)	101 (7.3)	0.039
Antibiotics, <i>n</i> (%)	277 (51.4)	342 (25.7)	< 0.001	7 (11.1)	33 (2.4)	0.001
Benzodiazepines, <i>n</i> (%)	125 (23.2)	328 (24.7)	0.491	22 (34.9)	501 (36.0)	0.856
Antipsychotics, <i>n</i> (%) ^a	96 (17.8)	167 (12.6)	0.003	27 (42.9)	553 (40.3)	0.680
Antidepressants, <i>n</i> (%) ^a	102 (19.0)	285 (21.5)	0.219	20 (31.8)	489 (35.6)	0.533
AChEInhibitors/memanti ne, <i>n</i> (%)	11 (2.0)	28 (2.1)	0.926	1 (1.6)	43 (3.1)	0.495

	Acute and rehabilitation hospital wards			Nursing homes		
	IUC (<i>n</i> = 539, 28.9%)	No IUC (<i>n</i> = 1328, 71.1%)	<i>P</i> value	IUC (<i>n</i> = 64, 4.3%)	No IUC (<i>n</i> = 1391, 95.7%)	<i>P</i> value
Laxatives, <i>n</i> (%)	102 (18.9)	298 (22.4)	0.093	24 (38.1)	586 (42.2)	0.523
Feeding tubes, <i>n</i> (%) ^a	26 (4.8)	14 (1.1)	< 0.001	3 (4.8)	8 (0.6)	< 0.001
Peripheral venous catheters, <i>n</i> (%)	335 (62.2)	513 (38.6)	< 0.001	6 (9.5)	13 (0.9)	< 0.001
Physical restraints, <i>n</i> (%) ^a	22 (4.1)	39 (2.9)	0.208	16 (25.4)	172 (12.5)	0.003
4AT score, <i>n</i> (%)			< 0.001			0.004
0	138 (25.6)	625 (47.1)		11 (17.5)	255 (18.3)	
1–3	202 (37.5)	473 (35.6)		17 (27.0)	636 (45.8)	
≥ 4	199 (36.9)	230 (17.3)		35 (55.6)	500 (36.0)	
Item attention (score), <i>n</i> (%)			< 0.001			0.109
0	209 (38.8)	792 (59.6)		17 (27.0)	399 (28.7)	
1	236 (43.8)	425 (32.0)		23 (36.5)	644 (46.3)	
2	94 (17.4)	111 (8.4)		23 (36.5)	348 (25.0)	
Item acute change/fluctuating course (score), <i>n</i> (%)			< 0.001			0.042
0	378 (70.1)	1146 (86.3)		44 (69.8)	1118 (80.4)	
4	161 (29.9)	182 (13.7)		19 (30.2)	273 (19.6)	

Item alertness (score), <i>n</i> (%)	< 0.001				0.002
0	443 (82.2)	1263 (95.1)	44 (69.8)	1179 (84.8)	
4	96 (17.8)	65 (4.9)	19 (30.2)	212 (15.3)	

The 4A Test: screening instrument for cognitive impairment and delirium; 4AT score 4 or above: possible delirium ± cognitive impairment; 4AT score 1–3: possible cognitive impairment; 4AT score 0: delirium or cognitive impairment unlikely. Item attention, months of the year backwards: achieves 7 months or more correctly, 0; starts but scores < 7 months / refuses to start, 1; untestable (cannot start because unwell, drowsy, inattentive), 2. Item acute change of fluctuating course: No, 0; Yes, 4. Item alertness: normal, 0; mild sleepiness for < 10 s after waking, then normal, 0; clearly abnormal, 4

IUC indwelling urinary catheters, *ADL* activities of Daily Living Score, *AChE-I* Acetylcholinesterase inhibitors, *SD* standard deviation

^aNumber and percentage refer to data with missing values

In the hospital wards, prevalence of delirium and cognitive impairment was higher among patients with IUC (36.9 and 37.5%, respectively) than in those without (17.3% and 35.6%, respectively) ($p < 0.001$) (Table 2). Moreover, disturbance in attention, alertness and acute change or fluctuating course, which are delirium-specific items included in 4AT test, were more prevalent in catheterized patients ($p < 0.001$) (Table 2). After multivariate logistic regression analysis both delirium (OR 2.45, 95% CI 1.73–3.47) and cognitive impairment (OR 1.60, 95% CI 1.19–2.16) remained significantly associated with presence of IUC. In another multivariate logistic regression analysis, being unchanged other covariates, disturbance in attention (score 1 vs 0) (OR 1.39, 95% CI 1.05–1.83) and alertness (OR 2.48, 95% CI 1.55–3.98) were independently associated with presence of IUC. After excluding patients with known dementia, leaving a sample of 1418 patients (75.9%), delirium was still significantly associated with IUC (OR 2.28, 95% CI 1.52–3.43), as well as the disorders of attention (score 1 vs 0) (OR 1.40, 95% CI 1.02–1.91) and impaired alertness (OR 2.94, 95% CI 1.35–6.41).

Among NHs residents, those with IUC were older, more frequently males, more impaired in activities of daily living and more malnourished than those without (Table 2). Additionally, they were more likely to be prescribed antiarrhythmic and antibiotic drugs, to be fed with nasogastric or percutaneous gastrostomy tubes, to be physically restrained and to have a peripheral venous catheters than their counterpart was (Table 2). A 4AT score ≥ 4 was more prevalent in those with IUC (55.6%) than in those without (36.0%), while a 4AT score 1–3 was more prevalent in patients without IUC (45.8%) than in those with IUC (27.0%) ($p = 0.004$) (Table 2); use of IUC was associated with two 4AT specific items (impaired alertness and acute change/fluctuating course; $p = 0.002$ and $p = 0.042$, respectively) (Table 2).

After multivariate logistic regression analysis, neither 4AT scores nor 4AT items remained significantly associated with presence of IUC. Results did not change in the subset of patients without history of known dementia.

Discussion

The present study aim to compare the prevalence of IUC use among two cohorts of hospitalized and NHs patients, to provide an in-depth evaluation of the association between use of IUC and delirium among hospitalized patients and to evaluate whether the use of IUC is associated with global 4AT score and delirium specific items among NHs residents. The latter is a topic rarely investigated in literature [32].

Our findings are in keeping with previous studies, which showed a higher prevalence of patients with IUC among those admitted to acute hospital wards than in NHs residents. In a multicentre study involving 14,252 older patients from 28 medical and surgical wards in Dutch hospitals, 21.2% had an IUC in place on the day of the survey [2]. The second National Survey of the Prevalence of Hospital Acquired Infection (HAI) in Scotland, identified 24.6% of patients with IUC within geriatric settings and 15.5% in Internal Medicine [3]. Prevalence studies reported a IUC prevalence of 17.5% in 66 European hospitals [1] and 23.6% in 183 US acute care hospitals [4].

Use of IUC in NHs is reported to be lower than in hospital setting: a recent large-scale prospective project showed a prevalence of IUC in US NHs of 4.9% [29]; in Germany ranged between 5 and 15% [30], while a questionnaire survey in United Kingdom (UK) nursing homes showed that 9% of residents had IUC [35].

The higher prevalence of IUC use observed in our cohort of hospitalized patients compared with previous studies might be accounted for either by greater severity of diseases across different settings of care or by poor widespread dissemination among hospital physicians of current recommendations about IUC use in older in-patients. On the contrary, the lower prevalence of IUC use among NHs residents suggests a wise use of urinary catheters in this setting, although participating centers should not be considered representative of the whole national NHs scenario.

Findings of this study also confirm that, in hospitalized patients, IUC use is significantly associated with delirium as well with impaired attention and alertness, suggestive items of delirium. Importantly, these associations remained statistically significant in the subset of patients without known history of dementia. Our findings are in keeping with, and add on to, previous studies, mainly conducted in smaller cohorts of patients and in selected settings (Table 1) [12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27]. It is demonstrated that a multicomponent intervention including wise use of IUC has the potential to reduce the risk of developing incident delirium in hospitalized older medical

patients [25, 26, 27]. Both the National Institute for Health and clinical Excellence (NICE) guidelines for the diagnosis, prevention and management of delirium [36] and the Hospital Elder Life Program (HELP) protocol [37], a strategy to prevent delirium and functional decline in hospitalized older patients, recommend to avoid unnecessary catheterization and to remove it as soon as possible.

Among NHs residents, who have lower prevalence of IUC than that observed among hospitalized patients (4.3 vs 28.9%), we do not find significant association of IUC neither with 4AT scores suggestive of delirium and cognitive impairment nor with 4AT items. Although the lack of a significant association might be, at least in part, explained by a lack of power due to the limited number of NHs residents with IUC, findings from the Delirium Day suggest that the increased individual vulnerability in the acute clinical context in which IUC is placed or used, beyond its potential contribution to urinary infections [38] and limited mobility [39], might be crucial for delirium occurrence.

Therefore, IUC placement should be regarded as one of the several hospital-associated potentially correctable factors that may have deleterious effect on delirium occurrence in older patients in the context of acute hospitalization.

Strengths of the present study are the large sample size, the inclusion of nearly 200 healthcare facilities and the use of a simple validated tool for delirium and cognitive assessment. Furthermore, we used a comprehensive geriatric evaluation. We used several different analytical approaches to detect a potential association of IUC with delirium among NHs residents, but results were consistent in suggesting no significant association in this setting. The main limitation of the present study is that the 4AT test has been validated for detecting delirium among older hospitalized patients but not among NHs residents. However, validated methods to detect delirium in these settings are lacking [40]. Moreover, a caveat regarding the 4AT score is that severe chronic cognitive impairment might also yield a score of 4, which usually suggests delirium but is not diagnostic: more detailed assessment of mental status may be required to reach a diagnosis; in the validation study, among 234 hospitalized older patients, the 4AT cut off ≥ 4 showed a sensitivity of 89.7% and a specificity of 84.1% in the whole cohort, a sensitivity of 83.3% and a specificity of 91.3% in the subgroup without dementia, a sensitivity of 94.1% and a specificity of 64.9% in the subgroup with dementia [34]; although we analyzed separately items associated with delirium (alertness, attention and acute change/fluctuating course) we cannot definitely exclude that some cases of delirium were superimposed on dementia.

As a minor potential limitation, we did not collect data regarding the reasons of IUC positioning, if appropriated or not and how long did catheter remain in place. Moreover, data about possible confounders, such as main diagnoses, severity of disease i.e. physiological derangement as measured with the Acute Physiology Score, hemodynamic disturbances, are not available for the “Delirium Day 2015”, but have been collected in the more recent editions of “Delirium Day”.

In conclusion, present findings demonstrate lower prevalence of IUC use among NHs residents than in hospitalized patients, and reinforce the association between use of IUC and delirium in hospitalized patients. On the contrary, IUC use among NHs residents was not associated with neither 4AT global scores, potentially reflecting delirium and cognitive impairment, nor with its specific items. These data provide evidence of wise and safe use of IUC among NHs residents, and suggest that the “acute clinical context” in which IUC is placed or used might be crucial for delirium occurrence.

Acknowledgements

The corresponding author affirm that she has listed everyone who contributed significantly to the work. The authors gratefully acknowledge the contributions of Dr. Agosta Luca and Bottignole Giuliana (Section of Geriatrics, Città della Salute e della Scienza—Molinette, Torino, Italy) for the support in the statistical analyses and the preparation of manuscript. List of the ISGoD (Italian Study Group on Delirium) members, who contributed to the design of the study and of the researchers participating in the study for the collection of data:

ISGoD members: Stefano Boffelli, Fabio Di Stefano, Francesco De Filippi, Fabio Guerini, Erik Bertoletti, Albert March, Alessandro Margiotta, Patrizia Mecocci, Carmelinda Ruggiero, Desirèe Addesi, Fausto Fantò, Gianluca Isaia, Babette Dijk, Paola Porrino, Antonino Maria Cotroneo, Giovanni Galli, Amalia Cecilia Bruni, Bruno Bernardini, Carla Corsini, Annachiara Cagnin, Amedeo Zurlo, Giuseppe Barbagallo, Maria Lia Lunardelli, Emilio Martini, Giuseppe Battaglia, Raffaele Latella, Donatella Petritola, Elena Sinforiani, Alberto Cester, Marino Formilan, Pasqualina Carbone, Ildebrando Appollonio, Diletta Cereda, Lucio Tremolizzo, Edo Bottacchi, Lucio Lucchetti, Claudio Mariani, Piero Rapazzini, Giuseppe Romanelli, Alessandra Marengoni, Giovanni Zuliani, Lara Bianchi, Teresa Suardi, Ettore Muti, Renato Bottura, Giovanni Sgrò, Antonella Mandas, Luca Serchisu, Patrizia Crippa, Claudio Ivaldi, Andrea Ungar, Daniele Villani, Clara Raimondi, Chiara Mussi, Giancarlo Isaia, Giuseppe Provenzano, Daniela Mari, Patrizio Odetti, Fiammetta Monacelli, Raffaele Antonelli Incalzi, Alice Pluderi, Claudio Bellamoli, Luciano Terranova, Elio Scarpini, Ferdinando D’Amico, Maria Chiara Cavallini, Gianbattista Guerrini, Anna Maria Scotuzzi, Antonino Chiarello, Alberto Pilotto, Sara Tognini, Giuseppina Dell’Aquila, Gabriele Toigo, Giuliano Ceschia, Maristella Piccinini, Andrea Fabbo, Marco Zoli, Paola Forti, Christian Wenter, Giorgio Basile, Anna Lasagni, Alessandro Padovani, Luca Rozzini, Maria Cottino, Silvia Vitali, Gabriele Tripi, Stefano Avanzi, Simona Umidi, Daniela Moretti, Giovanni Ruotolo, Federica Boschi, Paolo Bonino, Niccolò Marchionni, Maria C. Cavallini, Sara Fascendini, Gabriele Noro, Renato Turco, Maria C. Ubezio, Carlo Serrati, Maria Infante, Simona Gentile, Luigi M. Pernigotti, Carlo A. Biagini, Enzo Canonico, Pietro Bonati, Pietro Gareri, Paolo Caffarra, Alberto Castagna, Arcangelo Ceretti, Rosanna Castiglia, Carlo Gabelli, Mario Lo Storto, Paolo Putzu, Giuseppe Bellelli, Alessandro Morandi, Simona Di Santo, Andrea Mazzone, Renzo Rozzini, Ermellina Zanetti, Angelo Bianchetti, Mario Bo, Enrico Mossello, Antonio Cherubini, Nicola Ferrara, Alberto Ferrari, Massimo Musicco, Marco Trabucchi.

List of the researchers participating in the study: Alba Malara, Centro di Riabilitazione Estensiva e RSA San Domenico, Lamezia Terme (CZ); Fausto Spadea, RSA Casa Amica Fossato Serralta (CZ); Serena Di Cello, RSA Villa Elisabetta, Cortale (CZ); Francesco Ceravolo, Casa Protetta San Domenico, Palermiti (CZ); Francesco Fabiano, Casa Prot. Madonna del Rosario Lamezia Terme (CZ); Vincenzo Rispoli, RSA Santa Maria del Monte, San Sostene (CZ); Giuseppe Chiaradia, Casa

Protetta San Pio, Corigliano Calabro (CS); Amedeo Gabriele, RSA La Quietè, Castiglione Cosentino (CS); Vincenzo Settembrini, Casa Protetta “Villa Azzurra”, Roseto Capo Spulico (CS); Domenico Capomolla, Casa Protetta Villa delle Rose, Vibo Valentia; Antonella Citrino, RSA Ippolito Dodaro, Falerna (CZ); Antonietta Scriva, Casa Protetta Universo, Africo (RC); Irene Bruno, RSA Villa Serena, Bologna; Roberto Secchi, RSA Villa Sorriso, Marano sul Panaro (Mo); Eugenio De Martino, RSA Villa Ranuzzi Bologna; Roberto Muccinelli, RSA Villa Salus, Viserbella (RN); RSA Villa del Sole, Castiglione dei Pepoli (Bo); Gerardo Lupi, RSA I Platani, Bologna; Patrizio Paonessa, Istituto Sant’Anna, Bologna; Andrea Fabbri RSA Residenza Paradiso, Ferrara; Maria Teresa Passuti, RSA Il Pellicano, Bazzano (Bo); Sofia Castellari, RSA Villa Armonia, Imola (Bo); Andrea Po, RSA Villa Estense, Maranello (Mo); Guido Gaggioli, Senior Hotel Arcadia, Casalecchio di Reno (Bo); Massimo Varesi, La Collina, Nibbiano (Pc); Paolo Moneti, RSA Villa Gisella Firenze; Sebastiano Capurso, RSA Bellosguardo Civitavecchia (Ro); Vincenzo Latini, RSA Santa Rufina Rieti; Stefano Ghidotti, RSA Corviale Roma; Francesco Riccardelli; RSA Salus Roma; Maurizio Macchi, Piccola Casa della Divina Provvidenza - Cottolengo Nucleo Alzheimer Beato Paleari, Torino; Stefano Boffelli, Angela Cassinadri, Fondazione Poliambulanza, Brescia; Gabriele Tonini, Laura Andreani, Mirco Coralli, Azienda USL di Bologna; Antonio Balotta, Roberto Cancelliere Ospedale Infermi Rimini; Mara Strazzacapa, Pierangela Cavallino Centro di Recupero e Rieducazione Funzionale “Mons. Luigi Novarese”—Moncrivello (VC); Stefano Fabio, ASL Verbanò Cusio Ossola; Francesco De Filippi, Chiara Giudice, Patrizia Floris AO della Valtellina e della Valchiavenna/Presidio di Sondrio; Cosimo Dentizzi, Katia D’Elia RSA Larino; Margherita Azzini, Marco Cazzadori, Claudia Benati, Chiara Tobaldini, Angela Antonioli Azienda ULSS 20 Verona; Fabio Guerini, Casa di Cura “San Clemente”, Mantova; Paolo Mombelloni, Fulvio Fontanini, RSA Residenza S. Marta Genova; Martina Oliverio, Luciano Luca Del Grosso, Casa di Cura Malacarne, Ferrara; Cristina Giavedoni, Giuliano Bidoli, IPAB Residenza per Anziani “G. Francescon” Portogruaro; Bruno Mazzei, Andrea Corsonello, Sergio Fusco, Silvio Vena, Tommaso De Vuono, Giorgio Maiuri INRCA, Presidio Ospedaliero di Cosenza; Eugenio Castegnaro, Salvatore De Rosa; Rossella Bazzano Sechi, Ospedale Sant’Antonio, Padova; Enrico Benvenuti, Ilaria Del Lungo, Sante Giardini, Chiara Giulietti, Ospedale Santa Maria Annunziata, Firenze; Erik Bertoletti, Ospedale Santa Viola, Bologna; Ferdinando D’Amico, Francesco Caronzolo, Alessandro Grippa, Giuseppina Lombardo, Tiziana Pipicella, presidio ospedaliero Patti, AO Provinciale Messina; Albert March, Maria Teresa Nitti, Alessandro Felici, Silvia Pavan, Fabrizio Piazzani, Alessandra Lunelli, Ospedale Centrale di Bolzano; Sergio Dimori, Fondazione Angelo Poretti e Angelo Magnani Onlus Vedano Olona (VA); Alessandro Margotta, Tiziano Soglia, USL Ravenna; Demetrio Postacchini, Roberto Brunelli, Silvia Santini, Monia Francavilla, Ilenia Macchiati, Francesca Sorvillo, Cinzia Giuli, INRCA POR Fermo; Patrizia Mecocci, Ospedale S. Maria della Misericordia di Perugia; Francesco Perticone, Desireè Addesi, Paola Cerra Rosa, Giuseppe Bencardino, Tania Falbo, Nadia Grillo, Policlinico Universitario “Mater Domini” Catanzaro; Fausto Fantò, Gianluca Isaia, Stella Pezzilli, Daniele Bergamo, Elisabetta Furno, SokolRrodhe, AOU S Luigi Gonzaga, Orbassano (To); Simonetta Lucarini, Babette Dijik, Francesca Dall’Acqua, Francesco Cappelletto, RSA Chiavari (Ge); Donatella Calvani, Dimitri Becheri, Lucia Gambardella, Carlo Valente, Nuovo Ospedale Santo Stefano, Azienda ASL-4 Prato; Mario Bo, Paola Porrino, Giacomo Ceci, AO Molinette, Torino; Evaristo Ettore, Policlinico Umberto Primo, Roma; Renzo Rozzini, Sara Tironi, Fondazione Poliambulanza, Brescia; Maria Grazia Grassi, Elio Troisi, IRCCS Fondazione Santa Lucia, Roma; Anna Gabutto, RSA Pio Lascito Nino Baglietto, Cogoleto (Ge); Loredana Quazzo, Annalisa Rosatello, Casa di riposo Villa Sampo Cortemilia (CN); Domenico Suraci, P.O. di Locri ASP Reggio Calabria (RC); Benedetta Tagliabue, Chiara Perrone, Lucia Ferrara, Alberto Castagna, Maria Luisa Tremolada, istituti Clinici Zucchi, Carate Brianza (MB); Simonetta Piano, Casa di riposo Orfanelle Chieri (To); Gaetano Serviddio, Aurelio Lo Buglio, Tiziana Gurrera, Valeria Merlo, Carla Rovai, AOU Ospedali Riuniti di Foggia; Antonino Maria Cotroneo, Rosaria Carlucci, Anna Abbaldo, Ospedale Birago di Vische ASL To2, Torino; Fabio Monzani, Ahmad Amedeo Qasem, Giacomo Bini, Silvia Tafuto, AOU Pisa Cisanello

(Pi); Giovanni Galli, Comunita' Protetta Alta Assistenza Salo' (Bs); Amalia Cecilia Bruni, Giovanna Mancuso, AO Lamezia Terme (Cz); Bruno Bernardini, Carla Corsini, Istituto Clinico Humanitas, Rozzano (Mi); Annachiara Cagnin, Federica Fragiaco, Sara Pompanin, Ospedale di Padova; Amedeo Zurlo, Gianluca Guerra, Marco Pala, Luca Menozzi, Chiara Delli Gatti, Stefania Magon, Azienda Ospedaliera Universitaria S. Anna di Ferrara, Vincenzo Di Francesco, Silvia Faccioli, Luca Pellizzari, AOU Verona; Giuseppe Barbagallo, P.O." Carlo Basilotta" - Nicosia - ASP Enna; Maria Lia Lunardelli, Emilio Martini, Maria Macchiarulo, Maria Corneli, Monica Bacci, AOU S.Orsola-Malpighi Bologna; Giuseppe Battaglia, ASP Vibo Valentia; Mario Lo Storto, Chiara Seresin, Matteo Simonato, Michele Loreggian, Fausta Cestonaro, Mario Durando, ULSS Padova; Raffaele Latella, Marta Mazzoleni, Casa Serena di Brembate di Sopra (BG); Giuseppe Russo, Martino Ponte, Città della Carità, Taranto; Alessandro Valchera, Giuseppe Salustri, Donatella Petritola, Casa di Cura Villa San Giuseppe, Ascoli Piceno; Alfredo Costa, Elena Sinfioriani, Matteo Ramusino Cotta, Centro di Neuroscienze Cognitive e Comportamentali, Istituto Neurologico Nazionale C. Mondino, Università di Pavia; Simonetta Piano, Casa di riposo Luigi Zabert Valfenera; Renato Nicola Pizio, Germana Perego, ASL 4 Chiavarese (Ge); Alberto Cester, Marino Formilan, USLL Veneto Ospedale di Dolo (Ve); Pasqualina Carbone, RSA Oasi Domenicana Besana in Brianza (MB); Ildebrando Appollonio, Diletta Cereda, Lucio Tremolizzo; UO Neurologia AO S Gerardo Monza; Edo Bottacchi, Elisabetta Bucciantini, Marco Di Giovanni, Ospedale "Umberto Parini" Aosta; Fabrizio Franchi, Lucio Lucchetti, Sara Barbieri AO "Guglielmo da Saliceto" di Piacenza; Claudio Mariani, Giulia Grande, UO Neurologia Ospedale Sacco, Milano; Piero Rapazzini, Ospedale di Varese; Giuseppe Romanelli, Alessandra Marengoni, UO Geriatria, Spedali Civili Brescia; Luciano Fugazza, Chiara Guerrini, Giovanna De Paduanis, Ospedale Maggiore di Lodi; Lucia Iallonardo, Pasquale Palumbo, Centro Siria, Salerno; Giovanni Zuliani, Beatrice Ortolani, Eleonora Capatti, Cecilia Soavi, Lara Bianchi, Daniela Francesconi, Agata Miselli, UO Medicina AOU S Anna, Ferrara; Teresa Suardi, Andrea Mazzone, Cinzia Zaccarini, Gianluca Mirra, ASP Golgi Redaelli, Milano; Ettore Muti, Renato Bottura, RSA Fondazione Mons. Mazzali ONLUS, Mantova; Piero Secreto, Erika Bisio, Marco Cecchettani, Tamara Naldi, Alessandra Pallavicino, Presidio Ospedaliero Beata Vergine Consolata- Fatebenefratelli Torino; Michela Pugliese, Rosaria Cosima Iozzo, Giovanni Sgrò RSA San Vito Hospital, Associazione Vivere Insieme, San Vito sullo Jonio (Cz); Guido Grassi, Raffaella Dell'Oro, UO Medicina, AO S Gerardo, Monza; Antonio Mannironi, Elisa Giorli, Ospedale S Andrea, La Spezia; Sara Oberti, RSA Pensionato Contessi- Sangalli, Costa Volpino (BG); Brigida Fierro, Tommaso Piccoli, Fabio Giacalone, AUOP Paolo Giaccone, Palermo; Antonella Mandas, Luca Serchisu, Diego Costaggu, Elisa Pinna, Francesca Orrù, Martina Mannai, AOU Cagliari; Zeno Cordioli, Luca Pelizzari, Ospedale Sacro Cuore Don Calabria, Negrar (VR); Roberta Chiloiro, Centro Anziani "Opera Don Guanella" Bari; Rosella Cimino, Carmen Ruberto, AO "Pugliese Ciaccio" di Catanzaro; Pierluigi Dal Santo, Antonino Andriolli, Giuseppe Burattin, Laura Rossi, Fabiana Tezza, Ospedale S. Maria della Misericordia Rovigo; Patrizia Crippa, Paola Aloisio, Tiziana Di Monda, Gloria Galbassini, Domus Salutis, Brescia; Claudio Ivaldi, Anna Maria Russo, Ospedale Andrea Gallino Pontedecimo, Genova; Alberto Pesci, Giulia Suigo, UO Pneumologia, AO S Gerardo, Monza; Massimo Zanasi, Giovanni Moniello, AOU Ospedali Riuniti di Foggia; Carlo Rostagno, Alessandro Cartei, Gianluca Polidori, Andrea Ungar, Maria Ramona Melis, Eleonora Martellini, UO Geriatria AOU Careggi, Firenze; Bruno Battiston, Maurizio Berardino, Simona Cavallo, Città della salute e della scienza di Torino, presidio CTO; Bruna Lombardi, Pierpaolo D'Ippolito, Azienda USL 4 Prato; Angela Furini, Ospedale C Poma, Mantova; Daniele Villani, Raimondi Clara, Massimo Guarneri, CDC Figlie di S Camillo, Cremona; Stefano Paolucci, Andrea Bassi, Paola Coiro, Domenico De Angelis, Giovanni Morone, Vincenzo Venturiero, IRCCS Fondazione Santa Lucia, Roma; Lorenzo Palleschi, Paolo Raganato, Giuseppina Di Niro, AO San Giovanni-Addolorata Roma; Alessandra Imoscopi, RSA Istituto Altavita IRA Padova; Giancarlo Isaia, Vittoria Tibaldi, Giuliana Bottignole G, Elisa Calvi, Carlotta Clementi, Mauro Zanolchi, Luca Agosta, Antonio Criasia, Elena Spertino, A.O.U. Città della Salute e della Scienza di Torino; Antonella Nortarelli, USL Empoli; Giuseppe Provenzano, P

Principato, A Rizzo, E Cellura, ASP 1 Agrigento; Daniela Mari, Federica Ylenia Romano, Francesca Rosini, Marta Mansi, Silvia Rossi, Alex Riccardelli, Geriatria, Scuola di Specializzazione, Università degli Studi di Milano; Alfredo Potena, Mihaela Lichii, Clinica Salus, Ferrara; Tiziana Candiani, William Grimaldi, Emiliano Bertani, Ospedale di Magenta-Legnano (Mi); Pietro Calogero, Daniela Pinto, Roberto Bernardi, Francesco Nicolino, Caterina Galetti, Alice Gianstefani, AOU S.Orsola-Malpighi Bologna; Patrizio Odetti, Fiammetta Monacelli, Matteo Prefumo, AOU San Martino, Genova; Giuseppe Paolisso, Maria Rosaria Rizzo, Raffaele Prestano, Anna Maria Dalise, Università degli studi di Napoli; Davide Barra, Livio Dal Bosco, Vincenzo Asprinio, Luciana Dallape, Elisa Perina, RSA Residenza Valle dei Laghi, Cavedine (Tn); Raffaele Antonelli Incalzi, Isaura Rossi Bartoli, Campus Biomedico, Roma; Alice Pluderi, Antonella Maina, Elisabetta Pecoraro, Michela Sciarra, Angela Prudente, RSA Gruppo La Villa, Torino; Lucia Benini, Francesco Levato, Victor Mhiuta, Florin Alius, Diana Davidoaia, CRA Residenza Paradiso, Ferrara; Vittorio Giardini, Mattia Garancini, AO S Gerardo, Monza; Claudio Bellamoli, Luciano Terranova, Claudia Bozzini, Paolo Tosoni, Emma Provoli, Luisa Cascone, Andrea Dioli, Gianfranco Ferrarin, UO Geriatria Azienda ULSS 20 Verona; Anna Gabutto, Adelmo Bucci, RSA Villa Ferretto, Fontanegli, Genova; Guido Bua, Sara Fenu, Policlinico Sassarese; Giovanna Bianchi, Silvia Casella, Valentina Romano, Spedali Civili Gardone Valtrompia, Brescia; Gloria Belotti, Sabina Cavaliere, Estella Cuni, Nina Mercuc, Rosella Oberti, Katia Colombo Fondazione Carisma, Bergamo; Paolo D’Arcangelo, Nicola Montenegro, Cittadella della carità, Taranto; Giovanni Galli, Comunità Riabilitativa Alta Assistenza Lonato (Bs); Roberto Montanari, Pierpaolo Lamanna, Beatrice Gasperini, AO “Ospedali Riuniti Marche Nord” Fano (PU); Elio Scarpini, Andrea Arighi, Fondazione IRCCS Ca’ Granda Ospedale Maggiore Policlinico, Milano; Ferdinando D’Amico, Antonino Granata, AO Provinciale Messina, presidio ospedaliero Patti; Carlo Rostagno, Claudia Ranalli, Alessandra Cammilli, Maria Chiara Cavallini, Manola Tricca, Daniela Natella; AOU Careggi, Firenze; Gianbattista Guerrini, Anna Maria Scotuzzi, Ferdinando Sozzi, Luigi Valenti, Fondazione Brescia Solidale, Brescia; Antonino Chiarello, Monella Monia, Fondazione “Opere Pie Riunite G.B. Rubini” ONLUS, Romano di Lombardia (Bg); Alberto Pilotto, Camilla Prete, Barbara Senesi, EO Ospedali Galliera, Genova; Anna Cristina Meta, Enrico Pendenza, Presidio Ospedaliero di Tagliacozzo (AQ); Fabio Monzani, Giuseppe Pasqualetti, Antonio Polini, Sara Tognini, Elena Ballino, AOU Pisa DAI Area Medica, Antonio Cherubini, Giuseppina Dell’Aquila, Pina Maria Gasparri, Elisabetta Marotti, Monica Migale, Antonia Scrimieri, INRCA POR Ancona; Gabriele Toigo, Giuliano Ceschia, Alessia Rosso, Chiara Tongiorgi, Cristina Scarpa, AOU Triestina; Pacchioni Maurizio, ASP Milanese e Frosi Trigolo (Cremona); Luigino De Dominicis, Eugenio Pucci, Sara Renzi, Elisabetta Cartechini, ASUR Marche Area Vasta 3, Ospedale di Macerata; Giuseppe Barilaro, Pietro Gareri, AO “Pugliese Ciaccio” di Catanzaro; Francesca Ugenti, Pasquale Romeo, Azienda USL Bologna; Anna Nardelli, Fulvio Lauretani, Sandra Visioli, Ilaria Montanari, Francesca Ermini, Antonio Giordano, AOU Parma; Giorgio Pigato, AOU Padova; Emilio Simeone, Franco Colameco, Antonella Cecamore, Rosa Scurti, Maria Cristina Lupinetti, Ospedale Santo Spirito Pescara; Mario Barbujani, Osedale Santa Maria degli Angeli ULSS 19, Adria; Beatrice Perazzi, CRA La Madonnina, Caorso (PC); Marina Giampieri, INRCA POR Ancona; Raffaele Amoruso, ASP di Catanzaro/ Presidio Ospedaliero di Soveria Mannelli; Maristella Piccinini, Camilla Ferrari, Claudio Gambetti, Ospedale San Giovanni di Dio, Firenze; Mario Sfrappini, Letizia Semeraro, Rinaldo Striuli, Claudia Mariani, ASUR Marche Area Vasta 5; Giuseppe Pelliccioni, Donatella Marinelli, Tommaso Rossi, Martina Pesallaccia, Debora Sabbatini, Beatrice Gobbi, Raffaella Cerqua, INRCA POR Ancona; Giancarla Tagliani, Elena Schlauser, Fondazione Casa di soggiorno per Anziani ONLUS, Bedizzole (BS); Luciano Caser, Elisa Caramello, Franca Sandigliano, Giorgio Rosso, Casa della Divina Provvidenza Cottolengo di Biella; Alberto Ferrari, Chiara Bendini, ASMN-IRCCS Reggio Emilia; Moreno Scevola, Enrico Vitale, CDC Noale (Venezia); Domenico Maugeri, Rosaria Sorace, Massimiliano Anzaldi, AO Cannizzaro Università degli studi di Catania; Roberto De Gesu, Giuseppe Morrone, Federica Davolio, Andrea Fabbo, Casa Residenza per Anziani “E. Cialdini”, Modena; Giuseppe

Barbagallo, P.O.” Carlo Basilotta” - Nicosia - ASP Enna; Marco Zoli, Paola Forti, Luca Pirazzoli, Elisa Fabbri, AOU S.Orsola-Malpighi Bologna; Christian Wenter, Ingrid Ruffini, Miriam Insam, Elisabeth Abraham, Christine Kirchlechner, Azienda sanitaria comprensorio di Merano (Bz); Domenico Cucinotta, Giorgio Basile, AOU Policlinico Messina; Pasquale Parise, Andrea Boccali, Serena Amici, Maurizia Gambacorta, Ospedale Pantalla, Todi; Alberto Ferrari, Anna Lasagni, ASMN-IRCCS Reggio Emilia; Roberto Lovati, Francesca Giovinazzo, ElzbietaKimak, Marika Lo Castro, Flavia Mauro, Alessandro De Luca, RSA “Casa per Coniugi” Milano; Giuseppe Sancesario, Alessandro Martorana, Beatrice Scaricamazza, Sofia Toniolo, Francesco Di Lorenzo, Claudio Liguori, AOU Roma Tor Vergata; Antonino Lasco, Giorgio Basile, AOU Policlinico Messina; Natale Vita, Mirna Giomi, COOP Comunità Alloggio Bosco Mesola (FE); Sergio Dimori, Floriana Forte, RSA Residenza Ambrosiana; Alessandro Padovani, Luca Rozzini, Anna Ceraso, UO Neurologia Spedali Civili di Brescia; Maria Cottino, Silvia Vitali, Eleonora Marelli, ASP Golgi Redaelli, Milano; Gabriele Tripi, Salvatore Miceli, Giovanni Urso, ASP 9 Trapani Ospedale S. Antonio Abate; Giuseppe Grioni, Giuliana Vezzadini, Giulia Misaggi, Chiara Forlani, Stefano Avanzi, Fondazione Salvatore Maugeri Castelgoffredo (Mn); Francesco Iemolo, Antonello Giordano, Enzo Sanzaro, Gabriele D’Asta, Maria Proietto, Anna Carnemolla, Grazia Razza, Daniela Spadaro, AO Guzzardi di Vittoria, Ragusa; Marco Bertolotti, Chiara Mussi, Francesca Neviani, Nuovo Ospedale S.Agostino-Estense Baggiovara, Modena; Francesca Balestri, RSA Residenza Sanitaria Sole Misano Adriatico; Torrini Monica, Giulio Mannarino, Francesca Tesi, AOU Careggi, Firenze; Michela Bigolari, Alessia Natale, Simona Grassi, Cinzia Bottaro, Sara Stefanelli, Ugo Bovone, Umberto Tortorolo, Istituto Paverano, Genova; Roberto Quadri, Giuseppe Leone, Maria Ponzetto, Paola Frasson, Ospedale Chivasso, Torino; Giorgio Annoni, Giuseppe Bellelli, Adriana Bruni, Roberto Confalonieri, Maurizio Corsi, Daniela Moretti, Fabiola Teruzzi, Simona Umidi, UO Geriatria, AO S Gerardo, Monza; Paolo Caffarra, Federica Barocco, Marco Spallazzi, AOU Parma; Paolo Chioatto, Sandra Bortolamei, Lucia Soattin, USL Vicenza; Giovanni Ruotolo, Alberto Castagna, AO “Pugliese Ciaccio, Catanzaro; Marco Bertazzoli, Elisabetta Rota, Annamaria Adobati, Fondazione RSA Ponte S Pietro BG; Alberto Scarpa, Serena Granziera, Paola Zuccher, Angela Dal Fabbro, Daniela Zara, Ambra Lo Nigro, Lorena Franchetti, Marika Toniolo, Cinzia Marcuzzo, Ospedale Villa Salus Mestre; Simonetta Piano, Casa Gonella Pecetto Torinese (To), Marco Rollone, Fabio Guerriero, Carmelo Sgarlata, Istituto di cura S Margherita, Pavia; Alessandro Massè, Maurizio Berardino, Simona Cavallo, Città della salute e della scienza di Torino, presidio CTO; Giovanni Zatti, Massimiliano Piatti, Jole Graci, UO Ortopedia AO S Gerardo, Monza; Giuseppe Benati, Federica Boschi, Mario Biondi, Nicoletta Fiumi, Ospedale MorgagniPierantoni Forlì; Sergio Mario Locatelli, Sabrina Mauri, Mauro Beretta, Laura Margheritis, RSA Casa di cura Villa San Benedetto Menni, Albese con Cassano (Co); Giovanbattista Desideri, Ester Liberatore, Anna Cecilia Carucci, Presidio ospedaliero di Avezzano (Aq); Paolo Bonino, Margherita Caput, Maria Paola Antonietti, Giuseppe Polistena, Franz De la Pierre, Azienda USL Valle d’Aosta; Marcello Mari, Paola Massignani, ULSS Ovest Vicentino - Ospedale Valdagno (Vc); Fabio Tombesi, Fabio Selvaggio, Brunella Verbo, RSA Quinta Stella, PU; Paolo Bodoni, RSA Montanaro, Torino; Niccolò Marchionni, Enrico Mossello, Maria Chiara Cavallini, AOU Careggi, Firenze; Tony Sabatini, Eleonora Mussio, UO Medicina, Fondazione Poliambulanza, Brescia; Angelo Bianchetti, Giulia Titoldini, Beatrice Cossu, UO Medicina, Istituto Clinico S Anna, Brescia; Sara Fascendini, Cristina Licini, Angela Tomasoni, FERB Onlus Gazzaniga (BG); Massimo Calderazzo, AO Lamezia Terme (Cz); Alberto Ferrari, Raffaella Prampolini, ASMN-IRCCS Reggio Emilia; Rita Maria Melotti, Albina Lilli, Simona Buda, Marco Adversi, AOU S.Orsola-Malpighi Bologna; Gabriele Noro, Renato Turco, UO Geriatria S Ospedale Chiara Trento; M Chiara Ubezio, Anna Roberta Mantovani, Maria Cristina Viola, Fondazione Istituto Ospedaliero Sospiro, Cremona; Carlo Serrati, Maria Infante, IRCCS Ospedale S Martino, Genova; Simona Gentile, Alessandro Morandi, Viviana D’Ambrosio, Paolo Mazzanti, Cristina Brambilla, Silvia Sportelli, Daniela Quattrocchi, Dipartimento Riabilitazione Fondazione Teresa Camplani, Cremona; Luigi Maria Pernigotti, Cristina Pisu, Francesca Sicuro, RSA al Castello casa

di cura ospedale Koelliker Alpignano, Torino; Martina Oliverio, Luciano Luca Del Grosso, RSA S Chiara, Modena; Piergiuseppe Zagnoni, Stefania Ghiglia; RSA Mater Amabilis, Cuneo; Massimiliano Mosca, Ileana Corazzin, Mariangela Deola, Ospedale di Agordo, USLL Belluno; Carlo Adriano Biagini, Francesca Bencini, Claudia Cantini, Elisabetta Tonon, Silvia Pierinelli, USL Pistoia; Marco Onofrj, Astrid Thomas, Laura Bonanni, Ospedale Clinicizzato “SS. Annunziata” Chieti; Cacchiò Gabriella, Ospedale “C e G Mazzoni” Ascoli Piceno; Giancarlo Comi, Giuseppe Magnani, Roberto Santangelo, Salvatore Mazzeo, Ospedale San Raffaele, Milano; Cristina Barbieri, Liviana Giroldi, Federica Davolio, Casa Residenza Anziani “Ramazzini”, Modena; Fabio Bandini, Ospedale San Paolo Savona; Marco Masina, Simona Malservisi, Annalena Cicognani, Azienda USL Bologna; Laura Ricca, RSA Post-acuti S. Secondo Ventimiglia (Im), Laura Ricca, Maristella Piccininni, Camilla Ferrari, Claudio Gambetti, Ospedale S Giovanni di Dio, Firenze; Tiziana Tassinari, Davide Brogi, Annalisa Sugo, Ospedale Santa Corona Pietra Ligure (SV).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

Compliance with ethical standards

Conflict of interest

The authors declare that they have no financial relationship, no personal relationships with other people or organizations that could inappropriately influence (bias) the work.

Statement of Human and animal rights

The Ethical Committee of the IRCCS Fondazione Santa Lucia, Rome (Prot CE/PROG.500) approved the study protocol. All procedures performed in studies involving were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all participants or from their proxy when the participants had delirium or severe cognitive impairment.

References

1. Zarb P, Coignard B, Griskeviciene J et al (2012) The European Centre for Disease Prevention and Control (ECDC) pilot point prevalence survey of healthcare-associated infections and antimicrobial use. *Euro Surveill* 17:pii: 20316
2. Jansen IA, Hopmans TE, Wille JC et al (2012) Appropriate use of indwelling urethra catheters in hospitalized patients: results of a multicentre prevalence study. *BMC Urol* 12:25. <https://doi.org/10.1186/1471-2490-12-25>
3. Health Protection Scotland (2012) Scottish national point prevalence survey of healthcare associated infection and antimicrobial prescribing 2011. Health Protection Scotland (**First published April 2012 Version 1.1 published April 2012**)
4. Magill SS, Edwards JR, Bamberg W et al (2014) Multistate point-prevalence survey of health care-associated infections. *N Engl J Med* 370:1198–1208
5. Greene MT, Fakhri MG, Fowler KE et al (2014) Regional variation in urinary catheter use and catheter-associated urinary tract infection: results from a national collaborative. *Infect Control Hosp Epidemiol* 35:s99–s106
6. Saint S (2000) Clinical and economic consequences of nosocomial catheter-related bacteriuria. *Am J Infect Control* 28:68–75
7. Mody L, Krein SL, Saint SK et al (2015) A targeted infection prevention intervention in nursing home residents with indwelling devices: a randomized clinical trial. *JAMA Intern Med* 175:714–723
8. Witlox J, Eurelings LS, de Jonghe JF et al (2010) Delirium in elderly patients and the risk of post-discharge mortality, institutionalization, and dementia: a meta-analysis. *JAMA* 304:443–451
9. Inouye SK, Westendorp RG, Saczynski JS (2014) Delirium in elderly people. *Lancet* 383:911–922
10. Bellelli G, Mazzola P, Morandi A et al (2014) Duration of postoperative delirium is an independent predictor of 6-month mortality in older adults after hip fracture. *J Am Geriatr Soc* 62:1335–1340
11. Leslie DL, Marcantonio ER, Zhang Y et al (2008) One-year health care costs associated with delirium in the elderly population. *Arch Intern Med* 168:27–32
12. Solà-Miravete E, López C, Martínez-Segura E et al (2017) Nursing assessment as an effective tool for the identification of delirium risk in older in-patients: a case-control study. *J Clin Nurs*. <https://doi.org/10.1111/jocn.13921>
13. Tomlinson EJ, Phillips NM, Mohebbi M et al (2017) Risk factors for incident delirium in an acute general medical setting: a retrospective case-control study. *J Clin Nurs* 26:658–667
14. Limpawattana P, Panitchote A, Tangvoraphonkchai K et al (2016) Delirium in critical care: a study of incidence, prevalence, and associated factors in the tertiary care hospital of older Thai adults. *Aging Ment Health* 20:74–80

15. Pendlebury ST, Lovett NG, Smith SC et al (2015) Observational, longitudinal study of delirium in consecutive unselected acute medical admissions: age-specific rates and associated factors, mortality and re-admission. *BMJ Open*. <https://doi.org/10.1136/bmjopen-2015-007808>
16. Noriega FJ, Vidán MT, Sánchez E et al (2015) Incidence and impact of delirium on clinical and functional outcomes in older patients hospitalized for acute cardiac diseases. *Am Heart J* 170:938–944
17. De Castro SM, Ünlü Ç, Tuynman JB et al (2014) Incidence and risk factors of delirium in the elderly general surgical patient. *Am J Surg* 208:26–32
18. Díez-Manglano J, Palazón-Fraile C, Díez-Massó F et al (2013) Factors associated with onset of delirium among internal medicine inpatients in Spain. *Nurs Res* 62:445–449
19. Liv WS, EV Grue (2013) Hip fracture and urinary incontinence—use of indwelling catheter postsurgery. *Scand J Caring Sci* 27:632–642
20. Martinez JA, Belastegui A, Basabe I et al (2012) Derivation and validation of a clinical prediction rule for delirium in patients admitted to a medical ward: an observational study. *BMJ Open*. <https://doi.org/10.1136/bmjopen-2012-001599>
21. Van Rompaey B, Elseviers MM, Schuurmans MJ et al (2009) Risk factors for delirium in intensive care patients: a prospective cohort study. *Crit Care* 13:R77. <https://doi.org/10.1186/cc7892>
22. McAlpine JN, Hodgson EJ, Abramowitz S et al (2008) The incidence and risk factors associated with postoperative delirium in geriatric patients undergoing surgery for suspected gynaecologic malignancies. *Gynecol Oncol* 109:296–302
23. Inouye SK, Zhang Y, Jones RN et al (2007) Risk factors for delirium at discharge. Development and validation of a predictive model. *Arch Intern Med* 167:1406–1413
24. Ranhoff AH, Rozzini R, Sabatini T et al (2006) Delirium in a sub-intensive care unit for the elderly: occurrence and risk factors. *Aging Clin Exp Res* 18:440–445
25. Inouye SK, Bogardus ST, Williams CS et al (2003) The role of adherence on the effectiveness of non pharmacologic interventions. Evidence from the delirium prevention trial. *Arch Intern Med* 163:958–964
26. Inouye SK, Inouye SK, Bogardus ST Jr et al (1999) A multicomponent intervention to prevent delirium in hospitalized older patients. *N Engl J Med* 340:669–676
27. Inouye SK, Charpentier PA (1996) Precipitating factors for delirium in hospitalized elderly persons. Predictive model and interrelationship with baseline vulnerability. *JAMA* 275:852–857
28. Bellelli G, Morandi A, Di Santo SG et al (2016) Delirium Day”: a nationwide point prevalence study of delirium in older hospitalized patients using an easy standardized diagnostic tool. *BMC Med* 14:106–117
29. Mody L, Greene MT, Meddings J et al (2017) A national implementation project to prevent catheter associated urinary tract infection in nursing home residents. *JAMA Intern Med* 177:1154–1162

30. Heudorf U, Gasteyer S, Müller M et al (2016) Prevention and control of catheter-associated urinary tract infections—implementation of the recommendations of the Commission for Hospital Hygiene and Infection Prevention (KRINKO) in nursing homes for the elderly in Frankfurt am Main, Germany. *GMS Hyg Infect Control* 11:doc15
31. Saint S, Kaufman SR, Rogers MA et al (2006) Condom versus indwelling urinary catheters: a randomized trial. *J Am Geriatr Soc* 54:1055–1061
32. Gutiérrez Rodríguez J, Pinera MR, Ortiz Cachero E et al (2013) Delirium en centros residenciales para personas mayores. Estudio de la prevalencia y los factores asociados. *Rev Esp Geriatr Gerontol* 48:177–179
33. Katz S, Downs TD, Cash HR et al (1970) Progress in development of the index of ADL. *Gerontologist* 10:20–30
34. Bellelli G, Morandi A, Davis DH et al (2014) Validation of the 4AT, a new instrument for rapid delirium screening: a study in 234 hospitalised older people. *Age Ageing* 43:496–502
35. McNulty C, Freeman E, Smith G et al (2003) Prevalence of urinary catheterization in UK nursing homes. *J Hosp Infect* 55:119–123
36. Young J, Murthy L, Westby M et al (2010) Guideline Development Group. Diagnosis, prevention, and management of delirium: summary of NICE guidance. *BMJ* 341:c3704
37. Yue J, Tabloski P, Dowal SL et al (2014) The National Institute for Health and Clinical Excellence (NICE) to Hospital Elder Life Program (HELP): operationalizing nice guidelines to improve clinical practice. *J Am Geriatr Soc* 62:754–761
38. George J, Bleasdale S, Singleton SJ (1997) Causes and prognosis of delirium in elderly patients admitted to a district general hospital. *Age Ageing* 26:423–427
39. Saint S, Lipsky BA, Goold SD (2002) Indwelling urinary catheters: a one point restraint? *Ann Intern Med* 137:125–127
40. Voyer P, Champoux N, Desrosiers J et al (2015) Recognizing acute delirium as part of your routine [RADAR]: a validation study. *BMC Nurs* 14:14–19