1 **Title:** Two factors that can increase the length of hospital stay of patients with dementia.

2 **Título:** Dos factores que pueden aumentar la duración de la estancia hospitalaria de los
3 pacientes con demencia.

4 **Abstract, keywords and key-points**

5 **Abstract**

6 **Objectives**

7 Patients with dementia are at greater risk of a long hospital stay and this is associated with

8 adverse outcomes. The aim of this service evaluation was to identify variables most predictive

9 of increased length of hospital stay amongst patients with dementia

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11 **Methods/Design**

12 We conducted a retrospective analysis on a cross-sectional hospital dataset for the period

13 January-December 2016. Excluding length of stay less than 24 hours and readmissions, the

14 sample comprised of 1,133 patients who had a dementia diagnosis on record.

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16 **Results**

17 The highest incidence rate ratio for length of stay in the dementia sample was: a) discharge to

18 a care home (IRR: 2.443, 95% CI 1.778- 3.357) b) falls without harm (IRR: 2.486, 95% CI

19 2.029-3.045).

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21 **Conclusions**

22 Based on this dataset, we conclude that improvements made to falls prevention strategies in

23 hospitals and discharge planning procedures can help to reduce the length of stay for patients

24 with dementia.

Resumen

Objetivos

Los pacientes con demencia tienen mayor riesgo de una estancia hospitalaria prolongada y esto se asocia con resultados adversos. El objetivo de esta evaluación del fue identificar las variables predictivas de una mayor duración de la estancia hospitalaria de los pacientes con demencia.

Métodos/Diseño

Realizamos un análisis retrospectivo de un conjunto de datos hospitalarios transversales en el período enero-diciembre de 2016. Excluyendo la estancia hospitalaria inferior a 24 horas y los reingresos, la muestra estaba compuesta por 1133 pacientes que tenían un diagnóstico de demencia registrado.

Resultados

Los pacientes con demencia con estancia más prolongada presentaban mayor tasa de incidencia de: a) alta a una residencia (TIR: 2.443, IC 95% 1.778-3.357) b) caídas sin daño (TIR: 2.486, IC 95% 2.029-3.045)

Conclusiones

En base a estos resultados, concluimos que las mejoras realizadas en las estrategias de prevención de caídas en los hospitales y los procedimientos de planificación del alta pueden ayudar a reducir la duración de la mejor estancia de los pacientes con demencia.

Keywords

1 Dementia, Hospital, Length of stay, Falls, Discharge.

2 **Palabras clave**

3 Demencia, Hospital, Duración de la estancia, Caídas, Alta.

4 **Key point**

5 The occurrence of hospital falls and discharges to care homes were associated with increased

6 length of hospital stay for patients with dementia.

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Introduction

Dementia is a condition that affects the brain and subsequently results in memory and cognitive difficulties [1]. In the UK, 885,000 people have dementia [2] and are more likely to be admitted into hospital compared with their peers without dementia [3]. Also, patients with dementia experience longer hospital stays than patients without dementia [4]. A likely consequence of this increased length of stay is the possibility of acquiring nosocomial infections [5] which may require the use of antibiotics and subsequently result in the development of antimicrobial resistance [6]. This situation can further increase patient length of stay. In addition to having extended hospital stays, researchers have reported that people with dementia or cognitive impairment experience adverse outcomes in hospitals [7-10]. Some of the adverse outcomes include malnourishment [8], the occurrence of delirium [7], complications after surgical procedures [9] and the development of pressure sores [10]. Patients who stay in hospital for a longer period of time are also likely to experience functional decline [11]. Other researchers have suggested that longer hospital stays can make patients vulnerable to harmful medication reactions [12]. Extended hospital stays also reduces the availability of beds for those requiring urgent admission [5] at an increased cost to the National Health Service (NHS) [13].

Therefore, it is necessary to investigate the factors that influence length of stay of patients with dementia in hospital to identify appropriate strategies needed to improve patient outcomes and minimise the time they are in hospital. One way of improving patient outcomes is to generate knowledge from the evaluation of services so as to enhance bedside practice and organisational culture [14]. The aim of this service

evaluation is to investigate the impact of demographic (e.g. age), administrative (e.g. admission day) and clinical factors (e.g. early warning signal) on the hospital stay of patients with dementia. Most of the variables investigated in this study have been previously reviewed. However, most of the previous studies have been limited by small sample sizes that reduced their statistical power and generalisability (e.g. a study on falls and length of stay for 622 patients with a range of medical conditions [15]). We explored factors not previously investigated with a large sample including the patient's admission method (i.e. whether the patient attended A&E themselves or were referred by a doctor or transferred from another hospital) and also the various categories of pressure sores.

Materials and Methods

This study was a cross-sectional retrospective analysis of a hospital dataset. The dataset contained information on 35,792 patients who were admitted and discharged between 01/01/2016 and 31/12/2016 at a hospital in the south west of the UK. This hospital had a Care Quality Commission rating of 'requires improvement' in October/November 2015 (i.e. prior to the collection of the data). Findings from the report indicated that the hospital needed to improve hospital care for older patients [16]. The integrity of the dataset (i.e. compliance with NHS regulations) has been discussed in detail elsewhere [17]. This process involved the use of trained clinical coders who followed the UK coding rules for entering aspects of the data which are sent to the Secondary Uses Service of the NHS Digital Department. Patient data was excluded if they had been readmitted because findings from a recent study indicated that such patients are likely to have more co-morbidities and receiving a variety of medication [18]. Similarly,

people who were admitted for a short period (i.e. less than 24 hours) were excluded as they are likely to be healthier than their peers who have been on the ward for a longer period of time [19]. Our sample comprised of patients with dementia (n=1133). Dementia was defined as the existence of a dementia coding applied to a spell. The following codes were used for dementia: Alzheimer's disease, Multi-infarct dementia or vascular dementia, dementia due to other causes such as Picks disease, dementia with an unnamed aetiology, Alzheimer's Disease with an onset in older people and other types of Alzheimer's disease [1]. Patients with dementia may have been lost because we know that when it is not the principal diagnosis, it is sometimes not recorded/coded.

Statistical Analysis

Length of stay was defined as the time the patient was admitted until their discharge. The following variables were evaluated for their impact on the patient's length of stay:

See Table 1

These variables were selected because they are routinely collected in hospitals. The information available in the dataset were recorded by nursing and medical staff as well as clinical coders at the hospital.

Descriptive, bivariate and multivariate analysis were conducted using SPSS 19. The following non-parametric tests were used as the dependent variable (length of stay) was skewed and continuous: Mann-Whitney, Spearman and Kruskal Wallis Test [20]. Negative Bionmial Regression was used to analyse the data because findings from a

previous study indicated that it was the most appropriate multivariate test for a dependent variable that is skewed and continuous [21]. Missing data was handled using the exclude pairwise option in SPSS.

Ethics

Ethics approval was obtained from the University (Ethics ID: 23681) as the study was classified as a service evaluation. Before the NHS Trust provided the dataset, it was first anonymised, encrypted and password-protected. The information was transferred onto a password-protected university laptop for analysis.

Results

Descriptive statistics

The length of stay for dementia sample was high at an average of 344.9 hours. Patients with dementia were on average 85.5 years old. Some patients with dementia were admitted from a care home (36.7%). Some patients with dementia were discharged to a care home (40.4%). Patients with dementia experienced falls without harm (9.7%). Other patients with dementia experienced minor harm during a fall (4%). Some patients with dementia also experienced falls with moderate and major harm (0.4%). Some patients with dementia had pre-admission pressure sores of category 1 (8.4%), 2 (9.1%), 3 (2.3%) and 4 (0.9%). Some patients with dementia had post-admission pressure sores of category 1 (5.1%), 2 (7.1%), 3 (0.9%) and 4 (0.4%).

See Table 2

<u>Bivariate statistics</u>

In the dementia sample, the following variables were all significantly associated with length of stay (age, discharge method, admission from a care home, discharge to a care home, falls without harm, falls with minor harm, MUST scores, Category 1 and 3 pre-admission pressure sores, Category 1, 2, 3, 4 and un-stageable post-admission pressure sores).

See Table 3

<u>Multivariate statistics</u>

For the multivariate analysis only variables that were significant in the bivariate analysis were entered in the Negative Bionmial Regression Model. In the dementia sample, the highest incidence rate ratio for length of stay was: a) discharge to a care home (IRR: 2.443, 95% CI 1.778- 3.357) b) falls without harm (IRR: 2.486, 95% CI 2.029-3.045). Findings from the multivariate analysis indicate that some clinical variables (Medium MUST scores, Category 1, 3 pre-admission pressure sores and Category 3, 4 as well as un-stageable post-admission pressure sores) were not associated with length of stay in the dementia sample.

See Table 4

Discussion

The aim of this study was to investigate factors associated with the length of hospital stay of patients with dementia. Findings from this study indicated that two modifiable factors associated with an increased length of hospital stay amongst patients with dementia were discharge to care homes and experiencing an inpatient fall. Our analysis was novel in including admission method, which was not associated with length of hospital stay. In addition, we were able for the first time to demarcate in a large sample the level of harm sustained by an inpatient fall and also categories of pressure sores.

This study showed that the decision to discharge a patient to a care home was significantly associated with an increased length of stay. Previous literature has shown that the decision to discharge an older patient to a care home could be triggered by the needs of the patient (e.g. requiring additional nursing care) or the patient being unsafe in their own home (e.g. possibility of having a fall with an extended wait for a medical response) [22]. In addition to the decision making processes required for the safe discharge of patients, there is a serious shortage of care home beds due to the high demand for community services and residential facilities [23]. Appropriate national strategies are therefore needed to ease the pressures on care homes and community services. Furthermore, prolonged hospital stay could potentially be as a result of the appearance of new conditions (due to functional and cognitive decline, delirium, malnutrition) that can lead to institutionalization. On the other hand, the difficulty of obtaining a place in a nursing home can also lead to a prolonged hospital stay. Based on the evidence available, we believe that prolonged hospital stay is due to difficulty in obtaining a place in a nursing home.

This study indicated that falls with and without harm were significantly associated with an increased hospital stay. The findings of this research is consistent with that of previous researchers who have found an association between falls and the hospital stay of patients with and without dementia [15, 24]. In addition to increasing the length of hospital stay, falls can cause physical injuries [25], increase hospital costs [26] and have adverse psychological consequences [27]. The inadequacy of current fall prevention measures for people with dementia is therefore concerning [28]. There is an urgent need to develop innovative falls prevention interventions for patients with dementia in the hospital setting. One strategy would be to adjust the hospital stay to what is strictly necessary and to then develop care resources that are alternatives to conventional hospitalization such as hospital at home, primary care, and home-based physiotherapy.

The authors found that some types of pressure sores were associated with the length of stay in the dementia sample. This finding is consistent to previous research which has found an association between pressure sores and hospital length of stay [29]. Also, it has been reported that the development of pressure sores could lead to: an increase use of a hospital's financial resources [30], cause the patient pain, have negative psychological consequences (e.g. make patient feel sad) and also limit the patient's ability to engage in social activities [31]. The incidence of post-admission pressure sores needs to be minimised. The presence of pressure ulcers in people with advanced dementia usually indicates a shorter survival period [32], so the increase in hospital stay may be more related to the functional grade of dementia (GDS 7, FAST >7c) than to the ulcers themselves. With advanced dementia, social activities may not be valued when compared to interaction with family members and usual caregivers.

The main strength of this study was its large sample size. Although a previous study used a large dementia dataset, the authors did not investigate the impact of the various types of pressure sores on the hospital length of stay of patients with dementia [24].They also did not look at the relationship between the various categories of falls and length of hospital stay [24]. Another strength of the study is the assessment of the administrative variables (i.e. if they are referred by their doctor or not, if they were admitted during public holidays). It seems to be something interesting and to be considered in future studies. In the current study, although the authors could not validate the dementia diagnosis, the dataset used for this service evaluation complied with NHS quality assessments. Staff documentation of variables such as falls and MUST scores can be prone to errors which could not be eliminated in the analysis of this retrospective study. Also, data regarding the occurrence of delirium was not readily available in the dataset. In future studies, other strategies such as prevention of delirium should be investigated to ascertain whether they play a role in the length of stay of patients with dementia, as well as prevention of falls or discharge planning procedures.

To conclude, the analysis was conducted in a hospital which had a Care Quality Commission rating of 'requires improvement' prior to the collection of data. The findings may therefore not be transferable to hospitals which do not have a similar Care Quality Commission rating. Based on this dataset, we conclude that some of the factors that can be modified in order to reduce the hospital stay of patients with dementia are discharge planning and the prevention of falls. Other alternatives to conventional hospitalization (hospital at home, primary care, physiotherapy) need to be considered.

<u>Implications for clinical practice</u>

Our research indicates that nursing/care staff can reduce the length of hospital stay of patients with dementia by focusing their efforts on minimising in-patient falls and improving the discharge planning process. Hospital/Trust policies need to be improved by incorporating findings from robust patient focused research into their formation and application.

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40 **Table 1: <u>Variables evaluated for their impact on the patient's length of stay</u>**

age	gender	admission method (e.g. referral from a doctor or hospital)	discharge method (e.g. based on clinical advice or a court (e.g. mental health tribunal))	admission from a care home
discharge to a care home	admission day	admission is a bank holiday	first Early Warning Signal (based on physiological measurements such as blood pressure and respiration)	falls without injury
falls with minor harm	falls with moderate and major harm	MUST (Malnutrition Universal Screening Tool which is based on clinical factors such as the patient's weight and height) scores on admission	category 1, 2,3,4 and unstageable pre and post-admission pressure	Waterlow scores on admission (this assesses the patient's risk of developing pressure sores by for example, looking at the patient's ability to mobilise and eat).

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6 **Table 2:<u>Descriptive statistics for inpatients with dementia</u>**

Variable	n=1,133(%)
Discharge age	Mean=85.5
Gender	
Male	460 (41%)
Female	673(59 %)
Admission methods	
Attendance at Emergency unit	706 (62%)
Referral from a medical practitioner	400 (35%)
Referral from a consultant	2 (0.2%)
Other (e.g. hospital)	25 (2%)
Discharge methods	
Based on clinical advice	984 (87%)
Self-discharge	2 (0.2%)
Discharged by institution (e.g. court)	-
Death	147 (13%)
Admissions from a care home	
Yes	416 (37%)
No	717 (63%)
Discharges to a care home	
Yes	458 (40 %)
No	675 (60%)
Admission day	
Friday	161 (14%)
Monday	155 (13%)
Saturday	166 (15%)
Sunday	192 (17%)
Thursday	170 (15%)
Tuesday	155 (14%)
Wednesday	134 (12%)
Admission is a bank holiday	
Yes	28 (2%)
No	1,105 (98%)
First Early Warning Signal	
High(>6)	61 (5%)
Medium(5-6)	106 (10%)
Low(0-4)	808 (71%)
Missing	158 (14%)

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Falls without harm	

Yes	110 (10%)
No	1, 023(90%)
Falls with minor harm	
Yes	45 (4%)
No	1,088 (96%)
Falls major and moderate	
Yes	5 (0.4%)
No	1,128 (99.6%)
MUST scores	
High(>1)	261 (23%)
Medium (1)	44 (4%)
Low (0)	816 (72%)
Missing	12 (1%)
Category 1 preadmission pressure sores	
Yes	95 (8%)
No	1,038 (92%)
Category 2 preadmission pressure sores	
Yes	103 (9%)
No	1,030 (91%)
Category 3 preadmission pressure sores	
Yes	26 (2%)
No	1,107 (98%)
Category 4 preadmission pressure sores	
Yes	10 (1%)
No	1,123 (99%)
Un-stageable preadmission pressure sores	
Yes	3 (0.3%)
No	1,130 (99.7)

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Category 1 Postadmission pressure sores	
Yes	58 (5%)
No	1,075 (95%)
Category 2 Postadmission pressure sores	
Yes	80 (7%)
No	1,053 (93%)
Category 3 Postadmission pressure sores	
Yes	10 (0.9%)
No	1,123 (99.1%)
Category 4 Postadmission pressure sores	
Yes	
No	5 (0.4%)
Un-stageable	1,128 (99.6%)
Postadmission pressure sores	
Yes	4 (0.4%)
No	1,129 (99.6%)
Waterlow scores	
High (>15)	878 (77%)
Medium (11-15)	179 (16%)
Low (0-10)	66 (6%)
Missing	10 (1%)

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1   **Table 3: <u>Bivariate statistics for inpatients with dementia (N=1,133)</u>**

Variable	U or χ or rho value/p value/Z value
Age	.072/.015
Gender	153,033.5/.745/-.325
Admission methods	5.250/.154
Discharge methods	11.866/.003
Admissions from a care home	111,724.5/.000/-7.047
Discharge to a care home	133,349.5/.000/-3.927
Admission Day	4.856/.562
Admission is a bank holiday	15,275.5/.909/-.114
First Early Warning Signal	.562/.755
Falls without harm	24,117.5/.000/-9.858
Falls with minor harm	9,828.5/.000/-6.812
Falls major and moderate	2,143.0/.354/-.927
MUST scores	6.045/.049
Category 1 Preadmission pressure sores/	42,454.0/.025/-2.244
Category 2 Preadmission pressure sores/	47,821.0/.099/-1.650
Category 3 Preadmission pressure sores	10,376.0/.015/-2.435
Category 4 Preadmission pressure sores	4,523.0/.289/-1.060
Unstageable Preadmission pressure sores	1,214.5/.396/-.849
Category 1 Postadmission pressure sores	16,831.5/.000/-5.909
Category 2 Postadmission pressure sores	25,481.5/.000/-5.897
Category 3 Postadmission pressure sores	2,598.0/.003/-2.929
Category 4 Postadmission pressure sores	1,252.5/.032/-2.147
Unstageable Postadmission pressure sores	848.5/.031/-2.158
Waterlow scores	.172/.917

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Table 4: Negative Binomial Regression for inpatients with dementia with Length of stay as the dependent variable (N=1,133)

Variable	IRR/ p value	95% Confidence Interval	
		Lower	**Upper**
Discharge Age	1.000/.992	.992	1.008
Ref: clinical advice			
Death as a Discharge cause	1.228/.028	1.022	1.476
Self-discharge	.541/.390	.134	2.193
Admissions from a care home	.252/.000	.182	.349
Discharges to a care home	2.443/.000	1.778	3.357
Falls without harm	2.486/.000	2.029	3.045
Falls with minor harm	1.750/.000	1.284	2.384
Ref: Low MUST score			
High MUST scores	1.163/.037	1.009	1.340
Medium MUST scores	.945/.721	.694	1.287
Category 1 Preadmission pressure sores/	1.189/.113	.960	1.474
Category 3 Preadmission pressure sores	.978/.916	.652	1.467

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		Lower	Upper
Category 1 Postadmission pressure sores/	1.787/.000	1.363	2.342
Category 2 Postadmission pressure sores/	1.621/.000	1.275	2.060
Category 3 Postadmission pressure sores/	.966/.915	.508	1.837
Category 4 Postadmission pressure sores/	1.641/.279	.669	4.028
Unstageable Postadmission pressure sores	1.814/.242	.669	4.916

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