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Factors associated with use of restraints on older adults with home care: A secondary analysis of a cross-sectional survey study

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ABSTRACT

Background: Although there is evidence that use of restraints in home care is increasing, research into the factors associated with restraints in this setting is scarce.
Objective: To gain insight into the factors associated with restraints in older adults receiving home care.
Design: A secondary analysis of a cross-sectional survey about restraint use in home care.
Settings: Older adults receiving home care in Belgium.
Participants: 8000 subjects were randomly selected from a total of 45,700 older adults. The mean age of the sample (n = 6397) was 80.6 years, 66.8% were women and 46.4% lived alone.
Methods: A cross-sectional survey of restraint use on older adults receiving home care from a nursing organisation in Belgium was completed by the patients' primary care nurses. A binary logistic regression model with generalised estimating equations was used to evaluate factors associated with restraint use. Additional analyses focused on the subgroups with and without an informal caregiver and living alone / with others. Data from 6397 participants were analysed in detail.
Results: Multivariate logistic regression indicated that restraint use was associated with supervision [OR = 2.433, 95% CI = 1.948–3.038]; dependency in activities of daily living (i.e. eating [OR = 2.181, 95% CI = 1.212–3.925], transfer [OR = 2.131, 95% CI = 1.191–3.812] and continence [OR = 1.436, 95% CI = 0.925–2.231]; perceived risk of falling in the nurses' clinical judgement [OR = 1.994, 95% CI = 1.710–2.324], daily behavioural problems [OR = 1.935, 95% CI = 1.316–2.846] and less than daily behavioural problems [OR = 1.446, 95% CI = 1.048–1.995]; decreased well-being of the informal caregiver [OR = 1.472, 95% CI = 1.126–1.925], the informal caregiver's dissatisfaction with family support [OR = 1.339, 95% CI = 1.003–1.788]; patient's cognitive impairment [OR = 1.398, 95% CI = 1.290–1.515]; and polypharmacy [OR = 1.415, 95% CI = 1.219–1.641]. The nurses' perception of risk of falling, cognitive impairment (observed with the Cognitive Performance Scale) and supervision are the only variables consistently associated with restraint use across all the analyses.
Conclusion: The study results provide insight into new and context-specific factors associated with restraint use in home care (e.g. supervision, informal caregiver's decreased well-being and dissatisfaction with family support). These insights could support the development of interventions to reduce restraint use in home care.

What is already known about the topic?

- Evidence from studies conducted in the residential setting indicates that restraint use has negative consequences for the patient, the family and the nurses.
- Despite indications that restraints are used in home care, research in this setting is still scarce, especially with regard to the factors associated with the use of restraints.

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What this paper adds

- Patient-related factors (e.g. cognitive decline, activities of daily living dependency, poor mobility) influencing restraint use refer to characteristics of frail, older adults living at home.
- Supervision (e.g. in person by the family or informal/professional caregiver or by electronic means) and the well-being of the informal caregiver as well as dissatisfaction with family support are non-patient-related factors associated with restraint use. These factors are context-specific for the home care setting.

1. Introduction

A recent systematic review (Scheepmans et al., 2018) indicates that restraintuse is common in home care, across certain countries (Beerens et al., 2014; de Veer et al., 2009; Hamers et al., 2016; Kurata and Ojima, 2014; Scheepmans et al., 2014, 2017). The prevalence of restraint use varies from 7% in the Netherlands (Hamers et al., 2016) and 9.9% in eight European countries (i.e. England, Estonia, Finland, France, Germany, the Netherlands, Spain and Sweden; Beerens et al., 2014) to 24.7% in Belgium (Scheepmans et al., 2017, 2018). In Japan 40.5% of providers of home care have observed use of physical restraints in older patients' homes (Kurata and Ojima, 2014). About four out of five Dutch nursing staff members have physically restrained a person at some time (de Veer et al., 2009). Various types of restraints (e.g. bedrails, deep/overturned chair, belts, locked (front)door) (Beerens et al., 2014; de Veer et al., 2009; Hamers et al., 2016; Kurata and Ojima, 2014; Scheepmans et al., 2017, 2018) are used in this setting. The family seems to play an important role in restraining patients at home by initiating and applying these devices. They are also most involved in the decision-making to use restraints (de Veer et al., 2009; Kurata and Ojima, 2014; Scheepmans et al., 2014, 2017, 2018).

The demographic, epidemiological, social and cultural trends in Europe are changing the traditional patterns of care, affecting the demand and supply of home care (De Vliegher, 2015; Tarricone and Tsouros, 2008). These trends have resulted in a growing number of frail older people living at home (Hoeck et al., 2011) and the assumption shared by many that the vulnerability of these persons increases the need for restraint use (e.g. due to increased dependence, cognitive impairment and poor mobility) (Hofmann and Hahn, 2014). Healthcare professionals are confronted by increased demand for restraint use in home care. The negative consequences of restraints (e.g. incontinence, decubitus ulcers, depression, social isolation) (Hofmann and Hahn, 2014) make the prevention of restraint use an important target in home care.

Research on long-term residential care has revealed that cognitive decline, poor mobility and dependence in activities of daily living are the characteristics most commonly associated with use of physical restraints (Hofmann and Hahn, 2014; Heeren et al., 2014; Huizing et al., 2007). Other important characteristics are challenging behaviour (i.e. wandering, aggression, verbal and physical agitation), falls and the perceived risk of falling, advanced age, gender (female), and incontinence (Hamers et al., 2004; Hamers and Huizing, 2005; Heinze et al., 2011; Hofmann and Hahn, 2014; Meyer et al., 2009). In hospitals, similar characteristics are associated with restraint use, as well as other patient factors (e.g. polypharmacy, confinement to bed) (Heinze et al., 2011; Krüger et al., 2013; Raguan et al., 2015). There are also a number of non-patient-related factors (e.g. characteristics of job or types of nursing home wards; staffing levels; legislation, regulations and policy, use of medical devices) that may affect use of physical restraints (Heeren et al., 2014; Huizing et al., 2007; Meyer et al., 2009; Möhler and Meyer, 2014).

Research on the factors associated with use of restraints in home care is scarce. To our knowledge, there has been only one study (Hamers et al., 2016) of factors associated with involuntary treatment, including the use of physical restraints, psychotropic medication and non-consensual care. This study identified some factors that were specific to the home care setting (e.g. living alone, perceived caregiver burden).

The evidence about the prevalence of restraint use in home care and the specificity of this setting highlight the need for more research to improve understanding of the factors associated with use of restraints in home care, as a first step toward reducing restraint use in home care. The aim of this study was, therefore, to gain insight into the factors associated with restraint of older adults receiving home care.

2. Methods

To determine the factors associated with use of restraints in home care, we analysed data from a cross-sectional survey that has been described elsewhere (Scheepmans et al., 2017). We summarise the survey methodology below.

2.1. Design

We completed a secondary analysis of the data from a cross-sectional survey conducted in June 2013. In that survey, home care nurses completed a questionnaire reporting on the use of restraints on patients aged 60 years or older who were under their care. The Medical Ethics Committee of the Leuven University Hospitals approved the study (No. B322201317586).

2.2. Study setting and sample

The study was carried out in collaboration with Wit-Gele Kruis, a non-profit organisation for home nursing in Belgium. One hundred out of 101 divisions participated in the study. A random sample of 8000 older adults was selected from the database of all adults aged 60 years and older who were receiving home nursing care from Wit-Gele Kruis during March 2013 (N = 45,700).

2.3. Variables

A questionnaire was developed based on insights from a previous qualitative study of restraint use in home care (Scheepmans et al., 2014) and findings in additional literature (de Veer et al., 2009; Scheepmans et al., 2018). The questionnaire included validated scales (Cognitive Performance Scale, Resident Assessment Instrument). During development of the questionnaire, its content validity was assessed iteratively by experts until consensus was reached (Scheepmans et al., 2017). Based on the recommendations of the nursing directors of the five provincial organizations, the research team adapted the questionnaire. This version was evaluated again by the nursing directors and two international researchers. Finally, the procedure for data collection, the cover letter and the questionnaire were assessed by nurses of one division and adjusted accordingly (Scheepmans et al., 2017). Nurses were asked to record any occasions during the past month on which they had observed use of restraints or had used restraint themselves.

2.4. Primary outcome

Restraint use (absent/present) was the primary outcome in this study. In the literature, there are different definitions and descriptions for defining the concept of 'restraints' (e.g. 'restraints', 'physical restraints' and 'involuntary treatment') (Scheepmans et al., 2018), differing from each other in terms of the scope of types of restrictive or intrusive actions that the research considers. Common characteristics of the three different concepts are that they all include the physical restraint aspect, they all emphasize intentional and deliberated restriction of a person and refer to the impact of its application on the involved person. Based on the results of a qualitative study of restraint use in home care (Scheepmans et al., 2014) and the definition given by Retsas

(Retsas, 1998), we have defined restraint use in this study as "any actions performed by healthcare workers and/or relatives that restrict the patient's freedom to some extent (e.g. adaptation of the house, removal of aids such as a walker, forced or camouflaged administration of medication)".

2.5. Associated factors

From the literature, we identified patient- and non-patient-related factors associated with use of restraints (Scheepmans et al., 2018). Patient-related factors include age, gender, dependency in activities of daily living (Arnaert and Delesie, 1999), living situation (living alone versus living with others), a fall in the past six months, perceived risk of falling (Milisen et al., 2012), cognitive decline (according to a nurse's clinical judgement), cognitive functioning, hospitalisation in the past three months, polypharmacy (i.e. taking five or more different medicines) and the presence of behavioural problems. Non-patient-related factors are the presence of supervision (by a professional or informal caregiver, by electronic means, or otherwise), the presence of an informal caregiver and the informal caregiver's well-being and perceived support.

We assessed cognitive functioning with the Cognitive Performance Scale for home care from the Resident Assessment Instrument (Morris et al., 1994; Landi et al., 2000; Wellens et al., 2013; Hartmaier et al., 1995). This scale covers five domains: short-term memory, procedural memory, skills for daily decision-making, ability to communicate effectively and eating dependency. Cognitive status scores range from 0 (intact) to 6 (very severe impairment). Behavioural problems were measured on the basis of six behavioural symptoms (wandering, verbal violence, physical violence, socially inappropriate or disruptive behaviour, public undressing or inappropriate sexual behaviour and resisting care) using a four-point scale taken from the Resident Assessment Instrument (Morris et al., 2010). Based on these scores, we assigned patients to three groups: 'no behavioural problems', 'less than daily behavioural problems' and 'daily behavioural problems'. For each case, the informal caregiver's well-being and perceived support were assessed using six items adapted from the Resident Assessment Instrument (covering the informal caregiver's ability to care for the patient in the future; feelings of sadness, anger or depression; the extent to which the informal caregiver is upset by the patient's disease or condition; and dissatisfaction with family support and professional support) (Morris et al., 2010). We used the Belgian Activities of Daily Living Evaluation Scale-KATZ index to assess each patient's dependence in six activities (i.e. bathing, dressing, transfer, toilet, continence, eating) using a four-point ordinal scale ranging from 1 (no assistance) to 4 (total dependence) (Arnaert and Delesie, 1999).

2.6. Procedure

The data were derived from a combination of information retrieved from electronic patient records (i.e. age, gender, and the six-item Activities of Daily Living scale) and nurses' knowledge of patients under their care. The primary nurse completed the questionnaire with input from colleagues during weekly patient discussions. Nurses were given two weeks to complete the questionnaire and were not offered any incentives (financial or otherwise) to do so. The nurses and head nurses received a cover letter containing detailed instructions on how to complete the questionnaire, together with a description of the study objectives. An automatic data extraction procedure was applied to the questionnaire, and the data were anonymised.

2.7. Analysis

We assessed the database for missing data, correct database coding and outliers and performed all analyses using SAS software version 9.4. We expressed categorical data as numbers of cases and percentages and expressed continuous data as means with standard deviations. Percentages were calculated based on the actual number of answers.

We used a binary logistic regression model with generalised estimating equations to evaluate associations with restraint. Use of generalised estimating equations was necessary to account for the unknown correlations between the data of patients within a single nursing division. We used an unstructured covariance matrix and estimated the variance components using a sandwich estimator.

Use of restraints was treated as an outcome in univariable and multivariable generalised estimating equations models. In the univariable case, all predictors were individually regressed on restraint use. We included indicators of well-being and the informal caregiver's perceived support as predictors in a univariable generalised estimating equations model that was tested on a subset of patients with informal caregivers. In the multivariable case, all factors potentially associated with use of restraints were included in the model as independent variables. No interactions were considered. The variance inflation factor suggested that the potential predictors were not affected by multicollinearity.

Because the majority of the independent variables had missing values, only 4472 out of 6397 patients (about two-thirds of the sample) would have been included if the analysis had been restricted to complete cases. Excluding these cases would have resulted in biased estimates if the missing variables were not random (Rubin, 1976), so we performed multivariate imputation using the fully conditional specification approach (Van Buuren, 2007). This involves specifying, for all variables with any missing values, a regression model using all the other potential predictors and outcome variables as covariates. We used linear regression, binary logistic or nominal logistic regression model, depending on the variable. The process is iterative (one iteration consists of one cycle through all variables) and continues until convergence to the multivariate distribution is obtained. We created ten complete datasets and performed the multivariate analyses on each of the ten imputed datasets. In a pooling phase, we integrated the estimates for the ten datasets into one estimate for each effect using Rubin's rule (Rubin, 1987). The multivariate model for restraint use was also calculated without age and gender as covariates; these estimates did not differ from the model including age and gender as covariates, and so we report only the latter.

Finally, we carried out additional analysis to examine the associated factors of restraint use and the living situation (persons living alone versus persons living with others) and the associated factors of restraint use with the presence of informal caregivers (situations with versus without an informal caregiver).

All reported confidence intervals (CI) are 95% CI.

3. Results

3.1. Sample

Of the 8000 questionnaires, 6716 were completed and 6397 patient subjects (80%) were analysed. We excluded from analysis questionnaires for which the question 'Which restraints were used in the past month' was not answered (n = 319). Examples of reasons for not completing the whole questionnaires were death of patient, hospitalization, admission to a nursing home and the patient no longer being taken care for by the nurses (n = 972) (Scheepmans et al., 2017). One out of four patients was subject to restraints (24.7%; n = 1577; CI = 95% 0.2360–0.2573). The mean age of the total sample was 80.6 years (SD = 7.8). Most (66.8%) were female and 46.4% lived alone. One third of the patients (33.3%) were perceived according to the nurse's clinical judgement as persons with cognitive decline. Cognitive impairment (both the estimated cognitive impairment and cognition evaluated by the Cognitive Performance Scale) was higher in the group of persons who were restrained. Almost 60% were perceived to be at risk of falling, and one third of the subjects (30.3%) had a fall-related

incident in the previous six months. Both the perceived risk of falling and the fall-related incidents were higher in the group of persons being restrained. More than 40% were taking five or more different medicines (44.5%) or were completely dependent on help for bathing (42.4%) or dressing (40.1%). More than half of the patients (52.5%) were physically independent. More than a quarter (26.2%) of the patients were physically dependent for bathing, dressing, transferring or using the toilet. 17.2% were physically dependent for bathing, dressing, transferring, using the toilet, maintaining continence or feeding and 4.1% were totally physical dependent (Scheepmans et al., 2017). Many of the persons being restrained needed assistance for using the toilet (33.9%), transfer (41.5%) or maintaining continence (30%). In addition, 6.4% of the older adults in the total sample showed behavioural problems. These problems were more present in the group of restrained persons. In 70% of cases, there was an informal caregiver; 17.7% of informal caregivers expressed feelings of sadness, anger or depression and 13.2% were upset by the patient's disease or condition. The majority of the patients (76.3%) were supervised. Restrained persons had more supervision (92.7%) than persons not being restrained (70.8%). The presence of an informal caregiver (83.6%) was higher in the group of restrained persons compared to those not being restrained (65.6%) (Table 1).

3.2. Associated factors

The univariate analyses showed that all investigated factors were positively associated with restraint use, with the exception of sex, the informal caregiver's ability to care for the patient in the future and the informal caregiver's dissatisfaction with professional support. Living alone was significantly associated with lower odds for restraint use (OR = 0.695, 95% CI = 0.621–0.779).

The multivariate regression indicated that use of restraints was positively associated with supervision (OR = 2.433, 95% CI = 1.948–3.038); activities of daily living such as eating (OR = 2.181, 95% CI = 1.212–3.925), transfer (OR = 2.131, 95% CI = 1.191–3.812) and continence (OR = 1.436, 95% CI = 0.925–2.231); perceived risk of falling in the nurse's clinical judgement (OR = 1.994, 95% CI = 1.710–2.324); daily behavioural problems (OR = 1.446, 95% CI = 1.048–1.995) and less than daily behavioural problems (OR = 1.446, 95% CI = 1.04–1.995); informal caregiver's well-being, and more specifically his or her feelings of sadness, anger or depression (OR = 1.472, 95% CI = 1.126–1.925) and the informal caregiver's dissatisfaction with family support (OR = 1.339, 95% CI = 1.003–1.788); cognitive impairment (as measured by CPS) (OR = 1.398, 95% CI = 1.290–1.515) and polypharmacy (OR = 1.415, 95% CI = 1.219–1.641) (Table 2).

The same associated factors that emerged in the total sample were also associated with restraint use within three of the four subgroups (i.e. persons with/without an informal caregiver and persons living with others), with the exception of a few variables. In the subgroup of informal caregivers, dependency for continence (p = 0.0814) and eating (p = 0.0849) and dissatisfaction with the support of family/friends (p = 0.0572) were no longer associated with restraint use. Polypharmacy (p = 0.0743), behavioural problems (p = 0.8666), dependency for transfer (p = 0.4331) and eating (p = 0.0849) were no longer associated with restraint use in the subgroup of persons without an informal caregiver. Within the group of persons who lived with others, dependency for eating (0.0717) and dissatisfaction with the support of family/friends (p = 0.0984) were not associated any more. Finally, within the subgroup of persons living alone, sex (female) (OR = 0.732, 95% CI = 0.571–0.939) and age (OR = 1.015, 95% CI = 1.001–1.030) were two additional variables positively associated with restraint use; and behavioural problems (p = 0.1646), dependency for transfer (0.6953), continence (0.6668) and eating (0.2136) and dissatisfaction with support of family/friends (0.3904) were no longer associated (Table 2).

4. Discussion

The results of the total sample indicate that both patient- and non-patient-related factors are associated with use of restraints in home care. Many of these factors—dependence in activities of daily living (Hamers et al., 2004; Heeren et al., 2014; Heinze et al., 2011; Hofmann and Hahn, 2014; Meyer et al., 2009; Raguan et al., 2015), cognitive impairment (Hamers et al., 2016; Huizing et al., 2007; Meyer et al., 2009), behavioural problems (Hofmann and Hahn, 2014), poor mobility and fall history / risk of falling (Heeren et al., 2014; Huizing et al., 2007; Hamers et al., 2004), and polypharmacy (Heinze et al., 2011)—are also associated with use of restraints in hospitals and nursing homes. Some of the variables of the current study are also mentioned in a recent systematic review about restraint use in home care (Scheepmans et al., 2018), e.g. behaviour and cognitive impairment.

Table 1
Characteristics of the Overall Sample and Restrained and Unrestrained Groups.

Variable	Sample n (%)	Not subject to restraint n/N (%) 4,820/6,397 (75.3)	Subject to restraint n/N (%) 1,577/6,397 (24.7)
Age, mean (SD)	80.6 (7.8)	80.4 (7.8)	81.2 (7.8)
Female, n (%)	4,268 (66.8)	3,186/4,814 (66.18)	1,082/1,574 (68.74)
Supervision	4,599 (76.3)	3,198/4,517 (70.8)	1,401/1,512 (92.7)
Informal caregiver	4,186 (70.0)	2,960/4,512 (65.6)	1,226/1,466 (83.6)
Estimated cognitive impairment	2,095 (33.3)	1,221/4,741 (25.8)	874/1,551 (56.4)
Cognitive Performance Scale (mean)	5,867 (1.1)	4,424 (0.8)	1,443 (2.2)
Previous Hospitalisation	1,121 (18.5)	782/4,551 (17.2)	339/1,506 (22.5)
Polypharmacy	2,560 (44.5)	2,190/4,311 (50.8)	1,000/1,439 (69.5)
Behavioural problems			
No behavioural problems	5,342 (93.5)	4,161/4,308 (96.6)	1,181/1,403 (84.2)
Behavioural problems less than once a day	179 (3.1)	81/4,308 (1.9)	98/1,403 (7.0)
Daily behavioural problems	190 (3.3)	66/4,308 (1.5)	124/1,403 (8.8)
Previous fall within last 6 months?	1,841 (30.3)	1,209/4,564 (26.5)	632/1,503 (42.1)
Risk of falling according to nurses	3,670 (58.4)	2,436/4,736 (51.4)	1,234/1,546 (79.8)
Living alone	2,917(46.4)	2,305/4,735 (48.7)	612/1,550 (39.5)
Well-being and support of informal caregiver			
Able to care for the patient in the future	3,469 (85.4)	2,480/2,885 (86.0)	989/1,177 (84.0)
Expresses feeling of sadness, anger, depression	643 (17.7)	341/2,566 (13.3)	302/1,070 (28.2)
Upset by patient's disease or condition	471 (13.2)	243/2,523 (9.6)	228/1,057 (21.6)
Dissatisfied with support from family/friends	245 (6.9)	120/2,526 (4.8)	125/1,050 (11.9)
Dissatisfied with professional support	106 (3.0)	63/2,515 (2.5)	43/1,042 (4.1)

Table 2
Multivariate Model of Associated Factors of Restraint Use: Total Sample and Sub-analysis (with/without informal caregiver and living alone/together).

	Total sample		Presence of informal caregiver				Living condition			
			Informal caregiver n = 4,186 (70%)		No informal caregiver n = 1,792 (30%)		Living together n = 3,368 (53.6%)		Living alone n = 2,917 (46.4%)	
	Odds Ratio (95% CI)	*P-value*	*Odds Ratio (95% CI)*	*P-value*	*Odds Ratio (95% CI)*	*P-value*	*Odds Ratio (95% CI)*	*P-value*	*Odds Ratio (95% CI)*	*P-value*
Sex, female*	0.873 (0.742; 1.026)	0.0995	0.883 (0.735; 1.061)	0.1850	0.828 (0.597;1.149)	0.2590	0.977 (0.803;1.188)	0.8143	0.732 (0.571; 0.939)	0.0140
Age	1.003 (0.993; 1.012)	0.5947	1.006 (0.996; 1.016)	0.2170	0.989 (0.969;1.009)	0.2828	0.992 (0.981;1.004)	0.1916	1.015 (1.001; 1.030)	0.0404
Supervision **	2.433 (1.948; 3.038)	< .0001	3.032 (2.255; 4.077)	< .0001	2.005 (1.417;2.836)	< .0001	2.543 (1.774;3.646)	< .0001	2.360 (1.767; 3.154)	< .0001
Cognitive Performance Scale	1.398 (1.290; 1.515)	< .0001	1.368 (1.258; 1.489)	< .0001	1.549 (1.307;1.836)	< .0001	1.463 (1.340;1.596)	< .0001	1.286 (1.144; 1.445)	< .0001
Polypharmacy **	1.415 (1.219; 1.641)	< .0001	1.423 (1.207; 1.678)	< .0001	1.397 (0.970;2.012)	0.0743	1.429 (1.156;1.765)	0.0010	1.387 (1.127; 1.706)	0.0021
Behavioural problems		0.0004		< .0001		0.8666		0.0040		0.1646
Daily, behavioural problems	1.935 (1.316; 2.846)	0.0009	2.201 (1.429; 3.390)	0.0004	1.156 (0.489;2.733)	0.7407	2.272 (1.358;3.802)	0.0020	1.178 (0.597; 2.326)	0.6359
Behavioural problems less than once a day	1.446 (1.048; 1.995)	0.0248	1.619 (1.132; 2.316)	0.0083	0.895 (0.404;1.986)	0.7861	1.327 (0.863;2.040)	0.1981	1.640 (0.975; 2.759)	0.0628
No behavioural problems	#	.	#	.	#	.	#	.	#	.
ADL—KATZˆ										
TRANSFER		0.0202		0.0118		0.4331		0.0233		0.6953
With assistive device or minimal assistance	1.101 (0.849; 1.427)	0.4678	1.049 (0.792; 1.391)	0.7375	1.302 (0.713;2.379)	0.3901	1.095 (0.766;1.566)	0.6178	1.020 (0.730; 1.423)	0.9092
With assistance	1.404 (1.029; 1.915)	0.0323	1.369 (0.985; 1.904)	0.0617	1.612 (0.812;3.202)	0.1728	1.566 (1.031;2.379)	0.0353	1.140 (0.750; 1.733)	0.5400
Totally dependent	2.131 (1.191; 3.812)	0.0108	2.474 (1.290; 4.744)	0.0064	0.849 (0.205;3.522)	0.8216	2.425 (1.172;5.019)	0.0170	1.694 (0.621; 4.622)	0.3035
No assistance	#	.	#	.	#	.	#	.	#	.
CONTINENCE		0.0149		0.0814		0.0155		0.0256		0.6668
With assistive device or minimal assistance	0.849 (0.687; 1.050)	0.1304	0.888 (0.687; 1.146)	0.3606	0.816 (0.517;1.288)	0.3831	0.798 (0.602; 1.058)	0.1174	0.912 (0.668; 1.245)	0.5620
With assistance	0.806 (0.613; 1.061)	0.1237	0.805 (0.581; 1.116)	0.1926	0.954 (0.511;1.782)	0.8822	0.736 (0.510; 1.062)	0.1016	0.924 (0.620; 1.376)	0.6975
Totally dependent	1.436 (0.925; 2.231)	0.1070	1.321 (0.785; 2.222)	0.2941	3.081 (1.053;9.011)	0.0400	1.448 (0.879; 2.387)	0.1462	1.370 (0.638; 2.944)	0.4198
No assistance	#	.	#	.	#	.	#	.	#	.
EATING		0.0183		0.0849		0.1373		0.0717		0.2136
With assistive device or minimal assistance	1.041 (0.854; 1.269)	0.6917	1.038 (0.822; 1.311)	0.7535	1.029 (0.743;1.424)	0.8643	0.996 (0.758; 1.308)	0.9770	1.127 (0.857; 1.482)	0.3910
With assistance	0.982 (0.702; 1.372)	0.9139	0.995 (0.695; 1.424)	0.9772	0.877 (0.402;1.911)	0.7406	0.823 (0.527; 1.285)	0.3921	1.242 (0.702; 2.197)	0.4563
Totally dependent	2.181 (1.212; 3.925)	0.0093	2.062 (1.080; 3.939)	0.0284	3.867 (1.131;13.225)	0.0311	1.856 (0.912; 3.775)	0.0878	3.078 (1.026; 9.239)	0.0450
No assistance	#	.	#	.	#	.	#	.	#	.
Estimated risk of falling**		.								
At risk	1.994 (1.710; 2.324)	< .0001	2.018 (1.691; 2.410)	< .0001	2.059 (1.396;3.036)	0.0003	1.954 (1.536; 2.487)	< .0001	2.084 (1.632; 2.662)	< .0001
Well-being and support of informal caregiver:**										
Expresses feeling of sadness, anger, depression	1.472 (1.126;1.925)	0.0050	1.469 (1.116; 1.934)	0.0064	NA	NA	1.534 (1.120; 2.101)	0.0082	1.339 (0.840; 2.135)	0.2206
Dissatisfied with the support of family/friends	1.339 (1.003; 1.788)	0.0474	1.325 (0.992; 1.769)	0.0572	NA	NA	1.373 (0.943; 1.999)	0.0984	1.255 (0.748; 2.104)	0.3904

*men = reference category **no = reference category *** not at risk = reference category # = reference category.
ˆ All items of the Belgian Activities of Daily Living [ADL] Evaluation Scale-Katz Index are scored using a four-point scale: no assistance = score 1 (reference category) ; with assistive device or minimal assistance = score 2; with assistance = score 3; totally dependent = score 4.

This review also indicated the important role of the family/informal caregiver in the initiative, decision and use of restraints. The analysis of the current study confirms the significance of informal caregivers and the well-being and support of these persons. The risk of falling as estimated by the nurses confirms indirectly the role of the nurses as second-most-important involved persons, as mentioned in the review (Scheepmans et al., 2018). In contrast with some studies done in residential care settings (Huizing et al., 2007; Raguan et al., 2015; Krüger et al., 2013), the multivariate model indicated that gender and age were not associated with use of restraints during home care except for the subgroup living alone.

The non-patient-related factors that were positively associated with restraint use in home care were supervision, the informal caregiver's well-being and, more specifically, his or her feelings of sadness, anger, depression and dissatisfaction with support from family/friends. The association between supervision and restraint might be due to the characteristics of patients in home care (e.g. patients with activities of daily living dependency, poor mobility and cognitive impairment); this would emphasise the patients' vulnerability and highlight the important role of informal caregivers in restraint use, which is confirmed in the literature (Scheepmans et al., 2017, 2018). The association between restraint use and the informal caregiver's well-being in the total sample suggests that the burden placed on informal caregivers may contribute to their use of restraints. The results of the total sample are in line with those of Hamers et al. (2016) and confirm the assumption that informal caregiver burden is associated with use of restraints in home-based care (Hamers et al., 2016). They raise concerns because of the increased frailty of the older adults receiving home care. However, in three out of four subgroups (i.e. persons with an informal caregiver and living with others or alone), the variable 'dissatisfaction of the informal caregiver with the support of family/friends' disappeared in the final model. The p-value of this variable ($p = 0.0572$) was borderline-significant for the group of informal caregivers. It is difficult to find an explanation for this finding.

In accordance with research in residential care settings, cognitive impairment (Hamers et al., 2016; Huizing et al., 2007; Meyer et al., 2009) was also positively associated with use of restraints in home care. It is notable that in the multivariate model, use of restraints was associated with the objective measure of patients' cognitive functioning, but not with nurses' clinical estimation of patients' cognitive decline. A potential untested explanation of this finding is that the short visits that are typical in home care may not be sufficient for nurses to collect enough information to assess cognitive function accurately.

Also in accordance with studies in residential care settings (Heeren et al., 2014; Huizing et al., 2007; Hamers et al., 2004; Möhler and Meyer, 2014), nurses' perception of risk of falling was positively associated with use of restraints in home care. The finding that perception of the risk of falling has more impact on restraint than a previous fall is worrisome, given that restraint use is not a good way of preventing falls (Gastmans and Milisen, 2006). The nurses' perception of risk of falling seems to have a major importance. This variable, cognitive impairment (observed with the Cognitive Performance Scale) and supervision are the only three variables consistently associated with restraint use across all the analyses.

Both our study (univariate analysis: OR = 0.695, 95% CI = 0.621–0.779) and that of Hamers et al. (2016) show that living alone is associated with restraint use during home care. Unlike Hamers et al. (2016), we found that this association disappeared when the multivariate model corrected for the effect of other variables; nevertheless, our previous qualitative study (Scheepmans et al., 2014) indicated that subjecting frail older people who are living alone to restraint use creates dangerous situations. When restraints are used in the absence of any form of supervision, it is more likely to result in damage to the physical, social and mental well-being of the older adult.

5. Implications for policy and clinical practice

A clear policy within the home care setting aiming to support nurses and other healthcare providers in dealing with an increasing demand for restraint use in clinical practice is necessary. Processes such as comprehensive assessment, consultation and communication among all involved persons and multidisciplinary decision making (Scheepmans et al., 2016) need to be integrated within this policy. Given the prominent role of informal caregivers and the difficult circumstances they often face, healthcare organizations need to give special attention to the support of informal caregivers. More specifically, a profound assessment of the patient and his/her entourage (i.e. the informal caregivers), with regular follow-up of his/her cognitive and physical functioning, multidisciplinary meetings with all involved persons taking into account the patients' needs and preferences and the use of evidence-based guidelines for topics related to the increased risk of restraint use (e.g. guidelines for delirium management and fall prevention) are all examples of good practice that can prevent or contribute to the reduction of restraint use (Gulpers et al., 2011; Köpke et al., 2012). These standards of care are a crucial cornerstone and therefore need to be implemented in daily care practice.

The strengths of the study include the large randomised sample, the carefully developed questionnaire, high response rate and the demographically varied nature of the older adult sample (Scheepmans et al., 2017). Our study also has several limitations. A first limitation concerns validation of the questionnaire, which consisted only of establishing its content validity. Another is the limited number of non-patient-related factors included in the questionnaire. It might be worth investigating the relationship between contextual factors (e.g. nurse staffing levels, skill mix and education) and the prevalence of restraint use. Another limitation is that the study only indicates which variables are associated with restraint use; no conclusions can be drawn about possible explanations or causality. The data were based on nurses' observations and, although they were given clear instructions, their observations may have been biased.

In conclusion, the study indicates that use of restraints in home care is associated with both patient-related and non-patient-related factors, a finding which warrants further research. It also shows that the patient-related factors associated with restraint use (e.g. cognitive decline, activities of daily living dependency, poor mobility) are characteristic of frail, older adults living at home. Supervision and the well-being of the informal caregiver and the dissatisfaction with family support were non-patient factors associated with restraint use in the total sample. These factors are specific to the home care setting. This led us to conclude that knowledge about use of restraints in the residential care context cannot be directly translated to the home care context. Across all analyses, the nurses' perception of the risk of falling, cognitive impairment and supervision remained constantly associated factors for restraint use in home care. The results of the study provide insight into the factors associated with use of restraints in home care and could support the development of interventions to reduce it.

Conflict of interest

The authors have no conflicts in the manuscript.

Author contributions

Scheepmans, Paquay, Dierckx de Casterlé, Van Gansbeke, Milisen: study design. Scheepmans, Paquay: data collection. Scheepmans, Paquay, Dierckx de Casterlé, Milisen, Vanbrabant: data analysis, drafting the manuscript. Dierckx de Casterlé, Milisen: supervision. All authors critically reviewed and approved the final manuscript.

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The funding agency Vanbreda Risk & Benefits had no role in the design, data collection, analysis or interpretation of the study.

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