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IMPACT STATEMENT

- The framework hallmarks the safety perspective of older persons with diabetes receiving home care services, associated with the risk of hypoglycaemia, falls, pain, foot ulcers, cognitive impairment, depression and polypharmacy, quality of care, care environment, health care system and society.
- The global population is ageing: therefore, the safety perspective of older people with diabetes in home care services is an important perspective to future research, care planning and care evaluations.

ABSTRACT

Aims: To identify diabetes specific patient safety domains that need to be addressed to improve home care of older people; to assess research from primary studies to review evidence on patient safety in home care services for older people with diabetes.

Design: An integrative review.

Data Sources: Domains for patient safety in diabetes home care settings were identified by conducting two searches. We performed searches in: CINAHL, Medline, Embase and Cochrane Library for the years 2000-2017.

Review Methods: The first search identified frameworks or models on patient safety in home care services published up to October 2017. The second search identified primary studies about older people with diabetes in the home care setting published between 2000 - 2017.

Results: Data from the 21 articles populated and refined 13 predetermined domains of patient safety in diabetes home care. These were used to explore how the domains interact to either

increase or reduce risk. The domains constitute a model of associations between aspects of diabetes home care and adverse events. The results highlight a knowledge gap in safety for older persons with diabetes, influenced by e.g. hypoglycaemia, falls, pain, foot ulcers, cognitive impairment, depression and polypharmacy. Moreover, providers' inadequate diabetes-specific knowledge and assessment skills contribute to the risk of adverse events.

Conclusion: Older persons with diabetes in home care are at risk of adverse events due to their reduced ability to self-manage their condition, adverse medication effects, the family's ability to take responsibility or home care service's suboptimal approaches to diabetes care.

Keywords: older people, diabetes, nursing, home care services, primary care, safety.

Impact

What problem did the study address?

The risk of adverse events older people with diabetes receiving home care services are at, due to functional decline, renal failure, cognitive impairment or dementia, as well as current use of insulin or sulphonylureas in addition to other medication.

What were the main findings?

The identification of key domains for patient safety among older persons with diabetes in home care and their risk of adverse events due to their reduced ability to self-manage the condition, adverse medication effects, the family's ability to take responsibility or home care service's suboptimal approaches to diabetes care.

Where and on whom will the research have an impact?

The key domains are clinical tools for review of patient safety incidents in older individuals with diabetes in home care services. The key domains can frame future research, facilitate systematic assessment of the quality of services, care planning and evaluations

INTRODUCTION

Diabetes prevalence increases with advancing age and the condition and related long-term complications predispose people to frailty in older age (International Diabetes Federation, 2015; Sinclair et al., 2018; Wong et al., 2013). The proportion of older people is increasing globally. Likewise, the number of people living with chronic conditions and co-morbidities is rising. Thus, there is a growing need for health care services to provide care and support to people with diabetes in their homes. Significantly, 39% (115 of 291) of homebound older adults in the US receiving home care services had diabetes (Qiu et al., 2010). Older people with diabetes receiving home care services are vulnerable to a range of risks associated with poor management of diabetes, renal failure, cognitive impairment or dementia, as well as current use of insulin or sulphonylureas (Bruderer et al., 2014; Khunti et al., 2013; Rajpathak, Fu, Brodovicz, Engel, & Heaton, 2015; Villani et al., 2016). Further, both hypo- and hyperglycaemia increase the risk of falls, pain, urinary tract infections, cognitive impairment, depression, delirium and polypharmacy (Dunning & Sinclair, 2014; Meneilly, Knip, & Tessier, 2013).

The association between diabetes and hypoglycemia, comorbidities, silent myocardial infarction, impaired functional status, mood and cognitive disorders indicate strategies to maximize independence and self-management ability (Sinclair et al., 2012). Such strategies

could reduce the risk of adverse events and improve patient safety (Sinclair et al., 2012). Research in the US indicates that hospitalized older people with diabetes have 13.2 – 26.3% of unplanned readmissions. Readmissions are attributed to e.g. falls, urinary tract infections or other inter-current infections that could be prevented or managed in the home environment (Collins et al., 2017; Kim, Ross, Melkus, Zhao, & Boockvar, 2010; Raval et al., 2015). Adverse events due to sub-optimal diabetes care in the home are avoidable if the care is coordinated, if there is optimal communication among services and if the individual and their family carers are supported (Caughey et al., 2016). For example, implementing a general practitioner management plan (GPMP) reduced hospitalizations of people with diabetes by 22% including being hospitalized for a diabetes complication compared with people who did not have a GPMP (Caughey et al., 2016). Further, follow-up nursing interventions for patients with diabetes can improve psychosocial and health outcomes (Frich, 2003).

There is a need for a systematic review of the literature to provide a more comprehensive understanding of patient safety in diabetes home care. An integrative review as described by Whittemore and Knafl (2005) has the potential to propose how home care can achieve improvement in diabetes health care by raising awareness of the types of adverse events, unplanned admissions and readmissions people with diabetes in home care are at risk of. The review has direct applicability to informing research, practice and policy initiatives suggesting effective strategies and guidance for improving patient safety in home care services.

Background

Preventing adverse events and ensuring patient safety are major responsibilities for home care staff and service providers (McGraw, Drennan, & Humphrey, 2008). Sears et al (2013, p. 2) studied the incidence of adverse events among home care patients and defined an adverse event as:

"(i) an unintended injury or complication, (ii) which results in disability, death or increased use of health care resources and (iii) is caused by health-care management".

Home care services differ among and in countries with respect to policies and regulation, financing, organization and service delivery as well as the type of clients they care for and the contribution of informal family carers (Genet et al., 2011). Overall, home care services typically target older adults with multiple medical conditions and functional disability at high risk of being institutionalized (Edwards, Saha, Prentice, & Pizer, 2017). Health care management in the home is provided by formal caregivers in cooperation with informal caregivers (family member/ next of kin/ relatives) and the patient (Ellenbecker, Samia, Cushman, & Alster, 2008; Genet et al., 2011; Masotti, McColl, & Green, 2010; Sears et al., 2013). Challenges to care provision arise because homes are equipped for living, not for delivering healthcare. Further, informal caregivers and patients may not have the medical skills needed to assess and manage complex health situations or recognise deterioration.

In addition, healthcare personnel are not present on a continuing basis. Therefore, they are not able to monitor self-care behaviours and other important issues such as increasing or decreasing blood glucose levels (Blais et al., 2013). Likewise, the span of health care workers' level of knowledge and educational level influence the way they observe symptoms,

make decisions about their significance, or undertake procedures such as wound care (Berland, Holm, Gundersen, & Bentsen, 2012). In general, understanding the needs of care providers and care recipients is necessary to optimize the health care services provided at home (Beer, McBride, Mitzner, & Rogers, 2014). Hence, home care safety presents unique challenges and requires re-examination of the complexity of the issues and challenges affecting patient safety in the home (Lang, Edwards, & Fleiszer, 2008).

THE REVIEW

Aims

1) Identify diabetes specific patient safety domains that need to be addressed to achieve home care improvement.
1) Assess research from primary studies to review evidence on patient safety in home care services for people with diabetes.

Design

The integrative review approach allows for the inclusion of studies that applies diverse methodologies (Whittemore & Knafl, 2005). Thereby, it provided the opportunity to gain a comprehensive understanding of patient safety incidents and suboptimal approaches in diabetes home care services. An integrative review enables various perspectives of the same phenomenon to be identified and explained by integrating them into a specified framework (Whittemore, 2008). Although the general domains and issues related to home care patient safety are well recognized, there are no frameworks or models of patient safety particularly addressing professional diabetes care in home settings. We therefore performed an integrative review to: (1) identify a framework of specific patient safety domains of relevance for

diabetes care based on domains in the general home care patient safety literature; and (2) conduct an analysis of accounts of home diabetes care safety applying the identified framework.

Studies were included in the review if they were empirical primary research studies reporting older people with diabetes receiving home care services, health care personnel delivering care in the home to a person with diabetes, risks, accidents, incidents or adverse events due to care management. We searched for articles published in English or Scandinavian languages through to October 2017. The exclusion of people younger than age 65 was used because most articles define older age as 65 and older. The diabetes experts in our team provided definitions related to diabetes and risks derived from international diabetes guidelines and position papers.

Search methods

Patient safety in diabetes care in home settings was identified by conducting two searches. The first search identified frameworks or models on patient safety in home care services published up to October 2017. The second search identified primary studies about older people with diabetes in the home care setting published between 2000 - October 2017.

Frameworks and models were identified in collaboration with a trained librarian by searching the databases Embase, Medline, CINAHL and Psychinfo using the MeSH-terms “home care”, “home health care”, “home care services”, “patient safety”, “theoretical model”, “model”, “models, theoretical”, “conceptual framework”, “conceptual model”. The inclusion criteria

were articles describing a model or a conceptual framework of patient safety for home care services, limited to publications in English.

Primary studies and literature on older people with diabetes and safety in home care settings were identified. We searched in: CINAHL, Medline, Embase and Cochrane Library using the following key words and MeSH-terms: 'Diabetes Mellitus', 'type 1 diabetes', 'type 2 diabetes', 'community health services', 'community health nursing', 'home health care', 'home the aged', 'community care', 'community health nursing', 'home care', 'visits', 'home nursing, professional', 'health services for the aged', 'community health service', 'community health nursing', 'home care services', 'home health nursing', 'home nursing', 'respite care', 'health care service for visiting nursing service', 'aged', 'geriatr', 'elderly', 'gerontol', 'all ages 65 years and older'.

Search outcome

We found four articles describing five models of safety in home care services (Henriksen, Joseph, & Zayas-Cabán, 2009; Macdonald et al., 2013; McGraw et al., 2008; Sears, 2008). When we compared the domains for the five models and frameworks identified, we questioned whether they were specific to diabetes and slightly refined the definitions for each patient safety domain, so they were applicable to challenges of managing diabetes in the home.

We identified 3516 articles about older people with diabetes in the home care setting (Figure 1). Three pairs of reviewers independently read the abstracts and reached consensus that 109 articles appeared to meet the inclusion criteria. When the full texts were examined 76 articles

were excluded because they did not meet the inclusion criteria, which left 21 articles to be included (Table 1; Appendix).

Six authors acted as reviewers (JHa, MG, MK, AKS, TD, JH) and worked in pairs to independently screen the titles and abstracts for potentially relevant studies. Each pair discussed and agreed on their screening results. Thereafter, potential full text articles were retrieved and screened by the main author (JHa) and divided among four of the authors (JHa, MG, MK, AKS) for data extraction. The research designs in the articles were divergent and patient safety was not the primary focus of the articles. We discussed the judgement outcomes for ambiguous papers.

Critical appraisal

Since our interest was in how papers identified patient safety among older people with diabetes receiving home care services methodological limitations in included studies were not the primary concern.

Synthesis

Domains of patient safety relevant to home care services in the five models were compared with identify areas of concern and further organized into predetermined domains for a patient safety framework relevant to diabetes home care. The domains were checked to ensure that they were mutually exclusive. A data extraction spreadsheet was created containing the domains of the preliminary patient safety framework, which was used to extract relevant information from the included articles. Two authors (JHa, AKS) undertook the process of data extraction. The contents in each domain were then summarized to produce a description

of each domain of patient safety among older people with diabetes in home care services. Associations between domains were suggested by the review team based on their expertise providing care and education for people with diabetes (AKS and TD) and by expertise providing care in the home care setting (MK and JHa).

RESULTS

Data from the 21 articles was used to populate and refine predetermined domains, producing 13 domains related to patient safety in diabetes home care (Table 2). These were used to explore how the various domains interact with each other to produce an adverse event, or to increase or reduce risk of an adverse event (Figure 2). The domains constitute a model of associations between aspects of diabetes home care risk of adverse events and adverse events. Three domains describe the patient's circumstances in the home: their medical condition, their individual characteristics and the adequacy of their home environment. Risk and adverse events are dependent on responses in four domains to the patient in the home: Home care service support, the informal caregiver's knowledge, skills, motivation and judgment and communication within the team across staff.

Interpersonal relations between patients and caregivers are an 'interconnecting' domain which runs across and affects how the other domains work together to promote safety. Lastly, financial and administrative issues in the home care, the professional autonomy in the home care and the external environment constitute the three indirect domains. The model has bidirectional arrows to indicate the association between all the domains that need to be taken into account when patient safety in persons with diabetes receiving home care services are addressed.

Medical condition

Complexity of the medical condition challenges care, in ways that health care personnel or the family members may not recognize. Such challenges increase the risk of hyper- or hypoglycemia and diabetes specific complications such as foot ulcer, retinopathy and kidney problems (Barnett et al., 2006; Chen, Popoola, Radhakrishnan, Suzuki, & Homan, 2015; Forbes, Berry, While, Hitman, & Sinclair, 2004; Gershater, Pilhammar, & Alm Roijer, 2011; Goins, Tincher, & Spencer, 2003; Goldberg, Ralston, Hirsch, Hoath, & Ahmed, 2003; Hirakawa, Kuzuya, Masuda, Enoki, & Iguchi, 2008; Huang, Wu, Jeng, & Lin, 2004; Huber, Huber, & Shaha, 2011; Ibrahim, Kang, & Dansky, 2005; Jorde & Hagen, 2006; Larsen, Clemensen, & Ejskjaer, 2006; Lucas, 2013; Maxwell et al., 2008; Neumark, Brudin, & Neumark, 2015). Home care services may prevent hospitalization due to early symptom detection in in older persons with diabetes and complex conditions (Edwards, Prentice, Simon, & Pizer, 2014; Edwards et al., 2017). In some complex circumstances, however, complexity may make it difficult to detect risk. Polypharmacy, for example, is a concern for patients at home so home care personnel should monitor. Ibrahim et al. (2005) indicate that polypharmacy is a concern for home health care patients with diabetes. Therefore, home care personnel should monitor drug regimens of diabetic patients systematically to avoid adverse events such as hospitalization. Persons with diabetes receiving home care services also have a risk of suboptimal pain medication. Maxwell et al. (2008) found that clients aged 75 + years and those with diabetes, were significantly less likely to receive an opioid alone or in combination with a non-opioid, interpreted as a reluctance to give pain medication due to fear of a renal failure in patients with diabetes.

Individual characteristics

Factors such as activity level, nutrition intake, learning problems, general frailty in older people may affect the diabetes condition in ways that health care personnel or family members are not aware of. Other individual factors such health literacy, living alone or being homebound need to be judged in a diabetes care perspective to prevent individual factors to lead to adverse events (Chen et al., 2015; Edwards et al., 2014; Edwards et al., 2017; Forbes et al., 2004; Gershater et al., 2011; Goins et al., 2003; Hirakawa et al., 2008; Huang et al., 2004; Huber et al., 2011; Jorde & Hagen, 2006; Lucas, 2013; Maxwell et al., 2008; Neumark et al., 2015). Ethnicity is also a factor to evaluate, as Lee and Peng (2002) for example found that it was associated with increased risk for acute admission in home care patients with Asian Pacific Islander heritage and with diabetes, hypertension or cardio-vascular disease. In addition, when introducing diabetes telehealth interventions, or self-care strategies, individual factors need to be evaluated in a decision – making process to avoid adverse events (Barnett et al., 2006; Goldberg et al., 2003; Larsen et al., 2006).

Adequacy of the patient home as a care environment

Carers and professionals can adjust to enable better diabetes care and self-care. An adequate care environment includes adjustments to physical layout and inclusion of equipment that compensates for limitations of activities of daily living (Hirakawa et al., 2008). Adjustments may for example reduce the risk of falls, facilitate meal preparation and promote medication management. For the nurse, an adequate home environment facilitates care delivery. An inadequate home environment, conversely, increase the risk of adverse events for the family such as caregiver burden (Hirakawa et al., 2008).

Nature and performance of home care service support

Home care services can increase patient safety by increasing the patient's level of knowledge, promoting self-management by showing patients how to do things for themselves, supervising and observing self-care and providing direct care (Hirakawa et al., 2008; Huber et al., 2011; Ibrahim et al., 2005; Larsen et al., 2006; Lucas, 2013; Maxwell et al., 2008; Odegard & Andersson, 2001). For example, self-management can be promoted if diabetes specific education interventions that focus on self-care and diet advice are tailored to the individual (Barnett et al., 2006; Goldberg et al., 2003). If this is combined with practical support, nutritional and clinical outcomes can be improved (Huang et al., 2004). In terms of direct care, if nurses undertake an annual diabetes review when the patient is homebound, deterioration in the diabetes state can be detected at an early state and preventive strategies can be implemented to improve safety in home care (Forbes et al., 2004; Neumark et al., 2015).

Informal caregiver involvement, knowledge, skills and ability to take responsibility

Support from home care providers can be enhanced by informal carers working independently or as a team to reduce risk of adverse events associated with the patient's self-management (Huber et al., 2011). Informal caregivers who have diabetes knowledge and skills and who are involved in direct care, act as a resource for the home care services. However, it is important to regularly assess the burden on the informal caregivers and their health and wellbeing (Hirakawa et al., 2008). They need support to take responsibility for managing acute and chronic diabetes complications in the home. Informal caregivers in frail health or who have limited diabetes knowledge/skills, can inadvertently increase the risk of an adverse event (Huber et al., 2011).

Provider motivation, knowledge, skills, judgments and decision-making

If the providers do not maintain their diabetes-specific knowledge and skills in providing assessment and care, then their practices can increase the risk of adverse events (Maxwell et al., 2008; Neumark et al., 2015). If nurses are regularly exposed to professional level diabetes training, the risk of preventable diabetes-related adverse events such as ketoacidosis, hyperglycaemic hyperosmolar states, hypoglycaemia and hospital admission can be reduced (Odegard & Andersson, 2001). Furthermore, regular education for staff about how to identify actual and potential adverse events and when to seek advice about foot ulcers, other diabetes conditions, comorbidities and functional decline helps them make appropriate care decisions and identify diabetes care priorities, which helps avoid adverse events. Identifying changes in diabetes health status, medicines, diabetes specific complications and metabolic control early and documenting and communicating such changes reduces risks (Barnett et al., 2006; Flood, 2009; Forbes et al., 2004; Gershater et al., 2011; Goldberg et al., 2003; Jorde & Hagen, 2006; Lee & Peng, 2002). Mistakes in the provider's decision-making can cause stress for the nurse and adverse events can occur (Graue, Dunning, Hausken, & Rokne, 2013). The nurses' ability or motivation is influenced by the medical and nursing care training and lack of motivation and ability may lead to ignorance of patient and caregiver needs (Hirakawa et al., 2008; Huber et al., 2011; Lucas, 2013).

Team/staff communication

The home care environment and in the home care organization can pose further risks. If the team effectively cooperates and communicates the quality of diabetes care will be enhanced (Forbes et al., 2004). Conversely, if communication and cooperation among staff is inadequate, the risks of adverse events increase (Gershater et al., 2011; Huber et al., 2011).

For example, when new electronic interventions in "nurse-general practitioners" communication and cooperation are used cohesion within the care team and nurses' motivation to provide quality diabetes care can be maintained (Ibrahim et al., 2005; Larsen et al., 2006). If communication in-person or through documentation is suboptimal, then home care staff may feel they have to assume responsibility with little or no support (Graue et al., 2013).

Interpersonal relations between patients, providers and caregivers

The quality of the relationship between the care provider and the informal caregiver, as well as the quality of the patient-nurse relationship, influences care in the home (Flood, 2009). If a client centered approach and emotional support is facilitated, then social connectedness and more independent self-care is leading to better quality of care (Huber et al., 2011). Conversely, if patients regard nurse care visits to manage foot ulcers as a form of socialization, they can worry that the visits will stop if the ulcer heals, resulting in dependence as an adverse effect (Lucas, 2013).

Financial and administrative issues in home care

Risk of adverse events is not merely an issue between provider and the older person in their home there may be external factors in the wider environment that also have indirect effects. If a home care company employs staff with suboptimal diabetes qualifications and leaders' are not fully aware of their responsibility to continually uphold the staff's diabetes qualifications, substandard quality can increase the risk of adverse events (Graue et al., 2013). If a home care company allocates resources and expertise to diabetes care appropriately, then the leaders' efforts to prioritize diabetes care influences risk reduction (Graue et al., 2013).

Professional competence required in diabetes care is intertwined with a budget adequate to employ qualified staff in home care services (Chen et al., 2015; Edwards et al., 2014; Edwards et al., 2017). Financial and administrative priorities will increase patient safety.

Professional autonomy in home care

Delivery of high-quality diabetes care is dependent on professional authority. If nurses are enabled to lead and plan nursing care in home care services in their own right, then obstacles to nurses' ability to decide and execute their work are reduced, which in turn increases safety (Graue et al., 2013).

External environment

If the health care system in a country includes health care insurance coverage for persons with diabetes who would benefit from assistance from home care services, then adverse events can be avoided (Lee & Peng, 2002). If the person is not eligible or able to afford health care insurance, or if the government has no responsibility to provide or subsidize care, then older people with diabetes have an increased risk of adverse event due to lack of assistance in suboptimal self-management. Eligibility to health care insurance may be associated with ethnicity. For example Lee and Peng (2002) found in their study of home health service use and discharge outcomes, that older Asian Pacific Islanders were more likely to be dually eligible for Medicare and Medicaid; entered with greater dependencies; and received more home health aide services than White elders.

DISCUSSION

The main strength of our identification of key domains for patient safety among older people with diabetes receiving home care services is to facilitate systematic assessment of the quality of services in relation to the different domains, which explain which aspects of the care program needed to be improved in evaluation and research.

We were able to describe a range of care provided to older people with diabetes receiving home care services. We abstracted characteristics from all the articles included in the review to identify the key domains. The integrative review has several limitations. These include that some of the risks identified may be unique to a health system, for example differences in insurance, regulations etc. A few studies directly investigated risk of adverse events, but none explicitly explained how homecare services could be associated with adverse events. Consequently, there was insufficient evidence to empirically determine relationships among the key domains. However, causal strands between the domains and risks of adverse events have been suggested. These associations map to the models developed outside of diabetes, which illustrate relationships between the human factors in home care that serve to either increase or undermine patient safety (Beer et al., 2014; National Research Council, 2011).

The key domains address key risk factors for adverse events such as increasing age, progressive functional changes and polypharmacy. These factors interact with family member's role, formal caregivers' roles, financial, organizational structure, society and political structures.

The domains reflect the importance of examining homecare safety by involving patients, informal caregivers and care providers in discussions to understand their individual perspectives, needs and strengths. Furthermore, the key domains reflect the incongruence between care demands or expectations by patients and the service capacity of providers as

well as the significance of organizational policies in association with adverse events (Lang et al., 2009; Macdonald, Lang, & MacDonald, 2011).

The search for studies concerning safe diabetes care in homes only yielded 21 relevant articles. To enable us to highlight safe diabetes home health services for older people, we identified themes based on five models of safety in home care. More empirical studies need to be conducted which further investigate and nuance relationships between the key domains. Specific elements that we underreported include: the challenges and hazards that exist when delivering home care services such as professional, financial and administrative issues in home care; the person's home as work environment; living conditions; informal caregiver health and involvement in providing care and their skills and the burden of care. The home care services leaders' responsibility to continually uphold the staff's diabetes qualifications was described (Graue et al., 2013). That the individual nurse is responsible to ensure that diabetes knowledge and competence is maintained was surprisingly not contrasted in the study's findings.

The patient's cognitive and affective state also needs more attention in future research. Interestingly, only one study mentioned depression (Huang et al., 2004). Depression is associated with diabetes especially in older people who are socially isolated or suffer bereavement. The ADA (2015) (American Diabetes Association, 2015) stated that older people with diabetes should be screened for depression and adequately treated. Depression can be difficult to diagnose in older people with other psychological challenges or cognitive impairment, such as dementia. It is also interesting that dementia was not included as a risk to safety, given that many families care for older relatives with dementia at home. Dementia can contribute to depression and/or make it difficult to diagnose depression.

In our experience as diabetes and home care practitioners, social, financial and political perspectives are also important. Those perspectives are not new to the wider literature on patient safety (National Research Council, 2011), but were rarely addressed in the empirical literature on home care services we identified. Those perspectives add complexity to the area and further highlight the fact that patient safety is not merely a question of who to blame, but the way the system is constructed and the processes function (Lang et al., 2008). Our key domains contribute to current thinking about patient safety and the way safety relates to diabetes care in homecare services.

CONCLUSION

The review contributes to existing knowledge, in that the identification of key domains highlights the gap in knowledge and understanding of safety for older persons with diabetes receiving home care services and their risk of adverse events influenced by e.g. hypoglycaemia, falls, pain, foot ulcers, cognitive impairment, depression and polypharmacy. Moreover, providers who do not maintain their diabetes-specific knowledge and skills in assessment and care can increase the risk of adverse events. To extend the model's significance to older persons with diabetes in home care services, more research is needed particularly about how the health care system, the society and political structures influence the characteristics of the incidents.

The identification of key domains for patient safety among older people with diabetes allows for further outline of hypotheses to be examined in future research. The domains might foster retrospective review of patient safety incidents among older patients with diabetes in home care services, as well as to guide leaders and clinical nurses in planning of quality care. Home

care service providers have a responsibility to demonstrate leadership and ensure resources are available to support care delivery in the home and to avoid adverse events, unplanned admission and readmission. Foremost, the included domains or framework forms a foundation to future research, especially in key domains suggested in the discussion.

Author Contributions:

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;

2) drafting the article or revising it critically for important intellectual content.

* http://www.icmje.org/recommendations/

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Table 1: Studies categorized by the domains for the identification of patient safety among older people with diabetes receiving home care services.

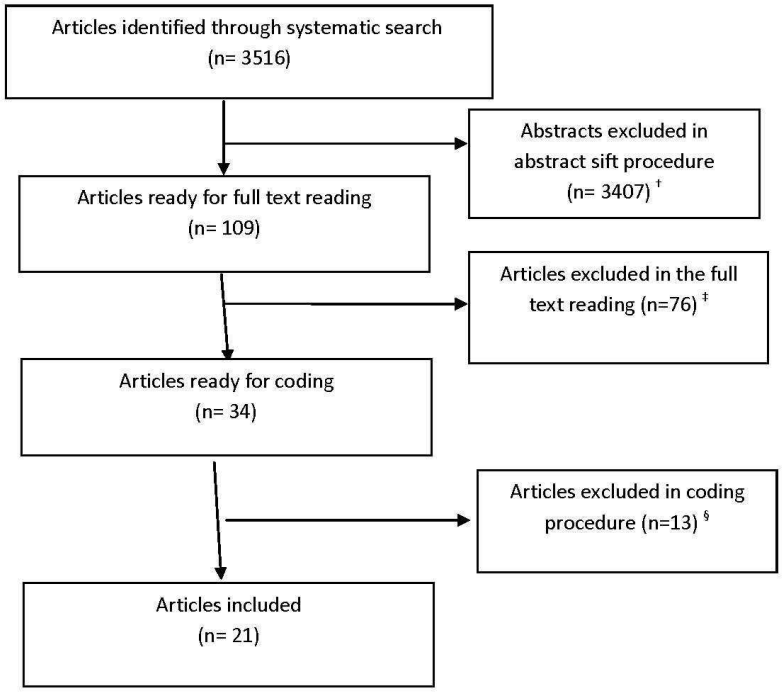
Author year Country	RISK Of ADVERSE EVENTS	ADVERSE EVENTS	MEDICAL CONDITION	INDIVIDUAL CHARACTERISTICS	ADEQUACY OF PATIENT HOME AS CARE ENVIRONMENT	NATURE AND PERFORMANCE OF HOME CARE SERVICE SUPPORT	INFORMAL CAREGIVER INVOLVEMENT, KNOWLEDGE, SKILLS, ABILITY TO TAKE RESPONSIBILITY	PROVIDER MOTIVATION, KNOWLEDGE, SKILLS, JUDGEMENT, DECISION-MAKING	TEAM/ STAFF COMMUNICATION	INTERPERSONAL RELATIONS BETWEEN PATIENTS, PROVIDERS AND CAREGIVERS	FINANCIAL AND ADMINISTRATIVE ISSUES IN HOME CARE	PROFESSIONAL AUTONOMY IN HOME CARE	EXTERNAL ENVIRONMENT
Barnett *et al.,* 2006 USA		X	X	X		X		X					
Chen et al 2015 USA	X		X	X							X		
Edwards et al 2014 USA	X		X	X							X		
Edwards et al 2017 USA	X		X	X							X		
Flood, 2009 USA	X					X		X		X			
Forbes *et al.,* 2004 UK	X		X	X		X		X	X				
Gershater *et al*., 2011 Sweden	X		X	X				X	X				
Goins *et al.,* 2003 USA			X	X									
Goldberg *et al.,* 2003 USA	X		X	X		X		X					
Graue *et al*., 2013 Norway								X	X		X	X	
Hirakawa *et al.,* 2008 Japan			X	X	X	X	X	X					
Huang *et al.,* 2004 Taiwan	X		X	X		X							

Huber *et al.*, 2011 Switzerland	x		x	x		x	x	x	x	x		
Ibrahim *et al*., 2005 USA	x		x			x			x			
Jorde & Hagen, 2006 Norway	x		x	x				x				
Larsen *et al.*, 2006 Denmark	x		x	x		x			x			
Lee et al., 2002 USA		x		x				x				x
Lucas, 2013 Australia	x		x	x		x		x		x		
Maxwell *et al.*, 2008 Canada	x		x	x		x		x				
Neumark et al 2014 Sweden			x	x		x		x				
Odegard & Andersson, 2001 Sweden	x					x		x				

Table 2: Extracted domain content for the identification of key domains of patient safety among older people with diabetes receiving home care services

Domain	Extracted descriptions specific for older people with diabetes receiving home care services
Risk of adverse events	Prolonged hospitalization, risk of hypo-/hyper glycemia, overlooking symptoms, unawareness of symptoms, delayed risk detection, social isolation, uncoordinated or lack of diabetes care planning, adverse drug-drug interaction, overestimated kidney dysfunction which gives rise to suboptimal pain relief, misinterpretation of video images in foot care, inadvisable care actions taken by staff with limited diabetes knowledge.
Adverse events	Hospitalization, primary care visit, acute hypo- and hyper-glycemia events.
Medical conditions	Insulin- and other drug-regimens in patients with diabetes, diabetes specific complications such as foot ulcer, retinopathy, kidney problems, comorbidity like cognitive deficit, depression, cerebrovascular disease, heart disease, and neoplasm.
Individual characteristics	Inappropriate nutritional intake, low exercise level, limited activity of daily living level, need to help to walk, general frailty, poor dental health, pain, poor eyesight, low diabetes knowledge level, low health literacy, learning problems. Ethnicity and approach to health and daily living. People with diabetes living alone, or being homebound e.g. not able to attend the yearly diabetes assessment at the GP's office.
Adequacy of patient home as care environment	Adjustment of the equipment and decorations in the private residence as a factor in home based diabetes care to avoid e.g. risk of falls, facilitate meals, assure hygienic environment for wound dressing, medication, and avoid risk of urinary tract infection.
Nature and performance of home care service support	Administration of insulin and medication, foot care, home visit rehabilitation, bathing, respite care, home help, diabetes-specific support in ADL, diet supervision, health information, medical measures, telehealth interventions, and annual review of diabetes state.
Informal caregiver involvement, knowledge, skills and ability to take responsibility	The informal caregiver's burden and ability to take responsibility for diabetes specific and general care tasks.

Provider motivation, knowledge, skills, judgement, and decision-making	Home care personnel's request for regular exposure to diabetes specific training to enhance and maintain diabetes knowledge, skills and competence in decision control as well as in assessing diabetes symptoms and complications.
Team/ staff communication	Collaboration routines within the team, community pharmacies and with General Practitioners.
Interpersonal relations between patients, providers and caregivers	Patient-nurse interpersonal relationship as affective support, and client centered approach as a means to strengthen self-care, social connectedness, and patient's fear of being discharged from home care services.
Financial and administrative issues in home care	Appropriate staffing serving older people with diabetes in home care services is a matter of financing and a matter of how the administrative responsible prioritize.
Professional autonomy in home care	Necessary professional authority and confidence is a prerequisite for nurses to take the lead in delivering high-quality diabetes care.
External environment	Associations between characteristics in persons with diabetes and health care assurance prerequisite.



† Not fitting following inclusion criteria: Age 65 years or older; and Language English. People with diabetes receiving professional care at home; Health care personnel delivering care in the home for a person with diabetes; Risk factors in the patient situation; Care management risk factors; or Defense barriers, accidents, incidents or adverse events.

‡ Full text paper not retrieved (n=1); Articles with people less than 65 years (n=49); Brief reports, information for nurses (n=9); Conference abstracts (n =4); Not diabetes (n =8), not home care services (n=6)

§ Article with people less than 65 years (n=1); Position statement/ discussion paper (n=6); Conference paper (n=1), Not home care services (n=2), Vague methodological description (3)

Figure 1: Flowchart for the literature review process of patient safety in older patients with diabetes in home care services.

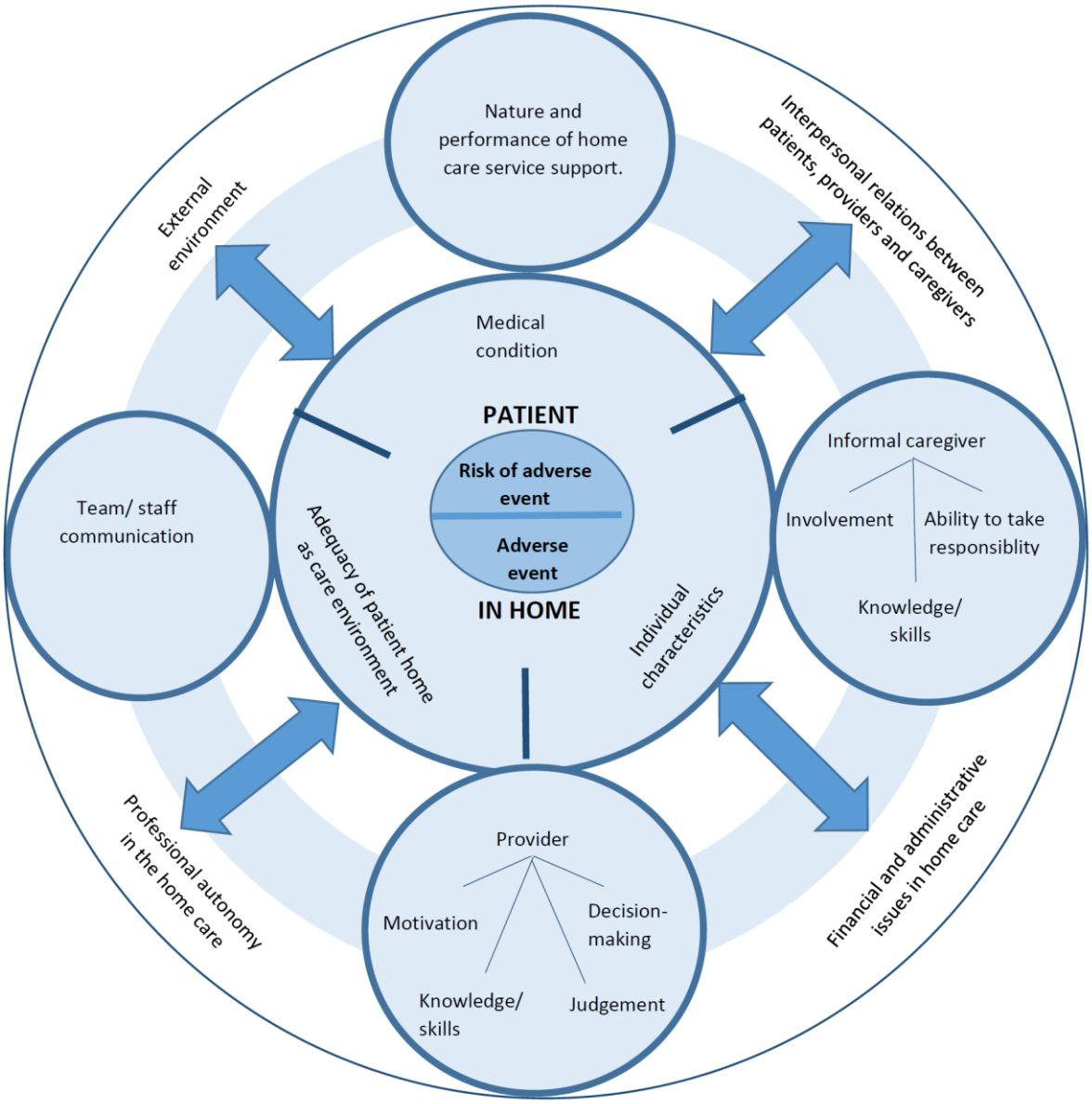


Figure 2: A model of associations between aspects of home care and adverse events