# ORIGINAL ARTICLE

WILEY | International Journal of Older People Nursing

# Mismatch between risk factors and preventive interventions? A register study of fall prevention among older people in one Swedish county

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## Abstract

**Background**: Falls are a common and often a devastating health hazard for older people, causing suffering, morbidity and mortality. Falls are costly for society in terms of both resources and direct medical costs. Although knowledge about falls and fall prevention is well known, falls among older people are still a major problem.

**Aim and objectives**: The aim was to estimate the prevalence of the risk of falls among older people receiving municipal health care. A further aim was to investigate the consistency between fall risk factors and preventive nursing interventions.

**Design**: A cross-sectional register study.

**Methods**: Data containing risk assessments based on the Downton Fall Risk Index (DFRI) and planned interventions by the municipal health care were collected from the Swedish national quality registry, Senior Alert. Data were analysed using descriptive and analytic statistics.

**Results**: In the sample of 5,427 older people, the prevalence of the risk of falling was 79%. There was a difference in prevalence between the different types of municipal health care, sex and age. The most common preventive intervention was environment adjustments, and the least planned intervention was information/education about falls. Physical activity as an intervention was planned among 13.2% of the participants. Approximately 27% of the older people did not have any planned interventions despite being at risk of falling. Planned interventions did not always correspond with the risk factors; for instance, only 35.4% of those at risk of falling due to medication obtained pharmaceutical reviews as a preventive measure to decrease the risk.

**Conclusion**: The risk of falling is common among older people, and the preventive interventions do not sufficiently follow current evidence. This implies that systematic implementation of fall-prevention guidelines is needed in municipal care.

**Implication for practice**: A better match between identified risk factors and preventive interventions is warranted.

**KEYWORDS**
nursing, older people, prevention of falls, quality registry, senior alert

# 1 | INTRODUCTION

Fall-related injuries are a major public health problem, and falls are a leading cause of morbidity and mortality among older people (Rubenstein, 2006; Shumway-Cook et al., 2009), and falls account for 87% of all fractures among people above the age of 65 (Ambrose, Cruz, & Paul, 2015; Marks, 2010). Therefore, it is important to identify fall-prone persons to prevent falls and guide the choice of targeted fall-prevention strategies. Previous research has demonstrated which preventive measures are most effective in preventing falls (Cameron et al., 2012; Gillespie et al., 2012; Pfortmueller, Linder, & Exadaktylos, 2014; Schleicher, Wedam, & Wu, 2012; Sherrington, Tiedemann, Fairhall, Close, & Lord, 2011; Stubbs, Brefka, & Denkinger, 2015). Nurses have an important role in the preventive work to reduce falls and are responsible for identifying patients that are considered to have a high risk of falling (Callis, 2016). However, the measures that nurses use to prevent falls in older people considered at high risk of falls and how these measures are congruent with best evidence-based practice are not well described.

Falls are defined as an unexpected event in which the person comes to rest on the ground, floor or lower level without known loss of consciousness (American Geriatrics Society/British Geriatrics Society, 2011), and they have devastating consequences for older people (Rubenstein, 2006; Shumway-Cook et al., 2009). Countries worldwide and the Nordic countries in particular face demographic changes likely to result in the increased lifespan of its citizens, where the number of older people is expected to double by 2050 (United Nations Department of Economic and Social Affairs, 2016). As the frequency of falls and fall-related injuries increases with age (World Health Organization, 2007, Nilson, Moniruzzaman & Andersson, 2013; Enderlin et al., 2015), the incidence of falls is accordingly expected to increase during the twentieth century (Marks, 2010), putatively resulting in increasing costs for the individual, the community and the society. First are the direct costs, of which are the health care costs, and second are the indirect costs, that is, societal productivity losses of activities due to fall-related injuries (World Health Organization, 2007). Therefore, efforts to prevent falls and fall-related injuries are important for both older people and society.

Because falls occur as a result of a complex interaction of multiple risk factors, it has been argued that preventive measures aimed at reducing falls among older people should be multifactorial and targeted to each individual (Karlsson, Vonschewelov, Karlsson, Cöster, & Rosengen, 2013). Multifactorial interventions seem to reduce falls in hospitals, although the effect on risk of falling is inconclusive (Cameron et al., 2012). In nursing homes, the effectiveness of multifactorial interventions is unclear but the use of hip protectors can prevent hip fractures (Oliver et al., 2007). Other studies have shown that multifactorial interventions and exercise programmes were the most effective interventions to reduce the risk of falling among older people

**What does this research add to existing knowledge in gerontology?**

- Evidence-based practice is not always used when planning interventions to reduce fall risks among older people.
- A preventive intervention was not planned for all older people at risk of falling.
- There appeared to be a mismatch between identified risk factors and planned preventive interventions.

**What are the implications of this new knowledge for nursing care with older people?**

- Because fall risk is a health hazard among older people, it is crucial to work proactively to avoid falls.
- Preventive interventions should be planned for all older people at risk of falling.
- A better match between identified risk factors and preventive interventions is warranted.

**How could the findings be used to influence policy or practice or research or education?**

- The findings could be used in education for nursing students prior to clinical placement in elderly care.
- The findings could be used in clinical practice to improve the adherence to existing preventive guidelines.

(Chang et al., 2004; Stubbs et al., 2015). Additionally, Stubbs et al. (2015) argued that individually tailored multifactorial interventions were most effective. Regarding individually tailored interventions, nurse-led rehabilitation programmes can reduce the risk of falling and improve the balance among older people with balance impairment (Gouveia et al., 2016). Conversely, another individualised intervention targeting specific risk factors, that is, impaired balance and vision in older people did not result in a reduction of fall rates, and no improvements in balance were seen (Lord et al., 2005). In a more recent individualised intervention programme, the participants were categorised as having mild, moderate or high fall risk and they received interventions according to the individualised programme. However, the findings led to the conclusion that the individualized intervention was not effective to reduce falls in a geriatric rehabilitation hospital (Aizen, Lutsyk, Wainer, & Carmeli, 2015). Several other interventions have been demonstrated to prevent falls and reduce risk of falling. For older people living in their own home, Tai Chi (Schleicher et al., 2012), home-based exercise programmes (Gillespie et al., 2012; Pfortmueller et al., 2014; Schleicher et al., 2012; Sherrington et al., 2011; Stubbs et al., 2015) and home safety interventions (Gillespie et al., 2012; Pfortmueller et al., 2014) have proved to reduce the rate of falls and the risk of

falling. In older people who are treated with fall-risk-increasing drugs (FRID), fall-prevention strategies should also include reducing the amount of drugs prescribed and the withdrawal of psychotropic medication (Milos et al., 2014). Even though pharmaceutical reviews and withdrawal of FRIDs are recommended, it has been argued that there is a lack of evidence showing the advantage of these preventive measures in relation to reduction of fall risk (Zia, Kamaruzzaman, & Tan, 2015).

The evidence-based knowledge regarding effective fall preventive interventions points towards both consistency and inconsistency. It could be queried whether there also is an inconsistency in clinical practice regarding the matching of risk factors and preventive measures among older people at risk of falling in municipal health care. The Swedish national quality registry, Senior Alert, is a tool for systematic preventive care processes for older people, which is used in municipal health care as a measure for quality improvement. The registry provides the best available clinical knowledge and practice to be used when performing risk assessments and planning preventive interventions for older people at risk of falling for instance (Edvinsson, Rahm, Trinks, & Höglund, 2015). Because Senior Alert is a tool for systematic preventive care processes for older people which is to be used by nurses in order to plan and execute the most appropriate preventive interventions when a risk has been identified (Edvinsson et al., 2015), we hypothesised that identified risk factors for falls corresponded with planned preventive nursing interventions. We also hypothesised that the setting may be of importance both for the prevalence of risk of falls and for the planning of interventions. Consequently, the aim was to estimate the prevalence of risk of falls among older people receiving municipal health care. A further aim was to investigate the consistency between fall risk factors and identify risk factors for falls and to describe associated preventive nursing interventions.

## 2 | METHODS

The study was conducted as a cross-sectional register study based on data from the Swedish national quality registry, Senior Alert. Senior Alert is a unique and modern national quality registry that focuses on population health among older people. Its uniqueness is that the registry focuses on nursing variables. A person may be included in the registry upon receiving a care contact after they have received information about the registry from the healthcare provider. The registrations are performed online in the Internet-based register, Senior Alert, by the healthcare providers such as municipal residential care homes. The aim of the registry is to enable better health outcomes and reduced costs for society (Edvinsson et al., 2015; Senior Alert, 2017).

### 2.1 | Participants

The sample consisted of all persons aged 65 years and older who live in a county in southern Sweden, receive municipal health care either in their own homes or in municipal residential care homes, and are registered in the national quality registry, Senior Alert, after a risk assessment regarding risk of falling had been made.

### 2.2 | Data collection

The data collection took place between 1 January and 30 June 2015. The following variables were gathered from Senior Alert: age, biological sex, type of municipal health care, risk assessments based on the Downton Fall Risk Index (DFRI) (Downton, 1993; Rosendahl et al., 2003) as well as all the risk factors of falls and the planned interventions to prevent falls (Senior Alert, 2017). The guidelines provided by Senior Alert (2017) regarding the interpretation of DFRI assessment along with information about the content of the various preventive nursing interventions were used.

### 2.2.1 | Instrument

Downton Fall Risk Index is an instrument aimed at assessing the risks of falls. The instrument has shown high sensitivity and lower specificity but deemed as having adequate predictive accuracy for falls among older people (Rosendahl et al., 2003). The older people are assessed through 11 different risk factors which are grouped into five categories:

1. *Previously known falls*
2. *Medication:* sedatives/antipsychotic/hypnotics (note: These three are measured as one risk factor), antidepressant, diuretics, antihypertensive, antiparkinson
3. *Sensory impairments:* impaired vision, hearing or motor skills
4. *Cognitive ability:* not oriented to time and space
5. *Walking ability:* impaired physical mobility.

Each of the 11 risk factors gives either a 0 or 1 yielding a maximum score of 11. After the risk assessment is performed, the scores are summarised, whereby scores ≥3 indicate high risk of falling (Downton, 1993; Rosendahl et al., 2003).

### 2.3 | Definitions

Dementia care units were defined as municipal residential care homes for older people with dementia.

*Home help service* was defined as assistance in the form of service and personal care in the older people's own home.
*Home health care* was defined as health care when given in the older people's own home.
*Short-term nursing homes* were defined as a shorter stay for older people at special municipal residential care homes, which offer rehabilitation, aftercare, diagnosis or assessment of needs.
*Nursing homes* were defined as municipal residential care homes for older people.

*Group homes* were defined as homes with special services for people with intellectual disabilities.

According to Senior Alert (2017), there are 24 different nursing interventions directed to prevent falls, and they are grouped into eight categories:

1. *Exercise*: weight training, balance training, walking training, training of physical capacity, other measure of muscle function and strength training
2. *Pharmaceutical review*
3. *Mobility and personal care*: mobility training, assistance in moving, support for personal care, assistance with personal care, training of dressing and undressing, other measure of mobility and personal care
4. *Environmental adjustments*: adaptation of the furniture and fixtures, assistive prescriptions, training in the use of aids, adaptation of lighting and sound, alarm supplementary supervision, hip protection pants, antislip socks, other measure of environment adjustments
5. *Information and education about falls*
6. *Other intervention*
7. *Care in the final stages of life*
8. *Declining all preventive interventions.*

## 2.4 | Analyses

We conducted all analyses using IBM SPSS Statistics 22, IBM, New York, United States. We used descriptive statistics (i.e., frequencies, percentages, means and standard deviations (*SD*))
to describe the study sample, chi-square tests to compare proportions and the Mantel–Haenszel test to test trends. We corrected for multiple comparisons by the Bonferroni method. Differences between investigated groups were regarded as significant if $p \leq 0.05$.

## 2.5 | Ethical considerations

The regional ethical review board at Lund University (registration number 2015:484) approved the study. The study adhered to the Declaration of Helsinki—Ethical Principles for Medical Research Involving Human Subjects (World Medical Association, 2013).

## 3 | RESULTS

### 3.1 | Sample characteristics

#### 3.1.1 | Demographic

As presented in Table 1, the results are based on 5,427 older people, of which a majority were women ($n$ = 3,651, 67.3%). The mean age was 86 years (*SD* 7.1), and the ages ranged from 65 to 103 years. In general, the women were older than the men (mean 86.7 *SD* 6.8 vs. mean 83.8 *SD* 7.4, $p$ < 0.001). Most of the older people in this study were living in nursing homes ($n$ = 3,663, 67.5%), and the second most common type of housing was dementia care units ($n$ = 668, 12.3%). Other types of housing were short-term nursing homes ($n$ = 300, 5.5%) and group homes ($n$ = 6, 0.01%). The remaining older people lived in their own homes and received municipal

**TABLE 1** Total sample overview ($n$ = 5,427)

| | Distribution of the total sample n (%) | Distribution of participants with risk of falling n (%) | Distribution of participants without risk of falling n (%) |
|---|---|---|---|
| Nursing homes | 3,663 (67.5) | 2,926 (68.2) | 739 (64.7) |
| Dementia care units | 668 (12.3) | 555 (12.9) | 113 (9.9) |
| Home help service | 501 (9.2) | 322 (7.5) | 179 ((15.7) |
| Short-term nursing homes | 300 (5.5) | 259 (6.0) | 41 (3.6) |
| Home health care | 287 (5.2) | 217 (5.0) | 70 (6.1) |
| Group homes | 6 (0.01) | 6 (0.01) | 0 (0.0) |
| Total | 5,427 (100) | 4,285 (100) | 1,142 (100) |
| Sex | | | |
| Women | 3,651 (67.3) | 2,917 (68.0) | 734 (64.3) |
| Men | 1,776 (32.7) | 1,368 (31.9) | 408 (35.7) |
| Total | 5,427 (100) | 4,285 (100) | 1,142 (100) |
| Age groups | | | |
| 65–74 years | 430 (7.9) | 314 (7.3) | 116 (10.1) |
| 75–84 years | 1,688 (31.1) | 1,329 (31.0) | 359 (31.4) |
| 85–94 years | 2,847 (52.5) | 2,259 (52.7) | 588 (51.5) |
| 95–103 years | 462 (8.5) | 383 (8.9) | 79 (6.9) |
| Total | 5,427 (100) | 4,285 (100) | 1,142 (100) |

**TABLE 2** Prevalence of fall risk factors

| | Total n (%) | Women n (%) | Men n (%) |
|---|---|---|---|
| Previously known falls | 2,937 (54.1) | 1,965 (53.8) | 972 (54.7) |
| Medication | | | |
| Antidepressant | 2,048 (37.7) | 1,443 (39.5) | 605 (34.1) |
| Diuretics | 1,716 (31.6) | 1,173 (32.1) | 543 (30.6) |
| Antihypertensive | 1,830 (33.7) | 1,221 (33.4) | 609 (34.3) |
| Antiparkinson | 274 (5.0) | 142 (3.9) | 132 (7.4) |
| Sedatives/ antipsychotic/ hypnotics | 2,556 (47.1) | 1,768 (48.4) | 788 (44.4) |
| Sensory impairments | | | |
| Impaired vision | 2,534 (46.7) | 1,785 (48.9) | 749 (42.2) |
| Impaired hearing | 1,659 (30.6) | 1,107 (30.3) | 552 (31.1) |
| Impaired motor skills | 1,786 (32.9) | 1,150 (31.5) | 636 (35.8) |
| Cognitive ability | | | |
| Not oriented to time and space | 2,549 (47.0) | 1,735 (47.5) | 814 (45.8) |
| Walking ability | | | |
| Impaired physical mobility | 1,930 (35.6) | 1,269 (34.8) | 661 (37.2) |

health care in terms of a home help service (n = 501, 9.2%) or home health care (n = 287, 5.2%). As presented in Table 2, the most common risk factors for falling were previously known falls (54.1%), using sedatives/antipsychotic/hypnotics 2,556 (47.1%) and impaired cognitive ability (40%).

### 3.1.2 | Risk of fall

In the total sample, the prevalence of the risk of falling was 79% according to the risk assessment DFRI. The mean value on the DFRI scale was 4 (SD 1.8), and the scores ranged between 0 and 10. The prevalence of risk of falling was significantly higher among older people living in dementia care units or in their own homes having

home health care compared to those having home help service. The risk of falling was also significantly higher in short-term nursing homes compared with older people who receive home health care or home help service. The prevalence was lower among participants who receive home help service than with participants who live in nursing homes. The risk of falling increased by age and was higher among women than among men (Table 3).

## 3.2 | Interventions

### 3.2.1 | Planned interventions

A total of 16,106 interventions were planned during the study period. Most of the interventions were planned for persons at risk of falling, but there were also 173 interventions planned for persons without the risk of falling. The most common planned interventions were (in the following order) environmental adjustments, mobility and personal care, exercise and pharmaceutical review. The three alternatives, information/education, declining all preventive interventions and care in the final stages of life, were seldom used (Figure 1). There was no statistical significance between sex and planned interventions or between the different age groups and selected interventions. In all cases with the risk of falling (n = 4,285), 1,143 older people did not have any planned intervention conducted, which is more than a quarter of the whole group (26.7%).

### 3.2.2 | Planned interventions and care location

As presented in Table 4, the interventions of "exercise" and "mobility" were significantly more common among older people staying at short-term nursing homes compared with the other types of housing. Environmental adjustments were significantly more common in short-term nursing homes than among older people receiving home health care, home help service and/or live in nursing homes. Pharmaceutical reviews were significantly more common in dementia care units and in nursing homes compared with the other types of housing. The intervention information/education was significantly more common among older people who receive home health care or home help service. No significant differences were found regarding care in the final stages of life. Declining

**TABLE 3** Prevalence of risk of falling—comparisons between men and women, age groups and type of municipal health care

| | Dementia care units | Home health care | Home help service | Short-term nursing homes | Nursing homes | p-values ≤0.05 |
|---|---|---|---|---|---|---|
| Risk of falling (%) | 83.1 | 75.6 | 64.3 | 86.3 | 79.8 | B, E, F, H, I |
| | **65–74 years** | **75–84 years** | **85–94 years** | **95–103 years** | | **p-values** |
| Risk of falling (%) | 73.0 | 78.7 | 79.3 | 82.9 | | 0.001* |
| | **Men** | **Women** | | | | **p** |
| Risk of falling (%) | 77.0 | 79.9 | | | | 0.016** |

Note. A: Dementia care units/Home health care; B: Dementia care units/Home help service; C: Dementia care units/Short-term nursing homes; D: Dementia care units/Nursing homes; E: Home health care/Home help service; F: Home health care/Short-term nursing homes; G: Home health care/Nursing homes; H: Home help service/Short-term nursing homes; I: : Home help service/Nursing homes; J: Short-term nursing homes/Nursing homes. *Test for trend; **chi-square test.
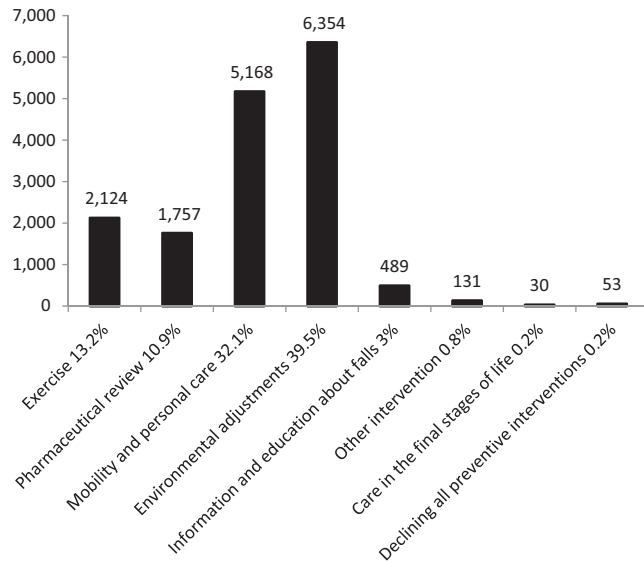
**FIGURE 1** Distribution of nursing intervention per group and % of total (16,106)

interventions was more common in home health care than in short-term nursing homes, where no one declined an intervention to prevent falls.

### 3.2.3 | Planned interventions and fall risk

In the next step, whether older people with certain risk factors obtained planned interventions that matched these specific risk factors was determined. In these analyses, four risk factors with clearly corresponding interventions were used. As presented in Table 5, older people with impaired physical mobility did not all receive interventions that matched this specific risk factor. This also applied to persons with impaired vision and/or hearing. In 4,460 of the older people, their medication treatment was identified as a risk factor for falling, but only 35.4% of them obtained pharmaceutical reviews as a preventive measure to decrease the risk of falling. Of the 2,549 older people with impaired cognitive ability, 40.4%

received preventive measures in terms of alarm or supplementary supervision.

## 4 | DISCUSSION

The current study showed that the prevalence of risk of falling was almost 79% in short-term nursing homes, thus making them the most common place for falls. The prevalence of the risk of falling increased by age and was somewhat higher in women than in men. The most common planned intervention to reduce the risk of falling was environmental adjustments, and the least common was care in the final stages of life. Regarding planned interventions in relation to housing, exercise and mobility were significantly more common among older people staying at short-term nursing homes compared with the other types of housing. There was a mismatch between risk factors for falling and planned interventions.

The highest prevalence of the risk of falls was found in short-term nursing homes compared with the other investigated care locations. This finding supports our hypothesis stating that the setting could play role for the prevalence of risk of falls. The higher prevalence of risk of falls in short-term nursing homes may be because older people are often transferred to short-term nursing homes to recover, for instance, after a hospital stay, and thus, some are already frail. In the short-term nursing homes, they are likely still recovering from an acute illness (or surgery or both) which constitutes an increased risk of falls posthospitalisation. Importantly, the prevalence of the risk of falls was also high among the older people receiving home health care or home help service. Older people receiving these kinds of health services live in their own home and receive intermittent care or service. It should be noted that planned interventions in terms of exercise, mobility and environmental adjustments were least common among older people living in their own homes and receiving home health care or home help service. A higher prevalence of the risk of falls was found with women compared with men, which is in line the study conducted by Brito, Coqueiro Rda, Fernandes, and de Jesus (2014), which demonstrated that women were associated with an increased risk of falling. However, Callis (2016) reported that men were

**TABLE 4** Comparisons of prevalence (%) of planned interventions between different types of municipal health care

| Intervention | Dementia care units | Home health care | Home help service | Short-term nursing homes | Nursing homes | p values ≤0.05 |
|---|---|---|---|---|---|---|
| Exercise | 25.6 | 26.1 | 16.4 | 57.0 | 25.6 | B, C, E, F, H, I, J |
| Mobility | 53.1 | 23.0 | 28.9 | 65.3 | 47.6 | A, B, C, F, G, H, I, J |
| Environmental adjustments | 54.9 | 33.1 | 45.9 | 60.7 | 49.0 | A, B, D, F, G, H, J |
| Pharmaceutical review | 41.6 | 16.4 | 20.6 | 9.7 | 35.4 | A, B, C, D, G, H, I, J |
| Information/education | 2.7 | 21.3 | 21.4 | 6.7 | 7.7 | A, B, D, F, G, H, I |
| Care in the final stages of life | 0.3 | 0.7 | 0.0 | 1.7 | 0.6 | None |
| Declining | 0.7 | 2.8 | 1.8 | 0.0 | 0.8 | F |

*Note.* A: Dementia care units/Home health care; B: Dementia care units/Home help service; C: Dementia care units/Short-term nursing homes; D: Dementia care units/Nursing homes; E: Home health care/Home help service; F: Home health care/Short-term nursing homes; G: Home health care/Nursing homes; H: Home help service/Short-term nursing homes; I: Home help service/Nursing homes; J: Short-term nursing homes/Nursing homes.

**TABLE 5** Planned interventions in relation to the risk factors for falling

| Risk factors | Planned interventions | | | |
| --- | --- | --- | --- | --- |
| | Balance training n (%) | Walking training n (%) | Mobility training n (%) | Assistance in moving n (%) |
| Older people with impaired physical mobility (n = 1,930) | 213 (11.0) | 663 (34.0) | 223 (12.0) | 693 (36.0) |
| | Adaptation of the furniture and fixtures n (%) | Adaptation of lighting and sound n (%) | | |
| Older people with impaired vision and/or hearing (n = 3,194) | 718 (22.5) | 345 (11.0) | | |
| | Pharmaceutical review n (%) | | | |
| Medication (n = 4,460) | 1,979 (35.4) | | | |
| | Alarm/supplementary supervision n (%) | | | |
| Older people with impaired cognitive ability, that is, not oriented to time and space (n = 2,549) | 1,030 (40.4) | | | |

a risk factor for falling. Another explanation for the higher prevalence of falls among women in the present study may be that women were older than men because the risk of falling increased by age, which is in line with previous research highlighting one's increase in age as a risk factor for falling (Callis, 2016; Rose, Roman, & Prakash, 2016).

In the current study, environmental adjustments included measures to reduce common household hazards such slippery floors, insufficient lightning and/or unstable furniture, which increase the risk of falling in older people (Pfortmueller et al., 2014), and these were the most common type of planned intervention. This finding is in line with previous research which recommends environmental adjustments as an efficient intervention to reduce the risk of falling in older people (Gillespie et al., 2012). It should be noted that this intervention tends to be most efficient among older people with previous history of falls and with mobility limitations. It is also recommended that environmental adjustments aimed at reducing household hazards are combined with other preventive measures (Pfortmueller et al., 2014).

Alarmingly, approximately one quarter of the older people with the risk of falling did not have any planned intervention. Providing safety to prevent hazards is one cornerstone in fundamentals of caring (Kitson, Conroy, Wengstrom, Profetto-McGrath, & Robertson-Malt, 2010) but meeting patients' fundamental care needs is a complex nursing challenge which among other factors involves the context of care at a system level such as resources and staffing (Kitson, Muntlin Athlin, & Conroy, 2014). In Sweden, where the study is conducted, there is a lack of nurses and an even greater lack of specialist nurses in the field of elderly care, which may partly explain why not everyone at risk had a planned intervention. However, Senior Alert as a tool for quality improvement and safety for older people (Edvinsson et al., 2015) could be a valuable help in identifying shortcomings in nursing care like the present findings are identified and can be remedied. Importantly, it should be noted that 173 of the older people included in the present study received preventive interventions without being assessed as being at risk of falling. This finding could perhaps be interpreted as promotive action.

Information and education as a measure to reduce the risk of falling were seldom used. On one hand, this finding may be regarded as positive because there is no evidence supporting that this intervention results in a reduction in the risk of falls (Gillespie et al., 2012). This does not necessarily mean that information and/or education is ineffective but rather that there is a lack of complex interventions which show any effect. On the other hand, it may be problematic that older people are not informed and educated about fall risks. For example, it could be argued that older people have difficulties participating in decisions regarding their care and making informed decisions without proper information or knowledge. Therefore, ensuring that older people are provided easy-to-understand information about their care is essential because older people prefer to have information about self-care (Xie, Wang, Feldman, & Zhou, 2014). However, in connection with counseling on fall preventive measures for older people at risk, it is important to show respect for their self-management strategies and beliefs and to preserve their identity as competent and independent persons (McInnes, Seers, & Tutton, 2011). For that reason, it is recommended that nurses prioritise to create a good healthcare relation with the older people and then adapt the information about fall prevention to each individual's needs and preferences. Another option may be to develop educational materials together with older people and their relatives which seem to be fruitful for addressing fall prevention (Schoberer, Eglseer, Halfens, & Lohrmann, 2018).

Our hypothesis that the setting is of significance for the planning of preventive interventions was also confirmed. Our findings showed for instance that the interventions of the interventions of "exercise" and "mobility" were significantly more common among older people staying at short-term nursing homes compared with the other types of housing. One speculation for that finding is that older people stay temporarily at short-term nursing homes partly in order to recover physically before being able to come home to their own home. Regarding exercise as a preventive intervention, previous research shows that exercise is one of the most efficient

interventions to prevent falls (Gillespie et al., 2012; Pfortmueller et al., 2014; Schleicher et al., 2012; Sherrington et al., 2011; Stubbs et al., 2015). However, in the current study, this intervention was the third most common, and it could be claimed that exercise as a preventive measure to reduce falls in older people is used too seldom. One speculation for this finding is that it may be challenging to initiate exercise programmes for older people and to obtain sufficient resources to meet each individual's specific needs (Swedish Council on Technology Assessment (SBU), 2014). Another possible explanation may be that nurses regard exercise as a responsibility for physiotherapists, although nurse-led exercise programmes to prevent falls have proven to be effective in reducing falls in older people (Robertson, 2001). A further explanation may be related to ageism, according to which, older people may be discriminated against (Minichiello, Browne, & Kendig, 2000) because exercise may be viewed as a low-priority activity for older people. Still, exercise among older people has proven to increase their muscle strength (Serra-Rexach et al., 2011), indicating that exercise is to be promoted in this group.

The current study investigated the congruence between the risk factors of falls and planned interventions because the correspondence between identified risk factor and fall prevention has been recommended as best practice (Chang et al., 2004). Importantly, the findings identified some mismatches between risk factors and planned interventions. Thereby, our hypothesis that identified risk factors for falls would correspond with planned preventive nursing intervention was not confirmed. Approximately, one-third of the older people with a risk of falling related to their pharmacological treatment received a pharmaceutical review as a preventive intervention to reduce the risk of falling. This is remarkable because fall-increasing drugs constitute essential risk factors for falling in older people (Milos et al., 2014; Pfortmueller et al., 2014). Reducing the total number of drugs and withdrawing psychotropic medications are recommended fall-prevention strategies (Milos et al., 2014). In short-term nursing homes, only 9.7% of the older people at risk of falling received a pharmaceutical review, which could be explained by the short length of stay that this kind of care often implies. Another mismatch was that only 11% of older people with impaired physical mobility received balance training. This kind of preventive intervention has proven to be effective in reducing fall risks among older people (Sherrington et al., 2011). Although insufficient lightning is a well-known risk factor (Callis, 2016), only 11% assessed as having impaired vision received the adaptation of lighting as a preventive intervention. These findings seem to have recognised a significant mismatch between identified hazards and planned preventive interventions to reduce falls, which emphasise the need for quality improvement regarding fall prevention in older people. Although Senior Alert through its supportive systematic preventive care process claims to have increased interventions associated with a risk assessment (Edvinsson et al., 2015), our study argues that a better match between risks and preventive actions is warranted. To achieve this, we suggest an educational intervention for nurses in municipal health care focussing on preventive interventions to reduce the risk of falls among older people. Similar interventions have resulted in a reduction of falls in nursing homes (Teresi et al., 2013). The quality registry Senior Alert could be used to evaluate such an intervention.

One strength of the current study is its large sample consisting of older people who all receive different kinds of municipal health care in one county in Sweden which is composed of both metropolitan and rural areas. Thus, the sample could be regarded as representative, which in turn, strengthens the generalisability of the findings. Another strength is that the risk assessments were made using DFRI which contains a number of known risk factors thus providing satisfactory content validity (Polit & Beck, 2016; Rosendahl et al., 2003). Senior Alert (2017) provides instructions to help the nurses perform the risk assessments, which is a good aid and strengthens the reliability. A potential limitation may be nonadherence to the instructions, which could result in incorrect risk assessments.

## 5 | CONCLUSION

The current study has recognised some areas of quality improvement regarding prevention of falls among older people. Evidence-based practice is not always used when planning interventions to reduce fall risks. Importantly, there appears to be a mismatch between identified risk factors for falling and planned preventive intervention.

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**IMPLICATIONS OF PRACTICE**

- Because fall risk is a health hazard among older people, it is crucial to work proactively to avoid falls.
- A better match between identified risk factors and preventive interventions is warranted.
- Actions aimed at matching risk factors with preventive interventions are suggested.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### CONTRIBUTIONS

Sofia Witt and Emma Englander contributed to the study design, data collection, analyses and manuscript preparation. Christine Kumlien contributed substantially to the study by manuscript preparation, critical revision for important intellectual content. Malin Axelsson contributed substantially to the study conception and design, preparation of the manuscript, critical revision for important intellectual content and supervision.

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