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Exploring nursing-sensitive events in home healthcare: A national multicenter cohort study using a trigger tool

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ABSTRACT

Background: The provision of home healthcare is increasing in response to the growing aging population with the need for chronic disease management in their homes. Safety work differs from hospital care. The incidence of adverse events in home healthcare is sparsely studied but is estimated to occur in-one third of patients, and most are deemed preventable. Although nursing care is crucial for risk assessment and preventive work in the home environment, the role of registered nurses in the prevention of no-harm incidents and adverse events has not received sufficient scientific attention.
Objectives: To explore nursing-sensitive events in patients receiving home healthcare.
Design, setting and participants: A Swedish national multicenter study based on a structured record review of 600 randomly chosen healthcare records from 10 organizations in different regions of the country.
Methods: Ten trained teams, each including physician(s) and registered nurses, undertook a review based on the Global Trigger Tool method. The review covered a maximum of 90 days from admission to home healthcare. First, each record was screened for the presence of 38 predefined triggers. In the second step, every potential event was assessed according to preventability, types of events, severity, time of occurrence, consequences of the event, and potential contributing causes.
Results: In total, 699 events were identified in the study. Of these, 495 (74.0%) were classified as nursing-sensitive (227 no-harm incidents and 268 adverse events) and affected 267 (44.5%) patients, with a mean of 1.9 events per patient. The majority (n = 367, 73.1%) were considered preventable. The most prominent types of nursing-sensitive event were falls (n = 138, 27.9%), pressure ulcers (n = 62, 12.5%), healthcare-associated infections (n = 58, 11.7%) and medication management (n = 50, 10.1%). Concerning severity, 45.9% were classified as no-harm incidents and another 36.6% resulted in temporary harm that required extra healthcare resources: 226 hospital days, 66 physician visits in outpatient care, and 99 in home healthcare. All severity types occurred from day 1, except death, which included only one patient. The most frequent contributing factors were deficiencies in nursing care, treatment & diagnosis, with the subgroups nursing care, observation, treatment & follow-up, followed by deficiencies in the organization.
Conclusions: Nursing-sensitive events in home healthcare are common, often preventable, and occur from the start of the care period. This study contributes to increased knowledge of patient safety shortcomings and points to the important role that registered nurses play in patient safety work.

What is already known

- Adverse events in home healthcare are limitedly explored, but is estimated to occur in one of three patients, mostly being preventable and require extra healthcare resources.

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- Increasing expectations in home healthcare have resulted in a disparity between competence demands and actual worker competence.
- Registered nurses in home healthcare have unique insights into the experiences and needs of patients and are the most likely to detect deteriorations, psychosocial and environmental risks, or therapeutic side effects.

What this paper adds

- This study found that nursing-sensitive events in home healthcare affect almost every other patient without differences in age or gender and are mostly deemed preventable.
- The most common nursing-sensitive no-harm incidents were falls, deficiencies in medication management and moderate constipation while the most common nursing-sensitive adverse events were pressure ulcers, healthcare-associated infections, and falls.
- This study contributes to increased knowledge of patient safety shortcomings in home healthcare and points to the important role that registered nurses play in patient safety work.

1. Introduction

In response to the global pressures of a growing aging population, living with the complexity of chronic disease management at home increases the need for safe and efficient provision of home healthcare. Although quality improvement and patient safety in home healthcare have attracted increasing attention during the last few decades, the prevention of safety risks has not been well explored (Lette et al., 2020). Home healthcare includes the provision of both episodic and long-term interventions to patients of all ages (birth to extreme old age) for the purposes of providing curative, supportive, palliative, and rehabilitation care for acute and long-term illnesses and conditions. The conditions for providing episodic or long-term care within people's homes are fundamentally different from the 24-h nursing presence in the controlled hospital setting (Beer et al., 2014; Lindblad et al., 2018b). Safety work is consequently quite different from hospital care, as a wide range of risks and problems are likely associated with a patient's cognitive and physical functioning and health behaviors, the home environment, social network, and the management of health and social services (Lette et al., 2020). Therefore, prioritizing a multidimensional approach to safety would enhance the ability of health and social care systems to support older people in living safely at home.

The key challenge for improvement work is to address preventable adverse events that occur in healthcare because of errors of commission, “doing the wrong thing”, or omission, “failing to do the right thing”, at either the planning or execution phase (Genet et al., 2012; Schwendimann et al., 2018). Thus, identifying characteristics associated with adverse events or no-harm incidents in healthcare organizations may help inform improvement. Although limitedly documented, the incidence of adverse events in home healthcare has been estimated to occur in one-third of the patients, most of these (76%) are deemed preventable but result in temporary harm that requires extra healthcare resources (Schildmeijer et al., 2018). A record review of a random sample of 1200 records of clients discharged from publicly funded home care programs in three Canadian provinces showed an adverse event incidence rate of 10.1% per client-year, of which 56% were judged preventable. An incident report was completed in only 17.3% of records with an adverse event, indicating that documented incidences reveal only the tip of an iceberg (Blais et al., 2013). Frequent adverse events in home healthcare include injuries from falls, different kinds of healthcare-associated infections, psychosocial, behavioral, or mental health problems and adverse outcomes from medication errors (Blais et al., 2013; Schildmeijer et al., 2018). Several studies provide support that falls are one of the most common injuries in home care, which increases the risk of visits to the emergency department, hospital care, or death (Doran et al., 2013; Sears et al., 2013). A group of international authorities on patient safety conclude that incident management has not reached its potential in providing safer care due to, for example, poor processing, insufficient visible action, inadequate funding and institutional support, and inadequate use of health information technology (Mitchell et al., 2016). The World Health Organization (World Health Organization, 2021a) has launched a global patient safety action plan including guiding principles, partners in action, a framework for action, implementation, and indicators.

Nursing care is crucial for risk assessment and preventive work in the home environment. Registered nurses in home healthcare have unique insights into the experiences and needs of patients and are the most likely to detect deteriorations, psychosocial and environmental risks, or therapeutic side effects (Gray et al., 2018). However, a great deal of responsibility is placed on registered nurses to detect possible risks in time, which, in turn, requires continuity and workflow with services that can respond rapidly to monitored risks. The potential contributing causes of identified no-harm incidences in a retrospective study in home healthcare, was delayed, erroneous, omitted or incomplete nursing care, and treatment (Lindblad et al., 2020). Increased expectations in home healthcare have resulted in a disparity between competence demands and actual worker competence (Bing-Jonsson et al., 2016). The assessment and interpretation of clinical data and the recognition of patient deterioration is a complex process associated with healthcare professionals' education and experience, including knowledge of patients' environmental and individual needs (Strømme et al., 2020).

Providers of home healthcare for older people comprise a mix of licensed healthcare professionals, assistant nurses, and family caregivers (Genet et al., 2012). Registered nurses often work alone and are responsible for a high number of patients, while assistant nurses who provide day-to-day assistance with basic patient needs, have little formal competence and limited experience in noticing and responding to patients' deterioration (Ekstedt et al., 2022; Gray et al., 2018). The registered nurse's important role in providing a safe home healthcare has not been given sufficient attention at a time when advanced care at home is a growing arena. Thus, there is a need to study adverse events and no-harm incidents that are potentially sensitive to nursing care (Hommel et al., 2020) to elicit proactive measures that ensure patients' safety in home healthcare.

1.1. Objectives

This study aimed to explore nursing-sensitive events in patients receiving home healthcare.

2. Methods

2.1. Design

This study focusing on nursing-sensitive events is a secondary subgroup analysis of a Swedish national multicenter study based on a structured record review of a cohort of adults in home healthcare. The primary study aimed to validate a trigger tool for home healthcare settings. The method has been described in detail elsewhere (Lindblad et al., 2018a), and is summarized below.

2.2. Setting and sampling

The provision of home healthcare in Sweden can be the responsibility of either the county council or the municipality. Patients are admitted to home healthcare and when the service no longer is needed, patients are discharged. In Sweden, the physicians that assist the municipalities are employed by the county councils. Their record notes are made in the county councils' record systems, which are mostly separate from the municipalities' record systems. Home healthcare organizations in Sweden mostly have their own medical guidelines.

Home healthcare usually means care provided by licensed healthcare professionals, with registered nurses providing the highest medical competence, and does not include home care organizations with unlicensed staff administering social care. Assistance with activities in daily life is provided in patients' homes. Registered nurses have the overall responsibility for medication management and delivery of specialized healthcare in patient homes, and consequently visit each patient less frequently than unlicensed staff. Physicians are always employed by county councils with which the municipalities collaborate.

The investigated cohort consisted of 600 randomly chosen healthcare records from 10 home healthcare organizations, 7 from municipal home healthcare, and 3 from county councils' specialized home healthcare in different regions of Sweden, included by convenience sampling.

2.3. Definitions and inclusion criteria

An event can be either an adverse event or a no-harm incident. An adverse event was defined as suffering, physical or psychological harm, illness, or death caused by healthcare or social care that was not an inevitable consequence of the patient's condition or an expected effect of the treatment received by the patient because of his or her condition. A no-harm incident was an event caused by healthcare or social care that reached the patient and could have led to an adverse event but resulted in no discernible harm. An event can be related to acts of commission or omission.

Inspired by a definition of nursing-sensitive performance measurements from the National Quality Forum (2004), a nursing-sensitive event is an event that was affected and/or influenced by nursing professionals but for which nursing was not exclusively responsible, and the relationship was not necessarily causal. This means that events involving also other professionals are included and that it not explicitly must appear that given or omitted nursing care caused the event.

A preventable adverse event or no-harm incident was defined as an event that could have been prevented if adequate actions had been taken during the patient's contact with healthcare or social care (Swedish Code of Statues, 2010).

All patients aged 18 years or older admitted to home healthcare at the investigated units during 2015 were included in the sample, from which the randomly selected records were retrieved. The record review covered a maximum of 90 days from admission to home healthcare (index admission) and continued if a patient was discharged from home healthcare and readmitted within the 90-day period.

To be included as an adverse event or no-harm incident in the study, one of the following criteria had to be met:

1. The adverse event or no-harm incident occurred within 90 days after enrollment in home healthcare, regardless of caregiver.
2. The adverse event or no-harm incident derived from caregivers outside home healthcare (outpatient care, social care or, in-hospital care), occurred within 30 days before the index admission and was detected during the index admission.

2.4. Record review teams and review process

The record review was undertaken by 10 different teams, specifically trained for this study, one team from each participating organization. Each team consisted of 1 or 2 physicians and 1 to 3 registered nurses. There were 28 reviewers in total.

The structured record review was based on the Global Trigger Tool method (Griffin and Resar, 2009). Using predefined triggers, which are specific terms or events in a record that could indicate adverse events or no-harm incidents, the medical record was structurally screened in a two-step manner. In accordance with the method, the primary screening was undertaken by registered nurses. In the second step, the findings were discussed and established in the review team. The team physician had the final decision if consensus was not met. We used a trigger tool based on the Global Trigger Tool and adapted to the home healthcare context (Lindblad et al., 2018a).

Each review team examined 60 randomly selected home healthcare records from their own organizations. In the primary review, the reviewers screened every record for the presence of 38 predefined triggers. A trigger is a clue that guide reviewers to events that are more likely to contain an adverse event or a no-harm incident. For every identified trigger, the reviewer looked for the presence of a potential adverse event or a no-harm incident. If either was found, the record was forwarded for a separate secondary review of each potential event. All potential events documented in the home healthcare records were included, regardless of their organizational origin.

During the secondary review, the potential event was initially assessed with a 4-point Likert scale to determine whether the event was associated with healthcare or social care or not: 1 = the event was not related to healthcare or social care, 2 = the event was probably not related to healthcare or social care, 3 = the event was probably related to healthcare or social care, and 4 = the event was related to healthcare or social care. Only events scored 3 or 4 were included in the continuing review process. Further, a similar scale was used to assess if the event was considered preventable or not. This was deemed from the patient's perspective. Events scored 3 or 4 (probably preventable or preventable) are presented as preventable in the following results and discussion.

We used a slightly modified version of the National Coordinating Council for Medication Error Reporting and Prevention Index (NCC MERP, 2022) to assess severity. Categories C and D represent no-harm incidents, and categories E to I represent adverse events.

The timing in relation to the event was collected, that is, the date of the first event symptom or alternatively, the detection date, if the date of the first symptom could not be determined. Data were also collected regarding the consequences of the event (extra physician visits or, extra hospital days), types of events, and potential contributing causes linked to the respective event. Several potential contributing causes per event could be selected from the predefined list.

In the present study, only nursing-sensitive events were included. These represent all events classified as nursing in a variable named work activities in the secondary review stage.

2.5. Statistical analysis

No specific sample size calculation was undertaken for this secondary study. Descriptive data are presented as median (interquartile range and/or min–max) or number (%). Comparisons between groups were performed using the Mann–Whitney U-test or the chi-square test, as appropriate. A p-value of less than 0.05 was considered statistically significant. Statistical calculations were performed using Statistica 64 V-13 (StatSoft, Oklahoma, USA).

2.6. Ethical considerations

Ethical approval was provided by the Regional Ethics Committee of Linköping (numbers 2014/150–31 and 2016/45–32). The Head of the department at each organization gave permission to review the records; therefore, no formal consent from the patients was necessary.

3. Results

3.1. Demographics

The demographic data are displayed in Table 1. In total, 600 medical records were reviewed, corresponding to 40,735 reviewed patient days. There were no differences in relation to gender ($p = 0.42$) or age ($p = 0.07$) between patients with or without nursing-sensitive events. The number of reviewed days was significantly higher for the group of patients with nursing-sensitive events ($p = 0.006$). Half of the patients were referred to home healthcare from hospital care. The dominant care

Table 1
Patient demographics.

Variable	All patients n = 600	Patients without nursing-sensitive event n = 333	Patients with nursing-sensitive event n = 267	P-value
Men/	280 (46.7)/	152 (54.3)/	128 (45.7)/	0.42
women, n (%)	320 (53.3)	181 (56.6)	139 (43.4)	
Age, median (min–max)	80.5 (20–99)	79 (20–99)	82 (29–99)	0.09
Reviewed days, median (min–max)	90 (1–90)	90 (1–90)	90 (2–90)	0.006
Referral to home healthcare from, n (%)				
Hospital care	300 (50.0)	160 (53.3)	140 (46.7)	0.53
Non-hospital care	212 (35.3)	118 (35.3)	94 (35.3)	
Social care	9 (1.5)	5 (55.6)	4 (44.4)	
Not possible to determine	79 (13.2)	50 (63.3)	29 (36.7)	
Diagnosis at inclusion[1], n (%)				
Malignancy	253 (42.2)	135 (40.4)	118 (44.4)	0.33
Cardio-vascular disease	119 (19.8)	58 (48.7)	61 (51.3)	0.14
Confusion/dementia	102 (17.0)	56 (54.9)	46 (45.1)	0.96
Diabetes mellitus	51 (8.5)	29 (8.7)	22 (8.3)	0.86
Skin wound/pressure ulcer	38 (6.3)	21 (6.3)	17 (6.4)	0.96
Stroke	36 (6.0)	18 (50.0)	18 (50.0)	0.72
Pulmonary disease	35 (5.8)	20 (57.1)	15 (42.9)	0.38
Neurological disease	33 (5.5)	17 (5.1)	16 (6.0)	0.62
Care needs in home healthcare[2], n (%)				
Medication assistance	233 (38.8)	119 (51.1)	114 (48.9)	0.10
Palliative care	144 (24.0)	90 (27.9)	54 (20.3)	0.06
Activities of daily living	111 (18.5)	52 (15.6)	59 (22.2)	0.04
Laboratory sampling	88 (14.7)	49 (55.7)	39 (44.3)	0.82
Wound care/assistance with compression stockings	74 (12.3)	41 (12.3)	33 (12.4)	0.96
Assistance with advanced medical devices	62 (10.3)	26 (7.8)	36 (13.5)	0.02
Rehabilitation, home modifications	51 (8.5)	36 (10.8)	15 (5.6)	0.02
Pain relief	39 (6.5)	22 (6.6)	17 (6.4)	0.92
Social situation at admission, n (%)				
Patient's own home, lives alone	265 (44.2)	152 (57.4)	113 (42.6)	0.43
Patient's own home, cohabiting	257 (42.8)	145 (56.4)	112 (43.6)	
Assisted living	50 (8.3)	22 (44.0)	28 (56.0)	
Not documented	28 (4.7)	14 (4.2)	14 (5.3)	

[1] Medical diagnosis that affects >5% of the patients. One patient can have several diagnoses.
[2] Care need for >5% of the patients. One patient can have several care needs.

needs were medication assistance, palliative care, and activities of daily living. There were significantly more patients in the group who experienced nursing-sensitive events with needs in activities of daily living (p = 0.04) and assistance with advanced medical care (p = 0.02), while the opposite was found for patients in need of rehabilitation, including home modification (p = 0.02). The proportion of patients living alone or with a spouse was similar.

3.2. Nursing-sensitive event outcomes in home healthcare

In total, 699 events were identified in the study, and 495 (74.0%) of these were classified as nursing-sensitive. Among the latter, 227 (45.9%) were classified as no-harm incidents and 268 (54.1%) as adverse events. Nursing-sensitive events affected 267 (44.5%) patients, with a mean of 1.9 events per patient. The majority (367; 73.1%) of the events were considered preventable. The number of nursing-sensitive events per 100 patients and per 1000 patient days was 82.5 and 12.2, respectively (Table 2).

Of all nursing-sensitive events, 393 were associated with home healthcare, 44 with hospital care, 41 with social care, and 10 with outpatient care; 7 could not be classified from information in the patient record. In total, 32 identified nursing-sensitive events caused 226 extra days at a hospital, with median of 9.5 (min–max, 1–29) days per event. The nursing-sensitive events contributed to 66 extra physician visits in outpatient care and 99 extra physician visits in home healthcare, of which 61 and 75 visits were judged to be related to preventable events, respectively.

3.3. Types of nursing-sensitive events

The types of nursing-sensitive events in connection with preventability and severity are shown in Table 3. The most prominent type of nursing-sensitive event was falls (n = 138, 27.9%), with less than half being preventable (n = 64, 46.4%), and the majority being no-harm incidents (n = 97, 70.3%). All 62 (12.5%) pressure ulcers, the second most frequent nursing-sensitive event, were classified as adverse events, as well as the third most frequent type, healthcare-associated infections (n = 58, 11.7%). These two types were deemed preventable in 83.9% and 69.0% of the cases, respectively. Preventability ranged from 37.5% to 100% for no-harm incidents and from 0% to 100% for adverse events.

3.4. Severity and timing of nursing-sensitive events

Adverse event severity category F was the most frequent, and 83.4% of these events were classified as preventable. The second most

Table 2
Nursing-sensitive event outcomes divided into no-harm incidents and adverse events.

	No-harm incidents	Adverse events	Total
Nursing-sensitive events			
Number of events (%)	227 (45.9)	268 (54.1)	495
Number of events per affected patient, mean	1.7	1.2	1.9
Number of affected patients, n (%)	135 (50.6)	187 (70.0)	267 (44.5)
Number of events per 100 patients	37.9	44.7	82.5
Number of events per 1000 patient days	5.6	6.6	12.2
Preventable nursing-sensitive events			
Number of preventable events (%)	152 (67.0)	210 (78.4)	362 (73.1)
Patients affected with preventable event/s, n (%)	102 (47.2)	151 (69.9)	216 (36.0)
Number of preventable events per 100 patients	25.3	35	60.3
Number of preventable events per 1000 patient days	3.7	5.2	8.9

Table 3
Types of nursing-sensitive events.

Type of event	All events n (%)	No-harm incidents n (%)		Preventable no-harm incidents n (%)	Adverse events n (%)				Preventable adverse events n (%)
		C[1]	D[1]		E[1]	F[1]	G[1]	I[1]	
Falls	138 (27.9)	75 (57.7)	22 (22.7)	40 (41.2)	9 (10.8)	32 (17.7)	–		24 (58.5)
Pressure ulcers, total	62 (12.5)	–	–	–	29 (34.9)	31 (17.1)	2 (66.7)	–	52 (83.9)
Category 1	24 (38.7)	–	–	–	14 (48.3)	10 (32.3)	–	–	21 (87.5)
Category 2	25 (40.3)	–	–	–	12 (41.4)	13 (41.9)	–	–	19 (76.0)
Category 3 and 4	7 (11.2)	–	–	–	1 (3.4)	4 (12.9)	2 (100)	–	6 (87.7)
Category unknown	6 (9.6)	–	–	–	2 (6.9)	4 (12.9)	–	–	6 (100)
Healthcare-associated infections, total	58 (11.7)	–	–	–	18 (21.7)	40 (22.1)	–	–	40 (69.0)
Oral candida	13 (22.4)	–	–	–	10 (55.6)	3 (7.5)	–	–	6 (46.2)
Skin and/or wound infection	12 (20.7)	–	–	–	–	12 (30.0)	–	–	12 (100)
Urinary tract infection	11 (19.0)	–	–	–	3 (16.7)	8 (20.0)	–	–	8 (72.7)
Candida skin infection	6 (10.3)	–	–	–	2 (11.1)	4 (10.0)	–	–	6 (100)
Pneumonia	5 (8.6)	–	–	–	1 (5.6)	4 (10.0)	–	–	4 (80.0)
Sepsis	2 (3.4)	–	–	–		2 (5.0)	–	–	0 (0)
Other infections	9 (15.5)	–	–	–	2 (11.1)	7 (17.5)	–	–	4 (44.4)
Medication management, total	50 (10.1)	26 (20.0)	21 (21.6)	46 (97.9)	–	3 (1.7)	–	–	3 (100)
Not given medication	25 (50.0)	16 (61.5)	9 (42.9)	25 (100)	–	–	–	–	–
Not administered according to prescription e.g., wrong dose	11 (22.0)	6 (23.1)	4 (19.0)	10 (100)	–	1 (33.3)	–	–	1 (100)
Unclear and/or missing prescription	6 (12.0)	1 (3.8)	4 (19.0)	5 (100)	–	1 (33.3)	–	–	1 (100)
Other	8 (16.0)	3 (11.5)	4 (19.0)	6 (85.7)	–	1 (33.3)	–	–	1 (100)
Skin, tissue or vessel harm	28 (5.6)	–	–	–	10 (12.0)	18 (9.9)	–	–	24 (85.7)
Pain	27 (5.4)	3 (2.3)	10 (10.3)	8 (61.5)	4 (4.8)	9 (5.0)	1 (33.3)	–	13 (92.9)
Psychological impairment	21 (4.2)	3 (2.3)	5 (5.2)	6 (75.0)	6 (7.2)	7 (3.9)	–	–	11 (84.6)
Constipation	19 (3.8)	4 (3.1)	10 (10.3)	13 (92.9)	–	5 (2.8)	–	–	5 (100)
Urinary retention	12 (2.4)	1 (0.8)	7 (7.2)	3 (37.5)	3 (3.6)	1 (0.6)	–	–	4 (100)
Failure in communication, coordination, and documentation	12 (2.4)	9 (6.9)	2 (2.1)	11 (100)	1 (1.2)	–	–	–	1 (100)
General deterioration in health status	8 (1.6)	–	2 (2.1)	1 (50.0)	1 (1.2)	5 (2.8)	–	–	6 (100)
Weight loss/decreased appetite/decreased nutritional intake	8 (1.6)	–	–	–	–	7 (3.9)	–	1 (100)	7 (87.5)
Affected laboratory values	6 (1.2)	–	3 (3.1)	3 (100)	–	3 (1.7)	–	–	3 (100)
Neurological deterioration	6 (1.2)	1 (0.8)	1 (1.0)	2 (100)	1 (1.2)	3 (1.7)	–	–	4 (100)
Errors in taking blood sample	6 (1.2)	3 (2.3)	3 (3.1)	6 (100)	–	–	–	–	0
Deterioration in vital signs	6 (1.2)	–	1 (1.0)	1 (100)	–	5 (2.8)	–	–	5 (100)
Hemorrhage, other reason than surgery	5 (1.0)	–	–	–	–	5 (2.8)	–	–	3 (75.0)
Other[2]	23 (4.6)	5 (3.8)	10 (10.3)	12 (80.0)	1 (1.2)	7 (3.9)	–	–	5 (62.5)
Total	495 (100)	130 (100)	97 (100)	152 (67.0)	83 (100)	181 (100)	3 (100)	1 (100)	210 (78.4)

[1] Severity according to National Coordinating Council for Medication Error Reporting and Prevention, no event was classified as H.
[2] The group other consists of the following events: vomiting, non-functioning subcutaneous venous port (all n = 4), dehydration, vertigo (all n = 2), allergic reaction, diarrhea, nausea, threats/violence, suicide attempt, urinary catheter problem, removal of nasogastric sonde, malfunction of stoma bandage, non-fitting compression glove, suture left in place by mistake, absconded from home (all n = 1).

frequent category was the no-harm incident category C (n = 130). One patient died from a nursing-sensitive event related to a massive loss of weight (Table 4).

The median time between admittance to home healthcare and the occurrence of a nursing-sensitive event was 26 days (interquartile range, IQR, 8–52). The corresponding for preventable nursing-sensitive events was 25 days (7–52). All severity types of nursing-sensitive events occurred from day 1, except category I, which only included the patient mentioned in the previous paragraph, who died after 28 days. There was no difference between time to severity for the various severity categories (p = 0.88, all events; p = 096, preventable events) (Table 4).

The time between admittance to home healthcare and the occurrence of the six most frequent nursing-sensitive events differed (p = 0.025) (Fig. 1). Pain occurred early during the care episode with a median time of 8 days.

3.5. Potential contributing factors

The most frequent potential contributing factors to a nursing-sensitive event were deficiencies in nursing care, treatment, and diagnostics with the four most common contributing subtypes: 1) Nursing care – delayed, erroneous, omitted, or incomplete; 2) Observation – delayed, erroneous, omitted or incomplete; 3) Treatment – delayed, erroneous, omitted or incomplete; and 4) Follow-up of care/treatment – delayed, erroneous, omitted or incomplete. The fifth most common contributing factor was attributed to deficiencies in the organization – routines/guidelines lacking, deficient, or have not been observed (Supplementary material Table S1).

4. Discussion

This study showed that nursing-sensitive events in home healthcare affected almost every other patient without differences in age or gender, and were mostly deemed preventable. There were slightly more documented nursing-sensitive adverse events than nursing-sensitive no-harm incidents. The most common nursing-sensitive no-harm incidents were falls, deficiencies in medication management, and moderate constipation, while the most common nursing-sensitive adverse events were pressure ulcers, healthcare-associated infections, and falls. Every third nursing-sensitive event resulted in temporary harm, which required extra healthcare resources, and almost all severity types occurred from day 1. The most potentially contributing causes of nursing-sensitive events included delayed, erroneous, omitted, or incomplete nursing care, observation, treatment, and follow-up, respectively.

In the present study, 74% (495) of all identified events were regarded as nursing-sensitive and affected 44% of the patients. To our knowledge, nursing-sensitive events have mainly been investigated in the hospital setting and included only adverse events, which limits the possibilities for comparison. In Canadian medical hospital units, 76.8% of the adverse events were considered nursing-sensitive, affecting

Table 4
Number, proportion, and timing of nursing-sensitive events and preventable events in relation to severity (NCC MERP[1]).

Severity scale		All events n (%)	All events median (min–max; IQR[2]) days[3]	Preventable events n (%)	Preventable events median (min–max; IQR[2]) days[4]
C	Reached the patient but did not cause harm	130 (26.3)	31.5 (1–90; 15–57)	76 (58.5)	41.5 (1–90; 16.5–62)
D	Reached the patient and required monitoring or intervention to ensure that no harm occurred	97 (19.6)	19 (1–90; 6–43)	76 (78.4)	18 (1–88; 6–37)
E	Contributed to or resulted din temporary harm	83 (16.8)	22 (1–87; 6–44)	56 (67.5)	26.5 (1–87; 6–55)
F	Contributed to or resulted in temporary harm to the patient and required outpatient, home health or hospital care or prolonged hospitalization or an extended period of home healthcare	181 (36.6)	25 (1–89; 8–54)	151 (83.4)	25 (1–89; 8–50)
G	Contributed to or resulted in permanent patient harm	3 (0.6)	3 (1–29; 1–29)	2 (66.7)	2 (1–3; 1–3)
H	Life-saving intervention required within 60 min	0	–	0	–
I	Contributed to patient death	1 (0.2)	28	1 (100)	28
Total		495 (100)	26 (1–90; 8–52)	362 (73.1)	25 (1–90; 7–52)

[1] National Coordinating Council for Medication Error Reporting and Prevention (categories C and D represent no-harm incidents and E to I adverse events.
[2] Interquartile range.
[3] 6 events without valid dates and 2 events that originated before admittance to home healthcare were excluded.
[4] 2 events without valid dates and 2 events that originated before admittance to home healthcare were excluded.

15.3% of patients (D'Amour et al., 2014), whereas in Swedish orthopedic hospital care, the corresponding figures were 54,3%, and 18.8% (Hommel et al., 2020). In a study of six Irish acute wards, 16% of the patients experienced a nursing-sensitive adverse event (Murphy et al., 2021). The conditions for registered nurses to provide safe care in patients' homes differ markedly from the hospital setting. Homes are not regulated environments and unlicensed care providers, or registered nurses are not present continuously. A deterioration in a patient's condition are often vague, unlicensed care providers tend to follow preplanned tasks and give limited attention to the patient's actual situation, measuring of vital signs are not performed regularly and mostly unlicensed care provider visits the patients alone imposing a barrier to collegial or registered nurse support (Strømme et al., 2020). Patient safety in home healthcare requires team collaboration among patients, relatives, unlicensed care providers, and registered nurses. In home healthcare, registered nurses have limited impact on the home environment and need to balance risks with patients' will, autonomy, and integrity (Lindblad et al., 2018b; Schildmeijer et al., 2019). It is important to underline that our study is based solely on events that are documented in the patient medical record. Other difficulties in comparing studies are different data collection methods, as previous studies often either included a list of predefined events (D'Amour et al., 2014; Murphy et al., 2021) or focused on a specific adverse event, such as pressure ulcers (Gunningberg et al., 2019) or falls (Dolci et al., 2020), instead of including all types of nursing-sensitive events.

In line with previous studies (Doran et al., 2013; Masotti et al., 2010; Sears et al., 2013), falls were the most common nursing-sensitive event in the present study, comprising 27.9% of all events. Although around 80% of the fall events were classified as no-harm incidents, the prevalence of this type of event points to a serious problem in home

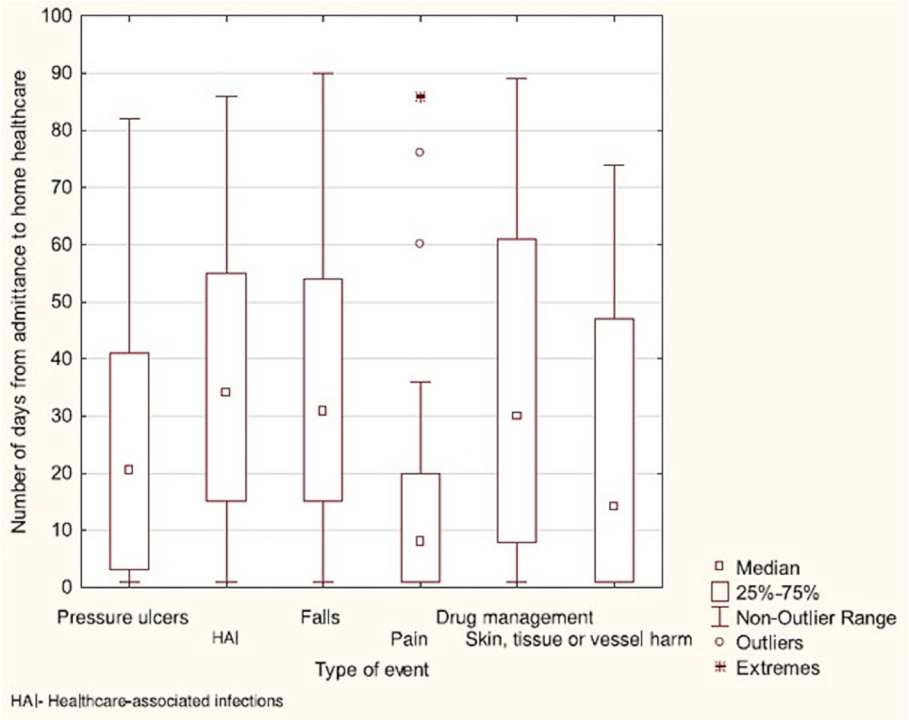

Fig. 1. Boxplot showing the median time between admittance to home healthcare and the occurrence of the six most common nursing-sensitive event types. The median number of days to occurrence (and the interquartile range) was 20.5 (3–41) for pressure ulcers, 34 (15–55) for healthcare-associated infections, 31 (15–54) for falls, 8 (1–20) for pain, 30 (8–61) for drug management, and 14 (1–47) for vessel, skin, and tissue harm.

healthcare. Preventive actions, such as moving furniture, adjust lightening, and providing different facilities, can be of great benefit, stressing the importance of cooperation between the patient and his or her relatives and the healthcare providers to accomplish a safe home environment. In contrast to the hospital environment that is new and unknown to a patient, the home is well-known and contributes to safety and wellbeing. Falls is also a common nursing-sensitive event in the hospital setting (Hommel et al., 2020). Further, to integrate endurance, strength and balance exercises in everyday tasks may enhance older adults´ functional orientation and integration into daily living to promote physical functioning (Dipietro et al., 2019).

The second most common nursing-sensitive event was pressure ulcers (12.5%), all classified as adverse events. Pressure ulcers are a worldwide patient safety problem that impairs the patients' well-being and quality of life, and they are costly for society (Black et al., 2011; Gorecki et al., 2009). Patient age and multiple comorbidities increase the risk of developing pressure ulcers (Guest et al., 2017). A large proportion of patients in home healthcare are older and have co-morbidities. A specifically designed pressure ulcer prevention bundle, including skin inspection, support surfaces, and repositioning, improved the provision of care in nursing homes (Lavallée et al., 2019). A focus on nutritional status (Munoz and Posthauer, 2022) and prevention of sedentary behavior are other examples of preventive actions.

No healthcare setting is exempt from the risk of adverse events, and current research shows there are the same types of nursing-sensitive events in hospital care and home healthcare (Lindblad et al., 2018a; Morioka and Kashiwagi, 2021; Schildmeijer et al., 2018; Strube-Lahmann et al., 2022,). In the present study, healthcare-associated infections were the third most frequent nursing-sensitive event type (11.7%), all adverse events and were largely classified as preventable. We found that infection in the mouth and throat was the most common healthcare-associated infection. Aging and physical changes, along with general diseases and medications, increase the risk of poor oral health and can lead to weight loss and pain (Ritchie et al., 2000). A systematic review and meta-analysis concluded that effective strategies for overcoming barriers and to increasing facilitators in providing oral care are among the most critical research gaps in improving oral care for nursing home residents (Hoben et al., 2017). A quality standard from the National Institute for Health and Care Excellence (2016) recommends that adults in care homes have their mouth care needs assessed upon admission.

Deficiencies in medication management were the fourth most common nursing-sensitive event (10.1%). This is a well-known patient safety risk in hospital care (Härkänen et al., 2015) and home healthcare (Bielsten et al., 2022; Lindblad et al., 2018a; Yoshimatsu and Nakatani, 2022). In the present study, medication management very rarely resulted in adverse events, but represented a highly preventable no-harm incident. The medication management process in home healthcare is complex and dynamic, involving many different participants (Lindblad et al., 2018a; Topinková et al., 2012), with unclear limits of liability (Lindblad et al., 2017). Routines, guidelines, and documentation systems are not well designed for home healthcare, as they are often transferred from hospital care. In addition, the administration of medication, including monitoring of effects and side effects, is undertaken by a proxy, that is, unlicensed staff, relatives, or the patient, making it difficult to create a safe process (Lindblad et al., 2017).

Nursing-sensitive events mostly resulted in temporary harm, and 73.1% were classified as preventable. The latter implies that interprofessional interventions can be addressed and implemented in a systematic way to hopefully prevent, or at least reduce, these events from occurring. Around one-third of the nursing-sensitive events resulted in temporary harm and required new or prolonged healthcare resources, including hospital care. In addition to suffering for patients and relatives, this generates costs for healthcare and society. Nurse-sensitive adverse events in Canadian acute-care hospital wards were calculated to generate nearly 1300 additional hospital days for the affected 166 of 2699 examined patients (Tchouaket et al., 2017). A hospital study from Ireland comprising more than 5500 patients showed that 16% had at least one nurse-sensitive adverse event at an average cost for the increased length of stay of approximately EUR 694 per event (Murphy et al., 2021). Although costs between hospital and home healthcare are not directly comparable, these studies indicate that large savings can be created by focusing on the potential contributing causes of nursing-sensitive events and prevention. The savings might be in multimillion-dollar amounts (Tchouaket et al., 2020), in addition to the reduced suffering for patients and relatives.

All of the six most common events occurred from the first day in home healthcare, and throughout most of the 90-day review period, although pain was most prominent in the early phase. Tourangeau et al. (2014) reported that unlicensed personal support worker visits often start one or two weeks before the coordinator has assessed the patient and developed a formal care plan. High-quality care decreases the risk of nursing-sensitive events (Lucero et al., 2010), indicating the important role of the registered nurses' competence concerning safe care to be implemented from the patients' first day in home healthcare. At the same time, the importance of continuously detecting deterioration in frail home healthcare patients is important to prevent events from occurring. This is challenging, as nonspecific signs and symptoms may be the only indicators. Limited attention is often given to the patient's actual situation, as the health worker mainly follows preplanned tasks (Strømme et al., 2020).

The most common contributing causes to nursing-sensitive events were classified as deficiencies in nursing care, but deficiencies in communication and organization were also common. The safe transfer of information is fundamental for patient safety (Kirsebom et al., 2013) and especially important for new patient admissions (Saari et al., 2017). In Sweden, municipal healthcare and county council healthcare mostly use different documentation record systems. This includes medication lists and laboratory findings (Lindblad et al., 2018b). This points to the importance of communication between organizations and jointly developed care plans.

The most common types of nursing-sensitive events in the present study were falls, pressure ulcer, healthcare-associated infections, and deficiencies in medication management, consistent with other studies in home healthcare (Blais et al., 2013; Doran et al., 2013; Masotti et al., 2010; Sears et al., 2013). Systematic risk assessment in Swedish home healthcare found the prevalence of risk of pressure ulcers, malnutrition, poor oral health and falls to be 13.8%, 47.3%, 27.8%, and 63.7%, respectively (Neziraj et al., 2021). Nursing care represents registered nurses' specific area of competence and responsibility, and includes promoting health, relieving suffering, and performing preventive patient safety work (Swedish Nurses' Association (SSF), 2017). Registered nurses have the competence and preparedness to identify risks and prevent adverse events from affecting patients. In these aspects, the work in home healthcare differs from the in-hospital setting. The hospital environment is adjusted to support patient safety, whereas a home is built for living, making it more challenging to be risk aware, follow regulations, and work proactively by identifying risks and finding solutions. Making changes in a home is not obvious of respect for patients' and relatives' wishes to live in a personal home and not in a care environment. However, being cared for at home increase the patients' quality of life (Shepperd and Iliffe, 2005; Tarricone and Tsouros, 2008), although it carries safety risks.

It is the registered nurse's responsibility to prevent nursing-sensitive events in home healthcare. Research on hospital care has shown an association between low staffing levels of registered nurses, low education levels, and a non-supportive work environment and the occurrence of adverse events and mortality (Aiken et al., 2014; Audet et al., 2018). A higher number of patients per registered nurse is associated with more deficiencies in medication management, pressure ulcers, and falls (Cho et al., 2016). Similarly, an increased number of registered nurses is associated with a lower rate of mortality (Griffiths et al., 2019) and

healthcare-associated infections (Shang et al., 2019). However, most of the time, assistant nurses, with little or no formal competence, and relatives are a patient's closest care providers (Genet et al., 2012). The mix of competences in home healthcare is an increasingly relevant question. The isolated nature of home care work has been identified as a barrier to the expansion of assistant nurses' roles (Swedberg et al., 2013), and registered nurses have expressed concern regarding their professional registration and liability when transferring skills to unlicensed staff (Saari et al., 2017). Education, training, and support from registered nurses to unlicensed staff is one barrier in the provision of safe home healthcare (Saari et al., 2017). Those authors report mixed feelings about on-the-job training for added skills for unlicensed staff and difficulties when real-time support from the registered nurse, leaving the unlicensed staff unable to complete required care. The continuity of care providers is a significant challenge associated with task shifting, as staff turnover is an issue (Saari et al., 2017). Furthermore, home healthcare patients' experiences of feeling safe are related to their relationships with the staff, which are based on their continuity (Silverglow et al., 2020).

The Swedish policy of striving for patients to stay in their homes for as long as possible makes preventive work in home healthcare crucial (Neziraj et al., 2021). The number of persons aged 80 years or older is expected to increase by more than threefold between 2017 and 2050 (United Nations et al., 2017). The responsibility for nursing in home healthcare lies with the municipalities, with registered nurses providing the highest medical competence. According to the World Health Organization (World Health Organization, 2021b), registered nurses play a key-role in achieving good and safe care. Their academic and clinical competence enables decisions that create conditions that promote patient safety. Politicians, decision makers, and managers in home healthcare should provide registered nurses with better conditions in which to perform and support safe care.

Retrospective medical record reviews are commonly used when collecting data about patient safety, such as no-harm incidents and adverse events, and they are found to identify more adverse events when compared with other methods (Naessens et al., 2009). In a recent meta-analysis, the overall risk of bias and applicability-related concerns was rated low (Eggenschwiler et al., 2022). Including no-harm incidents and potential contributing causes can increase knowledge of preventive patient safety work, as they point to recurring events and system failures that may lead to adverse events. This is based on the system safety approach conviction that the underlying causes of no-harm incidents and adverse events are equal, and that risks arise due to unexpected combinations of normal variability in the home healthcare system (Braithwaite et al., 2015; Hollnagel et al., 2011).

4.1. Strengths and limitations

The study was strengthened by a review of 600 randomly selected records by 10 review teams connected to home healthcare in different regions of Sweden. The length of the review period (90 days) was considered long enough to identify different types of events. A structured record review is a well-documented and valid method for identifying adverse events. Most of the reviewers did not have previous experience with the review method, but they did have extensive experience with home healthcare. To strengthen the inter-rater reliability, the review team participants performed test reviews in connection with training in the study material and method, and every tenth patient record was double reviewed. The kappa coefficient of 0.81 strengthens the reliability. The multi-professional review teams consisted of physicians and registered nurses, and a record review expert monitored all reviews to ascertain consistency with the study manual and the record review method, which further strengthened the validity. Record review has been shown to identify more adverse events than incident reporting or administrative data (Classen et al., 2011; Naessens et al., 2009). In subsequent patient safety work, the results from the trigger tool review can be used in prospective risk management projects.

A well-known weakness of record review methods is that only documented events can be identified, leading to the risk of underestimation of the true outcome. In addition, there is a risk of an underestimation of the no-harm incidents reported in the results. It seems that adverse events are easier to identify, and that they are also reported to a greater extent. Incidents involving home healthcare patients often occur in the absence of a healthcare worker, which also increases the risk of underestimation. Another weakness may be hindsight bias, which can affect the assessment of preventability and the overestimation of the number of preventable events. The results of the study could have been strengthened by a mixed-methods design by adding participant observations, interviews, or focus group discussions.

Overall, the study's size, distribution, and equivalence of the results with the support of previous data provide the possibility of generalizability regarding similar contexts and working conditions. However, some caution should be taken due to the study's convenience selection.

4.2. Conclusions

Nursing-sensitive events in home healthcare are common, are mostly no-harm incidents or adverse events causing temporary harm, are often preventable, and occur from the start of the home healthcare period. This study clarified the complexity of nursing care in home healthcare, specifically the value of knowledge, including adverse events and no-harm incidents, as well as contributing causes in proactive patient safety work. It is fundamental to provide good and safe care in all parts of the healthcare system. Home healthcare is characterized by multimorbid, frail older patients cared for in their own homes, with registered nurses providing the highest medical competence. This study contributes to increased knowledge of patient safety shortcomings in home healthcare and points to the important role that registered nurses play in patient safety work.

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Ethics approval

Ethical permission was obtained from the Regional Ethical Board of Linköping University, Sweden (No 2014/150-31 and 2016/45–32).

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Data Sharing Statement

The data are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Lena Nilsson: Methodology, Data Analysis, Writing – Original Draft, Writing – Review & Editing. **Marléne Lindblad:** Methodology, Data collection, Writing – Original Draft. **Nathalie Johansson:** Data Analysis, Writing – Original Draft. **Lisa Säfström:** Data Analysis, Writing – Original Draft. **Kristina Schildmeijer:** Methodology, Writing – Original Draft. **Mirjam Ekstedt:** Methodology, Writing – Original Draft. **Maria Unbeck:** Methodology, Project Administration, Data Curation, Data Analysis, Writing – Original Draft, Writing – Review & Editing.

All authors approved the final version of the manuscript and are accountable for all aspects of the work.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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