

The use of direct care in nursing home residents: A longitudinal cohort study over 3 years

Corinna Vossius^{1,2}  | Geir Selbæk^{2,3,4} | Jūratė Šaltytė Benth^{2,5,6} | Anders Wimo^{7,8} | Sverre Bergh^{2,3}

¹Centre for Age-Related Medicine, Stavanger University Hospital, Stavanger, Norway

²Centre for Old Age Psychiatry Research, Innlandet Hospital Trust, Ottestad, Norway

³Norwegian National Advisory Unit on Ageing and Health, Vestfold Hospital Trust, Tønsberg, Norway

⁴Institute of Health and Society, University of Oslo, Oslo, Norway

⁵Institute of Clinical Medicine, University of Oslo, Oslo, Norway

⁶Health Services Research Unit, Akershus University Hospital, Lørenskog, Norway

⁷Division of Neurogeriatrics, Department of Neurobiology, Care Sciences and Society (NVS), Karolinska Institutet, Stockholm, Sweden

⁸Centre for Research and Development, Uppsala University/County Council of Gävleborg, Gävle, Sweden

Correspondence

Corinna Vossius, Centre for Age-related Medicine, Stavanger University Hospital, SESAM, Stavanger PB 8100 4068, Norway.
Email: c.vossius@hotmail.com

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Objectives: To evaluate the trend in the use of direct care in a cohort of nursing home (NH) residents and explore its association with resident characteristics and organizational factors.

Methods/design: A total of 696 NH residents from 47 Norwegian NHs were included at admissions at NH. In 537 residents, the use of direct care was assessed every 6 months over a course of 3 years. A multiple model was estimated to identify demographic, clinical, and organizational characteristics associated with the use of direct care time.

Results: Six months after admission, on average, 76.2 hours of direct care were rendered to each resident per month, while this number was reduced to 50.3 hours per month at the end of the study period. Most residents (92%) showed a stable use of direct care time, while a small group of residents displayed a much higher and varying use of direct care time. Increasing dementia, neuropsychiatric symptoms, and decreasing function in activities of daily living were associated with higher use of direct care time. Direct care time constituted about 50% of the staff's working time.

Conclusion: In Norwegian NHs, high use of direct care time was associated with younger age, more severe dementia, and severe neuropsychiatric symptoms. By identifying factors that impact on direct care time, preventive measures might be put in place to the benefit of the residents and possibly to improve resource use. Further research should explore the association between direct care time, quality of care, and the residents' quality of life.

KEYWORDS

dementia, direct care, nursing home, nursing home residents, nursing home care

1 | INTRODUCTION

Health and care services in Norway are organized by the municipalities, with the main share of the costs borne by the municipalities and with relatively small out-of-pocket contributions by the users.¹ Nursing homes (NHs) constitute the highest level of formal care for persons

who are in need of care and supervision around the clock and when a sufficient level of care no longer can be provided in a home setting. In a study including patients at admittance to NH and with a planned stay for more than 6 weeks, 84% of the residents had dementia.²

Norway, like other developed countries, is facing an increase in the population of the elderly and thus an increase in the number of

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persons with dementia. The need for institutional care puts a high strain on the society, not only because of high costs but also due to the need for trained staff that will bind an increasing part of a country's work force.¹

On an NH ward, care will be delivered either as shared care time, referring to services rendered to several residents at the same time, like common meals and supervision of the residents in the common room or on outings, or direct care time, referring to services rendered to each resident separately like help with personal hygiene or supervising a resident regarding behavior that is distressing to the patient or might disturb other residents.³ While it is difficult to attribute shared care time to one single resident for health economic purposes, this is possible with direct care time.

The instrument Resource Use in Dementia (RUD) was developed to quantify care activities in dementia in order to calculate societal costs.^{4,5}

In 2010, RUD was validated for use in an institutional care setting (RUD-FOCA—Resource Use in Dementia—Formal Care).³ However, there are only two studies evaluating the use of care in NHs, which reported a use of direct care time of 53 and 300 hours per month, respectively.^{3,6} To the best of our knowledge, no study exists that has evaluated the use of direct care over time, or the assessment of demographic and clinical factors associated with the care time. As staff costs represent 84% of the costs for NH stay, knowledge about the actual use of direct care of NH residents and about the factors associated with high levels of direct care is necessary to plan and improve NH care as well as to develop new concepts of care that might respond better to the expected demographic changes.¹

The aim of this study was to evaluate the trend in the use of direct care time in NH residents over a 3-year period and to analyze how demographic, clinical, and organizational factors, such as NH size and staff characteristics, are associated with the use of direct care.

2 | METHODS

2.1 | Study design and setting

The project Resource Use and Disease Course in Dementia—Nursing Home (REDIC-NH) is an observational longitudinal cohort study including patients from a convenience sample of 47 NHs in four Norwegian counties, representing small and large NHs located in urban and rural areas.² Recruitment was at admission to the NH, and residents were followed over an observation period of 36 months or until death with standardized clinical assessments at baseline (BL) and every 6 months thereafter. Inclusion took place between January 2012 and August 2014. Four NHs withdrew from the study during the observation period.

2.2 | Participants

Inclusion criteria were (a) 65 years or older or (b) dementia irrespective of age at admission to the NH and (c) expected survival 6 weeks or more as judged by the responsible physician. Only residents that completed BL assessment were included in the study. BL assessment was

Key points

- Direct care time decreased slightly during the 3-year follow-up.
- Most residents (92%) showed a stable use of direct care time.
- The use of direct care was associated with increasing dementia, neuropsychiatric symptoms, and decreasing function in activities of daily living.
- Direct care time constituted about 50% of the staff's working time on general wards and 70% on special care units for persons with dementia.

aimed to be completed within 4 weeks after inclusion, but the mean interval between admission and completed BL assessment was 10.5 weeks (SD, 10.6). The participants were monitored with a clinical follow-up (FU) every 6 months, at FU6, FU12, FU18, FU24, FU30, and FU36, with the first follow-up (FU6) 6 months after admission.

2.3 | Data collection

Data collection was performed by health care workers at the NH, mainly trained nurses (74%), under the supervision of 10 research nurses. The research nurses completed a 5-day training prior to study start, while the data collectors completed a 2-day training. Data were collected through structured interviews with the patient and a caregiver and at BL also with the next-of-kin.

2.4 | Measures

The following clinical instruments were used for collecting data:

Demographic data was collected by reviewing the patient's journal.

RUD-FOCA assesses the use of direct care during the preceding 4 weeks. The time used to help the patients with personal activities of daily living (PADL), instrumental ADL (IADL), and for supervision, like helping the patient with orientation or preventing behavior that might be distressing for the patient himself or other residents, is recorded separately. We calculated the total direct care time by summarizing these three care times. The amount of care time was expressed in hours per month. The maximum of total direct care time could not exceed 24 hours per day. RUD-FOCA was recorded at FU6 to FU36, but not at BL.

Clinical Dementia Rating Scale (CDR) was applied to assess the severity of dementia as no dementia, possible dementia, and mild, moderate, or severe dementia. The CDR comprises six items.⁷ For statistical purposes, we calculated the CDR-Sum of Boxes (CDR-SOB), which offers an extended range of values and is calculated by adding the item scores (range, 0–18), where higher scores indicate more severe dementia.⁸

Neuropsychiatric Inventory (NPI) was applied to assess neuropsychiatric symptoms (NPS).⁹ The NPI contains 12 NPS assessed during an interview with a caregiver or next-of-kin. Severity (scored 0-3) was multiplied by frequency (scored 0-4), resulting in an item score from 0 to 12, where higher scores indicate more severe symptoms. On the basis of a previous principal component analysis, we created the following subsyndromes: NPI-Agitation (agitation/aggression disinhibition and irritability), NPI-Psychosis (delusions and hallucinations), and NPI-Affective (depression and anxiety).²

Diagnosis of dementia was set according to the ICD-10 criteria.¹⁰ The diagnosis of dementia was set independently by two of the authors (S.B. and G.S.), both specialists in psychiatry and experienced in old age psychiatry and research, based on all available information about the participants. If no consensus was reached, a third psychiatrist was consulted.

Physical Self-Maintenance Scale (PSMS) consists of six items (scored 1-5) and was applied to assess PADL function. The overall score ranges from 6 to 30, where higher scores indicate higher PADL dependency.¹¹

General Medical Health Rating (GMHR) was applied to rate physical health. It consists of one item with the four categories: excellent, good, fair, or poor.¹²

Charlson Comorbidity Index was applied to establish comorbidity at BL.¹³

Sight was recorded at BL as normal, slightly impaired, severely impaired, or blind.

Hearing was recorded at BL as normal, slightly impaired, severely impaired, or deaf.

The following organizational data from the NHs were collected: number of inhabitants in the municipality, number of beds in the NH, type of ward (general ward, special care unit [SCU], short time stay, and other), number of residents at the ward, NH staff at the ward during daytime and evening shift, physician time expressed as minutes per patient per week, and number of times a resident moved from one ward to another related to the time of observation (relocation ratio).

The staff ratio on the ward was calculated by applying the following formula:

$$\frac{(\text{number of staff at daytime} + \text{evening on weekdays}) \times 5 + (\text{number of staff at daytime} + \text{evening in weekends}) \times 2}{\text{Number of residents on the ward}}$$

2.5 | Statistics

Demographic, clinical, and organizational characteristics were described as means and standard deviations (SD) or frequencies and percentages.

By means of an exploratory approach of total direct care time, a growth mixture model¹⁴ was estimated to identify potential homogeneous groups of participants, following similar profiles from FU6 to FU36. The number of groups was determined by Akaike information

criterion (AIC), where a smaller value means a better model.¹⁵ In addition, we aimed at nonoverlapping confidence intervals and average within-group probabilities of at least 0.8. The identified groups were compared with respect to several clinical variables measured at BL by estimating nominal regression model with group-belonging as the outcome variable. Bivariate and multiple models were estimated, and multiple model was reduced by applying AIC.

To assess trend in direct care time, a linear mixed model¹⁶ with fixed effects for time up to second order was estimated. The model included random effects for participants, wards, and interaction between both factors. Furthermore, to explore which demographic, clinical, and organizational factors measured at BL or at each follow-up were associated to trend in direct care time, bivariate models were estimated. Finally, a multiple model including all factors was estimated and reduced by applying AIC. Similar models were also estimated separately for direct care time for PADL, IADL, and supervision. Results with *P* values below 0.05 were considered statistically significant. Statistical analyses were performed in SPSS v25, SAS v9.4, and STATA v14.

2.6 | Ethics

The residents' capacity to consent to participation in the study was considered by the NH staff, including the physician. Written informed consent was obtained by the participants with full capacity to consent, or by next-of-kin on behalf of the participants in case of reduced capacity to consent. The Regional Ethics Committee for Medical research in South-Eastern Norway approved of the study (2011/1378a).

3 | RESULTS

3.1 | Study sample

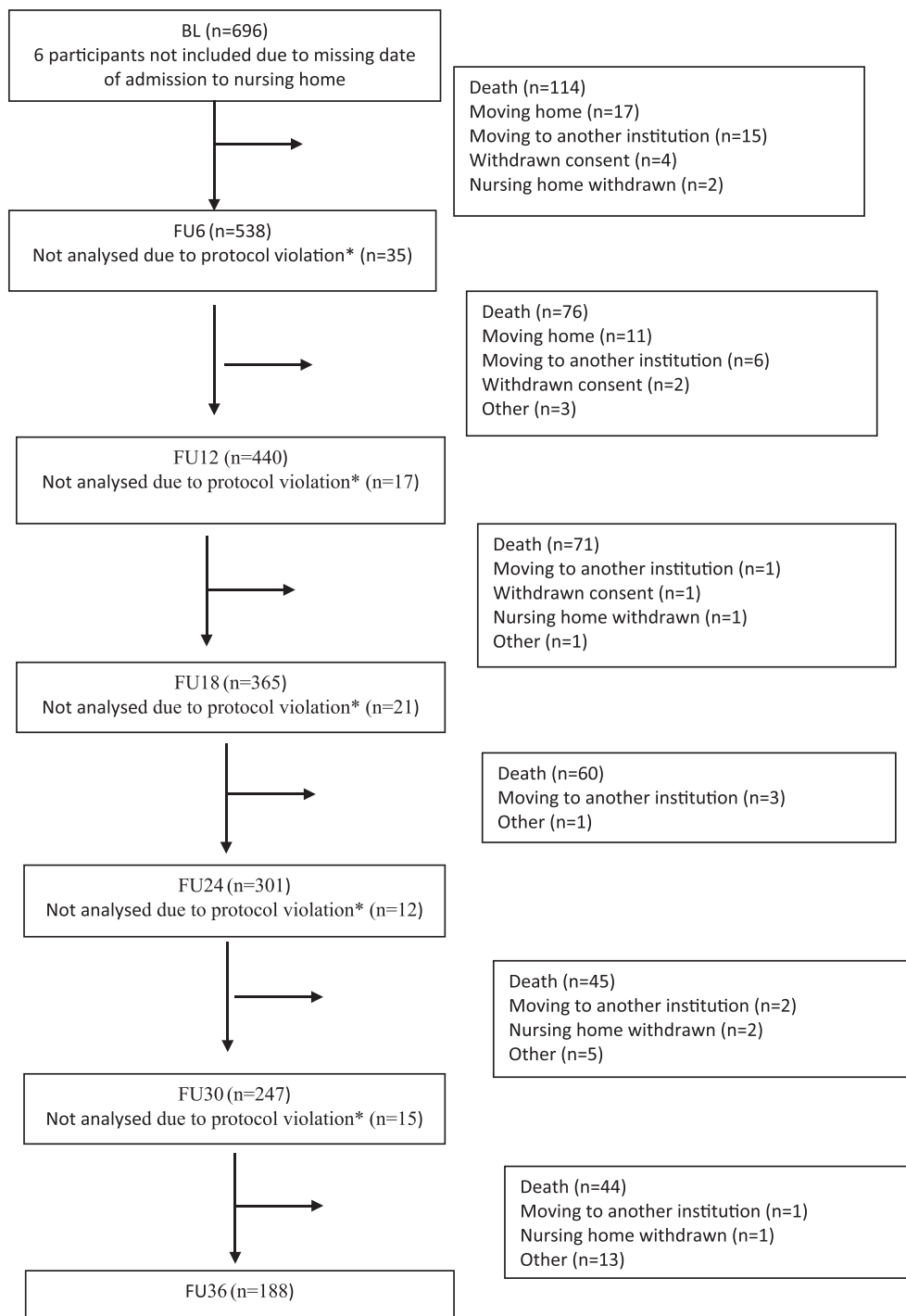
A total of 696 participants was included in the REDIC-NH study. In this study, we included 690 participants for whom the date of admission to the NH could be established. At FU36, 188 participants (27%) were still in the study, 410 participants (59%) had died, and 92 participants (13%) had been excluded for other reasons (Figure 1).

Mean age at BL was 84.4 years, 63.9% were female, and 83.8% of the participants had dementia.

Table 1 shows demographic, clinical, and organizational characteristics of the study sample at all assessments.

3.2 | Direct care time

Direct care time was only assessed at FU6 to FU36. Table 2 and Figure 2 show the amount of direct care time rendered to the NH residents for



* Indicating number of participants failing to complete a FU assessment

FIGURE 1 Flow chart describing attrition from baseline (BL) to follow-up (FU)36

PADL, IADL, and supervision. At FU6, direct care time was 76.2 hours per month. During the observation period, direct care time rendered was gradually decreased to a mean of 50.3 hours per month at FU36.

There were no differences in the use of direct care time between participants who died during or survived throughout the observation period ($P = 0.741$), and a selective analysis of participants surviving until the end of the study period ($n = 188$) showed a similar use of direct care, with 71.7 hours per months at FU6 and a gradual decline during the observation period.

PADL constituted the biggest part of direct care time (about 50% to 60%), while IADL constituted the smallest part.

A growth mixture model was applied to analyze whether certain groups of residents followed distinct trajectories in the use of direct care time throughout the observation period. We identified three groups of participants (Figure 3). The majority of participants ($n = 494$ [92.0%]) belonged to group 2 (G2), with a stable use of direct care time throughout the observation period. Two other groups were smaller, with 19 (3.6%) of participants in group 1 (G1) and 21 (3.9%) of

TABLE 1 Demographic, clinical, and organizational characteristics of the study population during the observation period

	BL	FU6	FU12	FU18	FU24	FU30	FU36
Number	690	537	440	365	301	247	188
Assessed (%)	690 (100)	503 (93.5)	423 (95.9)	344 (94.2)	289 (95.7)	232 (94.0)	188 (100)
Age at BL, mean (SD)	84.4 (7.5)	84.1 (7.5)	84.2 (7.6)	83.6 (7.8)	83.4 (7.9)	83.5 (7.9)	83.0 (8.0)
Gender, female (%)	441 (63.9)	355 (65.9)	294 (66.8)	245 (67.1)	199 (66.1)	163 (66.0)	132 (70.2)
Lived with partner before admission (%)	207 (30.4)	158 (29.8)	125 (28.8)	102 (28.4)	84 (28.5)	67 (27.7)	51 (27.7)
Dementia at BL (%)	574 (83.9)	461 (86.7)	380 (87.4)	317 (87.8)	264 (88.9)	216 (88.2)	163 (87.2)
CDR score (%)							
No or possible dementia	92 (13.5)	64 (12.8)	40 (9.7)	29 (8.8)	21 (7.4)	13 (5.7)	14 (7.7)
Mild dementia	174 (25.6)	112 (22.4)	69 (16.7)	56 (16.6)	40 (14.0)	24 (10.6)	17 (9.3)
Moderate dementia	276 (40.6)	193 (38.7)	177 (42.9)	111 (32.9)	87 (30.5)	59 (26.0)	51 (27.9)
Severe dementia	135 (19.9)	130 (26.1)	127 (30.8)	141 (41.8)	137 (48.1)	131 (57.7)	101 (55.2)
CDR-SOB, mean (SD)	10.3 (4.3)	11.0 (4.3)	11.7 (4.2)	12.4 (4.2)	12.9 (4.2)	13.6 (4.0)	13.6 (4.2)
PSMS, mean (SD)	15.3 (4.5)	16.1 (4.8)	16.6 (4.6)	17.4 (4.7)	18.4 (4.8)	19.3 (4.7)	20.0 (4.8)
NPI, mean (SD)	13.8 (16.5)	13.8 (17.4)	14.1 (16.5)	16.2 (17.1)	17.3 (19.0)	17.8 (19.9)	16.7 (17.7)
NPI subsyndromes, mean (SD)							
Agitation	4.1 (7.0)	4.2 (6.9)	4.6 (7.1)	4.9 (6.8)	5.8 (7.5)	6.6 (9.0)	5.6 (7.1)
Psychosis	1.7 (3.9)	2.2 (4.4)	2.0 (3.7)	2.5 (4.5)	2.5 (4.4)	2.2 (3.8)	2.5 (4.2)
Affective	3.7 (6.0)	3.7 (5.9)	3.6 (5.3)	4.1 (5.6)	3.8 (5.5)	3.6 (5.3)	3.5 (5.3)
GMHR (%)							
Poor/fair	345 (52.2)	260 (53.2)	244 (60.0)	213 (65.3)	184 (57.6)	151 (71.7)	117 (71.3)
BMI, mean (SD)	23.9 (4.5)	24.2 (4.2)	24.4 (4.4)	24.7 (4.6)	24.6 (4.6)	24.8 (4.7)	24.7 (4.8)
Charlson comorbidity index, mean (SD)	3.0 (2.4)						
Sight at BL (%) Normal	161 (23.9)						
Hearing at BL (%) Normal	295 (43.6)						
Inhabitants of municipality, mean (SD)	49 484 (91 501)	46 234 (88 457)	44 641 (87 267)	47 624 (90 871)	46 893 (89 873)	40 484 (83 312)	41 984 (86 364)
Number of beds in NH, mean (SD)	75.8 (43.4)	76.1 (44.9)	74.7 (44.0)	74.0 (43.3)	75.1 (43.9)	72.4 (43.2)	71.0 (43.9)
Type of ward (%)							
Short-time stay	85 (12)	26 (5)	31 (7)	29 (8)	19 (6)	18 (7)	15 (8)
General	361 (55)	311 (58)	260 (59)	203 (56)	180 (60)	146 (60)	116 (62)
SCU	224 (33)	191 (36)	146 (33)	131 (36)	99 (33)	81 (33)	55 (29)
Other	0	9 (2)	3 (1)	2 (1)	3 (1)	2 (1)	2 (1)
Number of residents on ward, mean (SD)	11.2 (6.1)	11.6 (5.6)	11.7 (5.6)	11.8 (6.1)	11.9 (6.1)	11.6 (6.0)	12.4 (8.1)
Carer-index, mean (SD)	3.6 (1.1)	3.7 (1.0)	3.6 (1.1)	3.7 (1.1)	3.6 (1.1)	3.7 (1.1)	3.6 (0.8)
Relocation ratio, mean (SD)		0.24 (0.58)	0.20 (0.40)	0.19 (0.31)	0.20 (0.31)	0.20 (0.30)	0.20 (0.30)

Abbreviations: BL, baseline; BMI, body mass index; CDR, Clinical Dementia Rating Scale; CDR-SOB, CDR-Sum of Boxes; FU, follow-up; GMHR, General Medical Health Rating; NH, nursing home; NPI, Neuropsychiatric Inventory; PSMS, Physical Self-Maintenance Scale; SCU, special care unit; SD, standard deviation.

participants in group 3 (G3). G1 and G3 had a significantly higher use of direct care time and different trajectories throughout the observation period than G2. While G3 had a very high use of direct care time 6 months after admission that steeply declined over time, there was a slower, but consistent, increase in G1. According to the nominal regression model (results presented in Tables A1 and A2), more severe dementia at BL was associated with higher odds of

belonging to G1 ($P = 0.008$) and G3 ($P = 0.001$) as compared with G2. In addition, a lower PADL function at BL was associated with lower odds of belonging to G1 than G2 ($P = 0.012$), while more agitation at BL was associated with higher odds of belonging to G3 than G2 ($P = 0.019$).

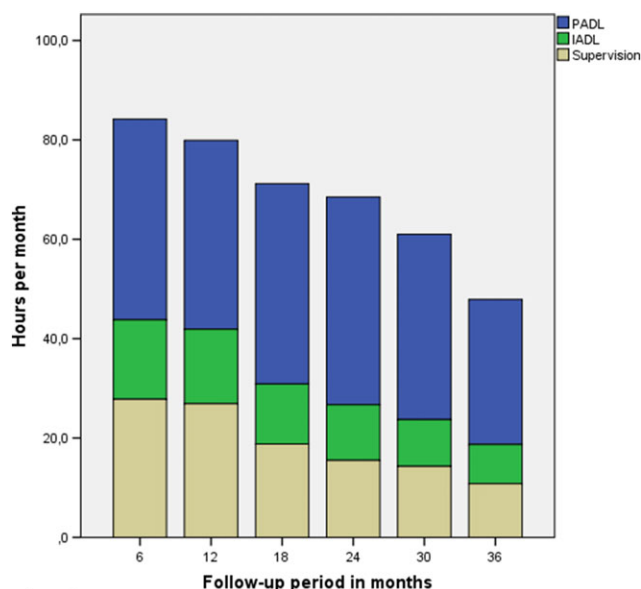
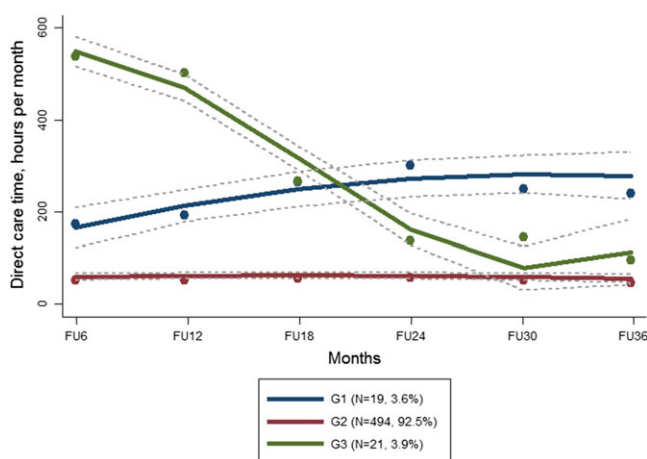
Growth models for direct care time for PADL, IADL, and supervision are presented in Figures A1–A3.

TABLE 2 Direct care time from FU6 to FU36

	Direct Care Time in Hours Per Month, Mean (SD)			
	PADL	IADL	Supervision	Total ^a
FU6	40.4 (62.9)	16.0 (54.0)	27.8 (86.6)	76.2 (118.4)
FU12	38.0 (58.2)	15.0 (56.4)	26.9 (88.7)	71.4 (109.6)
FU18	40.3 (49.3)	12.2 (29.4)	18.8 (54.0)	70.1 (92.4)
FU24	41.8 (43.3)	11.2 (25.0)	15.5 (35.5)	67.6 (79.2)
FU30	37.3 (37.8)	9.4 (14.0)	14.3 (37.1)	59.9 (64.2)
FU36	32.4 (29.2)	7.9 (7.5)	10.8 (22.9)	50.3 (47.4)

Abbreviations: FU, follow-up; IADL, instrumental ADL; PADL, personal activities of daily living; SD, standard deviation.

^aTotal direct care time cannot exceed 720 hours per month.

**FIGURE 2** Direct care time specified after PADL, IADL, and supervision [Colour figure can be viewed at wileyonlinelibrary.com]**FIGURE 3** Trajectories of total direct care time [Colour figure can be viewed at wileyonlinelibrary.com]

When relating direct care time to the staff ratio of the wards, we found that 50% of the working time was spent on direct care on general wards. On SCUs wards with a special focus on dementia care, the share of working time spent on direct care amounted to 70%.

3.3 | Factors associated with direct care time

No significant overall trend in direct care time throughout the observation period was found. However, a weak decrease was observed with a reduction of direct care time from a mean of 76.2 hours per month at FU6 to 50.3 hours at FU36, with a large variability between the participants (Table 2). According to the multiple linear mixed model (Table 3), higher use of direct care time was associated with younger age ($P = 0.034$), more severe dementia ($P = 0.010$), increase in PSMS score ($P < 0.001$), and increased scores in NPI-Affective ($P = 0.005$) and NPI-Psychosis ($P < 0.001$). No associations between other patient characteristics and use of direct care time were found. Regarding the organizational variables, in the bivariate analyses, an increased use of direct care time was associated with living at SCU and with a higher staff ratio as compared with general wards and a lower staff ratio; however, no significant associations were found in the multiple model.

The same models were also estimated separately for the use of direct care time for PADL, IADL, and supervision (results are presented in Tables A3–A5). In the multiple linear regression model, a higher use of direct PADL care time was associated with younger age, more severe dementia, increase in PSMS scores, and increase in scores on NPI-Psychosis and NPI-Agitation, as well as staying in a SCU as compared with a general ward. Higher use of IADL care time was associated with an increase in PSMS scores and living in a larger municipality, while higher use of care time for supervision was associated with more severe dementia and increased scores on all NPI subsyndromes.

4 | DISCUSSION

The REDIC-NH study includes 696 participants, of which 690 were included in this longitudinal study over 3 years to evaluate the use of direct care time and identify characteristics associated with the use of direct care. Six months after admission, we found that 2.5 hours of direct care per day were rendered to each resident, while this number was reduced to 1.7 hours per day at the end of the study period. Direct care time constitutes about half of the staff's working time. We further found that the majority of residents showed a stable use of direct care time, while there was a small group of residents that displayed a much higher use of direct care time. These residents were characterized by more severe dementia, lower PADL function, and more agitation.

SCUs normally consist of units with fewer beds than general wards and are designed to respond to the needs of residents with more neuropsychiatric symptoms by a higher staff ratio and, as our findings suggest, a higher share of the working time rendered as direct care time. In the unadjusted model, residents on small units received more direct care, and in the adjusted model, a higher use of direct PADL care time was associated with staying in a SCU. These results may indicate that the needs of residents with more complex demands are met by placing them on SCUs.

We had expected that the use of direct care would increase throughout the nursing home stay, due to an increasing dementia severity and overall decline in physical health. However, this was only found in one small group of residents (group 1), but not in the majority (group 2 or 3), nor for the study cohort as a whole. One possible

TABLE 3 Linear mixed models for association between total direct care time and demographic, clinical, and organizational variables

Variable	Unadjusted Model		Multiple Model		Multiple Model, AIC-reduced	
	Coeff. (SE/95% CI)	P Value	Coeff. (SE/95% CI)	P Value	Coeff. (SE/95% CI)	P Value
Trend						
Time	0.70 (0.92)	0.447	-0.49 (0.92)	0.593	-0.43 (0.92)	0.644
Time × Time	-0.03 (0.02)	0.188	-0.02 (0.02)	0.352	-0.02 (0.02)	0.318
Patient characteristics						
Baseline						
Age	-1.79 (-2.83 to -0.76)	0.001	-1.12 (-2.17 to -0.07)	0.036	-1.13 (-2.18 to -0.08)	0.034
Gender (female = 0)						
Male	7.06 (-9.52 to 23.65)	0.403	0.08 (-15.78 to 15.93)	0.992	0.11 (-15.71 to 15.93)	0.989
Lived alone (no = 0)						
Yes	-7.04 (-24.12 to 10.05)	0.419	9.19 (-7.24 to 25.62)	0.272	8.99 (-7.41 to 25.39)	0.282
Dementia at BL (no dementia = 0)						
Yes	33.47 (9.21-57.74)	0.007	-1.31 (-20.88 to 18.26)	0.895	0.57 (-23.71 to 24.86)	0.963
Sight (normal = 0)						
Impaired	-5.41 (-23.63 to 12.80)	0.559	-1.33 (-18.15 to 15.49)	0.877	-1.85 (-18.60 to 14.89)	0.828
Hearing (normal = 0)						
Impaired	-12.78 (-28.84 to 3.27)	0.118	-1.73 (-17.99 to 14.54)	0.835	-1.55 (-17.70 to 14.59)	0.850
Charlson's	2.11 (-1.68 to 5.90)	0.275	3.16 (-0.33 to 6.65)	0.076	3.17 (-0.31 to 6.65)	0.074
Time dependent						
CDR-SOB	5.75 (4.25-7.24)	<0.001	2.61 (0.70-4.52)	0.007	2.52 (0.61-4.43)	0.010
PSMS	4.75 (3.47-6.02)	<0.001	3.33 (1.78-4.89)	<0.001	3.25 (1.73-4.77)	<0.001
NPI-Affective	3.11 (2.12-4.09)	<0.001	1.47 (0.43-2.51)	0.006	1.48 (0.44-2.52)	0.005
NPI-Psychosis	5.08 (3.81-6.34)	<0.001	3.38 (1.96-4.79)	<0.001	3.37 (1.96-4.78)	<0.001
NPI-Agitation	2.31 (1.52-3.10)	<0.001	0.43 (-0.44 to 1.29)	0.336	0.44 (-0.43 to 1.31)	0.319
GMHR (good/excellent = 0)						
Poor/fair	5.92 (-4.56 to 16.40)	0.268	5.63 (-2.30 to 13.56)	0.164	-7.87 (-18.46 to 2.73)	0.145
BMI	-1.15 (-2.69 to 0.40)	0.146	-0.22 (-1.68 to 1.24)	0.768	-0.23 (-1.68 to 1.22)	0.757
Organizational variables						
Baseline						
Inhabitants	0.00004 (-0.00007 to 0.0001)	0.524	0.00003 (-0.00006 to 0.0001)	0.486		
Size of the NH	0.03 (-0.17 to 0.23)	0.770	0.02 (-0.16 to 0.21)	0.824	-7.38 (-23.19 to 8.43)	0.359
Relocation ratio	4.03 (-13.46 to 21.52)	0.651	-6.88 (-23.17 to 9.41)	0.407		
Time dependent						
Type of ward (general = 0)						
SCU	24.19 (10.17-38.20)	0.001	10.72 (-3.98 to 25.41)	0.153	10.65 (-3.96 to 25.26)	0.153
Short time	15.96 (-5.94 to 37.85)	0.153	12.49 (-8.62 to 33.60)	0.246	12.06 (-8.96 to 33.07)	0.261
Other	26.95 (-11.03 to 64.93)	0.164	20.27 (-16.91 to 57.45)	0.285	20.13 (-17.01 to 57.26)	0.288
Size of the ward	-0.83 (-2.00 to 0.33)	0.162	-0.03 (-1.15 to 1.10)	0.963	0.04 (-1.07 to 1.16)	0.938
Staff ratio	9.08 (2.62-15.54)	0.006	2.91 (-3.77 to 9.60)	0.392	3.13 (-3.51 to 9.78)	0.355

Abbreviations: AIC, Akaike information criterion; CDR-SOB, Clinical Dementia Rating Scale-Sum of Boxes; Charlson's, Charlson's comorbidity index; CI, confidence interval; coeff, coefficient; GMHR, General Medical Health rating; NPI, Neuropsychiatric Inventory; PSMS, Physical Self-Maintenance Scale; SCU, special care unit; SE, standard error.

explanation is that dementia in a more severe stage results in a more passive, apathetic behavior, or that residents during the course of their disease become bedridden with a decreased need for one-to-one care. It could also be possible that person-centered care lowers the need for frequent interactions between staff and resident and thus the use of direct care. We found that about half of the staff's working time was used for direct care of the residents, indicating a high level of individual care. We could, however, rule out a selection bias where the residents

with the highest use of direct care might die during the observation period, as there was no difference in the use of direct care between participants dying during or surviving throughout the observation period. Moreover, the statistical model used includes all information available, also from those lost to follow-up, in this way reducing bias.

Few studies have evaluated the use of direct care in NH residents, and to the best of our knowledge, no longitudinal studies have investigated this matter. Luttenberger et al³ evaluated direct care time in

148 residents who had lived in NHs in Germany for a mean of 2.1 years. They found that a mean of about 1.8 hours of direct care per day was rendered, which is slightly lower than our finding at FU24 of 2.3 hours. However, Luttenberger described that PADL constituted the largest part of the total direct care time (66%), as compared with 50% to 60% in our study. Nordberg et al evaluated direct care time in a Swedish cohort of 176 NH residents.⁶ They found much higher numbers with 10 hours of direct care time per patient per day, and most of which was derived from time used for supervision. However, the authors stated that the time for supervision, in particular, might have been overestimated.

It is tempting to convert the time used for direct care into cost figures using a linear association.^{6,17} However, we have not conducted a cost analysis as part of this study, as it would be beyond the scope of this study to convert Norwegian reimbursement rules to the costs of direct care. Most NHs in Norway are reimbursed by fixed rates per resident, and that rate might be higher for SCUs as they are better staffed, but rates are not adjusted for the needs of individual residents. Variations in the need of care are addressed either by shifting resources from one patient to another or, when residents present with needs that cannot be responded to using existing resources, by hiring extra staff. Only the latter will trigger extra costs. Nevertheless, in other health care systems, there may be a closer association between care time and costs.

4.1 | Strengths and limitations of the study

We followed a large cohort of 690 participants from 47 NHs in a prospective design over 3 years, with clinical assessments twice a year. High quality of the data collection was secured by standardized interviews carried out by health care workers with adequate training under the supervision of research nurses. Furthermore, the Norwegian health and care system provides a rather homogenous environment for health service research, as most of the nursing homes are run by the municipality. The care services are rendered with comparable criteria for admission of residents, staffing norms, medical services, and reimbursement systems.

However, the project did not include any interrater reliability analysis between the different informants or data collectors, and this might be especially problematic in rating nonstandardized variables like hearing or sight. The Charlson comorbidity index was calculated relating on information in the patient's journal, containing both diagnoses set at hospital stays, by the patients' general practitioners before NH admission or the nursing home doctors at NH admission, but we did not quality check the diagnoses by exploring the patients' journals in detail. Thus, there might be the possibility for misdiagnoses, resulting in wrongly calculated comorbidity indices.

Unfortunately, the instrument RUD-FOCA was not applied at BL, and we thus lack information about the use of direct care immediately after admission to NH. Furthermore, reporting of time used for direct care relies on the correct recollection of the resident's carer. We observed that, in a few cases, 24 hours of direct care time were reported for PADL, IADL, and supervision, resulting in a total need for care of 72 hours per day, which we consider impossible. The maximum time of total direct care was, therefore, limited to 24 hours per

day. However, when interpreting the findings of this study, the possibility for biased reports has to be taken into consideration.

Assessing the direct care time for IADL might also be complicated, as many IADL tasks, such as washing laundry or shopping for groceries, will not be applicable in an NH. Further, we evaluated the use of direct care time in nursing homes, which do not necessarily reflect the residents' need for care and interaction. This study did not include data about the residents' or next-of-kin's expectations regarding the extent of care, or whether they were met.

5 | CONCLUSION

In Norwegian NHs, about half of the staff's working time is rendered as direct care time in a one-to-one setting. The majority of residents have a stable use of direct care time throughout their NH stay, while a minority experiences a much higher use that alternated during the NH stay. High use of direct care time was associated with younger age, more severe dementia, and severe neuropsychiatric symptoms. By identifying factors that impact on direct care time preventive measures might be put in place to the benefit of the residents and possibly to improve resource use. Further research should explore the association between direct care time, quality of care, and the residents' quality of life.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Corinna Vossius contributed to the conception of the study, analysis and interpretation of the data, drafting of the results, and writing of the paper. Geir Selbæk contributed to the conception of the study, data collection, analysis and interpretation of the data, drafting of the results, and writing of the paper. Jurate Šaltytė Benth contributed to the conception of the study, analysis and interpretation of the data, drafting of the results, and writing of the paper. Anders Wimo contributed to analysis and interpretation of the data, drafting of the results, and writing of the paper. Sverre Bergh contributed to the conception of the study, data collection, analysis and interpretation of the data, drafting of the results, and writing of the paper. All authors approved of the final version of the paper.

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ORCID

Corinna Vossius  <https://orcid.org/0000-0001-7542-6346>

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APPENDIX A

TABLE A1 Participant characteristics for the trajectories in total direct care time, specified after group (G)-1, -2, and -3

Variable	G-1	G-2	G-3
N (%)	19 (3.6%)	494 (92.5%)	21 (3.9%)
Average probability	0.88	0.99	0.98
CDR-SOB			
N	19	485	21
Mean (SD)	12.11 (4.08)	10.04 (4.15)	14.05 (2.97)
GMHR			
N	18	477	21
Poor/fair			
N (%)	10 (55.6)	230 (48.2)	6 (28.6)
Good/excellent			
N (%)	8 (44.4)	247 (51.8)	15 (71.4)
NPI-Affective			
N	19	489	20
Mean (SD)	5.74 (8.43)	3.28 (5.21)	7.15 (8.52)
NPI-Psychosis			
N	19	482	19
Mean (SD)	3.26 (5.22)	1.58 (3.58)	4.05 (5.77)
NPI-Agitation			
N	19	479	20
Mean (SD)	5.84 (9.39)	3.55 (6.39)	10.05 (9.97)
PSMS			
N	19	490	21
Mean (SD)	13.16 (3.75)	14.77 (4.45)	16.43 (4.04)

Abbreviations: CDR-SOB, Clinical Dementia Rating Scale–Sum of Boxes; GMHR, General Medical Health Rating; NPI, Neuropsychiatric Inventory; PSMS, Physical Self-Maintenance Scale; SD, standard deviation.

TABLE A2 Predictors for belonging to the identified groups for trajectories of total direct care time, Group-1, -2, and -3. Nominal regression model

Variable	Unadjusted Model		Multiple Model		Multiple Model, AIC-reduced	
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value
CDR-SOB						
Group-1	1.14 (1.00-1.31)	0.044	1.27 (1.07-1.51)	0.006	1.25 (1.06-1.48)	0.008
Group-2—Ref.	1	-	1	-	1	-
Group-3	1.37 (1.17-1.60)	<0.001	1.34 (1.10-1.63)	0.003	1.37 (1.14-1.66)	0.001
GMHR						
Poor/fair						
Group-1	1.34 (0.52-3.46)	0.549	2.05 (0.75-5.62)	0.162		
Group-2—Ref.	1	-	1	-		
Group-3	0.49 (0.18-1.32)	0.160	0.63 (0.22-1.82)	0.390		
Good/excellent—Ref.	1		1			
NPI-Affective						
Group-1	1.06 (0.99-1.14)	0.086	1.04 (0.97-1.12)	0.284		
Group-2—Ref.	1	-	1	-		
Group-3	1.10 (1.04-1.16)	0.002	1.05 (0.98-1.13)	0.165		
NPI-Psychosis						
Group-1	1.07 (0.98-1.18)	0.142	1.03 (0.91-1.17)	0.682		
Group-2—Ref.	1	-	1	-		
Group-3	1.11 (1.03-1.20)	0.010	0.97 (0.86-1.09)	0.590		
NPI-Agitation						
Group-1	1.04 (0.98-1.10)	0.157	1.01 (0.93-1.09)	0.897	1.03 (0.97-1.10)	0.357
Group-2—Ref.	1	-	1	-	1	-
Group-3	1.09 (1.04-1.14)	<0.001	1.06 (0.99-1.13)	0.072	1.06 (1.01-1.11)	0.019
PSMS						
Group-1	0.93 (0.83-1.04)	0.204	0.81 (0.70-0.94)	0.006	0.83 (0.72-0.96)	0.012
Group-2—Ref.	1	-	1	-	1	-
Group-3	1.07 (0.97-1.19)	0.184	0.93 (0.81-1.06)	0.289	0.92 (0.81-1.04)	0.201

Abbreviations: AIC, Akaike information criterion; CDR-SOB, Clinical Dementia Rating Scale—Sum of Boxes; CI, confidence interval; GMHR, General Medical Health Rating; NPI, Neuropsychiatric Inventory; OR, odds ratio; PSMS, Physical Self-Maintenance Scale; SD, standard deviation.

TABLE A3 Linear mixed models for association between direct care time for PADL and demographic, clinical, and organizational variables

Variable	Unadjusted Model		Multiple Model		Multiple Model, AIC-reduced	
	Coeff. (SE/95% CI)	P Value	Coeff. (SE/95% CI)	P Value	Coeff. (SE/95% CI)	P Value
Trend						
Time	0.69 (0.49)	0.157	0.05 (0.48)	0.921	0.03 (0.48)	0.954
Time × Time	−0.02 (0.01)	0.144	−0.02 (0.01)	0.172	−0.02 (0.01)	0.180
Patient characteristics						
Baseline						
Age	−0.94 (−1.40 to −0.49)	<0.001	−0.62 (−1.07 to −0.18)	0.006	−0.61 (−1.05 to −0.17)	0.007
Gender						
Female	0		0		0	
Male	4.07 (−3.32 to 11.46)	0.280	0.69 (−5.96 to 7.35)	0.838	0.98 (−5.68 to 7.64)	0.773
Lived alone						
No	0		0		0	
Yes	−6.11 (−13.70 to 1.48)	0.114	2.53 (−4.36 to 9.42)	0.471	2.78 (−4.13 to 9.69)	0.429
Dementia at BL						
No	0		0		0	
Yes	9.23 (−1.57 to 20.03)	0.094	−5.16 (−15.64 to 5.32)	0.334	−5.93 (−16.41 to 4.55)	0.267
Sight						
Normal	0		0		0	
Impaired	−3.06 (−11.11 to 4.99)	0.456	−0.55 (−7.60 to 6.49)	0.877	−0.91 (−7.93 to 6.12)	0.800
Hearing						
Normal	0		0		0	
Impaired	−9.11 (−16.18 to −2.04)	0.012	−1.92 (−8.74 to 4.90)	0.580	−2.39 (−9.14 to 4.36)	0.487
Charlson's	0.24 (−1.45 to 1.93)	0.782	0.75 (−0.72 to 2.23)	0.314	0.62 (−0.85 to 2.09)	0.410
Time dependent						
CDR-SOB	3.06 (2.36-3.76)	<0.001	1.19 (0.27-2.11)	0.011	1.24 (0.32-2.16)	0.008
PSMS	3.53 (2.95-4.10)	<0.001	2.93 (2.20-3.65)	<0.001	2.95 (2.22-3.67)	<0.001
NPI-Affective	0.99 (0.50-1.48)	<0.001	0.49 (−0.005 to 0.99)	0.053	0.44 (−0.05 to 0.94)	0.080
NPI-Psychosis	1.18 (0.54-1.81)	<0.001	0.79 (0.10-1.48)	0.024	0.82 (0.13-1.51)	0.019
NPI-Agitation	0.32 (−0.07 to 0.72)	0.109	−0.56 (−0.98 to −0.14)	0.009	−0.54 (−0.95 to −0.12)	0.013
GMHR						
Poor/fair	7.85 (2.56-13.14)	0.004	−0.69 (−5.96 to 4.59)	0.799	−0.44 (−5.72 to 4.83)	0.869
Good/excellent	0		0		0	
BMI	−0.65 (−1.36 to 0.06)	0.075	−0.18 (−0.82 to 0.47)	0.589		
Organizational data						
Baseline						
Inhabitants	0.00003 (−0.00002 to 0.00007)	0.261	0.00003 (−0.000001 to 0.0001)	0.113		
Size of the NH	−0.06 (−0.14 to 0.03)	0.207	−0.07 (−0.15 to 0.003)	0.061	−2.57 (−9.56 to 4.42)	0.471
Relocation ratio	3.49 (−4.54 to 11.51)	0.394	−0.76 (−7.93 to 6.41)	0.835		
Time dependent						
Type of ward						
General	0		0		0	
SCU	11.33 (4.63-18.04)	0.001	8.57 (1.68-15.46)	0.015	9.23 (2.36-16.09)	0.009
Short time	7.18 (−3.71 to 18.06)	0.196	6.31 (−3.89 to 16.50)	0.225	6.94 (−3.20 to 17.09)	0.180
Other	−2.51 (−22.13 to 17.10)	0.802	−0.72 (−19.64 to 18.20)	0.940	−0.43 (−19.32 to 18.47)	0.965
Size of the ward	0.04 (−0.50 to 0.58)	0.888	0.37 (−0.13 to 0.88)	0.149	0.40 (−0.10 to 0.90)	0.119
Staff ratio	3.58 (0.48-6.68)	0.024	0.69 (−2.40 to 3.78)	0.661	0.43 (−2.64 to 3.51)	0.789

Abbreviations: AIC, Akaike information criterion; CDR-SOB, Clinical Dementia Rating Scale–Sum of Boxes; Charlson's, Charlson's comorbidity index; CI, confidence interval; coeff, coefficient; GMHR, General Medical Health Rating; NPI, Neuropsychiatric Inventory; PSMS, Physical Self-Maintenance Scale; SE, standard error; SCU, special care unit.

TABLE A4 Linear mixed models for association between direct care time for IADL and demographic, clinical, and organizational variables

Variable	Unadjusted Model		Multiple Model		Multiple Model, AIC-reduced	
	Coeff. (SE/95% CI)	P Value	Coeff. (SE/95% CI)	P Value	Coeff. (SE/95% CI)	P Value
Trend						
Time	-0.53 (0.38)	0.156	-0.57 (0.38)	0.138	-0.60 (0.38)	0.116
Time × Time	0.007 (0.009)	0.446	0.007 (0.009)	0.473	0.007 (0.009)	0.432
Patient characteristics						
Baseline						
Age	-0.27 (-0.53 to -0.002)	0.049	-0.15 (-0.46 to 0.16)	0.335	-0.14 (-0.45 to 0.16)	0.350
Gender						
Female	0		0		0	
Male	1.46 (-2.82 to 5.75)	0.502	0.90 (-3.73 to 5.54)	0.701	1.09 (-3.50 to 5.68)	0.640
Lived alone						
No	0		0		0	
Yes	0.28 (-4.15 to 4.70)	0.903	2.89 (-1.91 to 7.69)	0.237	2.87 (-1.91 to 7.65)	0.239
Dementia at BL						
No	0		0		0	
Yes	4.01 (-2.23 to 10.25)	0.207	3.03 (-4.30 to 10.37)	0.417	2.96 (-4.31 to 10.23)	0.424
Sight						
Normal	0		0		0	
Impaired	-2.40 (-7.03 to 2.23)	0.309	-1.74 (-6.62 to 3.13)	0.482	-1.44 (-6.26 to 3.38)	0.557
Hearing						
Normal	0		0		0	
Impaired	-2.62 (-6.72 to 1.48)	0.210	-0.28 (-5.02 to 4.46)	0.906	-0.11 (-4.80 to 4.58)	0.963
Charlson's	0.12 (-0.86 to 1.10)	0.813	0.33 (-0.69 to 1.36)	0.524	0.34 (-0.68 to 1.36)	0.512
Time dependent						
CDR-SOB	0.48 (0.01-0.94)	0.045	-0.27 (-0.95-0.40)	0.430	-0.24 (-0.90-0.43)	0.487
PSMS	0.54 (0.14-0.95)	0.008	0.61 (0.08-1.14)	0.024	0.62 (0.09-1.15)	0.021
NPI-Affective	0.40 (0.06-0.73)	0.020	0.28 (-0.09 to 0.66)	0.132	0.32 (-0.02 to 0.67)	0.068
NPI-Psychosis	0.46 (0.03-0.90)	0.035	0.23 (-0.28 to 0.75)	0.377		
NPI-Agitation	0.20 (-0.07 to 0.46)	0.148	-0.07 (-0.39 to 0.24)	0.657		
GMHR						
Poor/fair	0.65 (-3.07 to 4.37)	0.732	-1.46 (-5.46 to 2.55)	0.476	-1.41 (-5.40 to 2.58)	0.487
Good/excellent	0		0		0	
BMI	-0.19 (-0.63 to 0.25)	0.390	-0.17 (-0.62 to 0.29)	0.475		
Organizational data						
Baseline						
Inhabitants	0.00003 (0.00000-0.00005)	0.048	0.00003 (0.00000-0.00005)	0.044	0.00003 (0.000001-0.00006)	0.039
Size of the NH	-0.01 (-0.06 to 0.03)	0.537	-0.03 (-0.08 to 0.02)	0.221	-0.03 (-0.08 to 0.02)	0.248
Relocation ratio	0.34 (-4.48 to 5.17)	0.888	0.69 (-4.38 to 5.75)	0.790	0.56 (-4.49 to 5.61)	0.828
Time dependent						
Type of ward						
General	0		0		0	
SCU	5.90 (1.64-10.16)	0.007	4.88 (-0.06 to 9.83)	0.053	4.85 (-0.04 to 9.75)	0.052
Short time	-0.47 (-7.86 to 6.92)	0.900	-0.16 (-7.66 to 7.34)	0.967	-0.25 (-7.69 to 7.19)	0.947
Other	4.84 (-9.91 to 19.58)	0.520	5.63 (-9.27 to 20.52)	0.459	6.04 (-8.81 to 20.89)	0.425
Size of the ward	-0.06 (-0.40 to 0.27)	0.711	0.05 (-0.31 to 0.41)	0.783		
Staff ratio	1.25 (-0.75 to 3.25)	0.219	-0.005 (-2.25 to 2.24)	0.996	-0.01 (-2.23 to 2.21)	0.991

Abbreviations: AIC, Akaike information criterion; CDR-SOB, Clinical Dementia Rating Scale—Sum of Boxes; CI, Charlson's, Charlson's comorbidity index confidence interval; coeff, coefficient; GMHR, General Medical Health Rating; NPI, Neuropsychiatric Inventory; PSMS, Physical Self-Maintenance Scale; SCU, special care unit; SE, standard error.

TABLE A5 Linear mixed models for association between direct care time for supervision and demographic, clinical and organizational variables.

Variable	Unadjusted model		Multiple model		Multiple model, AIC-reduced	
	coeff. (SE/95% CI)	p-value	coeff. (SE/95% CI)	p-verdi	coeff. (SE/95% CI)	p-value
Trend						
Time	-0.45 (0.60)	0.453	-0.92 (0.60)	0.127	-0.91 (0.60)	0.131
Time x Time	0.002 (0.01)	0.917	0.008 (0.01)	0.576	0.008 (0.01)	0.581
Patient characteristics						
Baseline						
Age	-1.04 (-1.81; -0.27)	0.009	-0.69 (-1.51; 0.13)	0.097	-0.72 (-1.53; 0.10)	0.087
Gender						
Female	0		0		0	
Male	4.59 (-7.77; 16.95)	0.466	2.53 (-9.89; 14.95)	0.689	2.39 (-10.03; 14.81)	0.705
Lived alone						
No	0		0		0	
Yes	0.95 (-11.79; 13.69)	0.883	8.93 (-3.91; 21.78)	0.172	8.53 (-4.30; 21.36)	0.192
Dementia at BL						
No	0		0		0	
Yes	22.14 (4.09; 40.18)	0.016	1.59 (-17.23; 20.40)	0.868	2.62 (-16.12; 21.37)	0.783
Sight						
Normal	0		0		0	
Impaired	-5.45 (-19.09; 8.20)	0.433	-2.79 (-16.03; 10.44)	0.678	-2.44 (-15.65; 10.77)	0.717
Hearing						
Normal	0		0		0	
Impaired	-3.96 (-15.94; 8.02)	0.516	1.07 (-11.63; 13.78)	0.868	1.91 (-10.72; 14.54)	0.766
Charlson's comorbidity index	1.22 (-1.58; 4.03)	0.392	1.84 (-0.86; 4.55)	0.182	1.96 (-0.75; 4.66)	0.156
Time dependent						
CDR-SOB	2.88 (1.82; 3.95)	<0.001	2.01 (0.68; 3.33)	0.003	1.98 (0.65; 3.30)	0.003
PSMS	0.90 (-0.01; 1.82)	0.054	-0.45 (-1.50; 0.61)	0.408	-0.46 (-1.51; 0.60)	0.398
NPI-Affective	2.40 (1.73; 3.07)	<0.001	1.32 (0.60; 2.04)	<0.001	1.36 (0.64; 2.07)	<0.001
NPI-Psychosis	3.87 (3.01; 4.73)	<0.001	2.33 (1.37; 3.30)	<0.001	2.31 (1.35; 3.28)	<0.001
NPI-Agitation	2.08 (1.54; 2.62)	<0.001	1.03 (0.43; 1.62)	0.001	1.01 (0.42; 1.61)	0.001
GMHR						
Poor/fair	0.12 (-6.91; 7.16)	0.972	-5.06 (-12.13; 2.02)	0.161	-5.23 (-12.30; 1.84)	0.147
Good/excellent	0		0		0	
BMI	-0.13 (-1.24; 0.98)	0.820	0.24 (-0.84; 1.32)	0.666	0.17 (-0.90; 1.25)	0.756
Organisational data						
Baseline						
Inhabitants	-0.00002 (-0.0001; 0.00006)	0.679	-0.00003 (-0.0001; 0.00005)	0.450		
Size og the NH	0.07 (-0.07; 0.22)	0.329	0.08 (-0.06; 0.22)	0.243	-4.94 (-16.85; 6.97)	0.415
Relocation ratio	0.60 (-12.11; 13.30)	0.927	-6.86 (-19.14; 5.43)	0.273		
Time dependent						
Type of ward						
Open	0		0		0	
SCU	11.04 (1.23; 20.84)	0.027	-2.37 (-12.60; 7.87)	0.650	-2.87 (-13.06; 7.32)	0.581
Short time	7.51 (-7.24; 22.27)	0.318	3.80 (-10.43; 18.03)	0.601	3.34 (-10.83; 11.52)	0.644
Other	26.64 (1.74; 51.55)	0.036	17.00 (-7.18; 41.19)	0.168	16.77 (-7.41; 40.94)	0.174
Size of the ward	-0.94 (-1.78; -0.11)	0.027	-0.27 (-1.10; 0.56)	0.519	-0.28 (-1.11; 0.54)	0.500
Staff ratio	7.30 (2.80; 11.80)	0.002	4.23 (-0.45; 8.92)	0.077	4.44 (-0.23; 9.11)	0.062

AIC= Akaike's Information Criterion; coeff=coefficient; CI=Confidence interval; SE=Standard error; CDR-SOB=Clinical Dementia Rating Scale-sum of boxes; PSMS=Physical Self Maintenance Scale; NPI=Neuropsychiatric Inventory; GMHR=General Medical Health rating; SCU=Special Care Unit.

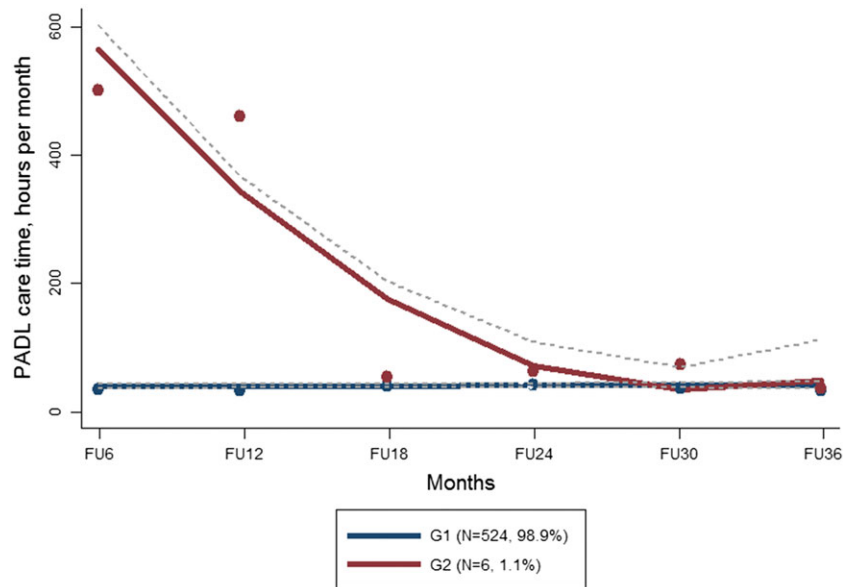


FIGURE A1 Trajectories of PADL care time
[Colour figure can be viewed at
wileyonlinelibrary.com]

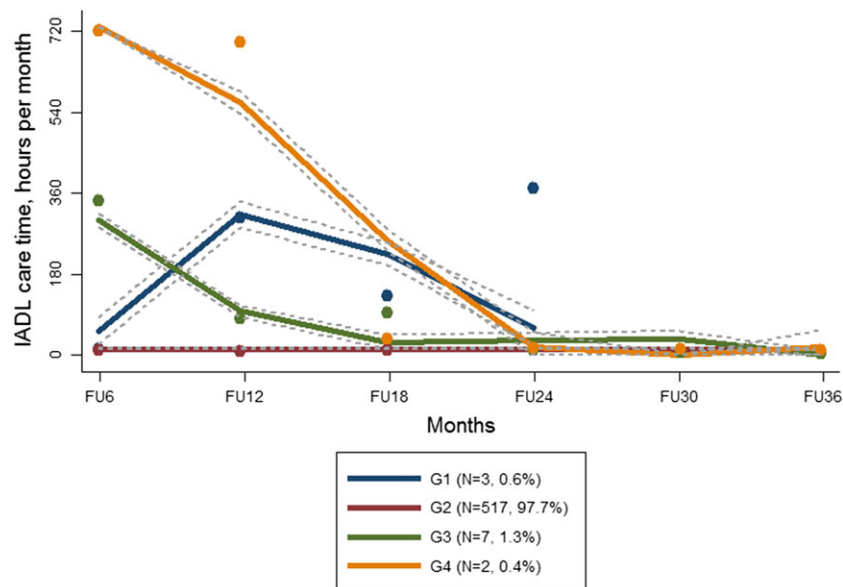


FIGURE A2 Trajectories of IADL care time
[Colour figure can be viewed at
wileyonlinelibrary.com]

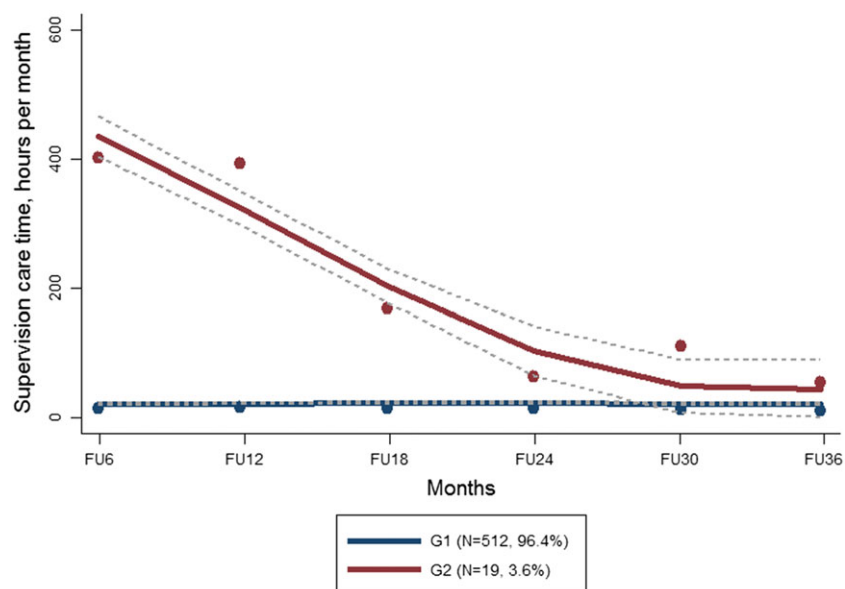


FIGURE A3 Trajectories of supervision care time [Colour figure can be viewed at wileyonlinelibrary.com]