Experiences and outcomes of systematic preventive work to reduce malnutrition, falls and pressure ulcers in nursing home residents

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Abstract

**Background:** Frail older people living in nursing homes are at a high risk of becoming malnourished, falling and developing pressure ulcers. In Sweden the national quality registry Senior Alert was developed to support prevention in these areas. Prevention according to Senior Alert follows a *preventive care process* of four steps, including risk assessment, analysis of the causes of risk, to determine and perform appropriate actions, and finally to evaluate the care given. Persons aged 65 years or older, in all health and social care systems, can be registered. The registry has been used since 2008, however, few scientific studies have reported about what results the process generates.

**Aim:** The overall aims of this thesis were to investigate how the preventive care process in Senior Alert functions as a tool for preventive work among older persons living in nursing homes, and to investigate the results of risk assessments and actions.

**Design:** The thesis is based on three longitudinal quantitative studies (I, III, and IV) and one qualitative study (II). In Studies I and III, process- and patient results were compared among different groups of nursing home residents, with a follow-up time of 6 months. In Study IV, associations between the assessment instruments and the outcomes of weight loss, falls and pressure ulcers were investigated. The qualitative study (II) was based on focus group interviews with healthcare professionals in nursing homes and was analyzed using content analysis.

**Results:** The residents included in the registry during the later years (2013-2014) had a higher proportion of registered preventive actions in the three areas, and were followed up more frequently regarding weight and new assessments than those included during the earlier years (2010-2012). Nevertheless, regardless of risk only 30% were reassessed, and 44% of the residents at risk for malnutrition were followed up for body weight. No difference in weight change was found between a group of residents included in Senior Alert and a second group receiving ‘care as usual’. Generally, the mobility variables in the risk assessment instruments had the strongest associations with the outcomes of weight loss, falls and pressure ulcers albeit in different ways. Healthcare professionals described that Senior Alert stimulated better teamwork while at the same time they experienced increased documentation and time constraints as aggravating
circumstances. They also described a lack of reliability of the assessment instruments in that they overrated the risks compared to their own clinical judgement. Healthcare professional’s knowledge about the evaluation part of the process was low.

**Conclusion:** Although the overall preventive actions and follow-up of measures taken were higher in the later-included group in Senor Alert, the higher process performance was not reflected in better patient outcomes. Moreover, the evaluation and follow-up step of the preventive care process was not sufficiently applied. This was expressed by the participants in the focus groups and was also reflected in registry data by the varying time to follow-up and the poor event registration. As a consequence, the sample for measuring outcome within 6 months became small. Therefore, larger samples are needed to study longitudinal outcomes if a fixed system-mandatory time point for follow-up is not implemented. A committed leadership is important to improve the preventive work and to stimulate a follow-up of results.
Original papers

This thesis is based on the following studies, which are referred to by their Roman numerals in the text.

Paper I
*Lannering, C., Ernsth Bravell, M., Andersson, A-C., & Johansson, L*  
(submitted)

Paper II
Prevention of falls, malnutrition and pressure ulcers among older persons – nursing staff's experiences of a structured preventive care process (2016)  
*Lannering, C., Ernsth Bravell, M., & Johansson, L*  
Health & Social Care in the Community, 25(3), 1011-1020.

Paper III
*Lannering, C., Johansson, L., & Ernsth-Bravell, M.*  
The Journal of Nursing Home Research Sciences (3), 64–70

Paper IV
Factors related to falls, weight-loss and pressure ulcers – more insight in risk assessment among nursing home residents (2016).  
*Lannering, C., Ernsth Bravell, M., Midlöv, P., Östgren, C., & Mölstad, S.*  
Journal of Clinical Nursing, 25(7–8), 940-950.

The articles have been reprinted with the permission from the respective journal.
Abbreviations

ADL = Activities of Daily Living
BMI = Body Mass Index
DFRI = Downton Fall Risk Index
MMSE = Mini Mental State Evaluation
MNA-SF = Mini Nutritional Assessment (Short form)
MNS = Modified Norton Scale
NCP = Nutritional Care Programme (Study III)
NQR = National Quality Register
PPM = Point Prevalence Measure
SA = Senior Alert
SALAR = Swedish Association of Local Authorities and Regions (SKL)
SALT = Screening Across the Lifespan Study (part of the twin registry)
SHADES = Study on Health and Drugs in the Elderly
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Introduction

Safe care is one of the cornerstones of providing quality in healthcare (IoM, 2001, Disch, 2012), and both these issues have attracted much attention in Swedish healthcare organizations over the last two decades. Safe care means to protect patients from harm. Healthcare professionals need to have knowledge of risks, and work in such a way that the risks are minimized. Older people living in nursing homes are often frail, and frailty is often associated with high risk and high prevalence for malnutrition, falls and pressure ulcers (Ernsth Bravell et al., 2011). The prevalence of malnourished residents has been reported to 30% (Törmä et al., 2013) and corresponding value for falls is approximately 50% (Ericsson et al., 2008). According to point prevalence measures during 2013, pressure ulcers in nursing home residents were estimated to 9.2% (Senior Alert, 2017). With the purpose of supporting healthcare professionals in their preventive work to protect older persons from these conditions, the national quality registry (NQR), Senior Alert (SA) was developed. The preventive care process in the registry provides a structured and systematic work flow including four steps: 1) risk assessments 2) analysis of the underlying causes 3) decisions on individually tailored interventions and 4) evaluation of the care given (Edvinsson et al., 2015). When SA was launched in 2008, the three areas malnutrition, falls and pressure ulcers were included. For these conditions assessment instruments and risk reduction potential were supported by the research literature, indicating that the necessary requirements for evidence-based work were in place. Later on, oral health and bladder dysfunction/incontinence were added to SA, but not included in this thesis.

Studies in this area often focus on a single topic in which the researcher has a special interest, for example pressure ulcers, which makes such studies more in-depth in that particular area. However, it is often argued that the three areas studied here are interrelated, since they often share the same underlying factors and determinants. For example, a malnourished person is more prone to fall, which in turn may lead to immobilization, whereby the risk of developing pressure ulcers increases. Furthermore, nutritional actions
that aim to prevent malnutrition also prevent pressure ulcers. Nutritional actions also enhance the effects of exercise and have a direct impact on increasing muscle mass and strength, which prevents falls. For healthcare professionals, there is a pedagogical point to assess and consider these conditions simultaneously.

Although SA had been used since 2008, few scientific articles reporting on the outcomes and experiences of SA had been published (Rosengren et al., 2012, Edvinsson et al., 2015). This lack of knowledge motivated this thesis - to investigate how the preventive care process functions as a tool for preventive work. For example, can improvements such as better performance and reduced adverse events among older persons be found in registry data? What are the experiences among healthcare professionals concerning the different steps in the process? These issues will be addressed in this thesis which comprises studies based on registrations from Swedish nursing homes. Further, main focus is the process and its outcome, rather than nursing actions for a special problem.

With my background as a research nurse, I was a project administrator for the SHADES (Study on Health and Drugs in the Elderly) study from 2008 – 2011. My first study (Study IV in this thesis) was based on assessments and outcomes from SHADES, and from here my interest in this research field started. In 2014, I became engaged in another project titled Health development in late life, which allowed further studies in the field, but now based on registry data from SA. However, I do not have any clinical experience working in elder care or with SA. Therefore, from a clinical point of view, my initial understanding of these areas was low.
Background

An ageing population – healthy or frail?

In Sweden, as in other Western societies, the proportion of older people has increased in recent decades, mainly because of a combination of decreased fertility and longer life expectancy (Rechel et al., 2013). The expected remaining average length of life at 65 years is 18.8 years for men and 21.3 years for women (National Board of Health and Welfare, 2016b). In 2014, the group of people aged 80 and over consisted of approximately 500,000 persons and is expected to reach 826,000 in 2030 (SCB, 2015). This population ageing can be seen as a success story for public health policies and for socioeconomic development, but if the added years are dominated by declines in physical and mental capacities, the implications for older people and for society may be much more negative and challenging (Bell et al., 2014). Thus, the population ageing challenges society to adapt to optimize the health and functional capacity of older people, as well as their social participation and security.

The World Health Organization (WHO) has set the goal that older people should grow old with good health, maintain autonomy and independence as long as possible, and be able to participate in society (WHO, 2015). In addition to the length of life, the ability to function and interact within a supportive environment is an important outcome for healthy ageing. The Public Health Agency of Sweden (2009) has described that efforts to promote healthy ageing should focus on social interaction and support, meaningfulness and feeling needed, physical activity, and good eating habits. However, applying the concept of healthy ageing to older people in general has been criticized as reinforcing the stigma surrounding diseases and impairments in older age groups and contributing to the marginalization of a large group of people (McKee & Schuz, 2015) who are considered to be the in the fourth age of life. This fourth age of life is often associated with frail older people suffering from adverse health outcomes, impairments and dependency, whereas the previous third age is the part in life after retirement and onward, characterized by the possibility of healthy ageing (Hicks & Conner, 2014, Koss & Ekerdt, 2017). There is no fixed age limit between the
third and fourth ages, as the transition is related to functional and biological decline, such as when people are no longer ‘getting by’, when they are seen as not managing the daily routine and become third persons in the eyes of others (Laslett, 1994, Gilseard & Higgs, 2010). However, McKee & Schuz (2015) also argued that the concept of healthy ageing may indeed embrace even frail older persons depending how the concept is operationalized. If healthy ageing is a relative state grounded in the person’s current situation, it is applicable to all older persons because gains in physical and mental health are always possible, although they not always easily achieved. An interview study by Marent et al. (2016) reported on health promotion among nursing home residents in Austria. Healthcare professionals emphasized the importance of physical mobility and healthy nutrition and described prevention as part of, or synonym of health promotion. Prevention of malnutrition, falls and pressure ulcers may therefore be considered as part of healthy ageing among frail older persons.

There is no common definition of frailty, but most studies in the field summarize frailty as an age-related condition of reduced reserve capacity and resistance to stressors (Fried et al., 2001, Rockwood & Mitnitski, 2007). It has been debated whether frailty is a syndrome or a series of age-related impairments, but the main reason to use frailty as a concept is to move away from disease-based approaches and towards a more health-based approach (Bergman et al., 2007). The main consequence of frailty is increased vulnerability to multiple adverse health-related outcomes (Gilseard & Higgs, 2011). Frail older persons are vulnerable to underlying conditions such as malnutrition and major implications for care are to minimize the risk of falls and pressure ulcers (Fried et al., 2004)

Elder care in Sweden

The responsibility for Swedish elder care is at the municipality level and provides two main forms of publicly financed care: home care (both social care and healthcare) and institutional care, such as nursing homes. Access to elder care is based on need, and the level of care is decided by a specially trained social worker (need assessor). If health care is needed, it can be provided as a complement, both at home and in institutional care. In 2014
approximately 23% (N=115,460) of the age group 80 and over received home care while another 13% (N=65,056) lived in nursing homes (National Board of Health and Welfare, 2016b).

**Nursing homes**

The context of this thesis is based in nursing homes, which are a type of special housing where care is integrated and provided around the clock. Nursing home wards may be specialized in terms of the care they provide, such as dementia or psychiatric care. Registered nurses have the overall responsibility for the nursing care, while assistant nurses are the ones that provide care. Medical health-care is provided by primary care physicians, who serve as consultants and commonly visit the nursing homes once per week or when needed.

Approximately 20,000 persons move into nursing homes each year, and 63% of them are women (National Board of Health and Welfare, 2016b). Although the number of older people is rising, the number of beds in nursing homes is decreasing. In 2010, 94,000 persons 65 years or older lived in nursing homes in Sweden. The corresponding value for 2015 was 88,000 persons (National Board of Health and Welfare, 2016a). The decrease in beds is mainly due to a stay-at-home policy, whereby home care is offered for as long as possible. Consequently, persons moving into nursing homes are very old; the median age in 2014 was 87 years for women and 85 years for men (National Board of Health and Welfare, 2016b), and the remaining time spent in nursing homes has become shorter (Schön et al., 2015). Of the residents who moved into nursing homes in 2012, 33% died within 6 months (National Board of Health and Welfare, 2015). This finding implies that individuals moving into nursing homes today are frailer and in greater need of care than they were previously.

Most people who live in nursing homes need comprehensive help due to illness and disability (National Board of Health and Welfare, 2016c). This help includes assistance with moving, taking medication, eating, taking care of personal hygiene or participating in activities. Although the performance of regular medication reviews is recommended, the use of medication among
older people in nursing homes is high. The median number of prescribed medications per person has been reported to be 7 and 8 (Ernsth Bravell et al., 2011, Törnä et al., 2013). Moreover, the National Board of Health and Welfare reported that 26% of residents over 75 years of age were taking 10 or more medications and that 17% were taking 3 or more psychopharmacologic medications (2016c). Incontinence is another common problem, and nearly 80% of the residents needed incontinence aids (2017c). Cognitive status in research is often assessed with the Mini Mental State Examination (MMSE) (Folstein et al., 1975). According to this instrument, cognitive impairment was reported to be 60% and 70% (Fagerstrom et al., 2011, Ernsth Bravell et al., 2011). As a marker for nutritional status, the average body mass index (BMI) was reported to be 25kg/m² in Swedish nursing homes (Fagerström et al., 2011, Törnä et al., 2013, Ernsth Bravell et al., 2011).

Patient safety

In 1999, the Institute of Medicine (IoM) published its landmark report “To Err is Human” (Kohn et al., 2000). The report created an international sense of urgency to reduce patient harm, and specifically recommended incident reporting. By doing so, healthcare organizations could learn from adverse events, mitigate contributing factors and prevent future harm. In addition, clear policies, organizational leadership capacity, data to drive safety improvements, skilled healthcare professionals and effective involvement of patients in their care, are all needed to ensure sustainable and significant improvements in the safety of healthcare (WHO, 2017). Patient safety approaches have also evolved to creating sustainable strategies for prevention by focusing on the correct processes. Such approaches highlight the importance of proactivity and to facilitate the ability of healthcare professionals to make “things go right”. From a patient safety perspective this notation is related to the concept of Safety II, which defines safety as the ability to ensure that things go right, and not merely the absence of failures (Braithwaite et al., 2015). Further, healthcare professionals need to combine patient safety and quality improvement to reduce harm (National Board of Health and Welfare, 2017b, Benn et al., 2009). Hence, evidence-based methods and tools employed by healthcare professionals in their daily work have become more important. The systematic workflow of the preventive...
Care process in SA (see heading “Prevention according to Senior Alert”) may be regarded as well designed to fulfil such needs concerning prevention of malnutrition, falls and pressure ulcers.

Patient safety is regulated in The Swedish Patient Safety Act (SFS 2010:659§5), in which patient safety is defined as "protection against patient harm". Further, patient harm is described as suffering, bodily or mental injury or illness, and death that could have been avoided if adequate measures had been taken during the patient’s contact with healthcare. The concept of adequate measure includes prevention, early detection, and appropriate treatment while taking into account the patient’s basic disease. The application of adequate measures can also mean applying adequate routines and knowledge-based methods and that patients are being cared for by healthcare professionals with adequate competencies (The Swedish Society of Nursing, 2014).

Monitoring adverse events in nursing homes

In the area of patient safety, national efforts have been taken to survey different types of process indicators and adverse events to form a knowledge base for the future work (National Board of Health and Welfare, 2017b). In municipal care, pressure ulcers and falls are monitored as point prevalence measures (PPMs). Each year during a specific week, all the municipalities are invited to record fall events and pressure ulcers (National Board of Health and Welfare, 2017b). The PPMs for pressure ulcers were previously managed by the Swedish Association of Local Authorities and Regions (SALAR, 2017) but since 2013 they have been performed in collaboration with SA. Through this connection with SA the PPMs of falls began. Thus, the PPMs have become a way to nationally survey the results of SA.

Malnutrition in nursing homes – prevalence and risk factors

Malnutrition begins when food and nutrient intake is consistently inadequate to meet the individual’s nutrient requirements (Skipper, 2012). Consequently, malnutrition is an overall term, encompassing both over-
nutrition, specific nutrient deficiencies, and imbalance because of disproportionate intake (Chen et al., 2001). However, in this thesis malnutrition refers to undernutrition. Malnutrition is not included in the PPMs, probably because of difficulties in how an “on-the-spot account” should be defined. European and Swedish studies have demonstrated an assessed risk varying from 58% to 64% of which 18% to 30% was considered malnourished (Kaiser et al., 2011, Stange et al., 2013, Strathmann et al., 2013, Törmä et al., 2013). In these studies, the percentage of risk was calculated on the basis of a cutoff value according to the Mini Nutritional Assessment (MNA) instrument (Rubenstein et al., 2001). Risk factors for malnutrition can be divided into three main types: medical, social and psychological. Medical risk factors can be exemplified by; poor appetite, loss of taste and smell, gastrointestinal disorders, poor oral health and endocrine disorders. Social risk factors are, e.g., isolation or loneliness, and the inability to shop or prepare food. Psychological risk factors include confusion, dementia and depression (Hickson, 2006, Ahmed & Haboubi, 2010, Pilgrim et al., 2015).

**Falls in nursing homes – prevalence and risk factors**

A fall is an event that causes the patient to come unintentionally to the ground or some lower level, regardless of the cause (Lamb et al., 2005). As mentioned above, falls in Swedish nursing homes are monitored by PPMs. The PPMs performed between 2013 and 2016 reported falls during a period of two weeks in 7% of the residents (Senior Alert, 2017). The PPM performed in the autumn of 2016 included 15,627 persons in 124 municipalities. This PPM showed that 80 % were at risk of falling and that 1,023 persons (6.6%) had fallen. The majority of fallers (804 persons) had fallen once (National Board of Health and Welfare, 2017b). Nearly a quarter of the falls resulted in an injury, with 3% sustaining fractures, 11% acquiring soft tissue injuries and 9 % sustaining wounds (ibid). Previous scientific research in the field has reported falls in 53-62% of the residents (Meyer et al., 2009, Rosendahl et al., 2008, Rosendahl et al., 2003) however these studies were based on longer study periods than were the PPMs. Risk factors for falls have been described as gait and balance instability, cognitive and
functional impairment, sedating or psychoactive medication (Rubenstein et al., 1994, Ferrari et al., 2012) and the number of diseases (Damian et al., 2013). Environmental factors and the person’s attitude or risk-taking behaviour are also important (Jones & Whitaker, 2011). Ericsson et al. (2008) reported that persons with dementia showed a higher fall rate than did persons without dementia. For persons in dementia care, four causes stand out as the most frequent: forgetfulness related to physical impairment, impaired mobility, anxiety, and inability to call for help (Struksnes et al., 2011). Several studies have described that previous falls are a main predictor for future falls in older people (Tromp et al., 2001, Jones & Whitaker, 2011).

Pressure ulcers in nursing homes – prevalence and risk factors

A pressure ulcer is defined as a localized injury to the skin and/or the underlying tissue, usually over a bony prominence as a result of pressure or pressure in combination with shear (NPUAP-EPUAP-PPPIA, 2014). A common used classification system describes category 1 pressure ulcers as a non-blanching erythaema, category 2 as a partial thickness loss of the dermis, category 3 as full thickness skin loss, and category 4 as full-thickness tissue loss (ibid). The PPM values from 2011 to 2015 showed decreasing prevalence from 14% to 7% (Bååth et al., 2014, Senior Alert, 2017). In the PPM from autumn 2016, SA reported a risk of 30% and a prevalence of approximately 8%. Of these ulcers, 62% were classified as grade 1. These results demonstrate a decreased prevalence but an unchanged risk (Senior Alert, 2017). Previous studies in the field have shown prevalence rates from 4% to 12% among nursing home residents (Fossum et al., 2011, Kottner et al., 2010, Moore & Cowman, 2012). A systematic review of risk factors for pressure ulcers identified three primary risk domains: mobility/activity, perfusion and general skin status (Coleman et al., 2013). However, no single factor can predict pressure ulcers, which are caused by a complex interplay of factors with malnutrition being one important risk factor (Borgström Bolmsjö et al., 2015, Verbrugghe et al., 2013, Ek et al., 1991).
Prevention of malnutrition, falls and pressure ulcers

To prevent malnutrition, it is necessary to consider several individual aspects. It can, for example, be important to improve the oral health (Lindmark et al., 2018). For many older persons, suitable actions are decreased overnight fasting, snack and medication reviews. Adjusting food consistency and adjusting the environment can be important for others (Faxén Irving et al., 2016). Furthermore, earlier studies have reported improved nutritional results if the risk assessment was followed by a detailed analysis of causes (Johansson et al., 2016), and individually tailored nutritional interventions (Lorefält & Wilhelmsson, 2012, Lee et al., 2013, Wikby et al., 2009).

Previous research regarding the prevention of falls has stated that interventions to prevent falls in frail older people should be multifactorial and multidisciplinary (Neyens et al., 2009). A review by Cameron (2010) of studies on the effects of interventions to prevent falls in nursing homes concluded that the effectiveness of exercise, as a single preventive factor, remains uncertain; however multifactorial interventions delivered by multidisciplinary teams can be effective. Such approaches comprise an assessment followed by individually designed interventions. Additionally, vitamin D supplementation was found to reduce the rate of falls (Cameron et al., 2010), as falls may be a consequence of impaired neuromuscular function associated with vitamin D deficiency (Flicker et al., 2005).

Prolonged pressure exposure is the primary cause of pressure ulcers and is the reason why the use of pressure redistribution mattresses/cushions and regular repositioning is recommended (Sving et al., 2017). Preventing the majority of pressure ulcers is possible (Bååth et al., 2014), and studies have shown that the use of guidelines decreased the prevalence of pressure ulcers (Lahmann et al., 2015, van Gaal et al., 2011a). These guidelines promote preventive actions including systematic risk assessment, skin examination, bed and chair support surfaces, repositioning and mobilization, as well as nutritional support (NPUAP-EPUAP-PPPIA, 2014, Moore & Cowman, 2012).
Prevention according to Senior Alert

Senior Alert was developed from collaborative improvement works conducted in the county council of Jönköping during 2002-2005. Healthcare teams with different backgrounds worked together with a focus on patient safety and prevention (Edvinsson et al., 2015). Scientific panels decided on an evidence-based approach, both for the selection of instruments and for the compilation of the preventive actions in three areas. One result of this collaboration was a local prototype that was further developed and implemented as a web-based NQR in 2008. In SA, persons at 65 years or older are targeted for registration. SA can be used in any healthcare organization and usage may differ depending on the type care given.

Figure 1. The Senior Alert workflow – the preventive care process – (The figure was inspired by the SA web site)

Step 1 in the preventive care process involves risk assessment, with the concurrent use of the following assessment instruments suggested as default: the short form of the Mini Nutritional Assessment scale (MNA-SF) to assess risk of malnutrition (Rubenstein et al., 2001), the Downton Fall Risk Index (DFRI) to assess fall risk (Downton, 1993), and the Modified Norton Scale (MNS) to assess the risk of developing pressure ulcers (Ek et al., 1989) (Appendix I). The instruments are described in more detail in the Methods section of this thesis. Risk assessment is primarily performed by registered nurses and assistant nurses. In contrast, steps 2, 3 and 4 of the preventive care process are intended to be team-based, in which different healthcare professionals cooperate in regularly held team meetings. In addition to
nurses and assistant nurses, physiotherapists and occupational therapists usually form part of the teams (Edvinsson et al., 2015).

Step 2 is performed if the person is found to be at risk in any area. It is a more detailed analysis of the causes that may lead to risk (Appendix II).

Step 3 consists of the planning and execution of suitable actions, based on predetermined actions for each area (Appendix III). It is possible to choose from among around 100 predetermined preventive actions that are divided into the three areas to form an individualized care plan. A follow-up date for evaluation is decided on, and an “alert” function is set as a reminder.

Step 4 comprises the follow-up and evaluation of the performed interventions and also includes a decision regarding how to carry on the preventive work. A recommendation is to follow-up within 1 to 3 months. During the process cycle, events such as falls and planned measures of weight, as well as new pressure ulcers, are recorded. The process is iterative and should be repeated regularly. In addition to clinical improvement for the older persons, team-learning should be stimulated. For this purpose, visual reports and summaries can be used.

In general, NQRs are disease specific, and contain individualized data concerning medical interventions and outcomes after treatment. Further, data is usually recorded after the patient has left the ward. SA differs here, in that data is recorded during care and should guide the individual preventive care. SA is also one of few NQRs that acknowledge the importance of nursing and care teams to provide a good and safe care. However, what all NQRs have in common is that collected data should be used to compare adherence to guidelines, to improve quality and for research (Emilsson et al., 2015).

Implementation of Senior Alert

During the years 2010-2014 the Swedish government supported a great venture to improve the health and social care for “the most ill elderly”. This concept comprised ‘persons at 65 years or older, with extensive functional decline depending on ageing, injury or disease’ (Government offices of Sweden, 2014). From this venture, SA was given funding with the ambition
to be used countrywide in all Swedish health and social care organizations (Nyström et al., 2014). From 2010 organizations were provided financial bonuses for the registration of risk assessments in SA. In 2012 additional bonuses were granted to organizations in which a risk assessment was performed for a minimum of 90% of persons living in nursing homes (Nyström et al., 2014). An extra bonus could also be provided if planned actions were registered. From 2014 an additional demand was to participate in the PPMs of fall events and pressure ulcers. The dissemination of SA was effective with the help of the bonuses. Additional support was also provided by 24 coaches who were engaged by the registry with the commission to support the implementation (SALAR, 2015, Nordin et al., 2017, Nyström et al., 2014). During 2015, 79% of Swedish nursing home residents were registered in SA (N=65 479) (National Board of Health and Welfare, 2017a). This coverage was measured by comparing individuals registered in SA with individuals in the registry of Care and Social Services for the Elderly; the latter collects information regarding housing.

Quality of care

In 2001, the report “Crossing the Quality Chasm” (IoM, 2001) was published. In this report six quality domains were proposed in which healthcare in the U.S should improve to better meet patient needs. Healthcare should be safe, effective, timely, equal, evidence-based, and patient-centered. Since then, measurements related to these aims have been applied in healthcare organizations around the world (Ayanian & Markel, 2016). In Sweden, the prevailing quality policy of “good care” was built on these quality domains (National Board of Health and Welfare, 2012). However, to improve quality, continuous efforts are needed. According to Batalden & Davidoff (2007), these are the combined and increasing efforts of everyone – healthcare professionals, patients and their families, researchers, payers, planners and educators – to make changes that will lead to better patient outcomes (health), better system performance (care) and better professional development (learning). The six quality domains have also provided the foundation for the core competencies, emphasized as essential for healthcare professionals to ensure patient safety and a high quality of care. These competencies were first described in the U.S. by the
Quality and Safety Education for Nurses (QSEN) (Disch, 2012), and were later adopted into a Swedish context by The Swedish Society of Nursing. From this nursing perspective, the six core competencies are; person-centered care, team collaboration, evidence based care, quality improvement, safe care and technology for information and communication (Edberg, 2013, Sherwood & Zomorodi, 2014, The Swedish Society of Nursing, 2014).

To conclude, safe care and quality of care are two intertwined concepts, both of which form parts of the core competencies. Further, the core competencies are closely aligned to the principals of SA since prevention according to the preventive care process includes all the parts of the six core competencies, both in terms of their application and how they can be strengthened.

**Evaluation of quality of care**

Donabedian’s system model provides a framework for care evaluation in which the quality of care in a given context can be drawn from three categories; **structure, process and outcomes** (Donabedian, 1988). Donabedian was a pioneer in understanding healthcare as a system (Best & Neuhauser, 2004). Although this model was proposed in the sixties, it is still used today (Figure 2). To obtain a favourable outcome, the correct processes need to be applied. This in turn requires that a good structure is in place. Therefore, all three categories should be taken into account.

![Figure 2. Donabedian’s system model of the categories needed to consider when measuring quality of care (freely after Donabedian, 1988)](image)

*Structure* includes material resources, human resources and organization in the context in which care is delivered (Donabedian, 1988). For example; structure includes the physical facility, equipment, human resources (staff-mix, training), culture, attitudes, leadership, and organization (Donabedian,
Accreditations and certifications of organizations, assuming that the particular requirements are fulfilled, may be indicative of good-quality structure. \textit{Process}, denotes what is actually done while giving and receiving care. \textit{Outcome} is the clinical value that can be measured, such as patient results or quality indicators.

The original Donabedian model is essentially linear, assuming that structure affects process, which in turn affects outcome. Healthcare, however, is more dynamic and has aspects of reciprocal directions of influence (Mitchell et al., 1998, van Nie-Visser et al., 2011). The original model has also been criticized for its narrow description of structure and for excluding the patient’s condition (Battles & Lilford, 2003, Carayon et al., 2006). Based on the previous reasoning, a modified version of Donabedian’s system model was created for this thesis. This version was adjusted to include the preventive care process and its outcomes as well as the condition of the residents. This modified model was chosen as a framework through which to present the results of this thesis (Figure 3).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{donabedian_modified.png}
\caption{A modified version of Donabedian’s Structure, Process, Outcome model adapted to the work flow of Senior Alert.}
\end{figure}

Accordingly, resident characteristics are included in the description of structure (Figure 3). It is reasonable to believe that structure is dependent on the variety of patients being cared for and vice versa. Some persons enter the healthcare system with antecedent conditions that are affecting both processes and outcomes. This notion particularly applies to older persons in nursing homes, who moves in because of frailty and/or a large care need. \textit{Structure}, however, is not measured in SA or in other NQRs. One explanation for this has been that structure is reflected in the processes (Ekman & et al., 2015). Structure was not expressively measured in this
thesis but was partially described in Study II. *Process* is exemplified by the stepwise workflow in the preventive care process (Figure 1). An example of *Outcome* is a percentage of weight loss greater than 5%. This indicator was previously monitored on the SA website and was used in this thesis.
Rationale

Frail older persons are mostly excluded from research since they are considered too vulnerable. Therefore, considering that this group is rapidly growing, more knowledge from many perspectives is needed to provide better care to this group. Over the years, large amounts of data have been collected in SA and it is important to investigate whether this information may show any improvement, i.e., a decline in adverse events. In other words, how are frail older persons with complex conditions helped by the structured preventive work in SA?

Senior Alert is a quality registry focusing on the importance of nursing to provide a safe care. SA is grounded in the nursing process and has close connections to the core competencies, which are emphasized as essential for healthcare professionals to ensure patient safety and a high quality of care. Further, the registry has many users and is widely spread throughout the country. Therefore, an increase in the knowledge about usage and outcomes may be useful for many healthcare professionals and researchers since few scientific articles have been published on this subject. The implementation process at the hospital level has been described, but studies about the clinical outcomes or the experiences of healthcare professionals regarding their continuous work with the process and registry at the municipal level are lacking.
Aims

The overall aims were to investigate how the preventive care process in SA functions as a tool for preventive work among older persons living in nursing homes, and to investigate the outcome of assessments and actions.

The specific aims of the different studies were as follows:

- To investigate the effects of the preventive care process as outlined by SA and measured by process outcomes and patient outcomes between two groups included at different time points (I).

- To describe nursing staff’s experiences of preventive work as outlined in the structured preventive care process within SA (II).

- To examine whether a structured preventive care process, as outlined within SA, resulted in improved nutritional status, measured by body weight, compared with “care as usual” (III).

- To find patterns of associations between the items in MNA-SF, DFRI and MNS and the outcomes of weight loss, falls and pressure ulcers (IV).
Methods

Design of the studies

An overview of each study design is presented in Table 1. Both quantitative (Studies I, III, and IV) and qualitative (Study II) methods were used. An overview of how the different parts in the preventive process relates to the studies is given in Figure 4.

Table 1. Overview of the four studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Sample</th>
<th>Data collection</th>
<th>Data analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Quantitative, Comparable with six months’ follow-up</td>
<td>1103 nursing home residents included in SA divided in two time groups</td>
<td>Registry data</td>
<td>Descriptive statistics as the mean, median and chi2</td>
</tr>
<tr>
<td>II</td>
<td>Descriptive Qualitative Inductive</td>
<td>36 healthcare professionals in nursing homes</td>
<td>Seven focus groups interviews</td>
<td>Content analysis</td>
</tr>
<tr>
<td>III</td>
<td>Quasi-experimental intervention study with pre- and post-test.</td>
<td>321 nursing home residents. 135 had interventions in SA; 186 received “care as usual”</td>
<td>In-person-testing and registry data</td>
<td>Comparing groups using T-test, Mann-Whitney, Wilcoxon paired test, chi2 and McNemar’s test</td>
</tr>
<tr>
<td>IV</td>
<td>Prospective Quantitative</td>
<td>331 nursing home residents</td>
<td>In-person-testing</td>
<td>Descriptive statistics, Cox proportional hazard models</td>
</tr>
</tbody>
</table>

Study I was a descriptive study that included two cohorts of nursing home residents included in SA. The first group was included during 2010-2012, and the second group was included 2013-2014. The hypothesis was that evidence-based practices take time to be established, and for that reason, one might expect better results in the latter group. Study II was a qualitative study based on focus group interviews with healthcare professionals in nursing homes. The preventive care process requires team work, including several professionals. Focus groups were considered suitable as they reflect the different forms of communication people use in daily interaction.
(Jayasekara, 2012). In Study III, a quasi-experimental design was used. Such an approach may entail problems concerning discrepancies between the groups at baseline (Kazdin, 2003), which can affect the results. The use of a randomized controlled design would reduce such effects but was not possible to perform in this case. Study IV had a prospective design, which enabled measuring the effect of a certain cause. Cox regressions enabled analysis of the longitudinal time points. In this way, it was possible to analyse residents using two examinations (baseline measures and one follow-up) mixed with residents with several follow-ups.

Figure 4. Description of how the studies cover different parts in the preventive care process as outlined in Senior Alert.

Statistical analyses were performed using the SPSS statistical software (IBM SPSS version 20, IBM Corp, Armonk NY). P-values ≤ 0.05 were considered statistically significant.
Study populations

The SA population

In the project “Health development in late life” individuals from a twin population were matched to a selection of NQRs, one of which was SA. This twin population, called SALT (Screening Across the Lifespan Study), is part of the Swedish Twin Registry and comprise 44,816 twins born between 1911 to 1958 (Lichtenstein et al., 2006). The SALT population was used because of its convenience and the knowledge that this population was now elderly. However, for this thesis this population merely constituted a base for registry matching.

The match process was performed at the Department of Register Service at the National Board of Health and Welfare in 2015. The match between SA and SALT resulted in 1,595 twins being identified as nursing home residents in SA from 2010 to May 2015. Hereafter, this population is referred to as the SA population. Samples from the SA population were used for Studies I and III. Figure 5 shows how this population was used in the studies.

Healthcare professionals in nursing homes

Eight focus groups including persons clinically working with SA were conducted during 2015 whereas seven groups included healthcare professionals in nursing homes (N=36) (Table 2). The participants came from three municipalities, one large and two smaller, in two counties in southern Sweden. In the larger municipality (no. 1 in Table 2), 2 out of 10 geographic parts were randomly selected. The inclusion criteria for participants were experience in performing assessments using MNA-SF, DFRI and MNS. Once the managers agreed for their nursing home to participate in the study, they suggested suitable days and time points for the interviews. The managers also distributed written information about the study. For focus groups 1 and 3 (Table 2), the time points largely depended on staffing; consequently, those who worked on the suggested days were possible participants. The interviews with the registered nurses in groups 2 and 4 were conducted in connection with their professional meetings. For
focus group 8, the time agreed on depended on when the local “SA coach” could attend. Such local coaches or facilitators did not exist at the other nursing homes. The participants had worked in elder care for a mean of 10 (range 1–29) years.

Table 2. Description of the participants in the different focus groups. This table is derived from Table 2, paper II. Group 6 was omitted because it dealt with home care.

<table>
<thead>
<tr>
<th>Focus group</th>
<th>Municipal no. (part of municipal)</th>
<th>Registered nurses</th>
<th>Assistant nurses</th>
<th>Occupational therapist</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 (1)</td>
<td>6</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>1 (2)</td>
<td>7</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>1 (1)</td>
<td>6</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>1 (1)</td>
<td>6</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>1 (2)</td>
<td>1</td>
<td>4</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>17</td>
<td>1</td>
<td>3</td>
<td>36</td>
</tr>
</tbody>
</table>

The SHADES population

The Study on Health and Drugs in Elderly (SHADES) was a longitudinal cohort study of older persons living in nursing homes. The nursing homes were located in three different municipalities in three regions in southern Sweden. The study was launched in 2008 and completed in 2011. The overall aims were to describe and analyse morbidity, health conditions and medication use among older persons in nursing homes. The study was based on a convenience sample of 12 nursing homes (443 beds). Some of the included wards were specialized in dementia care, but short-term care wards were excluded. Three registered nurses, one from each municipality, were engaged part-time as study nurses. To ensure data quality, the study nurses were trained in the study methods to strive for consistency in the assessments and performance. Such training was performed before the start of the study and at regularly held study meetings. The study nurses collected data at six visits, with approximately six months in between. They examined
the participants regarding several aspects. Risk assessments for malnutrition, falls and pressure ulcers were performed with MNA-SF, DFRI and MNS respectively. The assessments were performed with support from the residents contact person at the ward. When the study nurses returned for a follow-up visit, persons who recently had attended the ward were also asked to participate. Thus, new participants were included throughout the whole study period. As a consequence, the participants had a varying number of follow-up examinations (0 to 5). Exclusion criteria were palliative care or language problems (117 residents during the whole study period). In total, 664 persons were asked to participate, and 429 (65%) persons were included, of whom 268 were included at the start of the study in 2008. Of the 35% who did not participate, the main reasons were declining to participate (15%), relatives declining to participate as a proxy for the older person (13%) or the respondents died during the time from consent signing to the baseline examination (7%). None of the included nursing homes in SHADES used Senior Alert. Figure 5 shows how this population was used in the studies.

![Flow chart showing how the populations were used in the different studies.](image)

Figure 5. Flow chart showing how the populations were used in the different studies. In the left upper circle, 150,000 is an estimated number.

**Assessment instruments**

The short form of the Mini Nutritional Assessment (MNA-SF) includes six items derived from the original 18-item MNA (Guigoz, 1994, Rubenstein et
This measure covers the past three months and addresses the following items: decreased food intake (0-2 points), weight loss (0-3 points), mobility (0-2 points), acute diseases or psychological stress (0 or 2 points), neuropsychological impairment (0-2 points) and BMI (0-3 points). A higher value for each item indicates lower risk (Table 3) (Appendix I). The maximum MNA-SF score is 14 points. A score of 7 points or less indicates malnutrition, 8-11 indicates risk of malnutrition and 12-14 points indicates no risk of malnutrition. The MNA-SF has been validated by the original MNA in a Swedish nursing home context. This validation showed that MNA-SF was a sufficient assessment (Wikby et al., 2008).

The Downton Fall Risk Index (DFRI) includes 11 risk items, including previous falls, use of drugs (tranquilizers/sedatives, diuretics, anti-hypertensives, antidepressants and anti-parkinsonian drugs), sensory deficits (visual- and hearing impairment), limb abnormalities (hemiparesis), cognitive dysfunction and walking ability (Table 3). Each item is scored one point and summed to give a maximum score of 11. A score of 3 or more indicates an increased risk of falling. The DFRI was validated in a Swedish study (Rosendahl et al., 2008) and appears to be a useful tool for predicting falls among older people in nursing homes (Appendix I).

The risk of pressure ulcers was assessed with the Modified Norton Scale (MNS). In addition to the more internationally known Norton Scale, MNS also includes two items assessing nutrition status: food and fluid intake. MNS has been validated in Swedish contexts (Ek, 1987, Ek et al., 1989, Ek et al., 1991). MNS consists of seven items; mental condition, activity, mobility, food intake, fluid intake, incontinence and general physical condition. Each item is assessed with a range from 1 (lack of function) to 4 (normal function) (Table 3) (Appendix I). The maximum score is 28 and a score of 20 or lower indicates an increased risk of pressure ulcers.
Table 3. Items included in the different assessment instruments.

<table>
<thead>
<tr>
<th></th>
<th>Mini Nutritional Assessment-short form (MNA-SF)</th>
<th>Downton Fall Risk Index (DFRI)</th>
<th>Modified Norton Scale (MNS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mobility</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Activity</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Previous falls</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquillizers/ sedatives</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diuretics</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antihypertensives</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antidepressants</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-parkinsonian drugs</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual and hearing impairment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limb abnormalities</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(hemiparesis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased food intake</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated weight loss</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute diseases or psychological stress</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass Index</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food intake</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid intake</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General physical condition</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data collection and analysis

Study I

In this study, a sample from the SA population was used. From 1595 persons a subsample of 1103 was selected and divided into two groups (Figure 6). Group 1 comprised residents who were included in SA in Aug 2010 - July 2012, and Group 2 residents were included in Jan 2013 - Nov 2014. In clinical work, it may take some time to establish routines that are evidence based, which motivated the comparison of the two groups included at different time periods. Further, in the light of patient safety and quality of care, it was assumed that a follow-up or a new assessment would likely be
performed within 6 months after the first assessment. Therefore, a follow-up interval was inserted between the groups and after Group 2. Figure 6 shows the inclusion flow of the study.

The preventive care process in SA should be repeated on a regular basis and consequently a person could have several records. For each person the first assessment at the nursing home was used as a starting point for the process.

The **Process results** were measured as the percentage of persons who received analysis of underlying causes (Step 2), had planned actions and performed actions (Step 3). Further, whether a new assessment was performed within the stated time frame and whether weight was recorded.
Outcomes, described in terms of patient results were measured as Earlier falls (an item from DFRI recorded as yes/no), Pressure ulcer (an item in SA recorded as yes/no), Weight loss ≥5%, and Fall events. The two former items were collected from the second assessment in SA (if present), which means that Earlier falls referred to any eventual fall between the first and the second assessment. The “second assessment” means that a new assessment with the three instruments was performed within the stated timeframe (Step 1). The variable Weight loss ≥5% was chosen because of its previous use in SA as an indicator to survey weight loss. Fall events were collected from the event registration in SA, but only as an occurrence of a fall or not. The number of individual falls was not calculated. Descriptive statistics with percentages, frequencies, means and medians were used to present the data. Group comparisons were performed with the chi-square test.

Study II:

This study was based on focus groups interviews with healthcare professionals. The interviews were semi-structured using an interview guide focusing on the participant’s experience of working with assessments and the structured preventive care process according to SA. Below, the questions in the interview guide are written in italics. All the interviews were led by a moderator (the author of this thesis) and an assistant. First, the participants were asked to describe how they distributed the work of the assessments and registrations, such as when, and who assessed. There were also questions about their experiences of the instruments and how they understood the different included items. As a basis of the discussion of this issue, paper copies of the instruments were distributed during the interviews. Further issues were aspects of improvement and how they used the quality registry for feedback. The moderator initially clarified the aim of the session and then guided and encouraged the discussion. The assistant was responsible for recording and taking notes. At the end of the interviews, the assistant presented a conclusion, which made it possible for the participants to clarify and add information (Polit & Beck, 2012). The interviews lasted approximately 60–90 minutes, were audio-taped and were transcribed verbatim. The interviews were subjected to a content analysis using an inductive approach (Elo & Kyngäs, 2008). The interviews were read
repeatedly and notes were written in the margins. These notes were then entered into a code scheme and thereafter grouped and labelled with descriptive codes. The coding was then discussed in the research group until agreement was reached about the code labelling. The condensation process was subjected to further critical discussion within the group, resulting in abstraction to seven subcategories and three categories.

Study III

This study was based on one sample from the SA population and one sample from SHADES (Figure 5). The “intervention” group was selected from the SA population. From this population, 135 persons were eligible, i.e., residents at risk for malnutrition or already malnourished according to MNA-SF, who were provided nutritional actions and had a registered weight after approximately 6 months (range 5-7) (Figure 7). This group was called the nutritional care programme group (NCP group). Since SA is used countrywide, this group was spread over 168 nursing home wards. From SHADES, 186 individuals were selected to form a control group. None of the included nursing homes in SHADES used SA or had any special focus on malnutrition prevention. The residents were thereby considered to receive “care as usual”. Body weight, BMI and MNA-SF scores were followed for both groups. Weight was measured with scales located at each nursing home ward. For some analyses, the BMI values were divided into two groups with a cut-off of 22. In Sweden, this cut-off value is recommended for use in persons over 70 years (Swedish National Food Administration). As a consequence, persons with a BMI value below 22 were considered underweight. The t-test, chi-squared test and Mann-Whitney test were used to compare variables between the groups. The paired t-test, Wilcoxon paired test and McNemar’s test were used for within-group analyses.
Figure 7. A flow chart showing how the study samples in Study III were selected from the larger SA population and SHADES. NCP=Nutritional care programme; MNA-SF=Mini Nutritional Assessment, short form.

Study IV

In Study IV, a sample of 331 residents from SHADES was eligible, i.e., residents with data from baseline and at least one follow-up (Figure 5). The dependent variables in the Cox regressions were Weight loss greater than 10% or 6 kg, Fall in the last six months and Presence of pressure ulcer. The weight variables were chosen because of their use in previous research and as markers of malnutrition (Norman et al., 2008, Faxén Irving et al., 2010,
Neyens et al., 2013, van Nie-Visser et al., 2011). Three Cox regressions in two steps were performed for each of these outcomes. Baseline data on age, sex, number of medications and number of diagnoses were included as covariates in the first step to control for sociodemographic factors and health. In the second step, all the items were simultaneously included as covariates from one instrument at a time. Finally, three additional two-step Cox regression analyses were performed with the sociodemographic factors described above as covariates in the first step and the total scores on each instrument as covariates in the next step. If no event occurred, the maximum time was set to approximately one year, or time of death. The time factor was maximized to one year because of the restricted validity of a risk assessment.

The choice of a method using all the items in one scale as covariates in multivariate analysis was an attempt to capture the whole, i.e., to test the impact of each instrument’s variables together. However, this analysis also led to difficulties in interpreting some results. Therefore, bivariate analysis was added as a complement in this thesis. For these analyses, each item in the three instruments was analysed together with each outcome with the same control factors as described above. Additionally, the ordinal variables were analysed as categorical variables.
Ethical considerations

Ethical considerations comprise ethical analysis (consequences of the research) and the obligation to comply with ethical regulations. The ethical considerations for the studies in this thesis were in accordance with the Helsinki Declaration (World Medical Association, 1964) and the Ethical Guidelines for Nursing Research in the Nordic Countries (SSN, 1987). Beauchamp and Childress (2013) developed an ethical platform, comprising the principles of autonomy, beneficence, non-maleficence and justice, which were taken into consideration for each study. The principles of autonomy were considered in the verbal and written information presented to the participants in the SHADES study (Studies III and IV) and to the participants in the focus groups (Study II). These written informed consent forms included a short rationale for the study, the voluntary nature of participation, the right to withdraw, a presentation of the researchers in charge and a contact person. However, the informed consent to participate in the SHADES study was in many cases given by a proxy. From a legal point of view, this cannot be called informed consent, but “participating based on consultation with a proxy”. Such participation (SFS 2003:460 §22) may be a threat to autonomy and must therefore be considered in light of the other principles. The principle of justice asserts that all groups should be included in research and leaving out persons suffering from dementia is also a threat against the principle of justice. The principles of beneficence and non-maleficence were particularly considered during the data collection in the SHADES study. Older persons living in nursing homes often suffer from cognitive impairment, which can negatively affect the contacts that an unknown study nurse needs to have. In general, to meet with and perform examinations on older people requires responsiveness, respect and knowledge about this group. Considering this, only nurses with considerable nursing home experiences were engaged as study nurses. The principle of non-maleficence was also considered for the confidentiality of the focus groups (Study II). Depending on the nature of the focus group interview, confidentiality could not be completely guaranteed. However, the moderator highlighted the importance of maintain any reflections of the discussions within the group.
The samples from the SA population (Studies I and III) were registry populations in the sense of their linking to SA. There is an ethical dilemma when using data for a purpose other than that communicated at the time of inclusion into a study. Even if the persons in the original SALT population had given consent for further research and collection of data, no special consent to combine data with SA or other NQRs was given. However, using previously collected data for uncontroversial research may be considered as more ethical than not using it, especially when it comes to frail older people, from which the information may not have been collected otherwise. Before being included in an NQR a person must be informed and given the right to deny registration (Ekman & et al., 2015), but it is not stated how this information should be provided. The matching of data between the SALT population and SA required personal identification numbers. This match was performed at the National Board of Health and Welfare where the code list was also kept. The received data were decoded.

According to the Swedish Act concerning the ethical review of research involving humans, permission is not required when professionals are interviewed about their work (SFS 2003:460). However, the Helsinki Declaration was followed according to the voluntariness to participate and confidentiality (Study II). Ethical approval for the SHADES study and the project “Health development in late life” was obtained from the Ethical Committee in Linköping, Sweden (M150-07 and 2014/25).
Results

The results of the different studies are presented according to the modified Donabedian framework of structure, process and outcome as described in Figure 4. The framework was used not to examine the relationship between the three categories but to map the results along the framework.

Structure

The Structure portion of the Donabedian framework was not explicitly studied; however, the focus group discussions (Study II) revealed several issues that could be related to structure. In the focus groups, limited staffing resources were discussed as affecting preventive care since SA increased the workload, and the duplicated documentation was perceived as time consuming. Participants described SA as a parallel system in a double sense. First, it was not linked to the electronic care record system. It was stressed that duplication of documentation demanded time; therefore, the ordinary documentation system was prioritized, which delayed the registration in SA. Second, assessments and follow-ups of the interventions were completed and documented approximately twice per year while daily care, which involved many small improvements, was continuous. Participants emphasized a lack of time during team meetings. The scheduled time for meetings also differed largely between care units. Despite this, the team meetings were more structured when SA was used, as they were conducted using a ‘common language’ that also promoted shared responsibility. Different roles for different professions were described. Registered nurses and assistant nurses were responsible for interventions regarding malnutrition, physiotherapists with fall prevention and occupational therapists with pressure ulcer prevention. The latter included obtaining special mattresses and other protection aids. In one municipality, the preventive work with SA had been neglected, and a reorganization of the work around SA was needed. One interested registered nurse was given the role as a coach with the purpose of encouraging and guiding future work. In this municipality, training was conducted to ensure concordance in the interpretation of the assessments items.
The participants highlighted that many nursing home residents were frail, with little time left in life when they moved in. They explained that the focus must be on the resident’s well-being: to ensure good quality at the end of life including a customized food order and comfortable rests. These facts lowered the participants’ motivation for SA.

The characteristics of the nursing home populations used in this thesis are shown in Table 4. The cognitive status measured with DFRI showed that approximately 50% of the residents were assessed as “not oriented” while cognitive status assessed by MNS showed that approximately 70% of the residents were assessed as having cognitive impairment. This difference in assessed cognition is likely a result of different scale steps. DFRI has 2 steps, and MNS has 4. Incontinence was shown in approximately 50% of the residents in both the SA and the SHADES groups. Nearly 30% of the residents in SHADES were immobile (wheelchair bound all day), while the corresponding percentage in the SA sample was 24%. In both groups, the nutritional status measured by BMI showed a mean of 25, and approximately 30% of the residents had a BMI under 22. Approximately 15% of the participants in both groups were deceased within 6 months from the first assessment.
Table 4. Resident characteristics based on data from the assessment scales at the initial assessment in the SHADES and SA samples in Study I. BMI=body mass index; DFRI=Downton Fall Risk Index; MNA-SF=Short-Form Mini Nutritional Assessment Scale; MNS = Modified Norton Scale. The two columns on the right show the SA sample divided into two groups. These two groups formed the cohorts in Study I and described here to understand the results in Study I.

<table>
<thead>
<tr>
<th></th>
<th>SHADES N=429 % (N)</th>
<th>SA sample N=1103 % (N)</th>
<th>SA sample Group 1 (N=567) % (N) 2010-2012</th>
<th>SA sample Group 2 (N=536) % (N) 2013-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean)</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Women</td>
<td>71%</td>
<td>65%</td>
<td>65%</td>
<td>64%</td>
</tr>
<tr>
<td>Risk of malnutrition (MNA-SF)</td>
<td>60 (259)</td>
<td>64 (709)</td>
<td>62 (354)</td>
<td>66 (355)</td>
</tr>
<tr>
<td>Malnourished (MNA-SF≤7)</td>
<td>14 (47)</td>
<td>16 (175)</td>
<td>15 (84)</td>
<td>17 (91)</td>
</tr>
<tr>
<td>BMI (mean, SD)</td>
<td>25±5</td>
<td>25±5</td>
<td>25±5</td>
<td>24±5</td>
</tr>
<tr>
<td>BMI&lt;22</td>
<td>29 (123)</td>
<td>31 (343)</td>
<td>30 (167)</td>
<td>33 (176)</td>
</tr>
<tr>
<td>Risk of fall (DFRI)</td>
<td>93 (400)</td>
<td>79 (867)</td>
<td>82 (463)</td>
<td>75 (404)</td>
</tr>
<tr>
<td>Earlier falls (DFRI)</td>
<td>61 (263)</td>
<td>52 (576)</td>
<td>54 (308)</td>
<td>50 (268)</td>
</tr>
<tr>
<td>Risk of pressure ulcer (MNS)</td>
<td>28 (122)</td>
<td>27 (300)</td>
<td>31 (177)</td>
<td>23 (123)</td>
</tr>
<tr>
<td>Pressure ulcer</td>
<td>9 (39)</td>
<td>4 (29)</td>
<td>5 (8 of 155)</td>
<td>4 (21)</td>
</tr>
<tr>
<td>Assessed as having two of three risks</td>
<td>33 (142)</td>
<td>36 (392)</td>
<td>33 (189)</td>
<td>38 (203)</td>
</tr>
<tr>
<td>Assessed as having all three risks</td>
<td>26 (113)</td>
<td>22 (239)</td>
<td>25 (143)</td>
<td>18 (96)</td>
</tr>
<tr>
<td>No risk</td>
<td>3 (13)</td>
<td>9 (97)</td>
<td>9 (48)</td>
<td>9 (49)</td>
</tr>
<tr>
<td>Cognitive disability (MNS)</td>
<td>71 (305)</td>
<td>73 (803)</td>
<td>77 (439)</td>
<td>68 (364)</td>
</tr>
<tr>
<td>Not oriented (DFRI)</td>
<td>58 (250)</td>
<td>51 (567)</td>
<td>57 (322)</td>
<td>46 (245)</td>
</tr>
<tr>
<td>Incontinence (MNS)</td>
<td>54 (231)</td>
<td>49 (537)</td>
<td>53 (300)</td>
<td>44 (237)</td>
</tr>
<tr>
<td>Wheelchair bound (MNS)</td>
<td>29 (123)</td>
<td>24 (261)</td>
<td>26 (148)</td>
<td>21 (113)</td>
</tr>
<tr>
<td>Walking with/without aids</td>
<td>54 (230)</td>
<td>60 (662)</td>
<td>56 (317)</td>
<td>64 (345)</td>
</tr>
<tr>
<td>Poor general health (MNS)</td>
<td>5 (20)</td>
<td>7 (77)</td>
<td>7 (37)</td>
<td>8 (40)</td>
</tr>
<tr>
<td>Deceased within 6 months of the first assessment</td>
<td>15 (65)</td>
<td>16 (181)</td>
<td>16 (88)</td>
<td>17 (93)</td>
</tr>
</tbody>
</table>

1 In Group 1 there were 412 missing values.
Process

*Risk assessment (Studies I - IV)*

The risk prevalence in the SA sample (Study I) and the SHADES population are shown in Table 4. The risk patterns were fairly similar, except for a larger risk of fall in the SHADES population. Fifty-seven percent of residents in the SA sample showed combinations of at least two risks (N=631). The most common was risk of malnutrition combined with risk of falls. In 9% of the residents (N=97), no risk was found in any of the studied areas. A median of two risk assessments were performed for each person in the SA sample (Q1:1, Q3:4), but 33% (N=368) were assessed only once. For residents with at least two assessments, the median interval was 214 days (Q1:148, Q3:353). However, in Study I the median interval was 124 days since this study was based on residents followed-up within 6 months. In the SHADES population, 64% (N=275) showed a combination of at least two risks, and 3% showed no risks in any of the three areas at baseline.

The experiences of risk assessment were described in Study II in which the participants emphasized the lack of agreement between how the instruments scored risk and their own views. The participant’s experiences were that almost every resident was assessed as being at risk according to the instruments, but their clinical estimation was different.

“I observe these risks better with my eyes and my presence than what I see on this paper. I can’t go by the paper – it does not show the reality”.

The participants also mentioned other factors to consider. For example, in assessing the risk of falling, the participants stated that sleeping habits and the use of alcohol and anticholinergic drugs were important but were not included in DFRI. A certain degree of resignation concerning the DFRI was expressed, and the participants had come to accept the high-risk frequency. Regarding MNA-SF participants mentioned that even if the older person was eating well and was not at risk based on the clinical assessment, participants
stressed that the combination of suffering from dementia and being wheelchair bound indicated a risk of malnutrition according to MNA-SF. As these conditions were common, the participants expressed their feeling of low confidence to the instrument.

“We think they eat well . . . as well as what one may expect . . . so therefore it is not really fair . . . because you often get a result that borders on malnutrition. But you couldn’t ask them to eat more”

The interpretation of the instrument items also differed and it was unclear whether the registered nurses and assistant nurses truly made assessments on the same basis. The registered nurses mentioned that they sometimes corrected the assistant nurse’s assessments. The best way to make assessments was when registered nurses and assistant nurses worked together but co-operation was not always possible, although this method increased the knowledge about the older person. Examples of disparities in assessment included divergent interpretations of cognition (an item present in all three instruments) and of ‘going out’, a mobility item in MNA-SF.

“I think that if you can manage to move unassisted or not . . . I don’t think about the word ‘out’ actually”.

The timing of the assessment and familiarity with the older person were also necessary to make a proper assessment.

”We are doing the assessments around two weeks after admittance, so they are feeling at home and are eating properly”.

In Study IV, the items in MNA-SF, DFRI and MNS were analysed regarding their associations with the three decided outcomes. Table 5 shows the statistically significant associations from the multivariate Cox regression analyses. The outcome *Weight loss at least 10% or 6 kg* demonstrated significant positive relations with two items indicating impaired cognition: *Cognitive dysfunction (DFRI)* and *Neuropsychological impairment (MNA-*. 
General physical condition (MNS) was negatively related to weight loss, which indicated that a better condition reduced the risk of weight loss.

The outcome **Falls last six months** was positively related to the items *Mobility* (MNA-SF) and *Activity* (MNS) in that increased values were associated with 1.53- and 1.72-fold increases in the risk of falling, respectively. *Limb impairment/hemiparesis* (DFRI) was negatively associated, which means that this condition reduced the risk of falling compared with no limb impairment. *Unsafe gait* (from the DFRI item *Walking ability*) was associated with an increased fall risk. A **Known previous fall** (DFRI) showed a 2.5-fold higher risk of falling than did the absence of earlier falls. **Number of diagnoses** and *Sedatives/neuroleptics* (DFRI) was negatively related to falls.

**Presence of pressure ulcer** was significantly related to **Number of drugs** and **Number of diagnoses** in that increased values of these variables increased the risk of pressure ulcers. *Limb impairment/hemiparesis* (DFRI) showed a nearly 2-fold higher risk of pressure ulcers than did not having this condition and *Mobility* (MNA-SF) and *Activity* (MNS) indicated that more physical activity decreased the risk of pressure ulcers.

The total score on MNS was significantly associated with all three outcomes in that increased scores increased the risk of falling but decreased the risk of developing pressure ulcers or losing weight. The total score on MNA-SF was not significantly associated with any outcome, and therefore is not shown in the table. The total score on DFRI was positively associated with falls.
Table 5. Summary of multivariate Cox regressions showing the significant associations between the items in the assessment instruments and the three outcomes: weight loss, falls and pressure ulcers. The items in each instrument were included simultaneously (Study IV).

<table>
<thead>
<tr>
<th></th>
<th>Weight loss 10% or 6 kg (HR)</th>
<th>Falls last six months (HR)</th>
<th>Presence of pressure ulcer (HR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of drugs</td>
<td></td>
<td></td>
<td>1.16*</td>
</tr>
<tr>
<td>No. of diagnoses</td>
<td></td>
<td>0.82**</td>
<td>1.32*</td>
</tr>
<tr>
<td>Known earlier falls (DFRI)</td>
<td></td>
<td>2.5***</td>
<td></td>
</tr>
<tr>
<td>Sedatives/Neuroleptic drugs (DFRI)</td>
<td></td>
<td>0.66**</td>
<td></td>
</tr>
<tr>
<td>Hearing imp. (DFRI)</td>
<td></td>
<td></td>
<td>2.06*</td>
</tr>
<tr>
<td>Hemiparesis (DFRI)</td>
<td></td>
<td></td>
<td>1.96*</td>
</tr>
<tr>
<td>Cognitive dysfunction (DFRI)</td>
<td>2.07*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsafe gait (DFRI)</td>
<td></td>
<td>0.52**</td>
<td>1.64**</td>
</tr>
<tr>
<td>Mobility (MNA-SF)</td>
<td></td>
<td>1.53***</td>
<td>0.46***</td>
</tr>
<tr>
<td>Activity (MNS)</td>
<td></td>
<td>1.72**</td>
<td>0.56*</td>
</tr>
<tr>
<td>Neuropsych. imp. (MNA-SF)</td>
<td>0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food intake (MNS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General physical condition (MNS)</td>
<td></td>
<td>0.44**</td>
<td>1.54*</td>
</tr>
<tr>
<td>DFRI total score</td>
<td></td>
<td></td>
<td>1.18**</td>
</tr>
<tr>
<td>MNS total score</td>
<td>0.90*</td>
<td>1.14***</td>
<td>0.86**</td>
</tr>
</tbody>
</table>

As a complement, bivariate regression analysis was performed in which the ordinal variables were analysed as categorical variables (Table 6). Bivariate analysis showed similar results to those in Table 5 for the mobility factors; however, associations between cognition and weight loss were not found.
Table 6. Summary of bivariate Cox regressions showing the significant associations between the items in the assessment instruments and the three outcomes: weight loss, falls and pressure ulcers (Study IV).

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight loss 10% or 6 kg (HR)</th>
<th>Falls last six months (HR)</th>
<th>Presence of Pressure ulcer (HR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known earlier falls (DFRI)</td>
<td>1.87***</td>
<td>1.85*</td>
<td></td>
</tr>
<tr>
<td>Hemiparesis (DFRI)</td>
<td>0.56**</td>
<td></td>
<td>1.85*</td>
</tr>
<tr>
<td>Unsafe gait (DFRI)</td>
<td>1.53**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No gait (DFRI)</td>
<td>0.31***</td>
<td></td>
<td>2.6**</td>
</tr>
<tr>
<td>Walking activity (MNS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheelchair=reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walk w personal support</td>
<td>2.84***</td>
<td>0.27*</td>
<td></td>
</tr>
<tr>
<td>Walking self – ambulant</td>
<td>3.1***</td>
<td>0.34**</td>
<td></td>
</tr>
<tr>
<td>Moving ability (MNS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full=reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slightly limited</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very limited</td>
<td>2.3*</td>
<td>0.35***</td>
<td>2.98**</td>
</tr>
<tr>
<td>Immobile</td>
<td>0.36*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incontinence (MNS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None=reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usually urine</td>
<td>3.1**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double</td>
<td>0.55*</td>
<td>2.1*</td>
<td></td>
</tr>
<tr>
<td>Moving ability (MNA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full=reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheelchair</td>
<td>0.4***</td>
<td>4.1***</td>
<td></td>
</tr>
<tr>
<td>BMI&lt;19 &lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td>2.5*</td>
</tr>
<tr>
<td>General physical condition (MNS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good=reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>2.1*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>3.9*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MNS total score</td>
<td>0.89**</td>
<td>1.07**</td>
<td>0.9**</td>
</tr>
</tbody>
</table>

<sup>1</sup>=Only BMI group <19 was associated. Reference is BMI ≥23

**Analysis of the underlying causes (Studies I and II)**

Step 2 in the preventive care process comprises an analysis of the underlying causes of risk, which are predetermined in the system and ticked off by the user. In the first assessment, on average 30% of the residents in both groups
were analysed for causes. In the residents at risk of malnutrition (30%), the most common registered causes (Group 1 vs Group 2) were as follows: taking >3 medications (72% vs 82%), impaired sight/hearing (65% vs 56%), impaired mobility (64% vs 58%), impaired mood (43% vs 47%) and loss of motivation to eat (38% vs 42%). In risk for fall, the most common causes were as follows: unsafe gait (60% vs 70%), confusion/anxiety (52% vs 57%), difficulties sitting/rising from chair (47% vs 57%), increased risk at personal care (40% vs 48%) and incontinence (41% vs 43%). In the risk for pressure ulcers, the most common causes were immobility (59% vs 47%), impaired intake of food (30% vs 49%) and moisture (38% vs 28%).

The analysis of underlying causes was rather unfamiliar to the participants in the focus groups, and the issue was discussed in only one out of seven groups.

*Planning and execution of interventions (Studies I and II)*

Step 3 in the preventive process is planning and executing of suitable actions, drawn from predetermined actions for each area and ticked off in the system. The percentage of planned and performed actions in Study I was significantly higher in the later-included group (Table 7). In all three areas the planned actions were approximately 60% in Group 1 and 75% in Group 2. The percentages of planned actions in Table 7 were based on at least one planned action per person in the specific area.
Table 7. Two groups included in Senior Alert at different time points were compared regarding registered preventive actions in the three risk areas. Both planned and performed actions showed significantly higher percentages in Group 2 (Study I).

<table>
<thead>
<tr>
<th>Risk of Malnutrition</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P-value</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=567</td>
<td>N=536</td>
<td>% (N)</td>
<td>% (N)</td>
</tr>
<tr>
<td>Planned preventive nutritional actions</td>
<td>60.5 (214)</td>
<td>74.9 (266)</td>
<td>&lt;0.001</td>
<td>67.7 (480)</td>
</tr>
<tr>
<td>Most planned actions</td>
<td>%</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight control</td>
<td>1</td>
<td>62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack</td>
<td>38</td>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased overnight fast</td>
<td>30</td>
<td>49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drug check</td>
<td>31</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enriched food</td>
<td>33</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment of light and sound</td>
<td>44</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation/registration of intake</td>
<td>20</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performed nutritional actions</td>
<td>47.2 (167)</td>
<td>59.2 (210)</td>
<td>0.001</td>
<td>53.2 (377)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk of Fall</th>
<th>N=463</th>
<th>N=404</th>
<th>N=867</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned preventive fall actions</td>
<td>60.9 (282)</td>
<td>76.0 (307)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Most planned actions</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Alarm/supervision</td>
<td>35</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Drug check</td>
<td>27</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Gait training</td>
<td>29</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Aids</td>
<td>27</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Assistance personal care/relocation</td>
<td>1</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Performed Fall actions</td>
<td>49.2 (228)</td>
<td>58.9 (238)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk of Pressure Ulcer</th>
<th>N=177</th>
<th>N=123</th>
<th>N=300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned preventive pressure ulcer actions</td>
<td>59.7 (105)</td>
<td>74.8 (92)</td>
<td>0.005</td>
</tr>
<tr>
<td>Most planned actions</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Skin control</td>
<td>52</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Reduce of shear and pressure</td>
<td>41</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Adjustment of bed/chair</td>
<td>41</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Snack</td>
<td>33</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Repositioning</td>
<td>31</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Decreased overnight fast</td>
<td>27</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Hygiene/Skin care</td>
<td>25</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Performed pressure ulcer actions</td>
<td>35.0 (62)</td>
<td>48.0 (59)</td>
<td>0.024</td>
</tr>
</tbody>
</table>
The participants in Study II emphasized their awareness and ability to detect early signs that could lead to adverse events. They were observant of how the patients were positioned in their wheelchair or in bed and made preventive repositioning and necessary adjustments, for example, with a pillow. This was part of the everyday care that involved many small improvements, independent and in parallel with the planned actions from SA.

**Follow-up of interventions (Studies I and II)**

In general, it is decided in the planning phase (Step 3) how and when to take follow-up actions (Step 4). Table 8 shows how the follow-up of weight was performed and how new assessments were conducted. Both of these measures showed higher values in Group 2 than Group 1 (Study I).

Table 8. Two groups included in Senior Alert at different time points were compared regarding follow-up of weight and new assessments within 6 months (Study I).

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (N=567) % (N)</th>
<th>Group 2 (N=536) % (N)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up of weight</td>
<td>31 (175/567)</td>
<td>41 (218/536)</td>
<td>0.001</td>
</tr>
<tr>
<td>Follow-up of weight for those at risk of malnutrition in the first assessment</td>
<td>30 (107/354)</td>
<td>44 (157/355)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>New risk assessment regardless of previous risk</td>
<td>20 (113)</td>
<td>30 (163)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

None of the participants in study II could describe local routines for the follow-up of SA data, and no participants seemed familiar with the report function in SA. Managers had occasionally shown some statistics, but opinions about the importance of feedback varied in the focus groups. Both the importance of visualization to keep the motivation and a lack of interest were described. Participants who expressed lack of interest in feedback from SA had a greater interest in following changes clinically:
“I decided to give her nutrition drinks and she felt better – the wound is healing, she’s gaining weight – that’s a positive result. That’s how it is.”

Apprehension was raised regarding whether the data from SA could ever show improvements in quality of care, as most of the residents were at the end of life, and regardless of any preventive action, they were ill and often in palliative care. Further, the participants showed little interest in discussing the learning perspective, although the moderator tried to encourage such discussion.

Outcome (Studies I and III)

Outcomes of the process were measured as patient results at group level. In the comparison between the groups in Study I, some differences were found in favour of Group 2 (Table 9), but the results were not statistically significant. In addition to weight loss ≥5%, each person’s individual weight change within 6 months was calculated. The weight change (percentage) showed no difference between the groups (0.4 in Group 1 and 0.2 in Group 2, P=0.744, T-test). For pressure ulcers, the base for which to measure their presence at the second assessment were only 30 persons in Group 1 and 37 persons in Group 2. This was due to the low performance of a second assessment within 6 months, and which explains the low prevalence of pressure ulcers.
Table 9. Comparisons of outcomes within 6 months (Study I). MNA-SF=Short-Form Mini Nutritional Assessment; DFRI=Downton Fall Risk Index; MNS=Modified Norton Scale.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>At risk at the first assessment and showing weight loss ≥ 5%&lt;sup&gt;1&lt;/sup&gt;</td>
<td>16% (17/107)</td>
<td>17% (27/157)</td>
<td>0.875</td>
</tr>
<tr>
<td>At risk at the first assessment and recorded with no risk (MNA-SF) at the second assessment</td>
<td>19% (13/68)</td>
<td>22% (25/112)</td>
<td>0.610</td>
</tr>
</tbody>
</table>

Risk of fall

<table>
<thead>
<tr>
<th>Risk of fall</th>
<th>Group 1 (2010-2012)</th>
<th>Group 2 (2013-2014)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At risk at the first assessment and recorded with previous falls (DFRI) at the second assessment</td>
<td>66% (58/88)</td>
<td>64% (81/127)</td>
<td>0.704</td>
</tr>
<tr>
<td>At risk at the first assessment and recorded with fall events&lt;sup&gt;2&lt;/sup&gt;</td>
<td>15% (69/463)</td>
<td>19% (76/404)</td>
<td>0.124</td>
</tr>
<tr>
<td>At risk at the first assessment and recorded with no risk (DFRI) at the second assessment</td>
<td>2% (2/88)</td>
<td>6% (8/127)</td>
<td>0.168</td>
</tr>
</tbody>
</table>

Risk of pressure ulcers

<table>
<thead>
<tr>
<th>Risk of pressure ulcers</th>
<th>Group 1 (2010-2012)</th>
<th>Group 2 (2013-2014)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At risk at the first assessment and recorded with pressure ulcer at the second assessment&lt;sup&gt;3&lt;/sup&gt;</td>
<td>11% (2/18)</td>
<td>3% (1/37)</td>
<td>0.198</td>
</tr>
<tr>
<td>At risk at the first assessment and recorded with no risk (MNS) at the second assessment</td>
<td>10% (3/30)</td>
<td>14% (5/37)</td>
<td>0.659</td>
</tr>
</tbody>
</table>

<sup>1</sup> Based on weight from the second risk assessment (if performed), otherwise based on follow-up weights

<sup>2</sup> Based on registered fall events

<sup>3</sup> For pressure ulcer, the calculation base in group 1 was 30 persons, where of 12 were missing values. The number should be 6% if based on 30. Group 2 had no missing values for this item.

In study III, one group selected from the SA population and one group from SHADES were compared regarding weight and outcomes of MNA-SF in a pre-post analysis. The intervention group was registered in SA as being at risk of malnutrition and with nutritional actions registered as performed (NCP group). The control group (SHADES) was assessed as being at risk of malnutrition but was not registered in SA. The NCP group had a mean baseline weight of 60.9 kg (SD 13.4 kg) and a mean follow-up weight of
61.9 (SD 13.7 kg), which was a statistically significant increase (P=0.018; 95% CI 0.16–1.7). The control group had a mean baseline weight of 63.6 kg (SD 13.8 kg) and a mean follow-up weight of 64.0 kg (SD 14.1 kg), which was a non-significant weight gain (P=0.197; CI -1.06–0.22). The weight change was also calculated individually for each participant. A comparison between the groups showed no statistically significant difference at follow-up regarding weight change (1.7% in the NCP group and 0.9% in the control group, P=0.274; CI -0.7–2.6). The median MNA-SF scores in both groups increased from 9 to 10 between baseline and follow-up. The NCP group showed statistically significant improved within-group values for body weight among residents with BMI <22 (Table 10). The NCP group also showed statistically significant improved within-group values for residents assessed as malnourished (MNA-SF<8) since this group decreased from approximately 30% to 16%. The two items that most affected the total score were “acute disease or psychological stress” and “weight loss” indicating that fewer persons scored low points on these items at follow-up.

Table 10. Comparison between the NCP group (followed in SA) and a control group (not registered in SA), all at risk for malnutrition according to the Short-Form Mini Nutritional Assessment MNA-SF.

<table>
<thead>
<tr>
<th></th>
<th>Baseline body weight Mean, SD</th>
<th>Follow-up body weight Mean, SD</th>
<th>Paired T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NCP group (N=135)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI &lt;22 (N=67)</td>
<td>51.2±6.7</td>
<td>52.7±8.4</td>
<td>0.011*</td>
</tr>
<tr>
<td>BMI ≥22 (N=68)</td>
<td>70.5±11.4</td>
<td>70.9±11.9</td>
<td>0.470</td>
</tr>
<tr>
<td><strong>Control group (N=186)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI &lt;22 (N=78)</td>
<td>53.4±7.8</td>
<td>54.2±8.7</td>
<td>0.089</td>
</tr>
<tr>
<td>BMI ≥22 (N=108)</td>
<td>70.9±12.5</td>
<td>71.2±12.9</td>
<td>0.665</td>
</tr>
</tbody>
</table>
Discussion

Discussion of results

The overall aims of this thesis were to investigate how the preventive care process in Senior Alert functions as a tool for preventive work among older persons living in nursing homes, and to investigate the outcome of its usage. The main results, which are discussed below, included problems related to the risk assessments, that better process results were not reflected in better patient outcomes and finally, the insufficient evaluation of results.

Risk assessments in practice

In Study II, a lack of agreement was expressed between how the instruments classified persons at risk and the participants’ perception of risk. The participants tended to rely on their own experience and judgement rather than the instrument. Although there is strong evidence to recommend the use of assessment instruments, their accuracy compared to clinical judgement has been debated (Balzer et al., 2014, Meyer et al., 2009, da Costa et al., 2012, Samuriwo & Dowding, 2014). The participants in Study II particularly expressed that MNA-SF and DFRI overrated the number of persons at risk of malnutrition and falls. Similar views have been expressed by others, arguing that MNA-SF overrated the number of persons at risk of malnutrition in nursing home settings (Beck et al., 2008, Smoliner et al., 2008). This was mainly due to other factors, such as immobility and cognitive impairment, affecting the total score, although food intake was not compromised, or weight loss had not occurred. The expressed lack of agreement in Study II may be due to the same reasons, and it is likely that the participants in the focus groups mainly considered food intake. Nurses’ clinical judgement also draws on other factors than those captured by an assessment instrument (Samuriwo & Dowding, 2014). For example, in assessing the risk of falling, the participants in the focus groups (Study II) mentioned that alcohol use, sleeping habits and anticholinergic medications
were important risk factors for falls; however they are not included in DFRI. Balzer et al. (2014) stated that nurses in their clinical judgement also tended to weigh a risk assessed by an instrument against the person’s “protective” capacity, such as their mental capabilities and willingness to engage in their own care. The results of an assessment need to be interpreted in light of these facts, and it must be understood that being at risk of malnutrition, for example, does not necessarily mean that increased food intake is needed. Generally, being at risk is an indication that professional knowledge is needed for an interpretation of the assessment and for deciding how to proceed.

One explanation for the low confidence into the risk instruments could be that they were developed in the early 1990s, and the populations who formed the base for the development of the instruments may differ from older people today. Patient populations are now older, and organizational structures for care have changed. The stay-at-home policy in elder care, the reduction of hospital beds, and the movement from in-patient care to primary care are examples of such organizational changes. This policy, together with new treatments, may motivate continuous and repeated examination of the predictive validity of instruments in the current context (Källman & Lindgren, 2014, Kaiser et al., 2009b). The most commonly used and recommended statistics for evaluating the predictive validity is sensitivity- and specificity test in the current context (Defloor & Grypdonck, 2004, Beck et al., 2008), but such studies are rare. This shortage may depend on the complicity to conduct predictive studies since sensitivity and specificity are affected by several factors; the preventive actions used, the heterogeneity of length of observation, setting, and by the choice of appropriate cut-off points. Thus, the act of preventing malnutrition, falls or pressure ulcers may lower the specificity and thus affect the predictive accuracy (Defloor & Grypdonck, 2004, Vassallo et al., 2008).

A pragmatic approach is to look at the use of assessment instruments and clinical judgement as complementary, and not as competitive parts. The clinical experience may differ between healthcare professionals and some may find themselves more supported by an instrument than do others. There is also an equality aspect to consider – that assessments should be performed in a similar way, based on the same information. However, the usage of
instruments demands education and concordance, since healthcare professionals seem to interpret the same observations differently. Such differences were described in Study II and have been reported by others (Vassallo et al., 2008). Another pragmatic approach could be to use alternatives to MNA-SF and DFRI, which is possible in SA. Rather than MNA-SF, the “SKL questions” (suggested by SALAR) could be used. This measure includes two questions together with BMI: 1) Unintentional loss of weight irrespective of time and proportion? 2) Existing difficulties to eat, such as lack of appetite, chewing or swallowing problems, or depending on physical impairment? Corresponding questions for fall risk exist, such as whether the person has fallen or is expected to fall. In Study IV, the total scores on MNS were significantly associated with all three outcomes. This implies that MNS covers many important items. Therefore, using the SKL questions together with MNS may be an alternative that could cause less doubtfulness in the instrument’s utility, which may decrease confidence in the subsequent process steps. However, the SKL questions require validation.

**Better process results but unchanged patients results**

In Study I, the process results of planned and performed preventive actions were higher in the group included in 2013-2014 than those in the group included 2010-2012. This better performance is likely not explained by poorer health or higher needs in the latter group (Table 4), but it may be explained by better adherence to the process. However, the percentage of registered causes did not differ, and registration was only performed for approximately 30% of the assessments. One reason for this low percentage may be that this step was not mandatory. Another reason may be lack of awareness since this step was unfamiliar to most of the participants in Study II. Nevertheless, taking the underlying causes into consideration is likely to broaden the picture and complete the assessment in a pedagogic way. To improve this analysis, the latest version of SA makes this a mandatory step to consider.

Although the process performance was higher in the later-included group (Study I), approximately 25% of those at risk still lacked planned actions
(Table 7). This rather high percent may depend on the discrepancy between assessed risk according to an instrument and that based on a clinical judgement, as discussed earlier. If healthcare professionals do not consider a person to be at risk, their motivation to plan for preventive care may be lowered, even if the instrument claims the opposite (van Gaal et al., 2011b). The shortage of planned actions may also be explained by the routine performance of Step 1 only, because only this step was initially remunerated. In Table 7 weight was planned for 1% in Group 1 but in fact 30% in this Group had a registered weight (Table 8). This difference may be explained by the parallel everyday care, which involved more than recorded in SA.

Persons at risk of pressure ulcers should be provided with methods to reduce pressing and shearing forces (NPUAP-EPUIAP-PPPIA, 2014). The action Reduce pressure and shear was planned for approximately 40% of the persons at risk for pressure ulcers. This was a low percentage compared with the data from the PPMs (2011-2014), in which approximately 73% of persons at risk received interventions such as pressure-reducing mattresses and approximately 40% received sliding sheets (Bååth et al., 2014, Senior Alert, 2017). This discrepancy may of course depend on different needs in different groups, but it may also be due to poor registration in SA. A similar pattern could be seen for persons at risk for falls; the most common action was alarm/supervision, which was planned for 40% in SA but was reported for approximately 70% in the PPM during 2013-2014 (Senior Alert, 2017).

In Study I, weight within 6 months was followed up more frequently in the later-included group than in the earlier (44% vs 30%), but 44% is still a low percentage for persons at risk of malnutrition (Table 8). This result may be considered as a quality problem, since it has been suggested that persons in elder care should have a weight check every third month, and those at risk for malnutrition should have a weight check even more often (National Board of Health and Welfare, 2016b). New assessments within 6 months were also performed more frequently in Group 2 although 30% may be considered low in a frail nursing home population. There are several possible reasons for these low percentages, such as lack of time among healthcare professionals, local routines to assess once a year, individual judgement that a new assessment or follow-up was not needed, and that persons died during the 6 months.
The better process performance demonstrated by Group 2 in Study I was not reflected in the measured patient outcomes. The reasons are complex but may be explained by the underreporting of events and small study samples. The study samples became small because of the decided 6 months’ timeframe for follow-up which was mentioned above. Using a wider timeframe might have provided a larger sample, but the safety and quality aspects in a residential setting motivated the timeframe of 6 months. Further, fall events were likely underreported, since only 15% and 19% of the residents in Group 1 and Group 2, respectively, had a reported fall event over the 6 months (Table 9). Compared with the PPMs, which showed falls for 6-7% of the residents based on a timeframe of two weeks, the rates were considered to be low (Senior Alert, 2017). A reasonable explanation for the poor registration of fall events may be that this information is routinely documented in a local failure system, giving the time-consuming double documentation low priority.

In Study III the nutritional care group (NCP group) showed significantly improved within-group values for body weight among those with BMI <22, indicating that the residents most in need were targeted. This finding may also indicate that using a multifaceted approach based on individual needs may have a positive effect. However, there were no statistically significant differences between the groups at follow-up regarding weight change, which may suggest that “care as usual” also provides nutritional actions. In Study III, “care as usual” was not defined, which may be a shortcoming: however, the ordinary care did not include any special routines or projects aiming to improve nutritional status. A potential bias may be that malnutrition has been widely discussed in elder care in Sweden over the last decade, which may have influenced healthcare professionals in general to be more observant of signs of malnutrition. Therefore, providing snacks, evening meals and supplemental nutritional drinks are examples of actions that may have been performed in any nursing home, irrespective of SA. The SA registry has documented these actions and made them visible.

In the focus groups, apprehension was raised regarding whether data from SA could ever show improvements among the residents. Generally, it is more complicated to measure and improve patient results than process
results. The process may not always produce the desired outcome because the persons may respond poorly (DesHarnais, 2011). In a nursing home population, frailty, cognitive impairment and multimorbidity may reduce the response to prevention. This situation raises the question of whether improvements are to be expected or whether absence of deterioration is sufficient. Another contributing explanation for poor patient results could be that although the planned actions should be communicated and agreed on with the older person, a disagreement can occur when the person refuses the agreed actions. Accordingly, healthcare professionals face an ethical dilemma when, in the course of preventing adverse events and thereby improving safety, they must choose between residents’ safety and their rights to integrity and autonomy (Johansson et al., 2009, Marent et al., 2016).

In general, quality registries aim to collect individual-based clinical data to examine and improve the delivery of care. The recorded data are mainly used to monitor and compare adherence to guidelines, but data should also be used for quality improvement and research (Emilsson et al., 2015). Senior Alert has an additional purpose – to support local preventive work and thereby reduce adverse events for the older persons even during care. This dual purpose means that local organizations are allowed to adapt the use of SA in different ways. Preventive care should be individualized. At the same time, local adaptions and individualized care can complicate comparisons and research. In this thesis, the varying time to follow-up affected the results. However, if fixed time points for follow-up were system mandatory, the user-decided follow-ups could be planned as complements to this. Of course, this is a question of the balance between the demand for data and “reporting fatigue” (Emilsson et al., 2015), but it is nevertheless important for quality of care.

**Insufficient evaluation of results**

The focus group participants in Study II shared different experiences and opinions about feedback and follow-up on results, but most of them were unfamiliar with this part of the preventive care process. The results were compared at the ward- and/or municipal level only occasionally, and reflections of the process- or patient results seemed to be poor. However, for
the preventive work to be effective, each organization must follow-up on their results, analyse them, and make improvements where needed (SALAR, 2015). This means that someone must request the results. In a recent study regarding the Stroke registry, colleagues asking for local results were identified as the most influential factor regarding improvement (Eldh et al., 2016). If local results are not visualized and discussed, an important part of the preventive care process would be missed, which may mean that the preventive care process as a whole is not fully understood. The need for a facilitator and a committed leadership is essential. Previous studies have emphasized a supportive organization, including committed leadership, as crucial when implementing evidence-based practices (Rosengren et al., 2012, Sandström et al., 2011, Green et al., 2014). However, a supporting and driving force may also be needed for the continuous work with SA, such as encouraging the daily work, educating healthcare professionals and giving feedback. When SA was implemented, pay-for-performance may have contributed as a driving force. When the economic compensation ended, engaged staff with knowledge of quality improvement in healthcare may be even more necessary to sustain motivation.

Methodological discussion

**Validity and reliability (Studies I, III, and IV)**

External validity concerns the possibility of transferring the results of a study to other groups, contexts or situations (Kazdin, 2003). In Studies I, III and IV, the populations were older persons living in Swedish nursing homes, which probably restricts the generalization to similar contexts.

Study I and III were based on twins from SALT, which is a population in the Swedish twin registry. Whether older twins differ from older non-twins may be questioned, but earlier studies have reported that twins included in the twin registry do not differ from the Swedish population in general (Öberg et al., 2012, Lichtenstein et al., 2002), and that older twins are similar to older non-twins in terms of health status and bio-behavioural functioning (Simmons et al., 1997). Moreover, to avoid the effect of potential
relatedness, no pair of twins was included in the selected samples. The method used to remove one twin of a pair was the random function in SPSS.

A threat to internal validity is selection bias, which is related to the inclusion of participants (Kazdin, 2003). In particular, the groups in Study III were strictly selected due to eligibility criteria, which can be a limitation. A longer timespan for follow-up might have provided a larger sample which could have affected the results. Alternatively, selecting residents with planned actions instead of performed actions may also have affected the results. In general, following older people in nursing homes over time can be problematic depending on attrition. Therefore, it is possible that the selected samples in Study III may reflect a healthier part of the total sample or, more precisely, those surviving 6 months from the first registered assessment.

Statistical regression might have negatively affected the internal validity in Study III. If persons are extreme on a given measure, one can predict on statistical grounds that a second testing will tend to revert towards the mean (Kazdin, 2003). The first measure recorded in SA may have reflected a status in which the person was in poor condition depending on whether they were newly admitted to the nursing home, and the second measure therefore reverted to the mean. However, the date regarding admission is not recorded in SA, which is a shortcoming. The registry of Social Services normally collects this information, but this registry was incomplete, and it was not possible to find this information for all persons.

In Study II, different opinions on how to interpret some of the items were expressed. Since risk assessments in SA are conducted by a large number of healthcare professionals with different backgrounds, disparities regarding how to interpret items in the instruments may have affected the interrater reliability (Polit & Beck, 2012). This disparity is likely a general problem when using clinical data compared to research data. Research studies are regulated by study protocols to ensure that the various operations are performed in the same way, and that training is provided if needed.
Trustworthiness (Study II)

In qualitative research, the concepts of credibility, confirmability, dependability and transferability are used to describe various aspects of trustworthiness. Credibility refers to the confidence in how well the data address the intended focus (Polit & Beck, 2012). Selecting the most appropriate method for data collection, as well as the amount of data, are important in establishing credibility (Graneheim & Lundman, 2004). Focus groups were chosen as they often reveal a level of understanding that can remain untapped when using other methods (Doody et al., 2013), such as (sub) cultural phenomenon’s and prevailing norms. The downside of such group dynamics is that the articulation of group norms may silence individuals (Jayasekara, 2012), but this phenomenon was not experienced. The number of groups was also considered sufficient and the data material was rich. Interpretation of the data can vary in depth and level of abstraction. In this case, the analysis was manifest which means that the interpretation of data and the level of abstraction did not seek depth, but to describe.

Confirmability refers to the objectivity of data and suggests the findings reflect the participant’s statements in a truthful way (Elo et al., 2014). Representative quotations from the transcribed text were shown to illustrate connections between the data and results.

Dependability refers to the stability of data over time (Elo et al., 2014). The same interviewer was the moderator in all groups, which strengthened dependability. However, interviewing is an evolving process in which interviewers acquire new insights over time (Graneheim & Lundman, 2004). This process may have affected the later interviews in terms of the follow-up questions asked, but at the same time it contributed to richer data. Moreover, the interviews were conducted in pairs with an experienced assistant supporting the interviewer.

To strengthen transferability, the participants and context must be carefully described (Elo et al., 2014). The selection of participants in the focus groups was both a purposive selection and a convenience selection. The selection was purposive in that participants were identified as having specific knowledge and as being willing and able to contribute. It was a convenience
selection in that the managers had a leading role in the recruitment. When conducting studies during work hours, one must rely on the manager’s willingness to spread information and perform recruitment. In this process, the managers were very obliging, and their help was essential. The participants varied in age and years of work experience. The composition of the groups varied (Table 3) and they contributed to rich discussions, and the participants seemed comfortable and open when sharing their thoughts.
Conclusions

The national quality register Senior Alert is based on a strong desire to improve the quality of preventive care in older persons and thereby reduce adverse events. In this thesis, better process performance was shown over time but this was not reflected in reduced weight loss, falls or pressure ulcers. Further, in residents at risk for malnutrition, no difference in weight change was shown between a group included in this registry and a group receiving ‘care as usual’. A large percentage of persons lacked an adequate follow-up of the actions taken, which could be considered as a quality problem in the care of such a frail group of persons. This lack of follow-up also made it difficult to study the outcome of patient results as the base for measure became small. However, there is a dilemma in balancing between the quality of care, the demand for data and ”reporting fatigue”. From the healthcare professional’s perspective, SA promoted better teamwork, but the increased workload and that the assessment instruments overrated the risks compared with clinical judgement of the professionals was a concern. The use of data from the registry for comparison, feedback and learning was low. A supporting organization and committed leaders are needed to promote the continuous work with the registry, and a facilitator should co-ordinate the work.
Future research and implications

Implications for practice

In this thesis the assessment scales were criticized for the lack of agreement between how they classified persons at risk and the healthcare professional’s view of risk. This notion was especially true for DFRI and MNA-SF. In SA, MNA-SF, DFRI and MNS are suggested as default instruments, but other instruments are included in SA and can be used. Therefore, local organizations may discuss the alternatives. For example, an alternative may be to use the SKL short questions about falls and nutrition in combination with MNS.

The longitudinal studies in this thesis used a timeframe of 6 months. At the local level, individual decisions are made when to follow-up on an intervention: therefore this time can vary greatly. It is important with individualized care, which is in line with person-centeredness, but for research and national comparisons it may be problematic. Therefore, a fixed measure point at 6 months, in addition to the user-decided follow-up, would be of great value.

A rather low process performance regarding follow-up was revealed, and the use of SA data for comparison, feedback and learning was low. This finding indicates that Step 4 in the preventive care process was not fully performed. Evaluation is an important task, and each organization must follow up on their results and make improvements where needed. To strengthen this step, the goals of SA need to be discussed and grounded at the local level. Organizations would benefit to discuss what value the use of SA provides, both locally and nationally, like — why are we doing this? A supporting organization is important to promote continuous preventive work, and a local coach or facilitator may be needed.
Implications for further research

As an implication for practice, SKLs short questions regarding falls and nutrition were suggested as possible alternatives to DFRI and MNA-SF. However, these questions need validation and future research could compare them with the default instruments of DFRI and MNA-SF.

To study local organizations that have shown improvements in patient outcomes could be important. How do these organizations work to produce successful outcomes in these areas? In contrast, it could be of great interest to understand the reasons why some organizations chose to stop using SA.

The prevention of harm in contexts other than nursing homes is important to study. For example, how does SA function as a tool for the prevention of malnutrition, falls and pressure ulcers among older persons living at home? Intervening at an early stage is essential because the process of becoming frail or care-dependent can be delayed, slowed or even partly reversed by interventions that are implemented early in the process of functional decline.
Svensk sammanfattning


**Resultat:** Gruppen som registrerades i registret under åren 2013-2014 hade en högre andel rapporterade åtgärder, 75% jämfört med 60% i den tidigare gruppen 2010-2012. Andelen personer med nya riskbedömningar inom 6 månader skiljde sig också; 30% i den senare och 20% i den tidigare. Andelen personer med risk för undernäring som följes upp med vikt inom 6 månader var i den senare gruppen 44% jämfört med 30% i den tidigare. Andelen med registrerade fall händelser och trycksår var låg och ingen skillnad mellan grupperna kunde påvisas. Andelen som hade minskat 5% i vikt var ca 16% i båda grupperna. Ingen skillnad i vikt eller viktförändring kunde påvisas beroende på om Senior Alert användes eller inte, men vid undergruppsanalyser kunde en viktuppgång påvisas hos de med lägst BMI i Senior Alert gruppen. Studie IV visade att mobilitetsvariablerna generellt hade störst betydelse för samtliga testade utfall, fast på olika sätt. Resultatet från studie II speglade både positiva och negativa erfarenheter. Deltagarna beskrev att Senior Alert stimulerade ett bättre teamarbete, men beskrev samtidigt en ökad dokumentationsbörda och tidsbrist som försvårande omständigheter. Vårdpersonalen ansåg också att bedömningsinstrumenten överskattade riskerna för fall och undernäring jämfört med deras egen kliniska bedömning. De hade liten erfarenheten av att följa kliniska resultat baserat på data från registret. Vårdpersonalen uttryckte också tvivel om arbetssättets förmåga att kunna påvisa bättre resultat eftersom de äldre personerna var i slutskedet av livet.

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Jönköping April 2018
Christina Lannering
References


Elo, S., Kääriäinen, M., Kanste, O, et al. (2014) Qualitative Content Analysis: A Focus on Trustworthiness Sage Open.


Neyens, J., Halfens, R., Spreeuwenberg, M., et al. (2013) Malnutrition is associated with an increased risk of falls and impaired activity in


SALAR (2017) Instruktioner - Nationell punktprevalensmätning av trycksår . https://skl.se/download/18.31b5f3a3160a5e1626753c1c/1514910421881/Instruktioner%20PPM-trycksa%CC%8Ar%20VT%202018.pdf


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